

Table of Content

TABLE OF CONTENT	I
LIST OF TABLES.....	VI
LIST OF FIGURES.....	VII
ACRONYMS AND SYMBOLS	VIII
ACKNOWLEDGEMENT AND DISCLAIMER	IX
AUTHORS DETAILS AND TASKS.....	X
EXECUTIVE SUMMARY.....	XI
1.0 INTRODUCTION	1
1.1 BACKGROUND	1
2.0 LEGISLATIVE REVIEW.....	3
2.1 ENVIRONMENTAL LEGISLATION	3
2.2 THE ATER ACT	4
2.3 ENERGY LEGISLATION.....	4
2.4 NATURAL RESOURCES CONSERVATION ACT	6
2.5 THE FORESTRY ACT.....	6
2.6 LOCAL GOVERNMENT ACT	6
2.6.1 <i>The National Water and Sanitation Act</i>	7
2.6.2 <i>The Town and Country Planning Act</i>	7
2.6.3 <i>The Public Health Act</i>	7
2.7 THE ZAMBIA WILDLIFE AUTHORITY ACT.....	7
2.8 FISHERIES ACT	8
2.9 LANDS ACT	8
2.10 MINES AND MINERAL DEVELOPMENT ACT	8
2.11 NATIONAL HERITAGE CONSERVATION COMMISSION ACT	8
2.12 INTERNATIONAL CONVENTION AND PROTOCOLS.....	9
3.0 THE ENVIRONMENTAL IMPACT ASSESSMENT STUDY.....	10
3.1 PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT	10
3.2 SCOPE OF THE ENVIRONMENTAL IMPACT ASSESSMENT	10
4.0 PROJECT DESCRIPTION.....	11
4.1 NEED FOR THE PROJECT	11
4.2 PROJECT OBJECTIVES.....	12
4.3 PROJECT SCOPE SYSTEM CONFIGURATION AND COST ESTIMATES.....	13
4.4 LINE ROUTE ALTERNATIVES.....	14
4.4.1 <i>Itezhi – Tezhi to Muzuma</i>	14
4.4.2 <i>Itezhi – Tezhi – Mumbwa – Lusaka West Upper</i>	15
4.4.3 <i>Itezhi – Tezhi – Mumbwa – Lusaka West Lower</i>	15
4.4.4 <i>No transmission option</i>	15
4.5 EVALUATION OF LINE ROUTE OPTIONS	16
4.6 TRANSMISSION LINE CONSTRUCTION STAGES.....	19
4.7 RAW MATERIALS	19
4.8 PRODUCTS	20
4.9 BY PRODUCTS	20
4.10 OPERATION PHASE	20

5.0	STUDY METHODOLOGY.....	21
5.1	LITERATURE REVIEW	21
5.2	SCOPING AND PUBLIC CONSULTATION.....	21
5.3	FIELD STUDIES	21
6.0	DESCRIPTION OF THE ENVIRONMENT	22
6.1	PHYSICAL ENVIRONMENT.....	22
6.1.1	<i>Location</i>	22
6.1.2	<i>Climate</i>	24
6.1.3	<i>Topography</i>	26
6.1.4	<i>Soils</i>	26
6.1.5	<i>Geology</i>	26
6.1.6	<i>Hydrology</i>	27
6.1.7	<i>Seismicity</i>	29
6.1.8	<i>Significant pollutant sources</i>	31
6.1.9	<i>Wetlands</i>	31
6.1.10	<i>Water Quality</i>	32
6.1.11	<i>Air Quality</i>	32
6.1.12	<i>Noise</i>	33
6.1.13	<i>Visual</i>	33
6.2	BIOLOGICAL ENVIRONMENT	33
6.2.1	<i>Flora</i>	33
6.2.1.1	<i>Open Forest with Grass</i>	33
6.2.1.2	<i>Miombo Woodland</i>	34
6.2.1.3	<i>Mopane Woodland</i>	35
6.2.1.4	<i>Munga Woodland</i>	36
6.2.1.5	<i>Kalahari Woodland</i>	37
6.2.1.6	<i>Dry Deciduous Forest</i>	38
6.2.1.7	<i>Termitaria</i>	40
6.2.1.8	<i>Riparian Woodland</i>	40
6.2.1.9	<i>Grasslands</i>	41
6.2.1.10	<i>Suffrutex Savanna</i>	43
6.2.2	<i>Fauna</i>	43
6.2.2.1	<i>Mammals</i>	43
6.2.2.2	<i>Birds</i>	47
6.2.2.3	<i>Reptiles</i>	47
6.2.2.5	<i>Rodents</i>	47
6.2.2.6	<i>Fish</i>	48
6.3	SOCIO-ECONOMIC.....	50
6.3.1	<i>Population</i>	50
6.3.2	<i>Settlement Patterns and Traditional Authority</i>	51
6.3.3	<i>Local Economy and livelihoods</i>	53
6.3.4	<i>Land Tenure</i>	55
6.3.5	<i>Land use</i>	56
6.3.6	<i>Protected Areas</i>	57
6.3.7	<i>Agriculture</i>	59
6.3.8	<i>Planned development activities</i>	61
6.3.9	<i>Employment</i>	62
6.3.10	<i>Infrastructure and Social Services</i>	62
6.3.11	<i>Water supply, Sanitation and waste management</i>	63
6.3.12	<i>Health</i>	63
6.3.13	<i>Education</i>	65

6.3.14	Industries.....	66
6.3.15	Transport.....	66
6.3.16	Minerals / Mining	67
6.3.17	Tourism	67
6.3.18	Recreation.....	67
6.3.19	Archaeological and Cultural Heritage.....	68
7.0	POTENTIAL IMPACTS.....	69
7.1	PHYSICAL ENVIRONMENT.....	69
7.1.1	Location	69
7.1.2	Climate.....	69
7.1.3	Topography.....	70
7.1.4	Soils.....	70
7.1.5	Geology.....	70
7.1.6	Hydrology.....	70
7.1.7	Seismicity	71
7.1.8	Significant pollutant sources.....	71
7.1.9	Wetlands.....	71
7.1.10	Water Quality.....	71
7.1.11	Air Quality	71
7.1.12	Noise	72
7.1.13	Visual Impact	72
7.1.14	Project implementation activities	72
7.2	ECOLOGICAL ENVIRONMENT.....	75
7.2.1	Flora	75
7.2.1.1	Open Forest and wood lands	75
7.2.1.2	Wood lands.....	75
7.2.1.3	Riparian Wood land	75
7.2.1.4	Grasslands.....	75
7.2.2	Fauna	76
7.2.2.1	Mammals.....	76
7.2.2.2	Birds	76
7.2.2.3	Reptiles.....	76
7.2.2.4	Rodents	77
7.2.2.5	Fish.....	77
7.3	SOCIO-ECONOMIC.....	79
7.3.1	Population.....	79
7.3.2	Settlement Patterns and Traditional Authority.....	79
7.3.3	Local Economy and livelihoods	79
7.3.4	Land Tenure	79
7.3.5	Land use.....	80
7.3.6	Protected Areas	80
7.3.7	Agriculture	80
7.3.8	Planned development activities.....	80
7.3.9	Employment.....	81
7.3.10	Infrastructure and Social Services	81
7.3.11	Sanitation and waste management.....	81
7.3.12	Health.....	81
7.3.13	Education	82
7.3.14	Industries.....	82
7.3.15	Transport.....	82
7.3.16	Minerals and Mining.....	82
7.3.17	Tourism	83

7.3.18	Recreation	83
7.3.19	Archaeological and Cultural Heritage	83
8.0	MITIGATION MEASURES	84
8.1	PHYSICAL ENVIRONMENT	84
8.1.1	Location	84
8.1.2	Climate	84
8.1.3	Topography	84
8.1.4	Soils	84
8.1.5	Geology	84
8.1.6	Hydrology	85
8.1.7	Seismicity	85
8.1.8	Significant pollutant sources	85
8.1.9	Wetlands	85
8.1.10	Water Quality	85
8.1.11	Air Quality	86
8.1.12	Noise	86
8.1.13	Visual Impact	86
8.1.14	Project implementation activities	86
8.1.14.1	Construction	86
8.1.14.2	Operation Phase	87
8.2	BIOLOGICAL ENVIRONMENT	87
8.2.1	Flora	87
8.2.1.1	Open Forest and wood lands	87
8.2.1.2	Wood lands	87
8.2.1.3	Riparian Wood land	87
8.2.1.4	Grasslands	87
8.2.2	Fauna	88
8.2.2.1	Mammals	88
8.2.2.2	Birds	88
8.2.2.3	Reptiles and fish	88
8.3	SOCIO-ECONOMIC	89
8.3.1	Population	89
8.3.2	Settlement Patterns and Traditional Authority	89
8.3.3	Local Economy and livelihoods	89
8.3.4	Land Tenure	89
8.3.5	Land use	90
8.3.6	Protected Areas	90
8.3.7	Agriculture	90
8.3.8	Planned development activities	90
8.3.9	Employment	90
8.3.10	Infrastructure and Social Services	90
8.3.11	Sanitation and waste management	91
8.3.12	Health	91
8.3.13	Education	92
8.3.14	Industries	92
8.3.15	Transport	92
8.3.16	Minerals and Mining	92
8.3.17	Tourism	92
8.3.18	Recreation	93
8.3.19	Archaeological and Cultural Heritage	93
9.0	ENVIRONMENTAL MANAGEMENT PLAN FRAMEWORK	95

9.1	INTRODUCTION	95
9.2	MAIN COMPONENTS OF THE EMP	95
9.3	MONITORING PROGRAMME	96
9.4	ESTIMATED COST OF MITIGATION AND MONITORING ACTIVITIES.....	96
10.0	RECOMMENDATIONS AND CONCLUSION.....	98
11.0	REFERENCES.....	99
12.0	APPENDICES.....	102
12.1	SOME WAY-LEAVE CONSENTS ON THE ITT-MUMBWA LUSAKA WEST TRANSMISSION LINE PROJECT	102
12.2	CHECKLIST OF PLANT SPECIES IN THE STUDY AREA.....	123
12.3	SOME OF THE BIRDS RECORDED IN THE NAMWALA GMA.....	124
12.4	COMMON LARGE MAMMALS IN THE NAMWALA GMA	125
12.5	TRANSMISSION LINE COORDINATES	126
12.6	ATTACHMENTS.....	127

LIST OF TABLES

Table 1	Itezhi-Tezhi-Mumbwa-Lusaka West 132/330kV line route description & approximate distances.....	17
Table 2	Line route selection and evaluation criteria (environmental & social constraint).....	18
Table 3	Monthly mean temperatures for ITT for the period 1965 to 1997 (Source Ngoma Research Station in the Kafue National Park-South).....	25
Table 4	Gauge stations in the catchment area.....	28
Table 5	Earthquake records.....	29
Table 6	Seismic events exceeding.....	29
Table 7	Raw Water quality monitoring data for the Kafue at ITT for the years 2006 and 2008.....	32
Table 8	Population estimates from aerial surveys of some large mammals in Namwala GMA in 1994 and 1997.....	44
Table 9	Families, Genera and Species of Fauna of KNP.....	45
Table 10	Habitat Preferences of some Big Mammals Predators in KNP Park & adjacent Areas (After Ansell, 1960, 1978).....	46
Table 11	Population of the project areas by ward, 2000.....	51
Table 12	Activity Cycle.....	54
Table 13	Summary anticipated impacts on the physical environment.....	74
Table 14	Summary of anticipated impacts on the biological environment.....	78
Table 15	Summary of Environmental Impacts and Mitigation Measures.....	94
Table 16	Mitigation budget and responsible agency.....	97

LIST OF FIGURES

Figure 1	Zambian Power Grid.....	2
Figure 2	Primary Energy Consumption in Zambia (Department of Energy 2002).....	12
Figure 3	Guyed Vee 330kV tower structure.....	14
Figure 4	Line route in pink colour.....	23
Figure 5	Amount of rainfall recorded in Itezhi-tezhi 1986-2006:	24
Figure 6	Showing the Main Hydrology of the Proposed Project Area.....	28
Figure 7	Hot springs in the Kafue Flats at Longola south bank of the ITT Dam.....	30
Figure 8	A young Miombo forest near Mumbwa.....	35
Figure 9	Palm trees common in Munga and open grasslands of the Kafue Flats...37	
Figure 10	Typical dambo grassland in a dambo near the Kafue Flats.....	42
Figure 11	Trees, shrubs & grass between Nangoma & Mwembeshi settlements...43	
Figure 12	A giant rodent sunbasking outside ZESCO guest house in Itezhi-Tezh....48	
Figure 13	Common fish found in the area.....	49
Figure 14	Different types of fish found in Lake Itezhi-Tezhi & Kafue Flats Fishery..49	
Figure 15	Typical common dwelling structure in the project area (Lubanda).....	52
Figure 16	Improved dwelling structure in Lubanda Village.....	53
Figure 17	Common preservation methods for fish and marketing system.....	55
Figure 18	Location of Namwala GMA in Itezhi tezhi District.....	58
Figure 19	Sunflower field in Mapulanga Village.....	60
Figure 20	Cattle grazing in Banamwaze Village on the edge of the Kafue Flats.....	61
Figure 21	Water pumping station for the water treatment plant at Itezhi-tezhi	63
Figure 22	Nansenga Clinic in Muwezwa Chiefdom.....	64
Figure 23	Nansenga Basic School in Muwezwa Chiefdom.....	66

ACRONYMS AND SYMBOLS

°C	Degrees Celsius
CBMB	Chibombo
CEC	Copperbelt Energy Corporation
CP	Central Province
ECO	Environmental Coordinator
EMP	Environmental Management Plan
FMP	Forestry Management Plan
GMA	Game Management Area
ITT	Itezhi - Tezhi
ITTPC	Itezhi –Tezhi Hydropower Company
KFD	Kafue District
KF	Kafue Flats
KNP	Kafue National Park
KM	Kilometers
KW	Kilowatts
kV	Kilovolts
MBW	Mumbwa
MW	Mega Watts
PFA	Protected Forest Area
REA	Rural Electrification Authority
SP	Southern Province

ACKNOWLEDGEMENT AND DISCLAIMER

This environmental study is part of the feasibility study and overall documentation that form part of the Itezhi-tezhi-Mumbwa to Lusaka West substation transmission line project. ZESCO Limited has embarked on the development of further hydropower projects in the country to meet the demand and to off set the current power deficit. The proposed line will carry power from the Itezhi-Tezhi power station to feed into the national grid at Lusaka West.

We acknowlegde the outstanding support and guidance we received from various Heads of Government Departments (District Administration, Agriculture, Tourism and Environment, Education and Health) and public and private institutions and individuals (the Air Force, Farmers, Headmen and Local Authorities) in the project area. Special thanks particularly go to their Royal Highnesses, Senior Chief Shakumbila, Chief Moono and Chief Chibuluma in Mumbwa District for granting us block permits to pass the line through their chiefdoms and allocating land for a substation in Mumbwa. We also wish to thank their Royal Highnesses, Chief Muwezwa, Chief Chilyabufu and Chief Shimbizi of Itezhi-Tezhi for granting us permission to go ahead with the project through their respective chiefdoms.

Last but not least our thanks go to the individuals, investors and farmers whose properties will be affected by the line for their coopertation, support and understanding and for granting us various permits to pass the line through their properties.

The information contained in this document and the estimated geographical designations (especially distance estimates) do not imply authority over those designations and shall not be used in any way whatsoever to determine the legal status of any area or concerning the delimitation of any frontiers through the project area.

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EXECUTIVE SUMMARY

The Kafue River Basin is one of Zambia's important basins for hydropower development. A number of feasibility studies have been conducted in the past that resulted in the development of the Itezhi Tezhi dam and the Kafue Gorge Power Station in the 1970s. Great potential still exists for further development of hydropower in the Kafue basin and two additional power stations along the Kafue River (Itezhi-tezhi – 120MW and Kafue Gorge Lower 750MW) have been proposed.

The proposed Itezhi Tezhi Hydropower project is located in Itezhi Tezhi District in Southern Province in Zambia. The power plant will be built adjacent to the existing Itezhi Tezhi Dam and will utilize the water in the reservoir. However, in order to evacuate the power that will be generated a new 220/330kV line is being proposed from Itezhi – Tezhi into a substation at Mumbwa, then into Lusaka West substation.

The current total national hydropower installed of 1730 MW, has been adequate to meet both regional (5% export) and local power (1200MW) demand. However, over the years power demand has been increasing tremendously due to among other factors, improvement in the national economic growth (average GDP of 4%) as well as increase in regional power demand. According to recent power demand forecast studies, the current regional imports and internal power generation has been outstripped by demand during the year 2007. This has led to an eminent power deficiency being experienced within Zambia and the Southern African region.

The Kafue River system presents an opportunity to develop another Power Station that could help lessen the impact of power shortages. The Itezhi Tezhi has a potential for hydropower development that has not yet been exhausted and will utilize the head from the dam and other already existing infrastructure.

The Environmental Impact Assessment

The Environmental Impact Assessment for the transmission line project was undertaken as a legal requirement and in accordance with the requirements of the Environmental Protection and Pollution Control Act of 1990 and in particular Statutory Instrument No. 28, the Environmental Impact Assessment Regulations of 1997. Section 3 (1) of Statutory Instrument No. 28 of 1997 of the above Act states that "A developer shall not implement a project for which a Project Brief or Environmental Impact Statement is required under these Regulations, unless the Project Brief or an Environmental Impact Statement has been concluded in accordance with these regulations and the Environmental Council of Zambia has issued a decision letter". These EIA regulations have the main objective of ensuring the protection of the environment by highlighting impacts and formulation of mitigation measures to ameliorate the identified adverse environmental impacts. The report is outlined as closely as possible to the general EIA outline given in the EIA regulations with appropriate sections.

In the category of Electrical Infrastructure, the types of projects which need EIAs are new electricity generation stations, electrical power transmission lines more than 1 km long and surface roads for electrical and transmission lines for more than 1km long. The transmission line project under consideration falls within the types of projects which require an Environmental Impact Assessment.

The identified significant environmental impacts of the project

The proposed Itezhi Tezhi project will utilize the existing dam facility hence, reduces the adverse impacts which are usually associated with hydro power development projects. However, in order to evacuate the power to load centres on the national grid, a single circuit 220kV line into Mumbwa and a 330kV line into Lusaka West has been proposed. The 273km transmission line system (estimated to cost about US\$147M) will have impacts on the physical, biological and social environment. For instance, bush clearing for wayleaves, excavation works for foundations and associated construction of access roads, tower erection, and stringing activities will cause and generate vegetation loss, noise, dust, destabilization to the geology especially in areas that will require blasting and the various activities could induce soil erosion.. The transmission system will also have visual impacts and in some sections lead to the relocation of some families. The transmission line once completed will enhance energy use that is environmentally friendly. . Improved health care services, education and agriculture are likely to be enhanced due to the provision of reliable clean energy.

The transmission line project is likely to trigger an influx of job seekers in the line route and this could create stress on the social amenities, especially in rural areas. An influx of migrant labour force could also be associated with the introduction of several vices including poaching and diseases not prevalent in these areas. The local economic activities may however, be enhanced due to an injection of capital in the project area with spill over effects of incomes and permanent structures like the proposed power station and associated switching system at Itezhi-tezhi and the new substation at Mumbwa.

The hydropower plant at Itezhi-tezhi and the proposed transmission line have inherent significant positive impacts both in the local and national economic aspects as additional power capacity for the country will lead to enhancement of the current economic growth in the country. In addition, both at construction and operation stages, there will be creation of jobs in different operational areas of the project. Hydropower development at Itezhi-tezhi will also lead to efficient water resources utilization in the Kafue River basin as the same water that was just being spilled to make available water for generation at Kafue Gorge Upper would now be channeled through the power station to generate power before being released for generation needs at the existing Kafue Gorge power station and in future the proposed Kafue Gorge Lower Hydropower station.

Mitigation measures

In projects of this nature, ZESCO has a policy to encourage contractors on such projects to employ as much as possible, local people in project areas. This works well in local income improvements in project areas while creating a sense of ownership of the new infrastructure that assist in subsequently stemming off vandalism of the infrastructure. This approach also helps avoid an adversarial relationship between project laborers and the surrounding population. Educational campaigns for both local community and construction workers will be given at regular intervals throughout the construction period to mitigate the spread of communicable diseases such as HIV/AIDS and STIs.

In order to deal with vices such as poaching during construction with its potential effects, educational programmes to the work force will be given in collaboration with ZAWA. This will help prevent any hunting activities that any worker or contractor may want to undertake. Selection of camp sites for construction workers, especially near the GMA shall be in collaboration with ZAWA and a monitoring plan shall be put in place.

The outlined activities during construction of the line shall be confined in the wayleaves only. In areas such as Lusaka West and the terminal point at Itezhi-tezhi where blasting may be required, timing for blasting shall be arranged in such a way that will reduce noise impact on surrounding communities.

An Environmental Management Plan (EMP) shall be developed to help the contractors implement the proposed mitigation measures. An amount of US\$ 206,080 has been estimated and proposed to implement the proposed mitigation measures including capital costs such as transport support to ZAWA and health personnel in rural areas. A comprehensive monitoring programme has been proposed to be part of the EMP to include: aspects of wildlife management and compensation for affected people in the project area.

Recommendations

The Environmental Council of Zambia approved the proposed Itezhi-tezhi Hydropower station some time back. The proposed power transmission project is therefore a supplement to the power station in that it will be used to evacuate power. The line project has been evaluated in terms of options for line route options and both negative and positive environmental impacts identified with recommended mitigation measures for the identified negative impacts and enhancement measures for positive impacts. The proposed line project will also among other reasons, help meet the growing local and regional power demand, to reduce the power shortages that may constrain economic growth, to reduce and in some places forestall environmental degradation in light of the power shortage in the country. It is also envisaged to create employment opportunities arising from improved power supply that will meet the economic growth of the country. The development of the Itezhi-tezhi Hydro Power Station and the associated

transmission system should therefore be considered favorably for implementation by the Authorising Agency (the Environmental Council of Zambia).

Signed:

Date:

1.0 INTRODUCTION

1.1 Background

The proposed Itezhi-Tezhi – Mumbwa – Lusaka West 220/330kV transmission line project is wholly in Zambia and shall be connected to the national grid at Lusaka West substation. Zambia is located in the Southern African Region and has a land surface of about 752,610km² with various open water bodies such as; Itezhi-tezhi (ITT) Reservoir , Lake Tanganyika (2100km²), Lake Bangweulu (2700km²) and Lake Kariba (5580 km² at maximum retention). It is a landlocked country with Angola, Botswana Democratic Republic of Congo, Malawi, Mozambique, Namibia, Tanzania and Zimbabwe as neighbours. Zambia lies on a plateau with an average altitude between 1000 and 1300metres though with some high spot (the Muchinga escarpment) standing at 2000metres above sea level.

Zambia has a mild climate and lies between 8° and 18° latitude south and 22° and 34° longitude East. The country generally has three distinct seasons: warm rainy summer (November – April), cool dry (May-August) with temperature varying from 4°C to 25°C and a hot dry season (September – October). The vegetation can be broadly described as woodland, forest and grassland. The country is divided into nine provinces with 72 districts and a population of about 10.3million people.

The country is mainly drained by two river systems, namely, the Zambezi and the Congo River systems. The Zambezi River system is the largest with sub-catchments of the, Kabompo, Luangwa and the Kafue Rivers. The three rivers are wholly in Zambia while the Zambezi is shared by Angola, Namibia, Botswana, Zimbabwe, Malawi and Mozambique. The Congo system drains north wards and has two major tributaries, the Chambeshi and the Luapula River. This gives the country a unique position in the region in terms of high hydropower development potential and inter-connectivity.

There are three power companies in the country, namely: the Copperbelt Energy Corporation (CEC), Lunsemfwa Hydropower Company and the national power utility, ZESCO Limited that was formed through an Act of Parliament in 1970. ZESCO Limited has three major hydro power stations with a total installed capacity of 1608 MW located at: Kafue Gorge (900 MW), Kariba North (600 MW) and Victoria Falls Power station (108 MW).

Additionally, ZESCO has four small hydro power stations (Lusiwasi, Chishimba Falls, Musonda Falls, and Lunzua) with a total installed capacity of 24 MW bringing the total installed capacity under ZESCO to 1692 MW. Diesel power plants contribute a further 8MW under the ZESCO power capacity. Lunsemfwa Hydro Power Company has two other small hydro power stations (Mulungushi -20MW and Lunsemfwa-18MW) with a

total installed 38 MW. CEC is mainly in power transmission to the mines on the Copperbelt.

The transmission system (see figure 1) originates from the major generation centers in Kafue Gorge, Kariba North and Victoria Falls and a system of 330kV to 66 kV bulk transmission lines interconnects the major substations. The total 330kV and 220kV line coverage is about 2625 km while the 132kV, 88kV and the 66 kV lines cover about 4200 km. Additional lines at 330kV (190km), 220kV (231km) and 66kV (200km) have been constructed and some recently completed to supply power to the new mines in the north west of the country and to interconnect with Namibia and some isolated towns within the country.

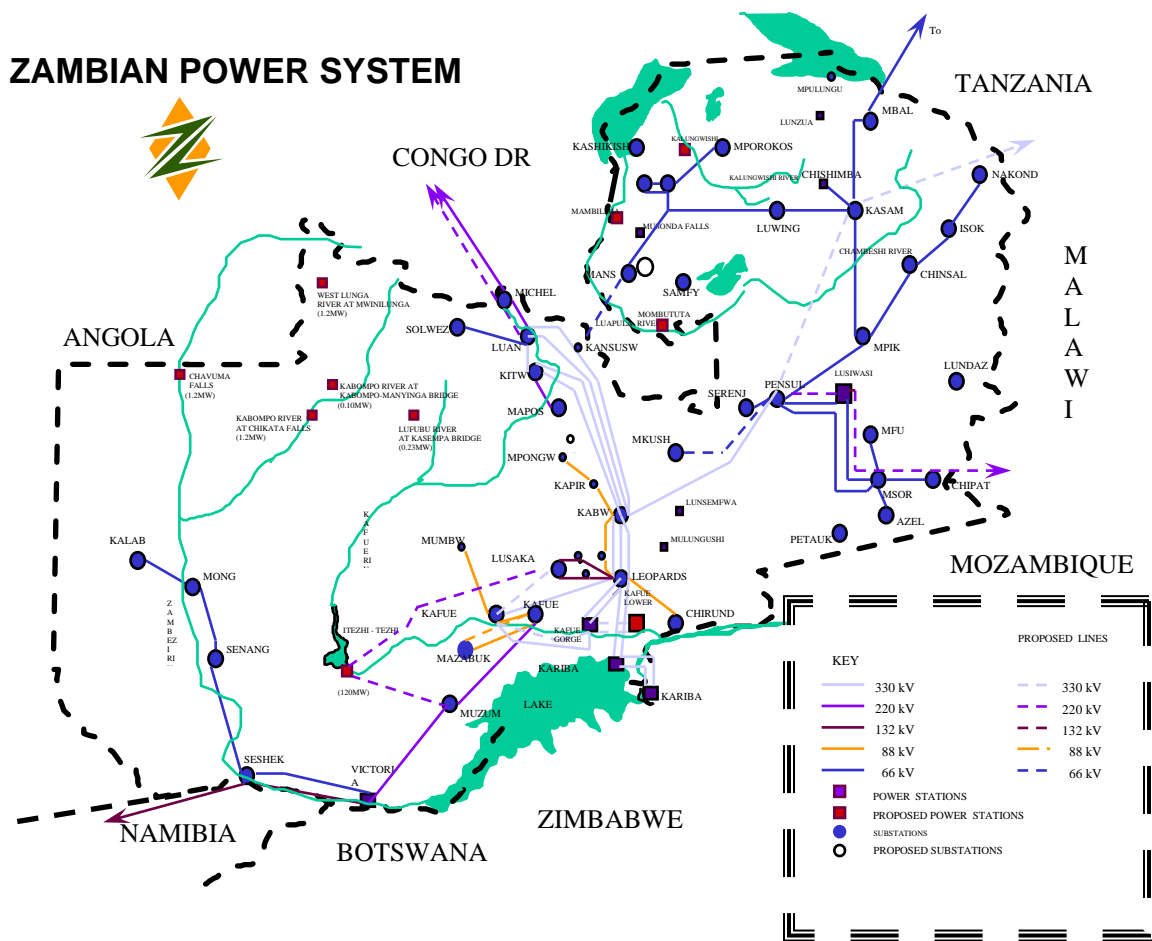


Figure 1 Zambian Power Grid

Increasing electricity demand in Zambia and surrounding countries has prompted the Government to reopen studies for the development of new hydropower resources. As a result, feasibility studies of the 1,600 – MW Batoka Hydroelectric Project in 1993,

followed by a feasibility study for the Kafue Gorge Lower Hydroelectric Project in 1995. The study of the Itezhi-Tezhi Hydropower and transmission line projects is a logical next step as the project will provide additional firm and secondary energy as well as the potential for increasing the firm supply from the existing Kafue Gorge Upper Hydropower station as well as the planned Kafue Gorge Lower Hydropower project.

The Itezhi – Tezhi (ITT) Hydropower Project is located on the Kafue River, about 295 Km upstream of the confluence of the Kafue River and the Zambezi River and 230 Km upstream from the Kafue Gorge Upper Hydro Project. The proposed transmission line into Lusaka from Itezhi – Tezhi, will traverse four districts namely, Itezhi – Tezhi, Mumbwa, Chibombo and Kafue. The proposed ITT hydropower project will be located on the south bank of the Kafue River at the existing Itezhi Tezhi dam. The transmission line will originate from a switch yard/substation just outside the power plant on the south bank of the river.

2.0 LEGISLATIVE REVIEW

2.1 Environmental Legislation

The legislative responsibility of environmental impact assessment is vested in the Environmental Council of Zambia (ECZ) which administers the Environmental Protection and Pollution Control Act No. 12 of 1990, Statutory Instrument No. 28 of 1997 – The Environmental Impact Assessment Regulations. The Environmental Council is mandated to: a) identify types of projects, plans and policies for which environmental impact assessments are necessary and to undertake or request relevant institutions to undertake such assessments for consideration by the Council; b) to monitor trends in the use of natural resources and their impact on the environment; c) to request information on the quantity, quality and management methods of natural resources and environmental conditions from any individual or organization anywhere in Zambia and; e) to consider and advise the government, on all major development, on all major development projects at an initial stage and on the effects of any sociological or economic development on the environment.

In addition to the above, the Ministry of Tourism, Environment and Natural Resources in consultation with the ECZ, is empowered to make regulations by statutory instrument for any matter that can be prescribed under the Act in the protection of the environment.

In Zambia, it is a legal requirement under the Environmental Protection and Pollution Control Act No. 12 of 1990, that developers should implement projects in line with the provisions of the law. Section 3 (1) of Statutory Instrument No. 28 of 1997 of the above Act states that “A developer shall not implement a project for which a project brief or

environmental impact statement is required under these Regulations, unless the project brief or an environmental impact statement has been concluded in accordance with these regulations and the Environmental Council of Zambia has issued a decision letter.”

In the category of electrical infrastructure, the types of projects which need Project Briefs are new electricity generation stations, electrical power transmission lines more than 1 km long and surface roads for electrical and transmission lines more than 1 km long. The project under consideration falls within the types of projects which require an Environmental Impact Assessment.

2.2 The Water Act

The Department of Water Affairs administers the Water Act (CAP 312). The Act prohibits the pollution of public water so as to render it harmful to man, animal, fish or vegetation. It also empowers the water officers to direct persons responsible for fouling or polluting water to take appropriate measures to prevent the fouling or pollution. The Department of Water Affairs is therefore mandated under the Water Act, to ensure that the development of such line projects conform to the provisions of the Water Act.

The Water Act, (1948) (although there is a bill awaiting parliamentary approval) focuses on the provisions for ownership, control and use of water. In this case mainly surface water. It makes a clear distinction between private and public water and primary, secondary and tertiary uses of water.

Tertiary use, in particular, deals with water for mechanical and industrial purposes for generation of power.

The Water Board, is responsible for allocating raw water rights to the various sectors of the economy, operates under the Water Act, Cap 198 (1948). The Act empowers the Board to control the use of water resources by charging abstraction fees. The development of the ITT hydropower station and the related power evacuation lines will entail applying for additional water rights from the Water Board.

2.3 Energy Legislation

The Department of Energy is responsible for the administration of the petroleum policy including pricing, storage and the oil pipeline control and administration of electricity, production and processing of fossil fuels, and development of renewable energy resources. The Department also administers the Electricity Act, the Petroleum Act (No. 13 of 1985), the Zambia – Tanzania Pipeline Act, the Energy Regulation Act, CAP 436 of 1995, the Rural Electrification Authority Act (No. 20 of 2003) and the Zambezi River Authority Act.

The development of the ITT transmission line therefore will have to be in line with the provisions of the Electricity Act that is administered by the Department of Energy.

The Electricity Act (No. 15 of 1995) under CAP433 of the Laws of Zambia is an Act established to regulate the generation, transmission, distribution and supply of electricity; and to provide the matters connected with or incidental to the foregoing ZESCO power projects and operations are carried out in line with the provisions of the Electricity Act.

The Energy Regulation Board (ERB) was created under the Energy Regulation Act of 1995 Chapter 436 of the Laws of Zambia following the issuance of Statutory Instrument number 6 of 1997, the Energy Regulation Act (Commencement Order) of 27th January 1997.

The role of the ERB is that of balancing the needs of undertakings with the needs of energy consumers. The Board has the responsibility to ensure that utilities earn a reasonable rate of return on their investments that is necessary to provide a quality service at affordable prices to the consumer. 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, investigates and remedies consumer complaints (refer to : www.erb.org.zm for details). The ERB is therefore expected to monitor the transmission line project development to ensure conformity to the provisions of the ERB Act.

The Rural Electrification Act (No. 20 of 2003) under CAP 173 of the laws of Zambia is an Act to establish the Rural Electrification Authority (REA) and to define its functions: to establish the Rural Electrification Fund; and to provide for matters connected with or incidental to the forgoing. The REA was established to promote and facilitate access to electricity by the rural population of Zambia. The functions of REA include among others:

- Develop, implement and update rural electrification master plans for systematic electrification of rural areas;
- Promote the utilization of the available rural electrification technological options to enhance the contribution of energy to the development of agriculture, industry, mining and other economic activities in rural areas.

The above functions of REA entail collaborative implementation of such projects in liaison with other organizations and stakeholders in observance of the applicable environmental and other legislation.

2.4 Natural Resources Conservation Act

The Department of Natural Resources administers the Natural Resources Conservation Act (CAP 315). The Conservation plan under the Act provide for the preservation of, or protection of, or limitation of entry upon, any hillside, water catchment, spring water, sponge mash, swamp forest, stream, stream bank or water hole; the allocation of land as preserves for water catchment; the construction of dams, weirs and any works for conserving water, or for regulating water supply, or for distributing water, or for irrigating land, or for draining the courses of rivers, and for flood prevention. The Natural Resources Department of the Ministry of Tourism, Environment and Natural Resources also has departmental functions as regards to forests, fisheries and wildlife in its provision for the conservation plans. Under the conservation plans, there is authority to provide for the demarcation of and preservation of nature and wildlife reserves, as well as for location of land for fuel wood, forestry or fish farms.

2.5 The Forestry Act

The Department of Forestry administers the Forestry Act (CAP 314). The Forestry Act of 1990 provides for the conservation of the forests through the establishment and management of forest reserves and through the licensing and sale of forest produce. Transmission line construction traverses long distances that could impact on local or protected forests.

2.6 Local Government Act

The Local Authorities, under the Ministry of Local Government and Housing, administers the provisions for the Local Government Act (CAP. 22 of 1991). The functions of the Local Authorities in relation to environmental regulation of water are to exercise general control, care and maintenance of public water resources and to remove obstacles thereof; to take and require the taking of measures of water drainage; to provide and maintain water supplies and establish and maintain water works; to take and require the taking of measures for the conservation and prevention of pollution of water supplies.

Transmission line development should therefore be carried out in line with the provisions of the Local Government Act to prevent pollution.

2.6.1 The National Water and Sanitation Act

National Water and Sanitation Act No 28 of 1997 established the National Water and Sanitation Council (NWASCO) and define its functions; to provide for the establishment, by local authorities, of water supply and sanitation services under the general regulation of the National Water Supply and Sanitation Council; and to provide for the matters connected with or incidental to the foregoing. (ref: Nwasco, Regulatory Tools and Legislation, 2004 Ed.)

2.6.2 The Town and Country Planning Act

The Town and Country Planning Act of 1995, CAP 283 was enacted to make provision for the appointment of planning authorities; for the establishment of a Town and Country Planning Tribunal, for the preparation, approval and revocation of development plans, for the control of development and subdivision of land, for the assessment and payment of compensation in respect of planning decisions, for the preparation, approval and revocation or modification of regional plans; and for matters connected with and incidental to the foregoing.

2.6.3 The Public Health Act

Public and Health Act Cap 295 of the Laws of Zambia, water borne diseases, mostly diarrhea in nature (i.e. Cholera, dysentery, typhoid etc) are either categorized as infectious or Formidable diseases. The object of the Act therefore, is to provide for the prevention and suppression of diseases which is in line with the vision of the Health Sector.

2.7 The Zambia Wildlife Authority Act

The National Parks and Wildlife Act (no.10 1991) provide for the establishment, control and management of National Parks, the conservation and protection of wildlife and objects of interest in National Parks; the establishment of Game Management Areas (GMA); Licensing of hunting; control of possession of trophies and the control of bush fires. However, in 1998, the Zambia Wildlife Authority Act came into force replacing the NPW Act. ZAWA now has the mandate to manage all the GMAs and the 19 national parks in the country.

2.8 Fisheries Act

The Fisheries department administers the Fisheries Act (CAP 314, 1974, 1998) The Act regulates commercial fishing through registration of fishermen and boats, and prohibition of certain fishing methods and equipment. During line construction, workers intending to venture into fishing activities will need to do so in line with the provisions of the Fisheries Act.

2.9 Lands Act

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

2.10 Mines and Mineral Development Act

The Ministry is responsible for mines and mining policy including the development of small mines; precious and semi-precious mineral; mineral research and mine safety. The ministry administers the Mines and Minerals Act (CAP 320), the Petroleum and Production Act (No. 13 of 1985) and the Zambia Iron and Steel Authority. Any form of land excavation during line construction that may lead to the discovery of minerals shall be carried out in accordance with the provisions of the Mines and Minerals Development Act.

2.11 National Heritage Conservation Commission Act

The National Heritage Conservation Commission Act (No. 23, 1989) provides for the conservation of ancient, cultural and natural heritage and establishes the Commission and sets out its functions. The Act is the implementing legal framework in Zambia of the World Heritage Convention 1992, under which the heritage site (such as the Victoria Falls) are included in the World Heritage list as World Heritage Sites.

Other local legislation which may be applicable includes:

The Factories Act, 1967

Zambezi River Authority Act, 1987

2.12 International Convention and Protocols

Zambia has signed and is party to more than thirty Regional and International Protocols and Conventions. The most relevant environmental conventions are: The Southern African Development Community (SADC) protocols on environment, natural resources management and water and soil conservation.

Some of the international conventions that Zambia is party to include that dealing with the Protection of the World Cultural and Natural Heritage (of 1972) and ratified by Zambia in 1982., statutes of the International Union for the Conservation of Nature and Natural Resources (IUCN), Convention on International trade in Endangered Species of the wild fauna and flora (CITES), 1993, ratified in 1993 and the RAMSAR Convention and Bonn Convention. Zambia has also ratified the Basel Convention (1994) which regulates trans-boundary movements of hazardous wastes.

Other International conventions that the country is party to include:

- Convention on Wetlands of International Importance, especially as waterfowl habitat
- African Convention on the Conservation of Nature and Natural Resources
- Montreal Protocol on Substances that Deplete the Ozone Layer
- Agreement on the Action Plan for the Environmentally Sound Management of the Common Zambezi River System
- Convention on Biological Diversity
- United Nations Framework Convention of Climate Change
- United Nations Convention to Combat Desertification

3.0 THE ENVIRONMENTAL IMPACT ASSESSMENT STUDY

3.1 Purpose of the Environmental Impact Assessment

The carrying out of the Environmental Impact Assessment (EIA) study for the Itezhi – Tezhi, Mumbwa to Lusaka West substation transmission line, allows the anticipated economic benefits of the project to be weighed against the environmental and social impacts that may arise from the implementation of the project, both during construction and operational phases. The EIA is undertaken as a legal requirement under the Environmental Protection and Pollution Control Act No.12 of 1990 - Environmental Impact Assessment Regulations, Statutory Instrument No. 28 of 1997. Section 3 (1) of Statutory Instrument No. 28 of 1997 of the above Act states that “A developer shall not implement a project for which a project brief or environmental impact statement is required under these Regulations, unless the project brief or an environmental impact statement has been concluded in accordance with these regulations and the Environmental Council of Zambia has issued a decision letter”. In the category of Electrical Infrastructure, the types of projects which need EIAs are new electricity generation stations, electrical power transmission lines more than 1 km long and surface roads for electrical and transmission lines more than 1km long. The transmission line project under consideration falls within the types of projects which require an Environmental Impact Statement.

The first step in Environmental Impact Assessment is to determine whether the project would cause any negative impacts on the physical, ecological and socio-economic environment in the project area. If negative effects are anticipated from the project, mitigation measures should be put in place to ameliorate negative impacts. The EIA study addresses both direct and indirect impacts as well as short and long term impacts of the project on the ecosystems, land use and communities and recommends measures which could be taken to minimize or eliminate negative effects.

It is intended that the EIA for the proposed transmission line project from Itezhi Tezhi will not only address the issue of power deficit but also incorporate and reflect the principles of sustainable development and climate change.

3.2 Scope of the Environmental Impact Assessment

The study is concerned with the environmental and social aspects through the project area, particularly the possible negative effects such as pollution, disturbance of natural habitats for wildlife, truncation of land uses, relocation (resettlement) of people and other forms of social distress, loss of buildings and restricted use on fields and dangers to people and animals.

Specifically, EIA:

- describe the nature of the project and identify and characterize the environment through the project area;
- provide a description of the regulatory framework applicable to the project under consideration;
- identify potential physical, biological, socio-economic and cultural impacts related to the construction and operation of the transmission line.
- describe the scientific analysis of ecosystem effects, local knowledge, and the experience of locals in the project area and other sectors that was used by the study team in the assessment of environmental effects;
- describe the consideration given to comments received from the public during the environmental assessment study; and
- propose mechanisms for follow-up to identify and manage the effects of the project and to confirm the effectiveness of mitigation measures employed.

Performing the EIA for the proposed development allows for comparison of the capacity and energy benefits generated by the project with the environmental and socio-economic impacts, in accordance with the requirements of the Environmental Protection and Pollution Control Act – Environmental Impact Assessment Regulations, Statutory Instrument No. 28 Of 1997.

4.0 PROJECT DESCRIPTION

4.1 Need for the project

Itezhi-tezhi district is currently supplied with power through a 33kV overhead line from Choma. The demand in the district and the surrounding areas is very small. The future power needs for the area has been forecasted at less than 10MW in ten years. The bulk of the power that will be generated from the proposed power station will therefore have to be transmitted to other load centres outside the district. The Itezhi – tezhi Power Company (ITPC) may enter into power supply contracts with parties within or outside the country hence the need for the evacuation of power from the station onto the national grid. It is for this reason that a Transmission line from Itezhi-tezhi to Lusaka West through Mumbwa has to be developed. The transmission line will also improve the reliability of power supply in the district as it will be a stronger link between the District and the national grid, than the existing 33kV line from Choma (at Muzuma substation). The transmission line will also provide stable electricity supply to Mumbwa District whose demand has increased due to growth in the mining and agricultural sectors.

4.2 Project objectives

The national electrification (grid) and access to electricity in Zambia is still very low with only about 20.3% people with access for the whole country. However, access to electricity in the rural areas is even much lower at 3.1%. There is also a remarkable increase in power demand in the country for all categories of consumers in the economy (such as mines, agriculture, commercial, industrial, residential and construction). Currently, the Southern African Region and the country are experiencing power shortages on a large scale. The current power deficits in the country range from 300MW to 400MW. Even though hydropower is not the principal source of energy in the country economic considerations dictate the use of hydroelectric power where hydropower potential and water is available. In the 1990s, nearly 70 percent of the national energy demand was met by burning of fuel wood (at household level thus both firewood and charcoal). The remainder was divided among electrical energy, petroleum and petroleum products and coal (see figure 2 below),.

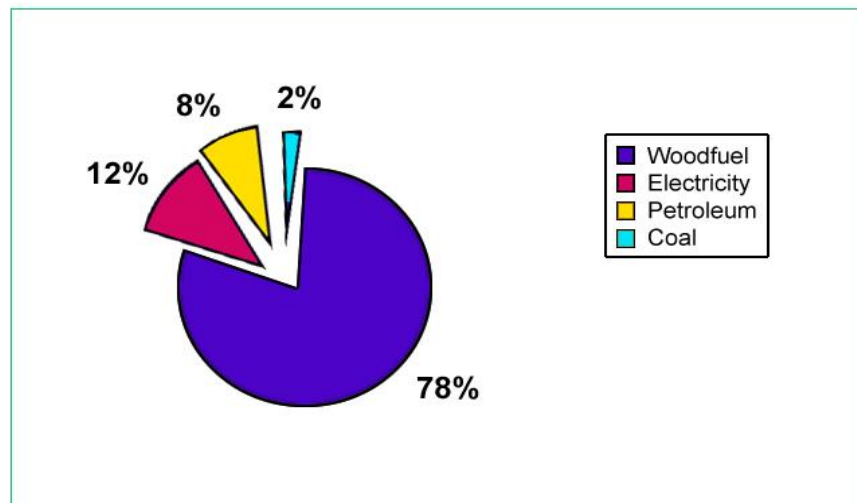


Figure 2 Primary Energy Consumption in Zambia (Source: Annual Report of Department of Energy, Government of Zambia 2002)

In an effort to increase access to electricity and to off set the power deficit, the Government has embarked on some projects that will make power available into the economy. Several hydroelectric projects are under consideration such as the Kafue Gorge Lower (with a potential of 750MW), Itezhi – Tezhi (with an installed capacity of 120MW). Through a partnership and other facilities (loans etc), the Itezhi – Itezhi hydropower plant is being developed under a joint venture between ZESCO Limited and Tata of India. The project objective is therefore, to provide additional electric energy to meet the growing demand of the Zambian economy. By utilizing the existing dam for

hydropower generation at the present height, inundation of arable land, habitat, displacement of people and considerable aquatic disturbance will be avoided.

The overall objective of the transmission line project is therefore to evacuate power from the new power station into the national grid at Lusaka West. The line will also provide security of supply by opening up a central transmission network therefore reducing over dependency on the eastern transmission network that converges at Leopard's Hill substation.

4.3 Project scope system configuration and cost estimates

The project scope and system configuration will involve the following works:

- Constructing 146km of 220kV single circuit transmission line on single bison from Itezhi Tezhi to Mumbwa town.
- Establishing a complete new 2 x 125MVA ,330/220/11kV substation at Mumbwa
- Constructing 145km of 330kV twin bison transmission line (see figure 3) from Mumbwa to Lusaka West Substation.
- Extend the existing Lusaka West 330kV substation to accommodate a new 330kV line bay, two transformers (1 No. 330/132kV and 1 No.132/33kV) and convert the existing 33kV indoor switchgear to outdoor.

The project total cost is currently estimated at US\$147M for both the line and the proposed new substation at Mumbwa.



Figure 3 Guyed Vee 330kV tower structure

4.4 Line route alternatives

Route selection process was conducted using various methods and through field studies and evaluated based on constraints (environmental, social, distances and cost implications). Maps, physical features and broad social parameters of the areas were among the evaluation criteria in route selection.

4.4.1 Itezhi – Tezhi to Muzuma

The first option was to construct the power line from Itezhi – Tezhi to Muzuma substation in Choma. The line was planned to leave the switch yard at the proposed Itezhi Tezhi – Tezhi hydropower station then pass through Basanga and Nazhila areas. After leaving Nanzhila, the power line would join the Namwala – Choma road between Kabulamwanda and Chitongo until reaching Choma. At Njase Girls Secondary area in Choma, the power line would take a South-Western direction to avoid Choma town. The line would have then crossed the Choma – Kalomo road (T2) mid way between Choma town and Kozo Lodge then into the substation at Muzuma. On this option the line would have been about 360km long.

4.4.2 Itezhi – Tezhi – Mumbwa – Lusaka West Upper

The proposed line is planned to originate from a switch yard on the south bank of the Kafue River at Itezhi - Tezhi. On this option, the line would have crossed the Kafue River east of Itezhi-Tezhi, then swing into a north east direction to run along the Mongu – Itezhi – Tezhi road (RD769) through Namwala Game Management into Kafue National Park, turn east along the Mumbwa-Lusaka Road (M9) through Nalusanga gate into a new substation in Mumbwa. The line would then be placed on the south side of the Lusaka – Mongu road till it crosses at a point near Nangoma then into Lusaka west substation. This option would have been about 350 km long.

4.4.3 Itezhi – Tezhi – Mumbwa – Lusaka West Lower

The lower line route is proposed to originate from the ITPC switch yard on the south bank of the Kafue River at Itezhi Tezhi dam. The line will be between the Namwala Road and the Kafue River through Choma and Khuta Farms on the south bank of the Kafue River. The line is proposed to take a 90° angle (on the two angle towers one on Khuta Farm on the south bank of the Kafue and one on the north bank of the river) to cross the Kafue River near Mwanalushi farm on the north bank. The transmission line will then cross and be aligned north of the New Namwala road (R350) crossing streams such Mbuma, Baunza, Banga, Lukomezi and Nansenga.

It is envisaged that the line will follow the old Namwala² game management fence in some areas such as through Kalombe Tsetse control point, north of Lubanda, continue north through Nyumbu Village near Kasaka School and road D180, through north of Banamwaze into Nansenga then into the substation near Nambala in Mumbwa. The line route from the substation will be near the Nambala mission road but south of Sanje Forest Reserve, into Nangoma for easy access. It will then cross the road just west of Mamvule at Kapyanga and stay north of the road traversing through areas such as behind Mubula Community School into Mwembeshi, then into Lusaka West substation (see appendix 12.6). The line will therefore traverse through several Chiefdoms from ITT, namely; Shimbizi, Chilyabufu, Muwezwa, Chibuluma, Moono, Shakumbila, part of Mungule and into Nkomesha in Lusaka West (see table 1 below). This option is about 273km long and generally traverses through less socio-economic and environmentally sensitive areas.

4.4.4 No transmission option

The “no option or zero option” alternative was not considered because the power deficit situation in the country need be addressed urgently, to avoid adverse impact on the growth of the national economy. Electric energy is one of the key ingredients in

economic development and subsequently poverty alleviation. Doing nothing therefore, would not be in line with Government Policy on economic and rural development.

4.5 Evaluation of line route options

Section 4.4 above outlines the route selection criteria used to firm up ITT-Mumbwa-Lusaka West Lower as the preferred route. Accessibility, security of supply and cost (based on line length) were also used as selection criteria. Line route selection criteria for the options, is shown in table 2 below:

Table 1 Itezhi-Tezhi-Mumbwa-Lusaka West 132/330kV line route description and approximate distances

Province	Line Section	km	District	Line Section	km	Chiefdom	Line Section	km
Southern	ITT- SP/CP Boundary	099.0	ITT	ITT SP/CP boundary	099.0	Musungwa – ITT	ITT Dam-Khuta Farms Ltd	002.5
Central	SP/CP - Mwembeshi River	134.0	Mumbwa	SP/CP –Kabile stream	121.5	Shimbizhi – ITT	Kafue River-Lukomezi River	048.5
Lusaka	Mwembeshi River-Lsk West	040.0	Chibombo	Kabile – Mwembeshi River	012.5	Chilyabufu – ITT	Lukomezi River –Nansenga River	037.5
			Kafue	Mwembeshi River-Lusaka West	040.0	Muwezwa – ITT	Nansenga River-District/Province boundary	008.5
						Chibuluma – MBW	District/Province boundary –Chibila Tributary	035.0
						Moono – MBW	Chibila tributary- Naakuni Stream	023.5
						Shakumbila – MBW	Naakuni Stream - Kabile Stream	065.0
						Mungule – CBMB	Kabile Stream-Mwembeshi River	012.5
						Nkomeshya – KFD	Mwembeshi River-Lusaka West	040.0
Total		273.0			273.0			273.0

Table 2 Line route selection and evaluation criteria (environmental and social constraint)

Evaluation/selection criteria	ITT-Muzuma	ITT-Mumbwa-Lusaka West Upper	ITT-Mumbwa-Lusaka West Lower
Length of transmission line	Approximately 360km	Approximately 350km	Approximately 273km
Construction costs (based on anticipated impacts, distance & type of line structure, conductor & insulators)	Higher (due to anticipated compensation, foundation costs in flood plains)	High (due to compensation for crop land, dwelling structures, GMA and park permits)	Moderate (since it avoids many settlements, the GMA, the park and is shorter)
Settlements/Agricultural land	Several around Namwala, Choma (near Njase) & into Muzuma east of Choma	Few sections in Chief Kaingu's, then Moon, Shakumbila and Nkomesha	Few sections in Kaingu, Chilyabufu, Moono, Shakumbila and Nkomesha
Game Management area	Non	Namwala GMA	Non
Protected Areas (National Park)	Non	Kafue National Park	Non
Protected Area (Forest Reserve)	Non	National Park wood land	Non (Avoids Sanje Forest Reserve)
Wetland Areas/Flats	Part of Kafue Flats, Naminwe flood plains and several dambos over long distances	Partly into the Kafue Flats & several but short low depressions (north of Banamwaze) that get waterlogged during the wet season.	Partly into the Kafue Flats & several but short low depressions (north of Banamwaze) that get waterlogged during the wet season.
Archaeological/ Historical	Not known	Not known	Not known
Accessibility	Restricted in dambos (west of Namwala & Maala) & the Kafue Flats	Marginally accessible (would require new access road in some sections)	Fairly accessible in most sections using existing road infrastructure
Security of supply	Restricted since it does not offer much flexibility into the grid	Good: it provides flexibility & a new transmission corridor into the grid	Good: it provides flexibility & a new transmission corridor into the grid
Extension potential	Low/Limit	Restricted into Western & North-western provinces due to KNP	High into Western (restricted) and North Western Province

4.6 Transmission line construction stages

There are several stages and activities that constitute construction works in a transmission line project. These include but not limited to the following:

Project preparatory activities and works

- Reconnaissance survey that involve maps and preliminary ground truthing,
 - Line firming based on the preliminary survey.
 - Detailed line survey and pegging
 - Way-leave acquisition (that form part of the EIA study since soliciting for permits involve public consultation)
 - EIA studies
 - Scoping
 - Draft TORs
 - Field studies
 - Draft EIA Report production (including environmental management plans – EMPs)
 - Public consultations
 - Final EIA report and submission to the ECZ
 - ECZ approval
 - Tendering process and award of contract(s)
- Construction**
- Bush clearing
 - Foundation construction
 - Tower erection and accessory fitment
 - Stringing
 - Energizing
 - Commissioning
- Operation**
- Annual maintenance (Bush clearing and technical)

4.7 Raw materials

The main construction materials on the project include but not limited to the following construction materials and components:

- Steel for towers, concrete reinforcement, fencing etc
- River sand for concrete works
- Cement for concrete works
- Aggregates for concrete

- Insulators
- Conductors
- Transformers
- Accessories such as bolts and nuts
- Optic fibre cable (OPGW)
- Fencing wire for substation and switch yard

4.8 Products

The main product of the project is hydropower that will be transmitted on the proposed line. Hydropower is one of the clean energies that do not cause environmental degradation during the operation phase.

4.9 By products

The resulting by products from the project could include: waste materials from the construction process such as cement bags and other packaging materials, aggregates, steel off cuts, bolts & nuts, wood, waste (domestic) from camp sites, etc.

4.10 Operation phase

The transmission line shall be declared operational once all pre-commissioning tests and activities are completed and the line energized. Route maintenance of the way-leave (vegetation control) and technical inspections (and line patrols), general line performance and normal switchings shall constitute the operation phase of the line.

5.0 STUDY METHODOLOGY

5.1 Literature Review

A set of documents and reports including initial feasibility studies for the proposed hydropower station at Itezhi – Tezhi; environmental project brief for distribution lines in Mumbwa and EIA report for transmission lines in Kafue and Lusaka and wild life management plans by the Zambia Wildlife Authority (ZAWA), were reviewed as part of the study. Other literature included topographic maps, geology maps, soil maps and census reports and other various reports were reviewed.

5.2 Scoping and public consultation

The EIA study team embarked on a scoping exercising and consultation process that mainly centred on small groups and one on one consultation with various stakeholders in the study area. These included Chiefs, Councillors, village headmen, civil servants (heads of departments and officers in various Government Departments and sections), the Zambia Wildlife Authority, fishermen and many ordinary people in the line route. Some of the issues that were raised by various stakeholders are as reflected in the scoping report (see attachments in section 12.6) with approved terms of reference for the study.

5.3 Field Studies

In order to acquaint themselves, the study team conducted field studies for both the proposed site of the hydropower station at Itezhi Tezhi, transmission line route (in accessible and selected points and locations and places of greater interest), the proposed 132/330kV substation at Mumbwa and various farms, mining areas, installations and villages in the proposed route of the transmission line. The field exercise also involved obtaining permission through way-leave consents and attending to various requests by traditional leaders concerning further information dissemination about the project activities in some areas (see way-leave consents in appendix 12.1).

6.0 DESCRIPTION OF THE ENVIRONMENT

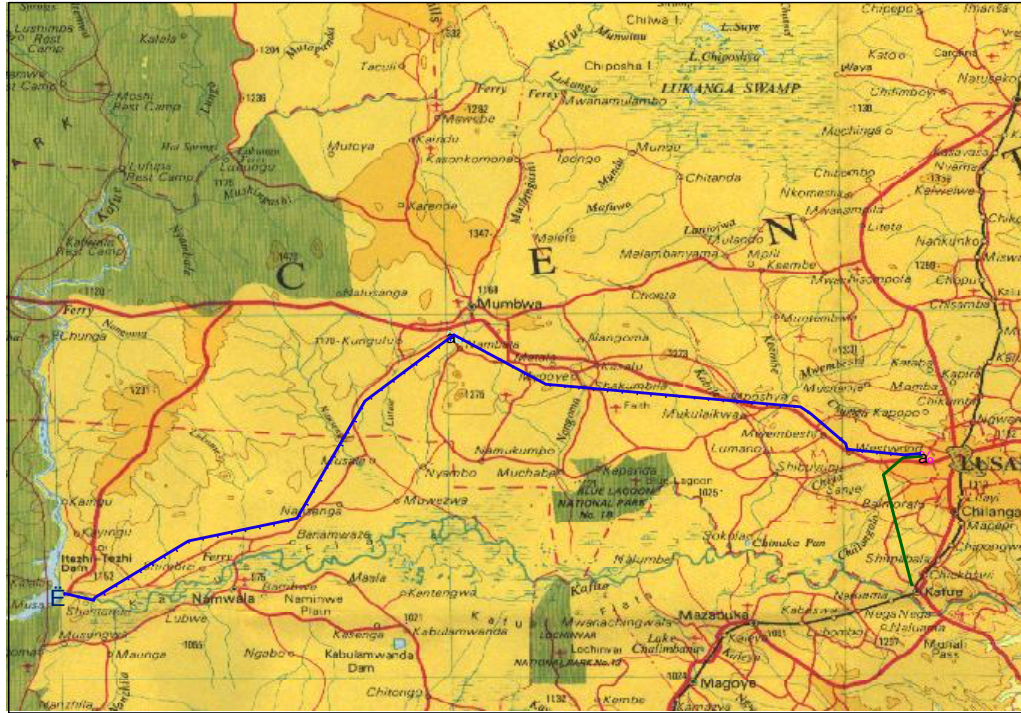
6.1 Physical Environment

6.1.1 Location






The proposed transmission line system is within the Kafue River basin that is approximately in the central part of the country approximately between 11 degrees and 16 degrees south latitude and 26 degrees and 29 degrees east longitude. The basin covers an area of about 150,000 square kilometers, up to the confluence of the Kafue Rivers and the Zambezi River, which is about 20 percent of the total area of the country.

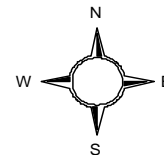
The proposed line will originate from the south bank of Itezhi – Tezhi dam then traverse low lying portions of the Kafue Flats, then cross the river into Chief Shimbizi's area, then into chiefdoms of Chilyabufu, Muwezwa, Chibuluma, Moono, Senior Chief Shakumbila and part of Nkomensha in Lusaka West (see figure 4). The line route coordinates are outlined in appendix 12.5.

PROPOSED ROUTE FOR THE NEW ITT-MUMBWA-LUSAKA WEST POWERLINE



LEGEND

-  Proposed transmission line.shp
-  Existing 330kv line into lusaka west substation.shp
-  Existing substation lusaka west.shp
-  Itt-hydrpower station.shp
-  Proposed mumbwa substation.shp



Compiled By:Chetwaile Nyendwa, Zesco HQ.

Source Sheet Scanned Relief Map of Zambia

Date: 22/08/08

Figure 4 Map of West Central Zambia showing the proposed transmission line (in blue)

6.1.2 Climate

The climate over the four districts where the proposed line traverses experience three distinct weather conditions which is subtropical continental and can be classified into three seasons: with a cool dry period April to August; hot and dry from September to November and a cool wet season from November/December to March.

Rainfall patterns and the onset has changed over the years although the on set of the rains used to be in late September, it now starts at the beginning of November and may last until end of March though this also varies from year to year. Annual precipitation ranges from slightly over 1,400mm in the upper Kafue River basin to about 800 mm in the lower basin although most part of the line falls in the second agro-ecological zone where average rainfall is above 800 mm. The maximum rainfall months are December and January though this varies also from season to season. The annual rainfall in the area is about 687mm. Figure 5 below shows the amount of rainfall recorded in ITT from 1986 to 2006. The average temperature in the project area is about 19°C ranging from an average low 7° to 10°C and an average high ranging between 30° and 35°C. October is the hottest month while July is the coldest month. Table 3 below shows the monthly mean temperatures for ITT from 1965 to 1997.

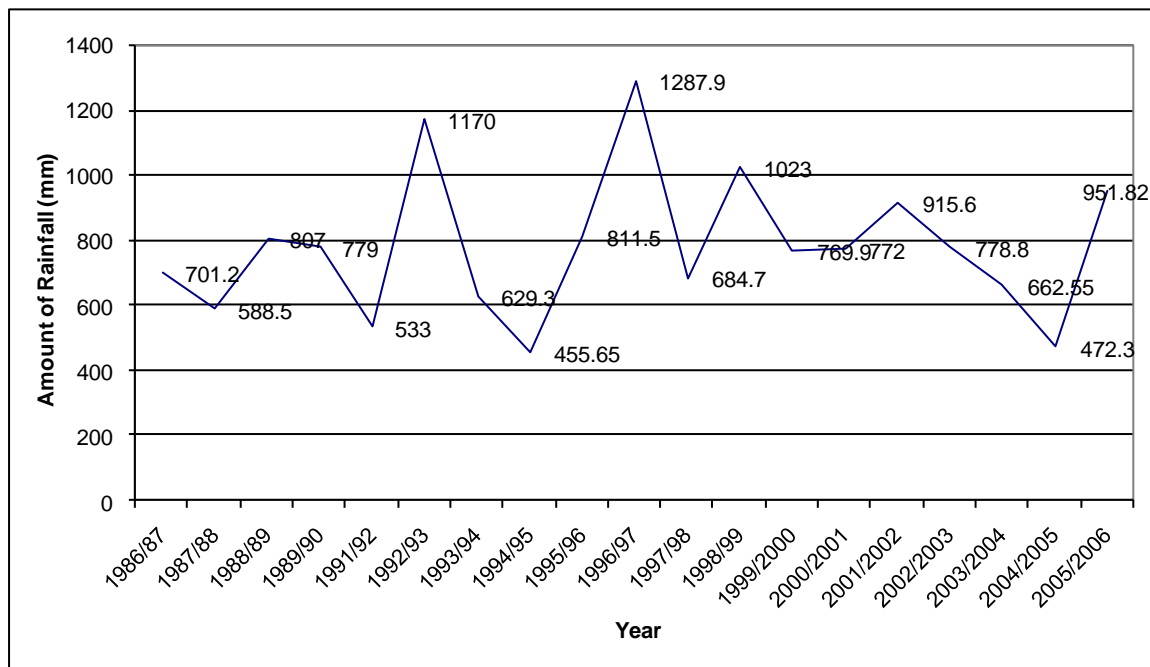


Figure 5 Amount of rainfall recorded in Itezhi-tezhi 1986-2006: (Source ZESCO ITT)

Table 3 Monthly mean temperatures for ITT for the period 1965 to 1997 (Source Ngoma Research Station in the Kafue National Park-South).

Month	Mean monthly temperatures	Mean monthly maximum	Mean monthly minimum
January	25.5	31.3	19.7
February	24.3	29.9	18.6
March	24.5	30.6	18.3
April	23.1	30.9	15.3
May	20.1	29.4	10.7
June	17.3	26.9	7.7
July	17.6	28.3	6.8
August	19.8	29.9	9.6
September	23.3	34.7	11.8
October	25.5	34.9	16.0
November	26.4	34.6	18.1
December	25.4	31.4	19.4

Relative humidity in some areas ranges between 34.3% (September) and 79.1% (February), minimum in winter and a maximum in summer. The post rainy season is often accompanied by heavy dew and early morning mists particularly in low lying dambos and the Kafue Flats. Winds are predominantly light, easterly, blowing from north east to south east for 80% of the year. In the dry season winds are relatively stronger, while in the rainy season there is a bit of variation in wind direction.

Mumbwa like in many parts of Central Province has a tropical climate with three distinct seasons: the warm-wet season, stretching from November through April; cool dry cold season from May to August with the mean temperatures varying between 14 degrees Celsius and 30 degrees Celsius. The hot dry season is experienced during the months of September and October. The annual rainfall averages of about 1240mm, most of which falls in the months of December to March. The rains in Mumbwa are caused by the convergence of the North-east and South-east Trade Winds that form the Inter-tropical Convergence Zone (ITCZ). The area experience early rains before most parts of Zambia and late rains, as the Inter-Tropical Convergence Zone moves northwards, later than the southern part of the country. This causes a relatively long rain season and the mean annual rainfall relatively high.

The average temperature in Lusaka is about 21⁰C ranging from an average low of 15⁰ c to an average high of 27⁰C. June and July are the coolest months averaging slightly more than 16⁰C while the warmest temperatures occur in October and November when the temperature reaches about 24⁰C. The mean humidity is about 62 percent ranging from 41 percent in November to 81 percent in January and February. Winds are generally from the east in the cool and dry months and from the northeast in the other seasons. Wind velocities are generally around 5m/s and range from calm to about 10m/s.

6.1.3 Topography

The average altitude of the project area lies between 1000 and 1200 meters above sea level. The climate is generally subtropical continental and can be classified in four seasons as indicated above in section 6.1.2. The terrain of the Kafue Basin, in which the line traverses, is generally gentle. Generally, the upper part of the study area is largely mountainous in some places. Topographical features in the area include gently undulating hills, floodplains and dambos.

6.1.4 Soils

The surface soils are two to five meters thick, with alluvium in the floodplain in the order of 10-12 meters thick. Most of the soils have been formed in place by weathering of the granitic substrate. The alluvium of the flood plain is mostly sandy.

6.1.5 Geology

The proposed terminal point of the line at the switch yard for ITTPC hydropower facility is located on a high (1000m) desert peneplain. Bedrock at both abutments of the dam and throughout most of the Itezhi Tezhi reservoir has granitic basement rock, but the central part of the valley, beneath the main section of the dam is underlain by 30 – 100 meters of flat-lying mudstone of the Karoo System. Granitic basement rock, including some foliated metamorphic rock that underlies the mudstone sequence.

The geological formation of the proposed line route from Itezhi-Tezhi can be described as alluvium, colluvium laterite in the flood plains with Kalahari sands that are tertiary to recent in formation. In the upland of the line route below the GMA, basic, igneous and meta-igneous rocks, amphibolites rocks of different ages occur. This is interspaced by granite, syenodiorite, syenite, diorite and metamorphic equivalents of different ages. Around Mumbwa, rocks of different ages pave way for the Katanga (conglomerate, quartzite, argillite, arkose, shale, greywacke, dolomite, banded iron formation, mixitite, limestone and schist) system probably of the late Precambrian and Lower Paleozoic. Towards Lusaka on road M9, the Katanga system paves way for the Pre-Katanga (schist, gneiss, and granulite) and basement complex with granitic gneiss, migmatite and granite. The main geological formation west of Lusaka in the proposed line route is metacarbonate, calcic silicate and metaquartzite rocks and limestone.

6.1.6 Hydrology

The major part of the line will be in Southern Province, in Itezhi Tezhi district and Central Province in Mumbwa district with short sections in Chibombo (Central Province) and Kafue District in Lusaka Province. However, the main drainage system of the project area is the Kafue River in the Kafue Basin (refer to figure 6 below). The Kafue River originates in the Copperbelt Province, at the eastern end of the Zambia – Democratic Republic of the Congo (DRC) water shed at an elevation of 1,400 meters and flows southward through the Copperbelt of Zambia, passes near the western edge of the Lukanga Swamps. The river then turns west and then south, down into the Itezhi-Tezhi reservoir. At the reservoir the river passes through a range of low hills and turns eastwards across the Kafue Flats, where it meanders for a distance of about 230 kilometres before entering the 90 kilometres long Kafue Gorge. From the gorge, the river flows (for about 65 km) to its confluence with the Zambezi River. The length of the main river is about 1,550 km and with a total drop in gradient of about 1,400 meters. The catchment of the Kafue River in the proposed project route is drained by many streams such as: Mbuma, Baunza, Banga, Lukomezi and Nansenga, in Itezhi-Tezhi District. Other rivers and streams include: Chipa, Lutale and Chibila in the section between Itezhi – Tezhi and the proposed Mumbwa substation. Others include, Matala, Nangoma, Mwembeshi River (that form the boundary between Central and Lusaka Provinces) and Namayani in Lusaka West.

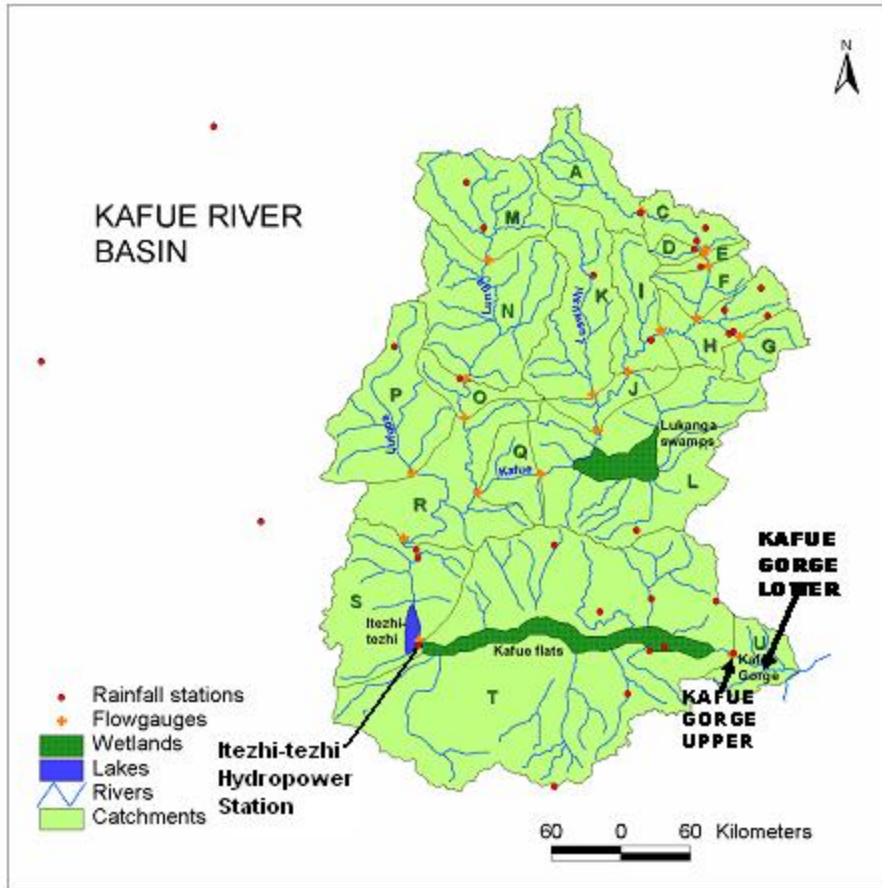


Figure 6 Showing the Main Hydrology of the Proposed Project Area

Catchment flows on the Kafue River in the study area are monitored and measured through some gauging stations given the table 4 below:

Table 4 Gauge stations in the catchment area

Station	Drainage Area Km ²	Period of Record
4-670 Kafue R. at Mankoya	94,924	February 1952 - June 1973
4-669 Kafue R. at Hook Bridge	95,053	October 1973 - August 1976
4-710 Kafue R. at Itezhi-Tezhi	105,620	May 1955 - April 1977
Itezhi-Tezhi Res. Outflow		October 1978- January 1994
4-997 Kafue River at Kasaka	150,971	October 1905-December1993

6.1.7 Seismicity

The proposed ITT-Mumbwa-Lusaka West 132/330kV transmission line will originate from the proposed ITT Hydropower station. The ITT hydropower station will be located at the already existing Itezhi – Tezhi dam that is located in the seismic region that lies on a relatively suitable plateau, about 200 km west of the more active regions of the East African Seismic System. Document review carried out during the environmental impact assessment studies for the ITT hydropower station revealed that there are frequent low intensity seismic activities with occasional larger events. Some data revealed no earthquakes larger than 5.6 M within approximately 300 km of the dam site from records kept in the early 1900s (1904 – 1910) to 1978. Large two earthquakes experienced in the past in the vicinity of the dam are presented in table 5 below.

Table 5 Earthquake records

Date	Magnitude	Epicenter	Distance from Site
12 Aug 1969	5.2	15S 26.5E	80 km
15 May 1968	5.6	15.9S 25.9E	20 km

Subsequent review of the worldwide seismic database (US Geological Survey), has revealed only three additional events exceeding the 5.6 level, in the period ending December 1995 details outlined in table 6.

Table 6 Seismic events exceeding

Date	Magnitude	Epicenter	Distance from Site
23 Sept. 1963	5.8	16.6S 28.8E	305 km
25 Sept. 1963	5.8	16.7S 28.7E	298 km
02 Dec. 1968	6.0	13.9S 23.8E	328 km

There is limited data indicating the possible occurrence of the reservoir induced seismicity at the Itezhi Tezhi reservoir. In early May 1978 and late August 1978, the number of earthquakes reached a local high (25 and 15 daily events) compared to more normal daily occurrences of <2/day. The Magnitudes of “most can be expected to be lower than 2.8” (Seismic Activity During Filling of Itezhi – Tezhi Reservoir, VBB, 27/79,p.5).

In addition to the evaluation by VBB (above reference), micro-seismic earthquake data in the period March 1981 to April 1987 were also reviewed and evaluated by the Central Water and Power Research Station, Pune, India. In their summery of activity, the following points are made:

- The increased seismic activity in 1978 shortly after filling began could be surmised to be RIS (reservoir induced seismicity).
- After a quiet period of about three years, the seismicity in close proximity to the dam increased in August 1982, with several shocks ranging in magnitude from 3.0 to 4.0. These can be considered as reservoirs induced shocks. (Ed. Note: This is also the seismic activity that has been associated with the general decline in aquifer pressures, which began in October 1982)
- After 1982, the level of activity “steadily reduced almost to its natural level”, the exception being a “spurt of activity” in October 1984, with the main shock rated as 4.4 M; this was judged by pune to have characteristics of a natural, rather than a reservoir induced shock.

The impoundment of water in the Itezhi-Tezhi reservoir has led to the development of a common feature of hot springs in the area of the Kafue Flats close to the reservoir. This is associated with the confined aquifer that has produced common features associated with artesian wells and hot springs in the area (see figure 7).



Figure 7 Hot springs in the Kafue Flats at Longola south bank of the ITT Dam

6.1.8 Significant pollutant sources

There are no known sources of significant pollutants in the study area. However, it is anticipated that planned developments such as lodges, housing estates, and other other activities at Itezhi Tezhi, could cause pollution of water in the reservoir and the river down stream of the dam. Newly opened up farm blocks upstream of most tributaries of the Kafue in the study area could also cause pollution due to cultivated agriculture that opens up land leaving some areas susceptible to soil erosion. Use of fertilizers could also cause water pollution.

6.1.9 Wetlands

The Kafue Flats, located downstream of the Itezhi-Tezhi Dam is the major wetland in the study area. It covers an area of about 5,000km². The flat slopes gently from west to east, with a drop of about 6m over some 230km. The total drainage area between ITT Dam and Kafue Gorge is about 45,400km². Along the river channel are numerous depressions, old river channels, and sloughs, which are flooded during high flow periods and retain water for some months. These depressions are known as “dambos,” that tend to regulate the flow of the Kafue River. One of these, Lukanga Swamp lies upstream of ITT reservoir and covers an area of about 2,500km². It consists mostly of reeds, with occasional patches of open water. It is generally believed that there are only two outlet channels. Another important wetland is Busangu Swamp, on the Lufupa River, upstream of ITT Reservoir. Other small dambos exist in the Kafue National Park area and close to rivers such as the Lukomezi. These dambos do not drain, due to the impervious nature of the soils, but lose water by evaporation. These are important areas for fisheries.

A very significant feature of the basin is the presence of swamps and marshy lands (generally known as “dambos”). The Lukanga swamp covers an area about 2,500 km² and consists of reeds with occasional patches of open water. The general depression in which the swamp is located has no outlet except two small channels that connect to the Kafue River. One channel connects to the Kafue River near Mswebi and a second channel connects downstream from Chilenga. The second channel operates during floods only, when the water flow from Kafue River to the Swamps. There is practically no contribution to the Kafue River from the Lukanga River. The Kafue Flats, located downstream from Itezhi-Tezhi, cover an area of about 5,000 km² and slope gently from the west to the east with a drop of about 6 meters in about 230 km. There are a number of tributaries in the Kafue Flats that contribute a small amount of runoff. Much of the runoff is used in filling the depressions, and is subsequently lost through evaporation.

6.1.10 Water Quality

Water quality in the study area is considered to be generally good as results from raw water of Ithezhi-tezhi/Kafue River analysis (see table 7) below show. The data below may be used as baseline data for future water quality monitoring. This is also compared to the waste water effluent in the Water Pollution Control (Effluent and Waste Water) Regulations of 1993. In Mumbwa, the water source for the town is from Chibile River. There is a treatment plant for water before it is pumped up for consumption.

Table 7 Raw Water quality monitoring data for the Kafue at ITT for the years 2006 and 2008.

PARAMETER	01/2008	01/2006	WHO Guidelines	Effluent into aquatic environment
pH	7.0	8.0	6.5 – 8.5	6.0-9.0
Turbidity (NTU)	0.63	1.53	5.0	15
Cond. (mMhos/m)	159	148	1500	4300
TDS (mg/l)	110	138	1000	3000
TSS (mg/l)	<1.0	<1.0	-	100
Temp. °C	25	24.5	-	40
Total Hardness (mg/l)	244	100	500	
Calcium Hardness (mg/l)	76	56	500	
Alkalinity (mg/l)	164	144		
Iron (mg/l)	<1.0	0.23	0.3	2.0
Ammonia (NH ₄ -N mg/l)	0.04	0.03	1.5	10
Sulphate (mg/l)	67.52	69.4	250	1500
Chloride (mg/l)	12.0	9.0	250	800
Nitrite (NO ₂ -N mg/l)	.002	0.019	0.100	2.0
Nitrate (NO ₃ -N mg/l)	<1.0	0.065	10.0	50
Acidity (CaCO ₃ mg/l)	Nil	Nil	500	
Total Phosphate (mg/l)	<1.0	0.44	5.0	6
Magnesium (mg/l)	40.32	10.56	-	500
Calcium (mg/l)	30.4	22.4	200	
Fluoride (mg/l)	0.08	0.16	1.50	0.5
Potassium (mg/l)	3.63	7.16	-	
Sodium (mg/l)	11.52	46.0	200	
Manganese (mg/l)	<1.0	<0.01	0.50	1.0

Tests carried out in conformity with “Standard Methods for the Examination of Water and Waste Water APHA. 1988”.

6.1.11 Air Quality

Air quality in the proposed project area is considered good as the area is not industrialized, except for Mumbwa that has a cotton ginnery. Most of the portions of the route is in a natural undisturbed forested areas and in some sections along the game management area cut line (or fence).

6.1.12 Noise

The study area has no known industrial activities except in Mumbwa at the cotton ginnery and in Lusaka West at a quarry and stone polishing facility. However, the line passes away from the crusher facility. Proposed developments around Mumbwa include a cement factory that could cause noise pollution. During construction there will be heavy duty equipment in the area which will contribute to noise pollution.

6.1.13 Visual

The ITT – Lusaka West line shall have two types of towers, a double circuit 132kV from ITT to Mumbwa and guyed Vee 330kV type into Lusaka West substation. It is envisaged that there will be angle towers (tension towers) in the first segment and two to three transposition towers. Segment two shall also have angle towers with two to three transposition towers. The minimum height of towers in segment 1 shall be about 20m while the 330kV section will have towers over 20m high.

6.2 Biological Environment

6.2.1 Flora

There are several vegetation types between Itezhi-Tezhi, Mumbwa and Lusaka West. The vegetation around Itezhi Tezhi largely consists of woodlands, thickets and shrubs in the game management area and grasslands increase towards the Kafue Flats. The vegetation types, therefore, include the miombo woodland, mopane woodland, mixed forest, baikiaea forest, munga shrub land, termitaria and grasslands. A checklist of some of the plant species is given in Appendix 12.2.

6.2.1.1 Open Forest with Grass

The open forests with grass are classified in four woodland types namely Miombo, Kalahari, Mopane, and Munga.

Open forest with Grass is one of the most important vegetation types due to its heterogeneity in its plant species composition. Therefore, these vegetation types attract almost all wildlife species for grazing and browsing purposes, while in the GMA the trees are used for house construction, timber for furniture and wood fuel. In GMAs this community is the most vulnerable to degradation due to pressure.

6.2.1.2 Miombo Woodland

Miombo woodlands occur in two forms: 1) dominated by *Julbernardia paniculata* north of the Kafue River and 2) dominated by *J. globiflora* on the south bank of the river.

A typical species which occur in the miombo woodland are *Acacia goetzei* spp. *Microphylla* in escarpment country, *Hymenocardia acida* and *Phyllanthus engleri*.

Common tall trees include *Amylonocarpus angolensis*, *Brachystegia boehmii*, *B. longifolia* and *B. speciformis* although most of the Miombo type *Brachystegia* appears to be intermediate between *B. longifolia* and *Erythrophleum africanum*. Small trees are chiefly *Diospyros kirkii*, *Monotes glaber* and *Pseudochnostylis maprouneifolia*.

Common shrubs are composed of *Dichrostachys cinerea*, *Diplorhynchus condylocarpon*, *Eriosema ellipticum*, *Flacourtia indica*, *Hippocratea indica* growing as a shrub instead of a climber. Other common shrubs are members of the following genera – *Abrus*, *Adenodolichos*, *Aeschynomene*, *Clerodendrum*, *Deesmodium*, *Diplolophium*, *Fadogia*, *Hypoestes*, *Indigofera*, *Lannea* and *Triumfetta* with broken fern (*Pteridium*) and small colonies of the succulent *Aloe christiani*.

The miombo woodland (see figure 8) is found along the upper part of the GMA and is more predominant from Mweengwa checkpoint to Kaundu gate, which is about 10km from Itezhi-Tezhi town centre. It stretches up to the Kafue River Basin where it merges with acacia species. The miombo woodland consists mainly of *Brachystegia longifolia* and *Julbernardia paniculata*. Other tree species found in this woodland include the *Pseudolachnostylis maprouneifolia*, *Diplorhynchus condylocarpon*, *Ochna afzeli*, *Brachystegia spiciformis*, *Baphia massaiensis*, *Dalbergiella nyase*, *Swartzia madagascariensis*, *Rothmannia fischeri*, *Monotes glaber*, *Uvaria lucida*, and *Albizia antunesiana*. Among these species, the *Swartzia madagascariensis*, *Brachystegia longifolia* and *Julbernardia paniculata* are endangered. The miombo provide important habitat for sable antelope, waterbuck, kudu, warthog and roan.



Figure 8 A young Miombo forest near Mumbwa

6.2.1.3 Mopane Woodland

Mopane woodland occurs the Kafue flats almost pure or in a mixture with the typical Munga species of the flats. In both cases, the Mopane trees are of poor quality and small. In general, the canopy associates are *Acacia nigrescens*, *Combretum imberb*, *Lannea Stuhlmannii* and *Sterculia quinqueloba*. The only common small trees are *Erythrina abyssinica*, *Piliostigma thoningii* and *Pterocarpus antunesii*. Colonies of the succulent *Aloe chabaudii* occur also.

The Mopane woodland occurs in the Kafue flats almost pure or in a mixture with the typical Munga species of the flats. In both cases, the Mopane trees are of poor quality and small. In general, the canopy associates are *Acacia nigrescens*, *Combretum imberbe*, *Lannea stuhlmannii* and *Sterculia quinqueloba*. The only common small trees are *Erythrina abyssinica*, *Piliostigma thoningii* and *Pterocarpus antunesii*. Colonies of the succulent *Aloe chabaudii* also occur.

6.2.1.4 Munga Woodland

This open savanna type of woodland occurs in two forms; on shallow Kalahari sands over alluvium and on upper valley clays and clay loams. The Woodland is only found on a few small areas of Kalahari sands. It is characterized by widely spaced *Acacia* and *Albizia* spp. especially *Acacia albida*, *A. galpinii*, *A. gerrardii* and *A. giraffae*, *Albizia amara* and *A. versicolor*. Common associates are *Combretum imberbe*, *Commiphora karibensis*, *Ficus sycomorus*, *Kigelia africana*, *Lonchocarpus capassa*, *Parinari curatellifolia*, *Acacia nigrescens*, *A. polyacantha* and *A. sieberama*, *A. harveyi*, *Erythrina abyssinica*, *Erythrophleum africanum*, *Pericopsis angolensis*, *Pseudolachnostylis maprouneifolia*, *Pterocarpus angolensis* and *Terminalia brachystemma*.

The Munga shrub land is dominated mainly by *Combretum zeyheri* with height ranging between 1 and 2.4m. The other species are *Piliostigma thonningi* forming only about 1% of the Munga shrubland. This vegetation type provides important habitat for puku, waterbuck and warthog. It is found along the Kafue River basin and in the eastern part of Namwala GMA. Other small trees are chiefly *Combretum fragrans*, *Diplorhynchus condylocarpon*, *Markhamia obtusifolia*, *Piliostigma thonningii* and *Terminalia brachystemma*.

Common shrubs include; *Baphia massaiensis* spp. *obovata*, *Bauchinia petersiana*, *Grewia praecox*, *Phyllanthus reticulatus*, *Urena lobata*, *Annona stenophylla* spp. *nana*, *Clerodendrum uncinatum*, *Eugenia angolensis*, *Ochna leptoclada* and the *Pollichia campestris*. Climbers are *Combretum paniculatum* and *jasminum fluminense*.

Small trees are *Acacia kirkii*, *Combretum fragrans*, *Piliostigma thonningii* and *Terminalia mollis* associated with *Antidesma venosum*. *Combretum apiculatum*, *Dalbergiella nyassae*, *Diplorhynchus condylocarpon*, *Lannea discolor*, *Markhamia obtusifolia*, *phyllanthus engleri*, *pterocarpus rotundifolius*, *Terminalia brachystemma*, *T.stengstachya*, *Combretum elaeagnoides* associated with *Boscia salicifolia* and *Schrebera trichoclada*.

Shrubs are less numerous, the most common being *Baphia massaiensis* spp. *obovata*, *Bauhinia petersiana*, *Holarrhena pubescens*, *Hymenocardia acida*, *Phyllanthus reticulatus* and *Vangueria infausta*.

Other shrubs found in the study area are; *Annona stenophylla* spp. *nana*, *Disperma crenatum*, *Impomoea vernalis*, *Lannea edulis*, *Ochna leptoclada*, *Sphenostylis marginata* and *Syzygium guineense* spp. *huillense*, *Boscia mossambicensis*, *Clerodendrum capitatum*, *Dalbergia martini*, *Friesodielsia obovata*, *Maerua juncea* and *Ximenia Americana*. Climbers are *Bonamia specabilis*, *Combretum mossambicense* and *Maerua friesii* associated with *Capparis tomentosa*, *Hippocratea Africana*, *Impomea shirambensis* and *Tiliacora funifera*.

The only common emergent is *Lonchocarpus capassa*, an invader of long standing. Grooves of *Borassus* and *Hyphaene* palms occur in Munga woodland or Munga grassland (see figure 9 below) on the Kafue flats.



Figure 9 Palm trees common in Munga and open grasslands of the Kafue Flats

6.2.1.5 Kalahari Woodland

Both Kalahari woodland proper and Miombo/Kalahari woodland occur in two forms on the south bank. Kalahari woodland is dominated by *Burkea Africana*, *Brachystegia spiciformis*, *Erythrophleum africanum* and *Julbernardia paniculata*.

Common tall trees in Miombo/Kalahari woodlands include *Amblygonocarpus andogenensis*, *Baikiaea plurijuga*, *Combretum collinum*, *Guibourtia coleosperma*, *Parinari curatellifolia*, *Pterocarpus angolensis* and *Terminalia sericea*.

Small trees are *Diplorhynchus condylocarpon* and *Schrebera trichoclada* associated with *Baphia massaiensis* spp *obovata*, *Diospiros batocana*, *Ochna pulchra*, *Phyllanthus engleri*, *Pseudolachnostylis maprouneifolia*, *Terminalia brachystemma*, *Xylopi odoratissima* and *Zahna Africana*.

Common shrubs are *Bauhinias* spp., *Byrosocarpus orientalis*, *Cissus cornifolia*, *Copaifera baumiana*, *Diospyros virga*, *Eriosema affine*, *Friesodielsia obovata*, *Grewia* spp., *Hymenocardia acida*, *paropsia brazzeana*, *Salacia luebbertii*, *Vangueria infausta* and *Xeromphis obovata*. *Annona stenophylla* spp. *nana*, *Chamaeclitandra henriquesianna*, *Gardenia brachythamnus*, *Hemizygia bracteosa* *Parinari capensis*, *Phyllanthus maderaspatensis*, *Sapium oblongifolium* and *Triumfetta annua*.

Climbers are few in numbers and species. Only *Ipomoea shirambensis* and *Landophia parvifolia* are common.

6.2.1.6 Dry Deciduous Forest

The Dry Deciduous Forest is classified in three distinct forest types namely, 1) *Baikiaea*, 2) Secondary *baikiaea* and 3) *pteleopsis*.

6.2.1.6.1 *Baikiaea* Forest

Baikiaea plant community is in the south and south west of Lake Itzhi-Tezhi in the Kafue National Park and south of Ngoma Wildlife Station. This community is probably the most widely distributed.

The *Baikiaea* forest mainly consists of Mukwa (*Pterocarpus angolensis*) with a relative abundance of more than 80%. This species is known to be endangered. Other tall trees in this type of forest are *Baikiaea plurijuga* and *Pterocarpus antunesii*. *Lonchocarpus nelsi* occurs in moderate numbers. The common short trees include *Baphia massaiensis obovata* and *Combretum celastroides*.

Other species include terminalia which provide good habitat for common duiker and other small mammals. The height of trees ranges between 0.58 and 4.27 m and the diameter at breast height is between 1.5 and 60 cm.

The overstory is dominated by *Baikiaea plurijuga* and *pterocarps antunesii*. *Lonchocarpus nelsi* occurs in moderate numbers. The common short trees include *Baphia massaiensis obovata* and *combretum celastroides*.

Other common understory trees are *Acacia ataxacantha*. *Acalypha cylindrical*. *Alchornea occidentalis*. *Grewia avellana*. *Tarenna luteola*, *Citropsis daweana*, *popowia obovata*, *Waltheria indica* and *Triumfetta dekindtiana*. Forbs and smaller shrubs common are *Achyranthes aspera*, *plumbago zeylanica* and *Blepharis madaraspatensis*.

Common climbers include *Hippocratea parviflora* and *Baissea wulfhorsti*. Epiphytes are few.

6.2.1.6.2 Secondary *Baikiaea* forest

This community is mainly found southeast of the lake and near Ngoma Wildlife Station and along the southeast of KNP. This forest community is easily vulnerable to fire and heavy browsing especially by elephant (*Loxondota Africana*).

Tall tree species include *Burkea Africana*, *Combretum callinum*, *Eythropleum africanum*, *Lonchocarpus capassa*, *Acacia giraffae*, *A. galpini*, *Terminalia sericea*, *Baikiaea plurijuga* and *xeroderris stuhlmanni*. Common small trees include *Croton gratissimus*, *Markhamia obtusifolia*, *Accacia fleki*, *Combretum celastroides*, *C.psdioides* and *Terminalia brachystemma*.

Shrubs include *Barkinia macrantha*, *Combretum elaeagnoides*, *Acacia ataxacantha*, *Dalbergia martini*, *Grewia SPP*, *Hemizygia bracteosa*, *Disperma crenatum*, *justice betonicoides*, *Waltheria indica* and *Tepharosia cophalanth*. The common climber is *Combretum microphyllum*. Under story grasses are *Panicum spp*, *Setaria spp.* and *Sporobolus spp.*

6.2.1.6.3 *Pteleopsis* Forest

Pteleopsis Forest is common south west of the Lake Itezhi-Tezhi and along Musa stream that is on the south bank of the Kafue and a tributary of lake Itezhi-tezhi. The dominant tall tree species of this community include *pteleopsis mystifolia*, *p. antunesis*, *p. anisoptera* and *Entandrophragma caudatum*.

Common small shrubs are *Phaulopsis longifolia*, *Sancivieria deserti*, *Achyranthes aspera*, *Blepharis madaraspatensis* and *Dicliptera nemorum*. Climbers are *Bonamia spectabilis*, *Tiliacera funifera*, *Baissea wulfhorsti* and *Strychnos lucens*.

The dry deciduous forest is of very economic from the standpoint of browsing and under story grazing by wildlife especially elephant. The important tree species include *Baikiaea spp.* used for timber and wood fuel in adjacent areas to KNP. Some shrubs within this vegetation community are used for local medicines.

6.2.1.7 Termitaria

Miombo Temitaria

Termite mounds are widely distributed in Miombo woodland. Their flora is quite distinct from that of the surrounding Miombo. They are dominated by *Diospyros mespiliformis*, *Manikara mochisia* and *Mimusops zeyheri* associated with *Albizia amara*, *combretum molle*, *Euphorbia candelabrum*, *Markhamia obtusifolia* and *Ziziphus mucronata* spp. *rhodesiaca*.

Small trees are represented by the two *Boscias*, *B. angustifolia* and *B. salicifolia*, *euclea divinorum* and *Lannea discolor*. Common shrubs are *Hyrsoecarpus orientalis*, *Diospyros lycioides*, *eretia aeruginescens* and *Grewia flavescens*. The succulent bowstring hems *Sansevieria desertii* and *S.kirkii* are the only common subshrubs with *Capparis tomentosa* and *Carissa edulis* the only common climbers.

Munga termitaria

Termite mounds in the Munga woodland are characterized by *Albizia amara*, *Ficus* spp., *Lannea discolor* and *Markhamia obtusifolia* in the upper storey, *Cassine aethiopica* in lower storey. Undergrowth shrubs are largely *Acalypha chirindica* and *Clerodendrum tanganyikense*. Subshrubs *Aloe zebriana* and the *Achyranthes aspera*. Common climbers include *Capparis tomentosa*, *Glycine wightii*, *jasminum fluminense* and *J.streptopus* and *Turbina shirensis*.

The Munga termitaria woodland is found in valley areas which include the Kafue River basin. This type of vegetation attracts both grazing wildlife and livestock in GMA. The trees are also used as fuel wood.

6.2.1.8 Riparian Woodland

Riparian woodland occurs in a few places along perennial or even seasonal streams where there are still pools of water in dry season. The riparian woodland is dominated by *Syzygium guineense* spp. *barotsense*. Naturally there is a greater variety of species along the perennial Kafue River than along the seasonal streams.

Common tall trees associated with *Syzygium guineense* include *Acacia albida* (on riparian sandbanks), *Albizia glaberrima*, *Diospyros mespiliformis*, *Homalium abdessammadii* and *Syzygium cordatum*. In some places, *Syzygium guineense* and *S.cordatum* are replaced by a hybrid between the two species. Small trees are

represented chiefly by *Nuxia oppositifolia*, *Oncoba spinosa*, *Phoenix reclinata*, *Rhus quartiniana* and *Salix subserrata*.

Common shrubs include *Acalypha ornate*, *Antidesma venosum*, *Byrsocarpus orientalis*, *Diospyros lycioides*, *Mimosa pigra*, *Nidorella resedifolia*, *Phyllanthus reticulates*, *Sesbania sesban*, and *Phragmites mauritianus*.

Climbers are chiefly *Cissampelos mucronata*, *Glycine wightii*, *Jasminum fluminense*, *Mikania cerdata*, *Mucuna pruriens*, *Paullinia pinnata* and especially *Tacazzea apiculata*.

This vegetation community is important for river bank stability and grazing by a variety of wildlife species. In the GMA the vegetation is used by both wildlife and cattle grazing.

6.2.1.9 Grasslands

6.2.1.9.1 Dambo grassland

The Dambo grassland is a moderately dense mat of grasses and forbs. The grasses are perennial bunch grasses, cushion like or tussocky with *Luodetia simplex* as the dominant species. This grassland type is found along the Kafue River and its tributaries. Some of the grasses are perennial bunch grasses, cushion like or tussocky with *Luodetia simplex* as the dominant species (see figure 10 below).

6.2.1.9.2 Riverine grassland

The riverine grassland is composed of a narrow belt of *Hyparrhenia* grasses of many different species. Bunch grasses typified by *Loudetia simplex* cover extensive areas of the seasonally inundated flats.

6.2.1.9.3 Flood plain grassland

The flood plain grassland consists of a very uniform mat of perennial bunch grasses. Pure stands of a single grass are a feature. Reeds are the common aquatic plants of value to wildlife species and some species of fish.

Hyparrhenia rufa associated with *Setaria phragmitoids* and *S. ciliolata* are the typical grasses of shallow flooded margins, while *Echinochloa pyramidalis* and *Vossia cuspidate* are of the swamp areas where the flooding is deepest and most prolonged.

Grasslands in the area are important source of forage for grazers that includes; Zebra, Lechwe, buffalo, waterbuck, etc. Livestock especially cattle also depend on grasslands in the area.

All vegetation types in KNP are almost in pristine condition with little disturbances due to protection. However, vegetation in the GMA is disturbed by various uses by human inhabitants who are allowed to reside in the area. Vegetation in settlements is also highly disturbed due to harvesting for various uses such as wood fuel, charcoal burning and cultivated agriculture (see figure 11).



Figure 10 Typical dambo grassland in a dambo near the Kafue Flats



Figure 11 Trees, shrubs & grass between Nangoma & Mwembeshi settlements.

6.2.1.10 *Suffrutex Savanna*

These savannas have a distinctive shrub, sub-shrub, herb, sedge grass flora characterized by the presence of *Annona stenophylla* spp. *nana*, *Combretum platypetalum*, *Eugenia angolensis*, *Lannea edulis*, *Ochna leptoclada*, *Parinari capensis*, *Pygmaeothamnus zeyheri*, *Salacia luebbertii*, *Sesamum calycinum* and especially *Syzygium guineense* spp. *huillense*.

6.2.2 Fauna

6.2.2.1 Mammals

The Kafue National Park and surrounding GMAs have historically been known as wildlife areas. Over 20 large mammal species have been recorded in the KNP (Appendix 12.4). Aerial surveys were carried out in 1994 and 1997 that indicated declines in some animal species (table 8 below).

Table 8 Population estimates from aerial surveys of some large mammals in Namwala GMA in 1994 and 1997

SPECIES	TOTAL NUMBER PER YEAR	
	1994	1997
Sable	509	162
Eland	50	-
Kudu	174	162
Hart beast	323	112
Puku	211	49
Warthog	236	74
Impala	-	349
Oribi	-	49
C/Duiker	-	24
Hippo	-	213

Source: ZAWA

KNP has the largest variety of large wildlife species (see table 9 and 10 below) in the country (about 80% of all Zambian mammalian species are represented). These species are distributed through out the park. A list of total numbers of families, genera, species of mammals, birds, reptiles and amphibians known to occur or have occurred in the past are listed in Table 8 below (Ansell 1960, 1978). Table 9 shows habitat preference of some big mammals and predators in KNP and adjacent areas.

Dominant antelopes include Roan antelope (*Hippotragus Niger*), buffalo (*Syncerus caffer*) eland (*Taurotragus oryx*), wildbeest (*Connochaetes taurinus*), Zebra (*Equus burchelli*), impala (*Aepyceros melampus*), warthog (*phacochoerus aethiopicus*), waterbuck (*Kobus ellipsiprymnus crawshayi*), bushpig (*Potamochoerus porcus*), Common duiker (*Silvicapra grimmia*), Oribi (*Ourebia ourebi*), reedbuck (*Redunca arundinum*), Kafue lechwe (*Kobus leche* subsp.) (these species are found in Kafue flats below Lake Itezhi-Tezhi), puku (*Kobus vardoni*), hartebeest (*Alcelaphus lichtensteini*), bushbuck (*Tragelaphus scriptus*), and kudu (*Tragelaphus strepsiceros*).

Less frequent seen antelopes include Blue duiker (*Cephalophus monticola*) and yellow backed duiker (*Cephalophus sylvicultor*). These mammals are under protection due to their low numbers.

Other mammals of great importance to the park and internationally are elephant (*Loxodonta Africana*) (which is protected and hunting is not allowed) and the rare black rhino (*Diceros bicornis*) which is said to be on verge of extinction in KNP due to poaching. The exact numbers of the remaining rhino if there are any, is not known. Many schools of hippopotamus (*Hippopotamus amphibious*) occur along the Kafue River and in Lake Itezhi-Tezhi.

Vervet monkey (*Cercopithecus aethiops*) and Chacma baboons (*Papio ursinus*) are plentiful all over the park and adjacent areas. Some habitat preferences for large mammals are indicated in table 9 below.

Carnivores include lion (*Panthera leo*), leopard (*Panthera pardus*), Hyaena (*Crocuta crocuta*), Cheetah (*Acinonyx jubatus*) wilddog (*Lycoan pictus*) and jackal (*Canis adustus*).

Table 9 Families, Genera and Species of Fauna of KNP.

Fauna	Families	Genera	Species
Mammals	36	95	158
Birds	77	215	423
Reptile	17	50	69
Amphibians	4	17	35
Fishes	12	28	55

Source: Ansell 1960, 1978

Table 10 Habitat Preferences of some Big Mammals Predators in KNP Park & adjacent Areas (After Ansell, 1960, 1978)

Species	Open Woodland and savanna	Dense woodland and thicket	Grassland	Floodplain	Riverine
Elephant	Common	Common	Occasional	Occasional	Common
Zebra	Common	Rare	Common	Common	Rare
Impala	Common	Rare	Occasional	-	Common
Puku	Common	-	Common	Common	Common
Roan	Common	-	Common	Common	-
Sable	Common	Rare	Occasional	-	-
Hartebeest	Common	-	Common	Common	-
Reedbuck	Common	-	Common	Rare	Common
Oribi	Occasional	-	Common	Common	-
Warthog	Common	Occasional	Common	Occasional	Rare
Kafue lechwe	-	-	-	Common	Common
Wildebeest	Common	-	Common	Common	-
Sitatunga	-	-	-	-	Common
Kudu	Occasional	Common	Rare	Occasional	
Buffalo	Common	Occasional	Common	Common	Rare
Eland	Common	-	Occasional	-	-
Oribi	Occasional	-	Common	Common	Occasional
Common duiker	Common	Occasional	-	-	-
Yellow backed Duiker	-	Common	-	-	-
Blue duiker	-	Common	-	-	-
Waterbuck	Common	Occasional	Common	Rare	Common
Bushbuck	Rare	Common	-	-	Common
Hyeana	Common	Occasional	Occasional	Occasional	Occasional
Lion	Common	Occasional	Common	Common	Rare
Leopard	Common	Occasional	Occasional	Rare	Common
Cheetah	Common	Occasional	Common	Common	Rare
Wilddog	Common	Occasional	Occasional	Rare	Occasional
Jackal	Common	Rare	Common	Occasional	Occasional
Crocodile	-	-	-	Common	Common

6.2.2.2 Birds

Few studies on birdlife have been carried out in Namwala GMA. However, there are indications that the area supports a good number of bird species (Appendix 12.3). The miombo woodlands provide good habitats for terrestrial birds while the damp and plains support water fowls. The checklist includes species such as *Bubulcus ibis*, *Ceryle rudis*, *Ardea cinerea*, *Anhingarufa* spp, *Burhinnus vermiculatus*, *Plectropterus gambensis* and *Alpochen aegyptiacus*.

Other common waterbirds include: pelican (*Pelecanus onocrotalus*), Spurwing goose (*Plectropterus gambensis*) Wattled crane (*Bucconas carunculatus*) Crowned crane (*Bucconas regulorum*), Openbill (*Anastomus lamelligerus*), White faced tree duck (*Dendrocygna viduata*), Redbilled teal (*Anas* spp.), Yellowbilled duck (*Anas undulate*) and pygmy goose (*Nettion auritus*).

Upland birds include helmeted guinea fowl (*Numida meleagris*), Crested guinea fowl (*Guttera edouardi*), Scaly francolin (*Francolinus squamatus*), African fish eagle (*Haliaeetus vocifer*) and bateleur (*Terathopius ecaudatus*).

6.2.2.3 Reptiles

The Kafue River provides good habitat for a number of reptiles in Namwala GMA. The largest reptile in the area is the Nile crocodile, which is an important species for commercial purposes. Apart from crocodiles, other reptiles include snakes, water monitors, lizards, and tortoise. However, very little information is available on reptiles in the KNP and adjacent Lake Itezhi-tezhi area. Lizards are represented by Geckos, Cameleons and Skinks and Monitor Lizard (*Varanus niloticus*). Snakes are represented by Python (*Python sebae*), Boomslang (*Dispholidus typus*), Cobra (*Naja mosambica*) and puffadder (*Bitis arietans*).

Very little information is available on reptiles in the KNP and adjacent Lake Itezhi-tezhi area. The important reptiles in the area from qualitative information are crocodile (*Crocodilus niloticus*) common both in the Kafue River and Lake Itezhi-tezhi. Lizards are represented by Geckos, Cameleons and Skinks and Monitor Lizard (*Varanus niloticus*). Snakes are represented by Python (*Python sebae*), Boomslang (*Dispholidus typus*), Cobra (*Naja mosambica*) and puffadder (*Bitis arietans*).

6.2.2.5 Rodents

A variety of rodents occur in the KNP and Namwala GMA These includes Giant rat (see figure 12) (*Cricetomys gambianus*), *Tetra valida*, *T. leucogaster*, *Saccostamus*

campestris, *Pelomys fallax*, *Lemniscomys Griselda*, *Elephantulus brachyrhynchus* and *Petrodromus tetradactylus*. Family pedelidae is represented by spring hare (*Pedetes capensis*).



Figure 12 A giant rodent sunbasking outside the ZESCO guest house in Itezhi-tezhi

6.2.2.6 Fish

Fishing activities are significant in ITT because of the dam and the Kafue flats. In Mumbwa, Chibombo and Lusaka-West fishing activities are not so significant. People only catch fish from the rivers that are in the area. Most of the fish (figure 10 and 11) caught is for consumption and the little excess is sold. The common fish species in the area are; Dashtail barb (*Barbus poechii*), Straight fin barb (*Barbus paludinosus*), Redeye labeo (*Labeo cylindricus*), Striped robber (*Brycinus lateralis*), Silver catfish (*Schilbe intermedius*), Sharptooth catfish (*Clarius gariepinus*), Blunt-toothed barbel (*Clarius ngamensis*), Banded bream (*Tilapia sparmanii*), *Synodontis kafuensis*, *Limnothrissa miodon*, Thin-faced bream (*Serranochromis angusticeps*), Purple-face bream (*Serranochromis macrocephalus*), Green headed bream (*Oreochromis macranchir*), Three spotted bream (*Oreochromis andersonii*), Dwarf bream (*Haplochromis philander*), Bulldog (*Marcusenius macrolepidotus*), Silver catfish (*Petrocephalus catostoma*), Pike (*Hepsetus odoe*), Redbreast bream (*Tilapia rendalli*), Yellow-belly bream

(*Serranochromis robustus*), Brown-spot bream (*Serranochromis thumbergi*). Some common fish found in the area are shown in figures 13 & 14 below.



Figure 13 Common fish found in the area



Figure 14 Different types of fish found in Lake Itzhi-tezhi & the Kafue Flats Fishery

Green headed bream (*Oreochromis machrochir*), Three-spotted bream (*Tilapia andersoni*), Red breasted bream (*Tilapia rendalli*), Thin faced bream (*Serrachromis angusticeps*), Purple faced bream (*Serrachromis marcocephala*), Bulldog (*Marcusenius macrolepidotus*), Silver Robber (*Alestes laterallis*), Dot Tail (*Barbus poechi*, *Clarias ngamensis*, *Claria gariepinu*) and bottle nose (*Mormyrus lacerda*).

6.3 Socio-Economic

6.3.1 Population

The proposed transmission line project traverse will originate from Itezhi – Tezhi in the Southern Province. The line will traverse two other provinces, namely Central and Lusaka Provinces. In 2000, Southern Province had a population of 1,212,124 while Central Province had a population of 1,012,257. Lusaka Province (one of the most populous provinces) had a population of 1,391,329 in year 2000. Lusaka Province had the highest average population growth rate of 3.5% between 1990 – 2000 while during the periods 1980 – 1990, the growth rate was at 2.7%. The population of Southern Province grew at 3.2 % during the 1980 - 1990 periods and 2.3 % between 1990 and 2000, which were above the average national growth rates of 3.1% and 2.9% for the respective periods. The population of Central province declined from 4.2% in the 1980 – 1990 intercensal to 2.8% in 1990 – 2000 period; a decline of 33.3%.

The high rate of growth of the population in these Provinces could be attributed to the high rates of return migration from the Copperbelt Province. These Provinces may have also been affected by an inflow of people from the Copperbelt Province. The low economic activities on the Copperbelt in the mining sector which led to a shrink in employment opportunities. This meant that the number of people migrating to the Copperbelt in search of jobs declined and at same time some of the people who were retrenched from the mines could have opted to return to their districts of origin.

In the project area, according to the 2000 Census of Population and Housing, ITT had a population of 43,111 of which 22,170 (51.4%) were males and 20,941 (48.6%) were females and Mumbwa had 158,861 of which 79,066 (49.8%) were males and 79,795 (50.2%) were females as provided by the two District Hospitals. It is projected that the population of Mumbwa would increase by 2010. Chibombo District according to the 2000 Census of Population and Housing had population of 241,612 of which 121,948 (50.5%) were males and 119,664 (49.5%) were females while Kafue had 150,217 of which 77,001 (51.3%) were males and 73,216 (48.7%) were females respectively.

ITT, Mumbwa, Chibombo and Kafue Districts are still developing and are predominantly rural districts and the majority of the people live in villages. Most of the people in the

project areas are Ilas and Tongas by tribe. However, a small number of people in the project area originate from other parts of the country, but have assimilated and speak these languages.

The proposed line in Itezhi – Tezhi covers three wards, four wards in Mumbwa, one ward in Chibombo and one ward in Kafue District. The nine wards in the project area have a combined population of 60,851 (Table 110) according to the 2000 Census Report.

Table 11 Population of the project areas by ward, 2000

District	Constituency	Ward	Population
Itezhi - Tezhi	Itezhi - Tezhi	Banamwaze	1,685
		Itezhi - Tezhi	2,764
		Lubanda	4,860
Mumbwa	Mumbwa	Nambala	3,580
		Shimbizhi	14,909
		Nangoma	13,797
		Mwembeshi	2,186
Chibombo	Katuba	Muchenje	7,783
Kafue	Chilanga	Chinyanja	7,101
		Total Population	60,851

Source: Central Statistics Office (CSO), 2000 Census of Population and Housing, Preliminary Report, April 2001

6.3.2 Settlement Patterns and Traditional Authority

The project area stretches over four districts in which the four towns are planned and zoned into residential, industrial and commercial/offices areas. Houses are built in designated residential areas. Settlements in the rural parts of the Districts are organized in form of villages. A village is made up of many households living in a defined geographical area under the leadership of a village headman. A group of villages in a defined geographical area make up a chiefdom, which is headed by a chief. Village headmen report to the chief in their area.

In the project area from ITT, there are five Chiefs, namely: Chief Musungwa, Kaingu, Shimbizhi and Chilyabufu and Muwezwa through which the line will pass (see attached consent forms in appendix 12.1). There are several villages in the project area that include among others; Kilombe, Lubanda, Kasaka, Nyumba, Banamwaze, Kabanga and Nansenga.

In Mumbwa District the line shall traverse through, Chinuluma, Moono and Shakumbila Cheifdoms. There are many villages in the project area through which the proposed line

will traverse: Chibuluma, Nambala, Malata, Kasalu, Natani, Nangoma, Kapyanga, Mamvule, Susu, Katumpa, Shamusonde, Hamaundu and Situmbeko.

The villages in this area are many and scattered but mainly concentrated in places where there is a school or rural health centre. There are two predominant groups in the area, namely; Ila and Sala people.

The line also traverses through a few villages in the before and across Mwmbeshi River, namely, Mbosha, Mapulunga and Chitukuko. The villages on this section are few and scattered whilst most of the land is under leasehold and mainly used for commercial farming.

Settlement patterns in the urban areas of the project have well defined and designated townships where people live. However, dwelling structures in rural areas are mainly traditional (see figure 15) while some families have improved dwelling structures (see figure 16).



Figure 15 Typical common dwelling structure in project area (Lubanda)



Figure 16 Improved dwelling structure in Lubanda Village.

6.3.3 Local Economy and livelihoods

Farming is an important and most dominant economic activity in the project area with many people earning their living from farming and other associated activities such as farm produce trading. Agriculture is a growing activity of economic importance especially for cash crop farming such as cotton, sunflower and maize. The agricultural produce from both commercial and subsistence farmers are transported to markets in urban centres for sale. The local economy along the proposed route is predominantly agricultural, mainly subsistence farming. However, cattle keeping is a major agricultural activity in areas such as Lubanda and Banamwaze.

Based on interviews with people in rural areas, a simple activity cycle (table 12) could be drawn showing clear division of labour by gender. Men concentrate on tasks such as fishing and cultivation while women take on relatively lighter, but more tedious tasks such as planting after men have prepared the land, weeding, harvesting and processing the harvested crop.

Table 12 Activity Cycle

Month	Activity	
	Men	Women
November to March	Cultivation (making mounds/ridges)	Planting seed (maize, groundnuts, beans, sorghum, pumpkin)
	Sowing millet	Sowing millet
		Weeding
	Fishing	Process maize into flour for cooking nshima
	Collecting firewood	Collecting firewood
April to June	Harvesting groundnuts	Harvesting groundnuts
	Cutting trees for firewood which is used for cooking and warming themselves	Harvesting other crops (maize, millet, beans and sorghum).
	Fishing	Process maize into flour for cooking nshima
July and August	Cutting trees for charcoal burning	Finalizing millet harvesting
	Making bricks for house construction	Gathering dry tree branches.
	Gathering grass for thatching house	Process maize into flour for cooking nshima
	Gardening	
September and October	Usually it is a period resting as it few activities	
	Building or re-roofing houses	
	Making hoes and axes	
	Gardening	

Source: Field interviews April 2008

Apart from Agriculture, people in the project area are involved in fishing activities. The ITT dam and the rivers in the project area provide abundant fishing grounds. Most of the people especially in ITT who are not in formal employment rely on fishing as a source of income. Fish also provides a cheap source of protein. The fishermen in the study area rely mostly on gill nets and seines. Some traditional gear, such as baited lines and traps, are used but not extensively. Gill nets are used day and night, with mesh sizes from 32 to 127mm (1.25-5in). Fish traders transport most of the fish to town, mainly into Lusaka and Mumbwa for sale although some prefer selling locally (see figure 17). During the fish ban, fishermen leave their fishing camps and go to their homes and engage in other

income generating activities such as farming. In Mumbwa and Lusaka-West fishing activities are not as significant as in ITT due to the lack of big rivers.



Figure 17 Common preservation methods for fish and marketing system

The non-agricultural and non mining sector in the study area is also big and comprises mainly government institutions (civil service) and non-governmental organizations in all the districts. Tourism is also a growing economic activity, especially in ITT. There are several lodges and tourism sites in the KNP and ITT town. Mumbwa too has seen a fair share in tourism activities through the development of new lodges and guest houses.

Mining is also one of the growing economic activities with copper and gold mining going on at a small scale in Mumbwa district only. New projects planned in the Mining sector include the proposed establishment of a Cement Plant at Mulyango Village in Senior Chief Shakumbila's Chieftdom. New copper mines are planned in an area not too far (about 3km) from the proposed new substation in Mumbwa

6.3.4 Land Tenure

The land tenure system in all the districts that the line passes can be categorized into three, namely; leasehold, state and customary. The predominant land type is customary,

followed by state land and leasehold. The land allocation system is normally through traditional leadership with endorsement from local authorities. However, within council boundaries, land is under the control of the District Councils and developers who need land apply to Councils for land. The land in the outskirts of town is under the jurisdiction of traditional chiefs. The proposed transmission line will pass through traditional land, under Chiefs Kaingu, Shimbizhi, Chiliabufu and Muwezwab in ITT while in Mumbwa, it will pass through Chiefs Chilbuluma, Moono and Shakumbila. Towards Mwembeshi River, the line will pass through a short section in Chibombo District under Chief Chitande, Chieftness Mungule and into Chieftness Nkomeshya in Kafue across the Mwembeshi River.

The GMA, Forest areas and other protected land parcels are state land that is managed by various quazi and Government entities such as the Zambia Wild Life Authority and the Forestry Department. Leasehold title holders include farmers, agro processing industries, mining companies, non Governmental organizations such as churches and individuals.

The trend in land tenure system in Mumbwa and parts of Chibombo where the line passes is similar to the one in ITT. However, the trend tips more towards lease hold from Mwembeshi River to the substation in Lusaka West.

There are several Acts governing the administration of land, viz; Cap 292, 289, 288 for the allocation and alienation of land, Land Acquisition Act which provides for the compulsory acquisition of land and the Local Government Act (No. 22 of 1991) which provides for control of land by Local Authorities. Under the Land Act, land has been demarcated into categories, namely: state, local authority and traditional land. The traditional authorities (Chiefs) have rights over the traditional land, with a mandate to recommend to Government lease to those who want to acquire land.

6.3.5 Land use

Land use in the project area is broad and includes: dwelling, grazing, fisheries, hydropower scheme, conservation, agriculture, mining, tourism, industrial, commercial and service provision. In ITT for instance, the ITT Dam complex is for hydropower, while the GMA and KNP are for conservation and tourism. The area under the Local Authority is divided into residential, commercial, industrial and services (churches, schools etc). The flood plains are used for cattle grazing and fishing, while some sections in the rural areas some land is used for cultivation, social services (such as churches, schools etc) and housing. The trend in Mumbwa, Mumbwa, part of Chibombo and Kafue Districts where the line is proposed to pass, is similar. In urban and peri-urban areas, land is demarcated into three main zones, namely residential, office/commercial and industrial zones. Land use in each zone is strictly for the prescribed use appropriate for each zone.

In the rural parts of the Districts and its surrounding areas, commercial and subsistence farming is the major Land use. Simple hoes and machetes in the rural sections of the project are used in subsistence farming.

Some areas in Lusaka West are used for tourism, wheat production, tourism, growing of flowers and other high value crops.

6.3.6 *Protected Areas*

The transmission line project cover a distance of about 273km over which there are several protected areas on the line and or in the vicinity of the project area. For instance, the line will cross on the margins of the Namwala GMA located on the eastern side of Kafue National Park (see figure 18) as it comes out of the switch yard at the proposed ITT hydropower station. The Namwala GMA lies between Longitudes 25°56'53.736"E and 26°52'413"E and Latitudes -15°16'59.3"S and -15°49'31.11"S. The GMA is found in the Itezhi Itezhi District of Southern Province and covers an area of 3,600 Km². The main access route to Namwala GMA is the Itezhi-tezhi –Mumbwa Road (D769). The Namwala Road can be used during the dry season to access the GMA from its southern boundary. Air transport provides access through Ngoma airstrip located approximately 30 kilometers from the GMA. The GMA can also be accessed by water using boats.

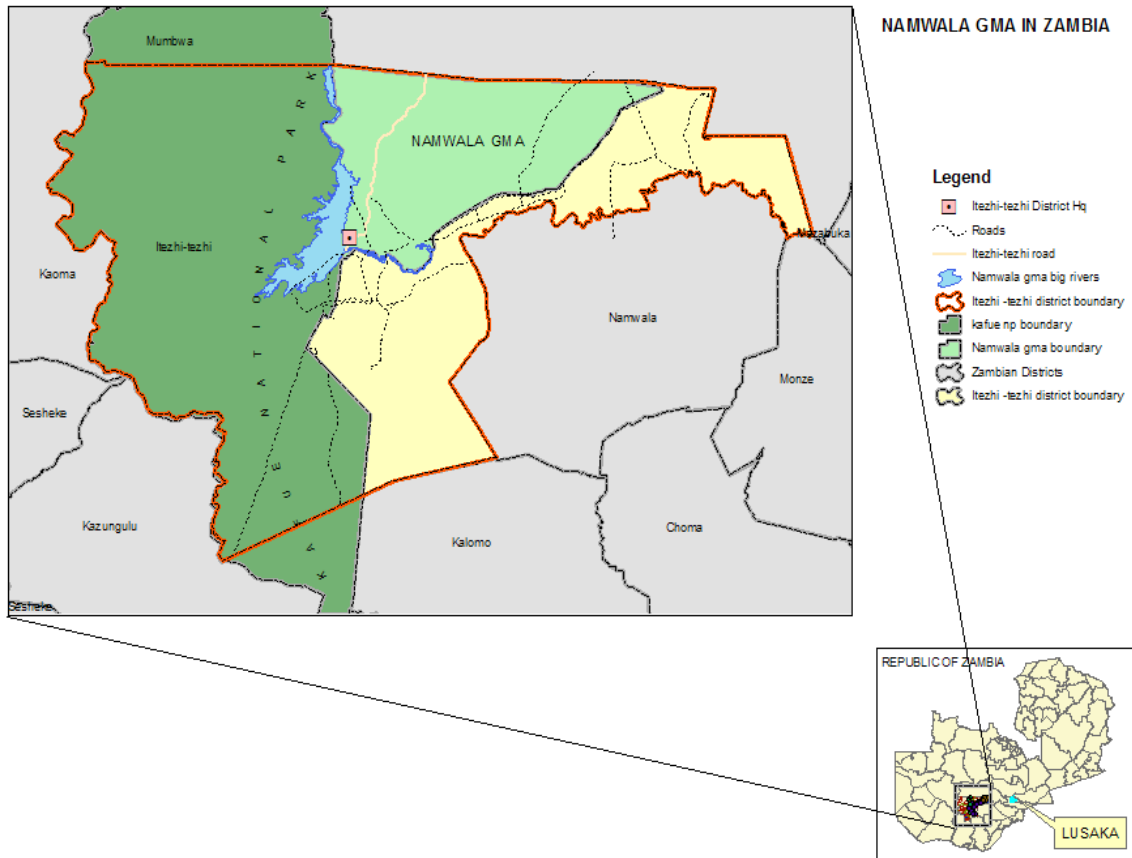


Figure 18 Location of Namwala GMA in Itezhi tezhi District

The GMA is bordered by the Kafue River on the south for about a quarter of its length and an open area for the remaining three quarters of its southern boundary. The Mumbwa GMA forms the entire length of the northern boundary of Namwala GMA. The Kafue River flows into Lake Itezhi-tezhi on the western side of Nawala GMA. On the northeastern boundary, the Namwala GMA meets the Kafue Flats GMA which is an important Ramsar wetland site.

The Namwala GMA consists of 3 chiefdoms namely, Chilyabufu, Kaingu and Shimbizhi. The Chilyabufu Chiefdom is located in the eastern part of Itezhi-tezhi District. It borders with 7 other chiefdoms namely Shimbizhi, Kaingu, Mulendema, Muwezwa, Mungaila, Mukobela and Chibuluma. The Kaingu Chiefdom is located in the northern part of Itezhi-tezhi District and shares boarders with other chiefdoms including Kabulwebulwe in the north, Musungwa in the south-west, Shimbizhi in the south and Chilyabufu in the east. The Shimbizhi Chiefdom is located in the central part of the district and shares boarders with other chiefdoms including Chilyabufu in the east, Kaingu in the north, Musungwa in the southwest and Mukobela in the southeast.

Mumbwa District also has a number of protected areas such as National Parks, Forestry reserves and Burial sites. Parts of the North and South of the Kafue National Parks are in Mumbwa District. The game parks in Mumbwa are Chunga North, Ngoma South, Blue Lagoon and Lunga. The district also has Forestry reserves namely Nambala, Sanje, Kawena, Mumba, Musi Ngashe, Lusale, Luba North and South and Kasanga.

There are no known protected areas towards Lusaka West substation. The area is predominantly private farming area.

6.3.7 Agriculture

Agriculture is the main activity in the study area. However, in rural areas, agriculture is still at subsistence level. In ITT for instance, main agricultural activities include cultivation of crops such as maize, groundnuts, various millets, some cassava, cotton, sunflower and other crops. The main agricultural activity of economic value is cattle keeping (see figures 19 and 20).



Figure 19 Sunflower field in Mapulanga Village

In Mumbwa, parts of Chibombo and Kafue Districts, agricultural activities include: crop production (Maize, sunflower, groundnuts and cotton among others). In Mumbwa there is a cotton ginnery that provides ready market for cotton. Other crops grown in these areas include sunflower, millet, cassava, sweet potatoes and groundnuts. There is very high potential for growth in the agricultural sector in these districts.

Animal husbandry is another significant agricultural activity in these areas. The predominant livestock kept are cattle (figure 20), sheep, pigs, chickens and goats. However, in Lusaka West, there are some game ranches that have a variety of wild animals like Kudu, Giraffe, antelopes, bush pigs, zebra, Puku, Impala among others.



Figure 20 Cattle grazing in Banamwaze Village on the edge of the Kafue Flats

6.3.8 *Planned development activities*

In ITT, the newly established local authority has come up with a development plan for the Council area that includes zoning off the area into residential, commercial and industrial. Plans are under way to put up a community radio station and new lodges. The district is also poised to get a face lift when ZESCO implements the new water works and the construction of a new power station at ITT Dam.

Mumbwa district has seen an increase in mining prospectors and agricultural entrepreneurs in the newly opened up Mumbwa Concession B. Planned developments in mining include copper, cement, gold and other minerals. Other planned developments are in the social sector; plans to build office blocks, residential houses, guesthouses, recreation clubs, upgrading of schools and other social facilities.

In the vicinity of Mwembeshi River into Lusaka West Substation, new developments include water harvesting (dam construction), agricultural expansion (wheat and maize), tourism (improvements to game farms) and mining (mainly for limestone). Most of these developments are being spearheaded by individual land owners in the project area.

6.3.9 Employment

In all the districts where the transmission line is proposed to traverse, the main employers are; the Civil Service (Government) such as Teachers, Health workers, Community Development Officers, Social Welfare Officers, Agricultural Extension Officers, Police Officers, Immigration Officers, ZESCO workers, Zambia Wild Life Authority Officers (ZAWA), Zambia Telecommunication Cooperation (Zamtel), Municipal Councils, private sector driven especially, Transportation, Telecommunication, Local Authorities and NGOs.

Farming is the most common occupation in the rural areas on the proposed line route. During the farming season from October to February people are engaged in cultivation to earn some income for their families. After harvest most people get involved in agricultural produce trading. However, due to the proximity of the KNP and Namwala GMA, tourism also contributes in employment opportunities. New employment opportunities are emerging in the agriculture and mining sectors.

6.3.10 Infrastructure and Social Services

The districts of ITT, Mumbwa, Chibombo and Kafue all have road infrastructure and services such as telecommunication, shops and schools among others. There are small shops in the project areas where limited stocks of groceries and other small household commodities are sold. However, Television, Telephone and GSM mobile coverage as well as Banks and big shops are there in the districts. The schools have social clubs like football, netball that contest with other schools and village teams seasonally.

The towns are linked to the rest of the country and the world by microwave satellites provided by the Zambia Telecommunications Corporation (ZAMTEL). Communication to the rest of the country and the world through the internet is feasible and available. In some rural parts of where the transmission line will pass, however, these facilities do not exist. Only a few rural health centres have radios for communication. The rural areas have access to radio, although only few households have radio receivers and a few selected places have mobile network in the project areas. The trend is however, changing since many people have access to satellite television powered using home solar systems.

Most of the goods and services are provided by the modern sector at ITT town. Goods provided are mainly household commodities such as groceries. Other goods, such as electrical appliances and agricultural inputs, have to be bought from Lusaka and Mumbwa.

6.3.11 Water supply, Sanitation and waste management

The established towns of ITT, Mumbwa including Chibombo have municipality water and waste management services. Some of the the services are provided by utilities such as ZESCO (see figure 21 below). In villages and households along the proposed line route have traditional waste pits for waste management. In Itezhi-Tezhi the municipality is also assisted by ZESCO on collection and disposal of domestic waste.



Figure 21 Water pumping station for the water treatment plant at Itezhi-tezhi

6.3.12 Health

There are a number of health facilities available in the four Districts. All the Districts have a general hospital which acts as a referral hospital to all the rural health centres scattered in the Districts. The ITT District Hospital caters for people in ITT town with the bed capacity of about 54 beds in 7 wards and 11 rural centres that include: Banamwaze, Lubanda and Kaanzwa along the transmission line route. Mumbwa District Hospital also carters for the people in the District with approximately 80 beds spaces and 28 Rural Health Centers which are under the District Hospital's Administration. Other health

centres in the district include: Nangoma Mission Hospital, Kabwanga RHC, Kaindu, Nampundwe, Luili, Mumbwa Urban, Mukulaikwa, Shabasonje, Kapyanga, Mwembeshi, ZAF, Keezwa, Muchabi, Nangoma HAHC, Prisons, Nakanjoli, Lutale and Nambala. Chibombo and Kafue also have District Hospitals to cater for the Districts, including several rural health centres in outskates. However, most people in the project area in Chibombo and Kafue seek medical attention either in Mumbwa or Lusaka respectively since they are nearer to the two towns. Other health facilities such as Lubanda, Banamwezi and Nansenga (see figure 22) exist along the route line but are, however, inadequate forcing some people to walk long distances to seek for medical attention and treatment



Figure 22 Nansenga Clinic in Muwezwa Chiefdom

The most common diseases in the project area are malaria, diarrhea (non-blood), respiratory infections (non-pneumonia) and sexually transmitted infections (STIs), upper respiratory, eye infection, skin infection, T.B, acute abdominal like appendicitis. The project area has no history of cholera and typhoid. Dysentery is quiet rare and occurs during the hot and dry seasons in some areas.

6.3.13 Education

The four Districts have many institutions of learning which provide education to the residents. ITT has one high school namely ITT High School while Nansenga Basic School is being upgraded to a boarding school. ITT has also has 49 basic schools and 21 community schools. The majority of these schools are concentrated in the rural areas and few in town. Combined enrolment for basic and primary schools was 13,638 of which 6,920 were boys and 6,728 were girls, representing an almost 50-50 enrolment sex ratio. Pupils who make it to grade 10 in ITT and the surrounding schools go to ITT Hill School while some are sent to Namwala. Some of the rural schools in the study area in ITT include: Baanga, Banamwaze, Kabanga, Lubanda, Mauluzhi, Nansenga and Kasaka,

Mumbwa District has two secondary schools namely Mumbwa and Nsanje secondary school. Nambala upper basic school is being upgraded to a full secondary boarding school. There are many basic and primary schools scattered throughout the district. Primary schools are currently adequate, but there is need to build some more to cater for anticipated increase in demand for school places as the population increases. Chibombo and Kafue also have High Schools to carter for the Districts, including several primary and basic schools in outskates.

Educational facilities exist along the route line but are, however, inadequate forcing some people to walk long distances especially that all the secondary schools are concentrated in towns and none in the project areas.

Staffing in the rural schools (see figure 23 below) in the districts is generally low as many teachers, especially female teachers, shun rural areas and prefer to work in urban areas.



Figure 23 Nansenga Basic School in Muwezwa Chiefdom

6.3.14 Industries

The section of the four districts where the proposed transmission line will pass, have very few industries. Many of the industrial activities are small scale like household food processing (grain threshing and milling) and light metal fabrication. Mumbwa district has a cotton ginnery while the line section in Kafue district has a number of upcoming quarry plants like Lions Group Company and Giacomini Zambia Branch.

6.3.15 Transport

The proposed transmission line is passing through rural areas where most people use various forms of transportation (ox carts, bicycles, open vans, motor cycles etc) and buses for public transport for long distances. For short distances, walking, cycling and motor cycling is common. In urban centres however, the trend is different in that some people own vehicles or use employment related transportation while public transport include buses and taxis.

6.3.16 Minerals / Mining

Mining is an important activity in Mumbwa District while there is little mining activities (for sand for construction mainly) in Itezhi-Tezhi. Minerals mined include copper, cobalt, and gold. The most prominent mine near the line route in Mumbwa is Luri Gold mine located south of the cotton ginnery. Precious stones are also mined by small scale miners. Mining activities in Lusaka West include quartzite stones (used to make flat stones and ceramic tiles) and sand for building.

6.3.17 Tourism

The transmission line project traverses through Itezhi tezhi and Mumbwa Districts that are generally tourism districts. The KNP that is located in both districts, attracts a substantial number of tourists annually. Some of the most famous lodges in Itezhi tezhi are Musungwa, Ngoma and New Kalala. These areas have abundant wildlife and are of high scenic beauty. Tourism therefore, has a lot of potential for expansion in these areas. For instance the Game management areas are important for safari hunting by clients from overseas (important income generation activity).

Other tourist attractions within Itezhi tezhi district include animal species, the Kafue River system, Mayovu trees (cultural value), the portion of the Kafue River flowing through the GMA has exceptional islands and ox-bow lakes, important hot springs (Mabiya and Kasambangole), Heritage sites (ing'anda isweka buchi, ibwe lyamalende and mwandiwa leza caves), important fishing grounds (Yongwe and Banamwaze) and the Itezhi-tezhi dam. These areas would attract more tourists if the dilapidated access roads are repaired and more marketing and advertising is carried out.

The short section through which the transmission line traverses in Chibombo District does not have any major tourist attraction. In Lusaka West, tourism through game ranching and game cropping is a growing sector.

6.3.18 Recreation

In ITT, ZESCO provides some recreation facilities such as a club and sports facilities. Football is the most popular sport. Boating and sport fishing (mainly as part of tourism packages) are also common on Lake Itezhi Tezhi. New facilities for recreation are opening up in townships within ITT. In the villages, recreation is provided through localized celebrations, sports, beer drinking and traditional ceremonies. In Mumbwa, recreational facilities are similar through with night clubs, hotel and new lodges. The line section through Lusaka West in Kafue has game ranches for recreation, some pubs and social clubs) while the short segment in Chibombo has mainly traditional pubs along road M8.

6.3.19 Archaeological and Cultural Heritage

In order to ascertain the heritage resources present in the project areas, the National Heritage Conservation Commission Register was used to conduct a heritage assessment survey in the areas. Based on the register the findings of the areas are discussed in the sections below.

The National register Archaeological and other sites in Zambia, reviewed that within the project area of Mumbwa, there are 4 sites for Later Stone Age, 3 sites for Later Iron Age, 1 site with a combination of Later Stone Age, Later Iron Age and Sangoan, 1 site for Middle Stone Age and Sangoan, 1 site with a combination of Later Stone Age and Later Iron Age and 2 sites of colonial heritage importance. The Iron Age people used to smelt iron to make tools for farming and weapons for hunting and fighting.

These sites however, are outside the study area and hence will not be affected by the proposed line and the other Districts don't have any Cultural Heritages.

There are no old or new graveyards sited in the project areas during the survey.

Although ITT dam is not a gazetted national monument, it is an important natural heritage in ITT and the surrounding areas. It is located in an area with undisturbed vegetation. It contributes to the scenic beauty of the area especially during the period high flows (rainy season) when the falls is more pronounced. There are no Natural Heritages in the other Districts.

7.0 POTENTIAL IMPACTS

This section of the report mentions and outlines the anticipated interactions (impact) of the project with the physical, biological and socio-economic environment and resources on the transmission line. Many of the effects of the project may be secondary benefits, such as improved and reliable power supply for grid extension to new mining and tourism schemes that are not part of the primary objective of the project.

Project effects are separated into direct (or primary) effects, from direct interaction of some component of the project construction activities with one or more environmental resources, and indirect (or secondary) effects, which arise from the primary effects. For example, bush clearing shall cause loss of vegetation in the way-leave. Improved power supply could lead to grid extension and subsequently electrification of some rural health centres and schools with indirect indirect (or tertiary) benefits of improved service delivery.

The main objective of assessing the potential impacts of the project therefore, is to allow for planning of actions to prevent or reduce undesirable negative impacts at whatever stage of the project these may be predicted or anticipated. Also, it may be possible to identify actions to enhance the secondary benefits of the project, through a programme of resource management and or design modification.

7.1 Physical Environment

7.1.1 Location

The proposed transmission line project location is outlined in section 6.1.1 above. However, in areas where the proposed line route is through planned developments such as irrigated agriculture, mining operations that may be challenging in terms of access, line deviations shall be permitted. Any such deviations therefore, could impact on different physical, biological and socio-economic environment over the deviated section.

7.1.2 Climate

The climate over the four districts where the proposed line traverses experience three distinct weather conditions which is subtropical continental and can be classified into three seasons: with a cool dry period April to August; hot and dry from September to November and a cool wet season from November/December to March. Vegetation removal may have some minor effect micro and localized climatic change. However, it is

unlikely to cause any shift in the weather pattern because most of the sections of the line route are open grassland, denuded open forest and cultivated. Only a small section of a protected forest reserve near Mumbwa may be affected over a short (about 4km) segment. This will have little or no effect on local climate.

7.1.3 Topography

The proposed transmission line route avoids many hills in the project area. However, low level undulation areas may be affected due to use of heavy construction equipment and bush clearing (for way-leave) and hence be susceptible to water induced soil erosion when the area is opened up.

7.1.4 Soils

The proposed transmission line will traverse through several different soil types. Sections with sandy soils such as east of ITT town, north of Lubanda and some areas around Banamwaze may be susceptible to soil erosion due to machine disturbance during line construction. Upland soils around Mumbwa may be subjected to water erosion in some steep slopes after disturbance from foundation excavations and use of heavy construction equipment.

7.1.5 Geology

The geology in the line route and subsequent different soil formation shall require use of different construction methods for foundations. Blasting and drilling may cause rock movement and breakages therefore, disturbing the general geology in localized areas and spots. However, such disturbance shall be confined to the construction period only.

7.1.6 Hydrology

The transmission line will cross the Kafue River once and over many streams into Mumbwa and then Lusaka West substation. Use of construction equipment for materials haulage, access road construction and during maintenance of the transmission line could cause stream bank erosion. Over the Kafue River crossing however, use of water transport will be required. This may cause water pollution due to use of fuels and lubricants.

7.1.7 Seismicity

Seismicity is normally experienced around ITT dam from the time the dam was constructed. However, blasting may induce minor localized earth movements though this may not be of similar magnitude as the frequent low intensity seismic activities with occasional larger events being experienced occasionally at ITT. Use of dynamite (and other explosives) around Lusaka West substation may induce localized earth shaking and may be with some movement during line construction.

7.1.8 Significant pollutant sources

The transmission line project construction period may cause pollution due to construction camp sites and contractor's workshops that may produce significant wastes such as human waste, construction waste and general household wastes from consumption.

7.1.9 Wetlands

The transmission line shall have few towers located in the Kafue Flats and some dambos with localized effect on tower spots. The line shall not cause significant changes since the construction activities shall not involve damming, nor will it cause obstruction to wildlife and fish migration to water and spawning grounds.

7.1.10 Water Quality

The ITT hydropower project and its associated transmission line system construction activities may cause water pollution downstream of the ITT dam. Construction activities over rivers, streams and dambos may cause water quality deterioration if done during the wet season. Lubricants and fuel leakages from construction equipment may cause water pollution during construction.

7.1.11 Air Quality

The air quality may change due to pollution from construction equipment and soil pulverisation during the construction phase of the line. Blasting and drilling for foundations in rocky areas will produce localized air pollution during construction. Industrial activities that may arise from the provision of electricity such as in factories for various processes, especially towards the substation in Lusaka West, may also contribute to air pollution in the study area.

7.1.12 Noise

The construction of a transmission line from ITT to Lusaka west will involve use of heavy duty and noisy construction equipment. Blasting, drilling and use of vehicles during construction shall cause noise pollution. However, during line operation and annual maintenance, no such noise shall be experienced.

7.1.13 Visual Impact

The two types of towers that shall be used shall cause visual protrusion on the line route. The double circuit towers and self supporting Guyed Vee towers shall be of a particular height in order to meet the minimum ground clearance as required by applicable national, regional and international standards. This is above most tree lines especially in the Kafue Flats hence will stand out against the background environment.

7.1.14 Project implementation activities

Construction phase

Construction activities on the project shall require construction materials such as construction steel, sand aggregates, cement and skilled, semiskilled and unskilled labour. Construction materials not available in the area may be trucked in from distant places causing dust pollution and excavation pits. Labour influx and its associated vices such as introduction of diseases, poaching etc shall be experienced. The line project is also in sparsely settled rural areas and may cause disturbance to the lives of local people, by competing (with project labour) for resources, such as fuelwood, drinking water, and health facilities.














Noise pollution from drilling, blasting, excavations and other mechanical construction activities shall be experienced during this period.

Operation Phase

The principal effect of the transmission line project on rivers, streams and dambos will be water system disturbance or pollution when crossing using vehicles during annual maintenance, line inspection patrols and during bush clearing. Bush clearing in way-leaves shall entail reduced plant growth and soil exposure to erosion.

A summary of anticipated impacts on the physical environment is given in table 13 below.

Table 13 Summary anticipated impacts on the physical environment

Physical feature	Very High	Significance of Impact	
		High/Marginal	Low
Location		 Less than 20% line changes	
Climate			 Not sigificant
Topography			 In few steep slopes for access
Soils			 Light soils in few areas
Geology	 Blasting at few spots at construction		
Hydrology			 Limited to banks
Seismicity	 Blasting at few spots at construction		
Significant pollutant sources			 Confined to temporal camp sites
Wetlands		 Few sections of the KF, & dambos	
Water quality			 Limited to construction period
Air quality		 Localised during construction	
Noise		 During construction only	
Visual Impact	 Towers shall be highly visible		

7.2 Ecological Environment

This section covers aspects of the biological environment (flora and fauna) that will be impacted by the project.

7.2.1 Flora

7.2.1.1 Open Forest and wood lands

The construction process of a transmission line includes bush clearing among other activities. A way-leave size of 50 m wide (25m from the centre of the line on either side) will involve cutting down of trees hence further opening up the open forest with grass. Plant species heterogeneity may be affected and subsequently affect both grazing and browsing animals. Way-leave clearing will compound the pressure on vegetation hence increase vulnerability of soil to degradation in open forest areas.

7.2.1.2 Wood lands

The woodlands through which the transmission line will traverse include: Mopane, Munga, Kalahari, Dry Deciduous and Termitaria. In all the vegetation types described, bush clearing for way-leave will be inevitable. Deliberate fires could be started by construction workers there by compounding the vegetation regeneration.

7.2.1.3 Riparian Wood land

The proposed 291km transmission line will cross the Kafue River with its various river and stream tributaries. Bush clearing for way-leave establishment shall be inevitable in such crossing points. Riparian woodland that occurs in a few of these crossing points along perennial and seasonal streams will be cut. Dry vegetation from cut trees in way-leaves will be prone to wild fires that could be deliberately started by construction workers.

7.2.1.4 Grasslands

The proposed transmission line will traverse through dambo grassland, riverine grassland and flood plain grasslands *Hyparrhenia* and other tall grass species will be slashed during bush clearing for survey and construction works. Dry grass is prone to

bush fires that could further cause damage to grasses outside the designated way-leave areas.

Generally, Vegetation removal may induce soil erosion in some section on the line route. Some animals may lose their habitat or browsers may lose their source of foliage. In woodlands such Miombos that are suitable bee habitats, some beehives may also be disturbed by the clearing of vegetation in the proposed way-leave.

7.2.2 Fauna

The transmission line route is envisaged to be constructed along the old GMA fence in ITT and will traverse open areas and some settlements in other areas. It is anticipated that construction activities will have impacts on fauna.

7.2.2.1 Mammals

The way-leave for the proposed transmission line could open or truncate some migratory routes for wild animals from the GMA and KFNP such as Elephants and antelopes. However, open areas under the way-leave could provide new grazing grounds for other animals, especially antelopes such as Roan antelope (*Hippotragus Niger*), buffalo (*Syncerus caffer*) eland (*Taurotragus oryx*), wildbeest (*Connochaetes taurinus*), Zebra (*Equus burchelli*), impala (*Aepyceros melampus*) and some Common duiker (*Silvicapra grimmia*) that are prey to carnivores. Carnivores such as lion (*Panthera leo*), Hyaena (*Crocota crocuta*) and Cheetah (*Acinonyx jubatus*) could colonise these new open areas as they follow the prey.

7.2.2.2 Birds

The transmission line will traverse through a short section of the KF where some migratory birds gather periodically. Some of these birds may get electrocuted by the power line once it is energised. Bird collision with conductors could also occur in migratory routes. Bird nets may be disturbed during the clearing of vegetation for way-leaves and may lead to the damage of eggs or newly hatched chicks.

7.2.2.3 Reptiles

Construction activities across the Kafue River and streams may disturb reptiles such as crocodiles due to use of equipment such as motorised boats when striding across the rivers. Small reptiles such as Geckos, Cameleons, Skinks and Monitor Lizards (*Varantus*

niloticus) and snakes may lose habitats during foundation excavations. Some could be killed due to use of heavy duty construction equipment.

7.2.2.4 Rodents

Foundation construction on the line could disturb habitats for small rodents such as rats and cane rats, especially in the KF and dambos.














7.2.2.5 Fish

The provision of firm and stable power supply to ITT where fishing activities are significant will be of benefit through preservation (refrigeration) of fish caught for consumption and sell. However, construction workers may resort to unlicensed fishing activities and methods that could be detrimental to fisheries in streams and dambos.

Generally, there is high potential impact of the work force on wildlife that could be through illegal hunting in KNP, game management area and in open areas, especially in areas where Game Scouts or Wardens already face challenges and are unable to prevent poaching by people living around the these areas. In some cases, foreign nationals on the project may bring in firearms for purposes of sport hunting or illegal hunting.

A summary of anticipated impacts of the biological environment is given in table 14 below.

Table 14 Summary of anticipated impacts on the biological environment

Biological feature	Very High	Significance of Impact	
		High	Low
Open forest & woodland		 Short distance	
Woodlands		 Moderate due to human settlements	 Not significant
Riparian woodland	 High in some localized crossing points		
Grassland			 Not significant
Mammals	 Anticipated high due to poaching		
Birds			 Minimal except due to poaching
Reptiles			 Not significant
Rodents		 Few sections of the KF, & dambos	
Fish		 Moderate in sections near rivers	 Limited to construction period

7.3 Socio-Economic

7.3.1 Population

The proposed transmission line project traverse will traverse over 273km through three districts. The line could trigger an influx of people seeking employment in the project. This influx could cause social distress in these communities especially in rural areas.

7.3.2 Settlement Patterns and Traditional Authority

The project area stretches over four districts in which some settlements shall be affected and relocation may be required. In ITT district, one home stead at Lukomezi River crossing point (belonging to Felix Mwangala) shall be affected. In Mumbwa district, one family for Joe Mwemba in Katumpa Village near the proposed substation may be relocated for safety reasons. About five other settlements between Mumbwa Substation and Mwembeshi River may be affected depending on the final line alignment after detailed survey works are completed.. Affected households due to line realignment are likely to be in Nachibila area (John Sinyinda's in Nambulwe Village) and around Mabula Community School into Situmbeko and Fumpa Villages. Near the Lusaka West Substation, three other households for Mr. Benard Munkonde, Mr.Eucredy Milimo and Mr. Jordan Kanyimbo will be affected.

Implementation of the project in various Chiefdoms shall not alter nor undermine Traditional Authority. The provison of reliable electricity shall enhance settlement patterns as planned by local authorities in the project area. Power provision to designated industrial, residential, commercial and farming blocks shall enhance development of such areas.

7.3.3 Local Economy and livelihoods

The transmission line traverses through areas where fishing, farming, mining, trading and tourism are some of the important economic activities. The provision of reliable power supply will enhance the development other above mentioned sectors. The resulting employment opportunites shall enhance improved income levels and subsequently improve livelihoods of local people.

7.3.4 Land Tenure

The land tenure system in all the districts that the line passes is predominantly customary while some sections are on leasehold and some state land (forest reserve

and the GMA). The way-leave acquisition for the transmission line shall not entail conversion of land into a different land tenure system. However, the land for the proposed substation in Mumbwa shall be converted from customary to leasehold.

7.3.5 Land use

Land use under the transmission line shall be restricted to activities such as animal, grazing, growing of low crops (but not under irrigation) and access (traversing). The provision of reliable power supply in the project shall enhance land uses such as tourism, mining, agriculture (especially production of high value crops such as wheat and flowers for export).

7.3.6 Protected Areas

The proposed line will traverse through the border of the Namwala GMA and settlements in Itezhi tezhi and a small Government reserve (between Sanje Forest Reserve in the north and Nambala forest reserve in the south) in Mumbwa. The presence of heavy machinery and vehicles on the margins of the GMA may scare away some animals and may disturb habitats for small animals. The clearing of vegetation in some areas may also induce soil erosion and endanger some insect life.

The clearing of trees within the forest reserve in Mumbwa could lead to loss of some plant species and may also induce soil erosion.

The clearing of the wayleave along the game fence will have a positive impact in that it will create an access road for ZAWA officers to easily patrol and carry out other operations within the GMA

7.3.7 Agriculture

Cultivated agriculture and animal husbandry are significant agricultural activities in the project area. Agricultural activities under the line in the way-leave shall be restricted for safety reasons. However, it is anticipated that the provision of reliable power in ITT, Mumbwa and the national grid shall enhance agricultural activities such as irrigated agriculture and agro-processing.

7.3.8 Planned development activities

The provision of reliable power supply in ITT for instance shall enhance the implementation of the development plans (in the zoned off areas for residential, commercial and industrial) and social amenities such the community radio station, new lodges and new water works and the construction of a new power station at ITT Dam.

Mining prospecting for minerals such copper, cement, gold etc in Mumbwa and the Mumbwa Big Concession farming block shall be supported by the hydropower from the proposed transmission line.

Planned new developments such as agricultural expansion, tourism and mining in Luska West shall be supported by availability of reliable electricity supply from the proposed transmission line.

7.3.9 Employment

The magnitude of the transmission line project shall entail creation of employment opportunities for both unskilled and skilled labour in the local communities. It is envisaged that during annual bush clearing, the contractors will create employment for locals in their respective sections on the transmission line.

7.3.10 Infrastructure and Social Services

Electricity provision is seen as one of the key ingredients to economic development in rural districts. The proposed transmission line project and its associated distribution lines in ITT and Mumbwa, is envisaged to enhance social service delivery: health care, telecommunication, social clubs, trade and commerce. Infrastructure development in mining and agricultural processing is likely to develop due to availability of power in places like Mumbwa.

During construction however, there will be disturbance on access roads and main truck roads where the line will cross. For instance, traffic on main roads will be stopped periodically to facilitate line stringing across such sections.

7.3.11 Sanitation and waste management

The influx of people seeking employment on the project may cause sanitation challenges especially in rural areas. Campsites and construction workshops and vehicles will produce wastes such as domestic waste, sewage, waste oils and construction waste.

7.3.12 Health

The influx of people in the project area seeking employment may create stress on public health services. For instance, a potentially serious adverse effect of a project work force on local people is the introduction of infectious diseases, especially sexually transmitted ones. It is an unavoidable fact that the entry into an area of a group of semiskilled and well-paid workers could lead to the introduction of such vices like prostitution.

There are a number of health facilities in the project area that are not on power supply. It is envisaged that with firm power supply from the project, such health centres and facilities will be electrified therefore, improving the health care delivery and general health of people. Health staff, that are shunning these health centres due to lack of power could be attracted to accept postings in rural areas.

7.3.13 Education

In the project area, there are many institutions of learning that are not yet electrified due to among other reasons lack of adequate power supply. It is envisaged that these institutions will be electrified under various schemes such as grid extension and increased access to electricity.

Staffing in the rural schools in the districts is generally low as many teachers, especially female teachers, shun rural areas due to lack of essential services such as power and prefer to work in urban areas.

7.3.14 Industries

The power deficit in the country has affected industry especially in cities like Lusaka. The provision of extra power into the national grid through the proposed transmission line shall help alleviate power outages. Power connection to proposed mining processing industries in Mumbwa (for cement and copper) will be enhanced under the proposed line.

7.3.15 Transport

The provision of reliable power supply through the proposed project will provide support service to the transport sector. This could be through opening up of new service centres for transport vehicles, fuel dispensing systems and their facilities that will be connected to power supply.

7.3.16 Minerals and Mining

Mining is an important activity in the project area especially around Mumbwa where various mining companies are already operating and some still prospecting. Power supply is a key input in mining and mineral processing. The transmission line project is likely to provide stable and reliable power supply to these mines. Benefits in the mining sector include employment opportunities, taxes for government, royalties to traditional

leaders, rates and other impositions by the local authorities. The proposed transmission line may traverse through Luiji Gold mine land in Mumbwa.

7.3.17 Tourism

Tourism is a growing sector in the project area, especially in ITT where new lodges are under construction. In Mumbwa and Lusaka West, game ranching is also gaining ground. The provision of power in these areas shall promote the development of tourism infrastructure.

7.3.18 Recreation

Power supply is one of the key ingredients in provision of social services in recreation. New facilities for recreation will be better supported with the provision of reliable power supply under the project.

7.3.19 Archaeological and Cultural Heritage

The proposed line project will cover a distance of about 291km over which some heritage resources may be discovered or disturbed during line construction. Most of the documented heritage and archeological sites in ITT are outside the study area and hence will not be affected by the proposed line. Other parts of the line project in Mumbwa and Lusaka West do not have known cultural heritage and archeological sites.

8.0 MITIGATION MEASURES

8.1 Physical Environment

8.1.1 Location

In order to avoid adverse impacts on some physical features due to line alignment, a deviation in the alignment of about 20% on the transmission line shall be permitted. The best route alternative has been chosen to avoid adverse impacts.

8.1.2 Climate

Bush clearing for way-leave on the transmission line shall be confined to the 50m swath and during bush clearing and maintenance, bush fires shall be prohibited to reduce air emissions that could lead to increase in air emissions that cause climate changes.

8.1.3 Topography

Use of heavy equipment such as bull dozers in steep slopes shall be restricted or prohibited to avoid soil erosion on slopes. Bush clearing in such steep slopes shall be as per guidelines in the EMP.

8.1.4 Soils

During line construction, appropriate methods and construction activities (such as hand excavation, piling, raft foundations etc) in the various soil types and conditions shall be used by the contractor in order to avoid soil erosion. Where the line passes in an area with existing access road, no new access shall be opened up to minimize inducing of soil erosion.

8.1.5 Geology

In order to avoid geological disturbance in rocky areas, use of controlled blasting by qualified and registered (licenced) blasters shall be used. Appropriate warning shall be given and blasting locations appropriately secured before blasting.

8.1.6 Hydrology

In river and stream crossings, appropriate towers for the transmission line shall be used and placed at least 50m away from river banks. In order to control river bank erosion, an access road shall be opened up and at river/stream crossings, appropriate crossing structures such as culverts or bridges where feasible, shall be constructed.

In order to avoid oil spills into the environment from camp sites and workshops, appropriate oil containment facilities such as oil interceptors or drums shall be used.

8.1.7 Seismicity

In order to avoid earth movement, use of dynamite (and other explosives) in rocky sites like around Lusaka West substation for instance, shall be controlled as mentioned in section 8.1.5 above.

8.1.8 Significant pollutant sources

In order to avoid, reduce or prevent pollution due to construction camp sites and contractor's workshops that may produce significant wastes such as human waste, construction waste and general house hold wastes from consumption, an environmental management plan shall be developed for use by contractors. Site selection criteria for setting up camp sites, shall be developed and all camp site setting monitored to ensure compliance.

8.1.9 Wetlands

Construction activities in the Kafue Flats and some dambos on the line shall be closely monitored to prevent poaching activities and bush fires that could cause damage to the wetlands. A collaborative working programme with appropriate organizations such ZAWA, Fisheries Department, Forestry Department and CBNRMs shall be developed and will form part of the EMP.

8.1.10 Water Quality

In order to avoid polluting water systems, the contractor shall develop a construction activity schedule that will outline methods and appropriate seasons to carryout certain activities. Machinery maintenance and camp site locations shall be monitored to avoid pollution of the water systems.

8.1.11 Air Quality

Use of heavy duty construction equipment on the line will require application of dust suppressant materials line water, on access roads and work sites. Opening up and use of access roads when there is still some reasonable amount of moisture in the soil could reduce dust emissions.

8.1.12 Noise

Use of heavy duty construction equipment on the transmission line will produce noise. However, in order to reduce noise impact, the equipment shall be maintained in good working condition at all times.

8.1.13 Visual Impact

The location of the line away from the main access roads is intended to reduce the inevitable visual intrusion.

8.1.14 Project implementation activities

8.1.14.1 Construction

Construction materials such sand aggregates, wood for shattering could be sourced locally, provided it meets the specified quality.

Timing for blasting shall be arranged in such a way that it there will be low noise impact on surrounding population. Contractors shall be compelled to put in place watering programmes to reduce dust from drilling, blasting and excavation during construction. Gravel roads in settled areas for instance, could be kept wet near populated areas to avoid clouds of dust.

The Client (project developer in this case, ZESCO) shall assist the contractor's work force with appropriate amenities and services such as electricity for construction, cooking and shall encourage local communities to provided other services such as food stuffs, fire wood or charcoal to the work force. The project shall also offer the possibility entrepreneurs and farmers to sell crafts, poles, vegetables and fruit to project workers.

8.1.14.2 *Operation Phase*

The annual maintenance on the line and bush clearing during line operation shall be carried out according to established standards. Public awareness on the activities shall be conducted before bush clearing teams move to site.

8.2 Biological Environment

8.2.1 Flora

8.2.1.1 Open Forest and wood lands

Way-leave clearing for the line shall be based on the standard guidelines in ZESCO. This will reduce pressure on vegetation and vulnerability of soil to degradation in open forest areas.

8.2.1.2 Wood lands

Bush clearing (by cutting as opposed to uprooting) for way-leave on the proposed transmission line way-leave shall be restricted to the 50m swath and bush fires shall be avoided and or controlled to enhance vegetation regeneration. All cut trees shall be left for use by local communities in the project area.

8.2.1.3 Riparian Wood land

Riparian vegetation removal in the way-leave shall be strictly based on way-leave standards and shall be confined to the 50m swath. Due to susceptibility of dry vegetation to fire, local communities shall be encouraged to claim ownership of felled trees. Sensitization about the use of appropriate vegetation removal in way-leaves shall be conducted to construction workers.

8.2.1.4 Grasslands

Grass management in way-leaves shall be through slashing and any bush fires shall be prohibited and appropriate sanctions prescribed to culprits. Since dry grass is prone to bush fires, all such cut grass that could be used by local communities for thatching or fishing baskets, shall be immediately surrendered to such communities.

8.2.2 Fauna

8.2.2.1 Mammals

In order to enhance and where necessary to avoid tempering with migratory routes for animals, a collaborative route identification scheme shall be developed with ZAWA and local communities. Antipoaching and general sensitization programmes shall be conducted in the study area, especially near the GMA.

8.2.2.2 Birds

On the transmission line section that will traverse through a short section of the KF, some bird divertors may be placed on conductors to prevent bird collision with conductors.

8.2.2.3 Reptiles and fish

The collaborative work with ZAWA during line construction shall be relied upon in the vicinity of the crossing point on the Kafue River and streams to avoid disturbing reptiles such as crocodiles. The Fisheries Department shall form part of the working group during line construction across rivers and streams in the study area. The Fisheries Department shall be assigned to sensitise construction workers on appropriate fishing methods and procedures that are not detrimental to fisheries in rivers, streams and dambos. The department could also be available to assist entrepreneurs who may want to set up fish processing facilities based on reliable power supply that will be made available through the project.

Generally sensitization of the workforce to engage into lawful hunting shall be carried out and workers may be allowed to engage in hunting. ZAWA shall be engaged to properly educate the work force, requiring registration of firearms to attaining a working arrangement between Game management and project staff, to ensure that there is no illegal hunting. ZAWA staff could advise project staff who wish to hunt game of places where hunting is permitted.

8.3 Socio-Economic

8.3.1 Population

In order to stem off the the anticipated influx of people seeking employment on the project, all contractors shall be encouraged to employ people from the local communities on the project. Recruitment of people shall be through any appropriate local management structure such as headmen, chifes etc. Only skilled labour not available in the project area shall be employed from outside. A comprehensive EMP shall out line the recruitment procedures and local administrative structures to liase with. An adversarial relationship between project labour and the surrounding population can easily be avoided by requiring the contractor to hire local labour preferentially.

8.3.2 Settlement Patterns and Traditional Authority

All affected settlements shall be requested to relocate away from the 50m way-leave under the line. However, any relocation of people or settlement shall be within the vicinity of their old settlements and shall be based on a valuation report by an independent and registered valuation entity or Government Valuation Department. All such valuations shall be in accordance with the Land Acquisition Act 1970 (CAP 296) and the Electricity Act 1995 (CAP 433) of the Laws of Zambia and shall be based on standard procedures such as the market value of affected properties, sentimental value and other relevant valuation aspects. It is also envisaged that where resettlement may not be the best solution, line deviation of up to 20% of the original route shall be considered. Traditional leadership in those locations where some people may be affected shall be consulted about the resettlement plans and for suitable areas.

8.3.3 Local Economy and livelihoods

The recruitment of labour on the project shall be controlled to enhance participation of locals on the project. Contractors shall be encouraged to engage local groups to supply and render services such as supply of local construction materials, accommodation, guides and labour for bush clearing for way-leaves. This will improve local income levels and livelihoods of people.

8.3.4 Land Tenure

The land tenure system in all the districts that the line passes is predominantly customary and it is envisaged to remain so even after commissioning ther the line. The sentiments that the Chief on land for the proposed substation in Mumbwa raised for

some kind of compensation by recruiting local people on the project, shall be complied with and where appropriate, other forms of compensation shall be paid to the local leadership.

8.3.5 Land use

In order to avoid conflicts over land use, sensitization programmes shall be carried out in the project area to outline permitted land use activities under the line. Power supply and connectivity from the new power facilities to enhance productivity for land uses such as tourism, mining and agriculture shall be encouraged.

8.3.6 Protected Areas

Collaborative work with line entities and departments such as ZAWA and the Forestry Department on the project shall be developed in order to develop specific management plans for construction activities on the project that will reduce negative impacts of protected areas.

8.3.7 Agriculture

Awareness and sensitization to farmers on dangers of electricity and safety measures shall be conducted. The Department of Agriculture shall be engaged in sensitizing farmers on switching to alternative farming practices under the line where permitted. Power supply and connectivity to new agricultural centres shall be encouraged.

8.3.8 Planned development activities

The proposed line alignment shall take into account planned developments in the study area and where feasible position the line to avoid impacting negatively on the said developments. Power connectivity to new developments shall be made available from the new power line investment.

8.3.9 Employment

The labour recruitment procedures and preferences shall be outlined in the EMP and the contractors guided through the whole process.

8.3.10 Infrastructure and Social Services

During construction, all activities across access roads and main truck roads shall be based on standards from the Road Transport and Safety Agency (RTSA).

Social service delivery in education, health, trade, commerce, mining and industry shall be assessed and provision made for power supply and connectivity from the new power infrastructure.

8.3.11 Sanitation and waste management

Contractors shall be encouraged to follow the provisions of the EMP for sanitation and waste management on the project. Campsites, construction workshops and vehicle wastes shall be disposed off in designated places as shall be prescribed by the respective local authorities and land owners.

8.3.12 Health

In order to protect the local population from major sexual and infectious diseases, public health awareness shall be carried out. The project management team from the Client shall arrange for sex education among project labour and the community in collaboration with the Ministry of health in the respective districts. These educational campaigns for both local community and construction workers shall be given at regular intervals throughout the construction period.

To cater for human waste, appropriate toilets shall be provided by contractors at construction sites. Several options (non-flush toilets) for disposal of sewage can be considered namely: Pit latrines, buckets, chemical toilets and dry composting toilets (e.g. Enviro-Loo) could be considered by the contractor(s).

However, in pit latrines, it may be difficult to control smell, flies and preventing polluting ground water systems. Buckets need regular waste removal which makes them cumbersome and expensive to maintain. Chemical toilets have high maintenance costs and are not environmentally friendly. The Enviro-Loo is a dry composting toilet which uses no water, electricity or chemicals.

Regarding domestic waste, rubbish bins shall be provided in which construction workers can put food remains and other domestic waste. Rubbish could also be disposed off in designated areas as approved by the the respective District Councils or local communities.

In order to improve health service delivery, all health centres within the proximity of the project area and where feasible, shall be electrified under various Government schemes.

8.3.13 Education

In the project area, the many institutions of learning that are not yet electrified shall be assessed for power connectivity and the requirements sent to appropriate Government Agencies for consideration for power connection.

8.3.14 Industries

Power connectivity to industries in the study area and into the national grid shall be encouraged to further enhance industrial development in the country.

8.3.15 Transport

Increased power availability in the study area and on the national grid shall be availed for use in the transport sector for such services such as new service centres for transport vehicles and fuel dispensing systems.

8.3.16 Minerals and Mining

Power supply is one of the key ingredients in mining, especially mineral processing. The new project shall make available stable and reliable power supply. However, mining entities shall be encouraged to put in place appropriate mitigation measures for all their operations, processes and decommissioning plans as provided for under the legislation such as: the Mines and Minerals Act, the Factories Act, Town and Country Planning Act, Explosives Act and the Public Health Act among others.

The line section that will traverse through Luiru Gold mine in Mumbwa shall be through a site agreement with the mine owners and through a way-leave consent as provided for under the Electricity Act.

8.3.17 Tourism

Tourism is a growing sector that has some proportionate power demand on the national grid. New tourism developments in ITT and Mumbwa for instance shall be encouraged to get on connected and those using diesel generators could switch to clean hydro electric energy.

8.3.18 Recreation

Power supply is one of the key ingredients is provision of social services in recreation. New facilities for recreation will be better supported with the provision of reliable power supply under the project.

8.3.19 Archaeological and Cultural Heritage

In order to preserve and protect any archeological and cultural sites that may be discovered on the project, a comprehensive reporting procedure shall be outlined in the environmental management plan. Liaison with local community and the National Heritage and Conservation Commission over such finds shall be included in the EMP.

A summary of some impacts and mitigation measures is given in table 15 below.

Table 15 Summary of Environmental Impacts and Mitigation Measures

Impact	Associated Impact	Mitigation Measure
Bush clearing	Soil erosion Bush fires	-Trees shall be stumped to encourage re-growth. -Where feasible and necessary, access roads shall be compacted -Avoid use of heavy duty equipment in erosion prone areas like steep hillsides Restrict bush clearing to the prescribed way-leave size in riverine areas - Replant where applicable to replace cut or destroyed trees -Sensitize workers against bush fires -Surrender all wood to the local communities
Danger of electrocution	Vandalism	-Sensitize the local community & construction workers against tampering with the line -Clearly label pylons with danger signs and put protective features.
Wildlife depletion	Poaching	-Avoid bush fires that could destroy animal habitats -Sensitize workers against poaching -Place bird diverters on the line in identified migratory sections on the line -Avoid use of herbicides when bush clearing to avoid contaminating wild life habitats
Public health	Introduction of diseases	-Awareness campaigns among workers & communities against diseases such as HIV/AIDS -Use mobile toilets or pit latrines in designated areas during construction -Dispose waste in designated areas and in prescribed and acceptable manner only -Establish campsite in ecologically less sensitive areas
Pollution/waste	Introduction of communicable diseases	-Dispose waste in designated areas only -Avoid disposing waste in sensitive areas such as water courses.
Waste oil and Lubricants	Water/soil contamination from leakages	-Procure Polychlorinated Biphenyls (PCBs) free transformer oil -Construct oil interceptors and containments chambers around transformers in substations -Set workshops in less sensitive areas with appropriate oil interceptors
Settlement	Resettlement/Relocation	-Deviate line where necessary -Compensate displaced households based on an independent valuation report/assessment
Economic interactions	Labour influx/in migration	-Hire unskilled labor locally to create employment -encourage local farmers and suppliers to service project contractors
Culture and heritage	Destruction	-Use the EMP for guidance on handling -Inform local leadership and NHCC for recovery and preservation
Construction activities	Material usage	-Source construction materials locally where applicable and subcontract locally -Use road worthy construction equipment -Use standard construction methods such as watering access roads to reduce dust

9.0 ENVIRONMENTAL MANAGEMENT PLAN FRAMEWORK

9.1 Introduction

An Environmental Management Plan (EMP) shall be developed in order to implement the mitigation measures. The EMP shall have various sections outlining procedures, activities and stages of implementing the mitigation measure. For instance, the introduction of the EMP shall outline the background to the activities to be undertaken as provided for in the detailed technical and tender documents. Background information to the project, purpose of the EMP, awareness (health, safety etc) and monitoring (compliance) programmes shall also be outlined in this section.

9.2 Main Components of the EMP

The main components of the EMP shall include:

- **Awareness and training:** with general code of conduct (for contractors, employees etc), employment and recruitment procedures, protection and management of cultural, heritage and archeological sites, protection of infrastructure and property (communal and private), anti-poaching (protection of fauna), health, safety, compensation procedures, working hours etc
- **Waste management;** refuse and waste management, water pollution control, sanitation, waste oil and solid waste, stock piles and spoil dumps management.
- **General guidelines on project implementation** that shall include: camp site selection criteria, temporary works, road signage, plant and equipment service area, explosives and other construction materials storage, fuel storage and workshop area, borrow pits and quarry sites, access roads and road transport, water supply and services on site.
- **Environmental management:** slope protection, erosion protection, noise pollution control, air pollution control, water pollution control, vegetation management (bush clearing, plant species protection, cut wood management), landscaping and rehabilitation of construction sites, monitoring and audit programme.
- **Work plan** and phasing of environmental management plan implementation activities with responsible persons or parties.

It is envisaged that project staff shall include a full time Environmental Coordinator to enhance implementation of the mitigation measures through the Environmental Management Plan. It is envisaged also that all awareness programmes (on health, safety, wild life conservation) to construction workers and communities in the project

area shall be conducted in liaison with but not limited to ZAWA, Health Department, Forestry Department, Fisheries Department and in consultation with community leaders in the project area.

9.3 Monitoring programme

The monitoring programme shall be implemented by ZESCO in collaboration with appropriate stakeholders and Government Departments operating in the project area. The monitoring programme shall concentrate among others but not limited to the following:

- Camp site selection
- Labour recruitment approaches and manning levels
- Construction practices
- Effectiveness of health awareness programme
- Effective of antipoaching awareness campaigns and poaching activities
- General implementation of the EMP.

9.4 Estimated Cost of Mitigation and Monitoring Activities

The cost of mitigating the effects of the project and monitoring the management programme shall be included as part of the total project cost. This cost shall consist of a number some small capital component for one-time expenses that will occur during or just after construction and an annual cost for continuing operations. Estimates of these costs are presented in table 16 below.

Table 16 Mitigation budget and responsible agency

ACTIVITY	IMPLEMENTING AGENCY	ESTIMATED COST US\$
1. Land acquisition/Resettlement <ul style="list-style-type: none"> • At substation & on the transmission line. 	ZESCO Limited: Based on professional advice (valuation report) from an independent & registered Property Valuator	150,000
2. Health Education <ul style="list-style-type: none"> • Conducting health awareness campaigns to construction workers & the local community 	Ministry of Health (ITT & Mumbwa) Project ECO: 1XUS\$ 100/dayX 20 days Health staff: 2XUS\$ 70/dayX 20 days RDC Member: 2XUS\$ 70/dayX 20 days Local Leader 1XUS\$ 70/dayX 20 days Logistics (fuel etc) US\$1,220/tripsX2 Note that the awareness would be conducted twice during the respective project component implementation.	11,440
3. Access and Road <ul style="list-style-type: none"> • Purchase or fabrication of appropriate road signage & warnings 	Contractor(s) (Note that the contractor may opt to buy already made signage or could fabricate all signage on site).	10,000
4. Wild life Conservation <ul style="list-style-type: none"> • For antipoaching and fisheries campaigns 	ZAWA and Fisheries Department Project ECO: 1XUS\$ 100/dayX 20 days ZAWA staff: 2XUS\$ 70/dayX 20 days Fisheries Officer 2XUS\$ 70/dayX 20 days RDC Member: 2XUS\$ 70/dayX 20 days Local Leader 1XUS\$ 70/dayX 20 days Logistics (fuel etc) US\$ 1,220 X 2 trips Note that the awareness will be conducted on the Mumbwa - ITT segment of the line (In Chief Chibuluma, Shimbizi & Chilyabufu areas)	14,240
5. Forest Management Plan <ul style="list-style-type: none"> • Develop a set of forestry management plans for Mumbwa Forest • 	Forestry Department Project ECO: 1XUS\$ 100/dayX 20 days Extension officer 2XUS\$ 70/dayX 20 days Research Officer 2XUS\$ 70/dayX 20 days Note that the FMP is intended to guide ZESCO during bush clearing and during annual bush clearing operations	7,600
6. Monitoring & Auditing <ul style="list-style-type: none"> • Regular monitoring of implementation of mitigation measures 	ZESCO Limited/ZAWA Project ECO: 1XUS\$ 100/dayX 7days/month (X10 months) ZAWA staff: 2XUS\$ 70/dayX 20 days Logistics (fuel etc) US\$3,000 for the Project duration	12,800
7. Total mitigation budget		206,080

10.0 RECOMMENDATIONS AND CONCLUSION

The Environmental Impact Assessment (EIA) for the proposed transmission line project was conducted following the laid down EIA procedures in the Environmental Impact Assessment Regulations, Statutory Instrument No. of 1997. During this process, the various options and alternatives were considered to come up with potential environmental Impacts and the mitigation measures for the negative impacts and enhancement measures for the positive impacts.

The proposed transmission line will facilitate the evacuation of power from the proposed Itezhi Tezhi Hydropower Station into the national grid. By opting for the line route outside the GMA and the KNP, will minimize impacts that are normally associated with transmission line development. This option will also immersely reduce environmental and social impacts. There are sensitive ecological sections and the line avoids major resettlement issues since it follows sparsely settled areas.

The identified impacts of the project will be addressed by the mitigation measures recommended in this report.

To ensure implementation of the proposed mitigation, monitoring and positive impact enhancement aspects, it is recommended that environmental costs totalling **US\$206,080** should be included in the total project cost. Further, the actual implementation of the various environmental aspects recommended in this report will be guided by the Environmental Management Plan for the different project components and will be strictly monitored by the project developer.

The transmission line project is cardinal in evacuating power from the proposed Itezhi-Tezhi hydropower station whose development has already been approved by the Environmental Council of Zambia. The combined projects (power station and transmission line) will help the country meet some of the challenges of power deficit currently being experienced. The transmission line project shall also provide two power supply options for future electrification of scattered rural growth centres such as clinics, schools, police posts, Government institutions and community social facilities and administrative centres such as palaces and local courts along the route. The line will also provide a viable option to meet some localized growth in electric power demand in sectors such as agriculture, tourism and mining. Approving the development of the transmission line project will therefore complete the total project package for the Itezhi-Tezhi hydropower development scheme.

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12.0 APPENDICES

12.1 Some way-leave consents on the ITT-Mumbwa Lusaka West transmission line project

TO PART II

Name & Address of:
Owner/ Leaser/ Occupier
JUSTINA MWAUSA MWAPE
OF 4/6255/M
LUSAKA

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1528A3
Property No. 4/6255/M

I acknowledge receipt of your letter reference A/K/LEA/ITT-mum-Hwest/08
Date 01.06.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed.....
Owner/ Leaser/ Occupier

NRC/Passport No: 14-0660/ST/11

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier (EMMANUEL)
Mwanja... SITUMBEKO... (EMMANUEL)
OF... SITUMBEKO VILLAGE
OF... CHIBAMBANO DISTRICT.

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1527 B1, B, B3
Property No. Customary Land

I acknowledge receipt of your letter reference A140/ED/ITT-MUM-LWEST/08
Date 26.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed [Signature]
Owner/ Leaser/ Occupier

NRC/Passport No. 1324291231
Mwanja EMMANUEL



TO PART II

003/07/08

Name & Address of:

Owner/ Leaser/ Occupier

ROSEMARY MUMBEWA
DINN PALACE BOX 91
ITEZHI-TEZHI

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No.....
Property No..... SD-35-14.....

I acknowledge receipt of your letter reference.....
Date..17.7.08. and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed... R. Mumbwa.....
Owner/ Leaser/ Occupier

NRC/Passport No: 124452/72/1



TO PART II

Name & Address of:
Owner/ Leaser/ Occupier
BADIYE LIMITED
Box 38060
LUSAKA

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1528 A3
Property No. 255a/B/118

I acknowledge receipt of your letter reference A/HO/ED/ITT-MUM-L/WEST/08
Date 23.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed [Signature]
Owner/ Leaser/ Occupier

NRC/Passport No. 0702M00023501

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier

MRS LOZA TEMBO
OF L/627/1/M
LUSAKA

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1528 A3
Property No. L/627/1/M

I acknowledge receipt of your letter reference A140/EA/ITT-MUM-HWEST/08
Date 01.06.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed LOZA TEMBO
Owner/ Leaser/ Occupier

NRC/Passport No: 206976/11/1

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier

MR HARRY MWANAMUSAKA
OF L/6269/M
LUSAKA

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1528A3

Property No. L/6269/M

I acknowledge receipt of your letter reference A/40/ED/ITT-MUM-HWEST/08
Date 01.06.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed: [Signature]
Owner/ Leaser/ Occupier

NRC/Passport No: 329129/1/1

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier

MUMBWA DIST. COUNCIL
Box 830001
MUMBWA

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. CUSTOMARY LAND 157A1

Property No. CUSTOMARY LAND

I acknowledge receipt of your letter reference A140/ED/I.T.F.MUM-HWEST/08
Date 13.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to carry out the work as detailed in your letter.

Yours faithfully,

Signed [Signature]
Owner/ Leaser/ Occupier

NRC/Passport No: 280339/16/1



TO PART II

Name & Address of:

Owner/ Leaser/ Occupier
MR. MARSH ZULO
OF LOT 6270.1M
LUSAKA

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1528A3
Property No. L/6270.1M

I acknowledge receipt of your letter reference A140/ED/ITT-MUM-HWEST/08
Date 01.06.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed *Thambo*
Owner/ Leaser/ Occupier

NRC/Passport No: 335849/52/1

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier
CHIEF MEDANO OF
THE I.K.A. PEOPLE -
MUMBWA DISTRICT

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1527A
Property No. CUSTOMARY LAND

I acknowledge receipt of your letter reference A140/ED/ITT-MUM-HWEST/08
Date 13.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed... [Signature]
Owner/ Leaser/ Occupier

NRC/Passport No. 123843/15/1

001/28/08

TO PART II



Name & Address of:

Owner/ Leaser/ Occupier
 Senior Chief Sitakumbe LA
 OFFICE PALACE
 P.O. Box 83001 - MUMBAWA

ZESCO Limited,
 Environment & Social Affairs Unit
 P. O. Box 33304
 LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No.....1527 A 1.....1527 A 2
 Property No.....1527 B1.....

I acknowledge receipt of your letter reference.....
 Date 24/07/08..... and as Owner/ Leaser/ Occupier, I give the necessary permission to
 carry out the work as detailed in your letter.

Yours faithfully,

Signed.....
 Owner/ Leaser/ Occupier

NRC/Passport No: 127206/15/1



TO PART II

Name & Address of:

Owner/ Leaser/ Occupier

*B. Mumbwa, P.O. Box 33304
Lusaka
Zambia*

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. *SD-35-14*

Property No. *24th July 2008*

I acknowledge receipt of your letter reference *SD-35-14*,
Date *24/7/08*, and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed *[Signature]*,
Owner/ Leaser/ Occupier

NRC/Passport No. *102388/7e/1*



TO PART II

REF 006/018/08

Name & Address of:

Owner/ Leaser/ Occupier
HON. CHIEF SHIMBISHI
LUBANDA PALACE
P.O. Box 91
ITEZHI-TEZHI.

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No.....
Property No. 1576 C 7 (M.A.P.)

I acknowledge receipt of your letter reference.....
Date 18.5.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to carry out the work as detailed in your letter.

Yours faithfully,

Signed *[Signature]*
Owner/ Leaser/ Occupier

NRC/Passport No: 130897/72/1



TO PART II

Name & Address of:

Owner/ Leaser/ Occupier

CHIEF CHIBUMBA
P.O. Box 830107
MUMBWA

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No.....15.265A.....
Property No.....CHIBUMBA CHIEFDOM.....

I acknowledge receipt of your letter reference.....
Date..... and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed.....
Owner/ Leaser/ Occupier

NRC/Passport No: 11D256115/1



TO PART II

Name & Address of:

Owner/ Leaser/ Occupier
SABLE TRANSPORT
Box RW 219X
LUSAKA

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1527 B4

Property No.

I acknowledge receipt of your letter reference A1401ED/ITT-MUM-LWEST/08
Date 27.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to carry out the work as detailed in your letter.

Yours faithfully

Signed.....
Owner/ Leaser/ Occupier

NRC/Passport No: 145551/53/1



Zesco
Please establish
the powerline
on the Northern
bank of the Mumbwa
Road
750Mtrs from the
Main Road

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier

SEN. HEADMAN SHANAUBE
OF SHANAUBE VILLAGE
MUMBWA DISTRICT...

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1527A1

Property No. CUSTOMARY LAND

I acknowledge receipt of your letter reference A/40/ED/ITT-MUM-HWEST
Date 30.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed L. SHANAUBE
Owner/ Leaser/ Occupier

NRC/Passport No: 131975/15/1

LOWRENCE SHANAUBE
0978177363

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier

SEN. HEADMAN SHANAUBE
OF SHANAUBE VILLAGE
MUMBWA DISTRICT

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1527A1

Property No. CUSTOMARY LAND

I acknowledge receipt of your letter reference A/40/ED/ITT-MUM-HWEST
Date 30.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed SHANAUBE
Owner/ Leaser/ Occupier

NRC/Passport No: 131975/15/1

LOWRENCE SHANAUBE
0978177363

TO PART II

Name & Address of:

Owner/Leaser/Occupier

1958 (FARM)
MARK/PETER SWINEPOEL

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1528A3

Property No. FARM 1958

I acknowledge receipt of your letter reference A/40/ED/ITT-MDM-HWEST/08
Date 20.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed 

Owner/Leaser/Occupier

NRC/Passport No: 995745/11/2

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier

HEADMAN
SIMASIKO KASHAMBA
F/1957: CHITOKOKO VILLAGE

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1528A₂

Property No. F/1957

I acknowledge receipt of your letter reference A/40/ED/ITT-MUM-LWEST-08
Date 24.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed. K. SIMBIKU
Owner/ Leaser/ Occupier

NRC/Passport No. 165495/82/1

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier
JAMESON MODIGA (HEADMAN)
OF JULIUS VILLAGE
F/1957

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1528A3

Property No. F/1957

I acknowledge receipt of your letter reference A140/ED/ITT-MUM-HWEST/08
Date 24.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed Jameson Modiga
Owner/ Leaser/ Occupier

NRC/Passport No: 138205/7411

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier

MR. BOYD HAMUSONDE
of BOX 32480
LUSAKA (FARM NO.....)

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,


SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 152/154

Property No. (740) L800 WEST

I acknowledge receipt of your letter reference A140/ED/ITT-MUM-LWEST/08
Date 24.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed 
Owner/ Leaser/ Occupier

NRC/Passport No: 3209.63/11/1
BOYD HAMUSONDE

TO PART II

Name & Address of:

Owner/ Leaser/ Occupier
Headman... MPULUBUSI
OF CHIEF SHAKUMBILA
MUMBWA DISTRICT

ZESCO Limited,
Environment & Social Affairs Unit
P. O. Box 33304
LUSAKA

Dear Sir,

SURVEY & ERECTION OF ELECTRICITY LINES SHOWN ON DRAWING

No. 1527... B3
Property No. CUSTOMARY LAND

I acknowledge receipt of your letter reference A/HO/ED/ITT-MUM-LWEST/08
Date 26.05.08 and as Owner/ Leaser/ Occupier, I give the necessary permission to
carry out the work as detailed in your letter.

Yours faithfully,

Signed... *Lampulubusi*
Owner/ Leaser/ Occupier

NRC/Passport No.: 371192/11/1
Lampulubusi

MPULUBUSI VILLAGE
CHIEF SHAKUMBILA
P. O. BOX 33700
LUSAKA

DATE 26 May 2008

12.2 Checklist of plant species in the study area

FAMILY NAME	SCIENTIFIC NAME	LOCAL NAME
Caesalpiniaceae	<i>Brachystegia longifolia</i>	Muombo (B), Mbovu (N)
	<i>Julbernardia paniculata</i>	Mutondo (B), Mtondo (N)
	<i>Piliostigma thonningi</i>	Mufumbe (B), Musekese (T)
	<i>Brachystegia spiciformis</i>	Muputu (B), Musewe (B)
	<i>Swartzia madagascariensis</i>	Ndale (B), Mulundu (T)
	<i>Colophosphermum mopane</i>	Tsanya (N), Mupane (T)
Euphorbiaceae	<i>Croton scheffleri</i>	Mupasila (L)
	<i>Pseudolachnostylis maprouneifolia</i>	Musangati (B), Mukunyu (T)
	<i>Euphorbia ingens</i>	
	<i>Croton megalobotrys</i>	Mutuatua (L), Mutua (T)
	<i>Sapium ellipticum</i>	
Combretaceae	<i>Securinea virosa</i>	Mubwanga (B), Mwilatuba (T)
	<i>Combretum zeyheri</i>	Mufuka (B), Mukutabulonga (T)
	<i>Combretum collinum</i>	
Rubiaceae	<i>Terminalia species</i>	
	<i>Feretia aeruginescens</i>	Munyansankula (T)
Loganiaceae	<i>Rothmannia fischeri</i>	Mulyansengele (B),
	<i>Strychnos madagascariensis</i>	
Flacourtiaceae	<i>Strychnos usambarensis</i>	
	<i>Onchoba spinosa</i>	Malaza (N), Mukumbuzu (T)
Anacardiaceae	<i>Ozoroa paniculosa</i>	
	<i>Lannea stuhlmannii</i>	Muonga (B), Mungongwa (T)
Fabaceae	<i>Dalbergiella nyase</i>	Lupweshya (B), Mukanganzovu (T)
	<i>Baphia massaiensis</i>	
	<i>Pterocarpus angolensis</i>	Mulombwa (B), Mukula (T)
Bignoniaceae	<i>Pterocarpus antunesii</i>	Mukambo (T)
	<i>Markhamia obtusifolia</i>	Mubu (B), Mupetankwale (T)
Mimosaceae	<i>Albizia antunesiana</i>	Musase (B), Kawizi (T)
	<i>Albizia anthelminitica</i>	Mzanga (N), Chondwe (T)
Annonaceae	<i>Uvaria lucida</i>	
Dipterocarpaceae	<i>Monotes glaber</i>	Mutembo (L and T)
Ochnaceae	<i>Ochna afzeli</i>	Musengu (L)
Apocynaceae	<i>Diplorhynchus condylocarpon</i>	Mtowa (N), Mutowa (T)
Ebenaceae	<i>Diospyros mespiliformis</i>	Mchenjasumu (N), Muchenja (T)
Capparaceae	<i>Capparis tomentosa</i>	Chiwezeze (L), Chonswe (T)
Clusiaceae	<i>Garcinia livingstonei</i>	Mutungwa (L), Mukwananga (T)
Olacaceae	<i>Ximenia americana</i>	Mtundu (L), Muchonfwa (T)
Bombaceae	<i>Adansonia digitata</i>	Mubuyu (L & T), Mulambe (N)
Verbenaceae	<i>Duranta repens</i>	

NB: T-Tonga, N-Nyanja, L-Lozi, B-Bemba,

12.3 Some of the birds recorded in the Namwala GMA

COMMON NAME	LATIN NAME	STATUS
Cattle Egret	<i>Bubulcus ibis</i>	Common
Pied Kingfisher	<i>Ceryle rudis</i>	Common
Grey Heron	<i>Ardea cinerea</i>	Common
African Darter	<i>Anhingarufa</i>	Common
Water Dikkop	<i>Burhinnus vermiculatus</i>	Common
Spurwinged goose	<i>Plectropterus gambensis</i>	Common
Egyptian goose	<i>Alpochen aegytiacus</i>	Common
Harmercop	<i>Scopus umbretta</i>	Common
Giant Kingfisher	<i>Ceryle maxima</i>	Common
Grey Hornbill	<i>Tockus nasutus</i>	Common
Barteleur Eagle	<i>Terathiopterus ecaudatus</i>	Common
Lilac breasted Roller	<i>Coracias caudate</i>	Common
Yellow bill stork	<i>Mycteria ibis</i>	Common
Blacksmith Plover	<i>Vanellus armatus</i>	Common
Crowned Hornbill	<i>Tockus alboterminatus</i>	Common
Trumpeter hornbill	<i>Bycanistes bucinator</i>	Common
Red billed Teal	<i>Anas erythrohyncha</i>	Common
Cape Trurtle Dove	<i>Streptopelia capicola</i>	Common
African Skimmer	<i>Rhynchops flavirostris</i>	Common
Lappet faced vulture	<i>Torgos tracheliotus</i>	Common
Green shank	<i>Tringa nebularia</i>	Common
Woogland Kingfisher	<i>Haleyon senegalensis</i>	Common
European Bee-eater	<i>Merops apiaster</i>	Common
Openbilled stork	<i>Anastomus lamelligerus</i>	Common
Knobbilled Duck	<i>Sarkidiomis melanotos</i>	Common
Black kite	<i>Milvus aegyptius</i>	Common
Honey buzzard	<i>Milvus migrans</i>	Common
Grey wagtail	<i>Motacilla cinerea</i>	Common
Broadbilled Roller	<i>Eurystomus glaucurus</i>	Common

12.4 Common large mammals in the Namwala GMA

SPECIES	Scientific name
Buffaloes	<i>Syncerus caffer</i>
Bush Pig	<i>Potamochoerus porcus</i>
Bushbuck	<i>Tragelaphus scriptus</i>
C/Duiker	<i>Sylvicapra grimmia</i>
Eland	<i>Taurotragus oryx</i>
Elephants	<i>Loxodonta africana</i>
Grysbok	<i>Raphicerus sharpei</i>
Hart beast	<i>Sigmoceros lichtensteinii</i>
Hippo	<i>Hippopotamus amphibius</i>
Impala	<i>Aepyceros melampus</i>
Kudu	<i>Tragelaphus strepsiceros</i>
Lion	<i>Panthera leo</i>
Oribi	<i>Ourebia ourebi</i>
Puku	<i>Kobus vardonii</i>
Reedbuck	<i>Redunca arundinum</i>
Roan	<i>Hippotragus equinus</i>
Sable	<i>Hippotragus</i>
Warthog	<i>Phacochoerus aethiopicus</i>
Water Buck	<i>Kobus ellipsiprymnus</i>
Zebra	<i>Equus burchellii</i>

12.5 Transmission line coordinates

Reference Point	East-Coordinates	South-Coordinates
DET (Terminal tower at ITT switch yard)	395540	8256700
ITT-MB 1a (First angle tower)	397828	8257382
ITT-MB2 (Second angle tower)	397870	8257710
ITT-MB3b (Third angle tower)	402700	8261500
IT-MB4e (Four angle tower)	428420	8265130
IT-MB5a ((Fifth Angle tower)	468570	8286750
MBS (Mumbwa Substation centre)	501500	8334500
MB-LSK1	519150	8324060
MB-LSK2	549875	8324625
MB-LSK3	583800	8312130
MB-LSK4	597850	8311450
MB-LSK5	605140	8307420
MB-LSK6	605670	8304750
MB-LSK7	624187	8297528
DET (Terminal tower at Lusaka West substation)	625900	8297620

12.6 ATTACHMENTS