

**CORPORATE AFFAIRS AND BUSINESS
DEVELOPMENT**

ENVIRONMENTAL IMPACT ASSESSMENT

**THE PROPOSED CONNECTION OF NORTH WESTERN
PROVINCE TO THE NATIONAL GRID AT 132kV**



PREPARED BY
THE ENVIRONMENT AND SOCIAL AFFAIRS UNIT

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EXECUTIVE SUMMARY

In the Northwestern Province (NWP) ZESCO Limited supplies electricity to five districts namely Mwinilunga, Mufumbwe, Kabompo, Zambezi and Chavuma from isolated Diesel Generation Stations located in each district. The older districts (Mwinilunga, Kabompo, and Zambezi) have been on diesel power supply for over forty years now. Solwezi and Kasempa are the only two districts in the province that are supplied from the national hydro power grid.

Power supply from the diesel power stations is characterized by high operational costs, inadequate capacity, very low reliability and high emissions. ZESCO Limited has therefore long sought to replace diesel generated power supply with reliable and cost effective power from the national grid by connecting all the diesel power stations to the grid. By the year 2000, ZESCO Limited was operating ten diesel stations country wide, but by 2007, four such stations had been replaced by grid supply while two new stations were installed in two newly designated districts.

Despite having great potential for mining and agricultural development, NWP generally remains underdeveloped due to insufficient and unreliable power supply. It is against this background that the Government of the Republic of Zambia through ZESCO Limited, intends to connect the 5 NWP Districts still on diesel, to the National Grid at 132 kilo Volts (kV) through a transmission line network from Kasempa T-Off (Nselauke) to Chavuma and linking Mwinilunga to Lumwana.

The main objective of the project is to replace the diesel generated electricity with hydro electricity by constructing a 132kV transmission line network which would be linked to the main national power grid. This would improve reliability of power supply to the five districts as well as provide sufficient power to boost economic activities such as mining, agriculture and tourism.

Environmental Impact Assessment

In order to address environmental and social issues that may arise from the proposed power line project an Environmental Impact Assessment (EIA) Study was undertaken in accordance with the Environmental Protection and Pollution Control Act of 1991, Statutory Instrument No. 28 of 1997 – The EIA Regulations. The EIA study identified potential impacts and recommended measures to mitigate adverse impacts while enhancing positive ones. An Environmental Project Brief for the first segment of the project which involves the connection of Mufumbwe District from Kasempa Turn-off was approved by the Environmental Council of Zambia in June, 2010.

Scoping is the first stage in the EIA process and has to be undertaken to make the EIA study successful. A scoping exercise was undertaken to meet stakeholders in the project area to explain the project to them and to get their input regarding key issues that needed to be addressed in the EIA study.

Scoping meetings were held in Mwinilunga, Kabompo, Zambezi and Chavuma Districts. Consultations were also conducted in Lumwana, Manyinga and Mumbefji areas. Various people in the local communities and individuals found/living along the proposed line route as well as various Government Departments within NW Province were also consulted during the scoping exercise.

The major issues raised during the scoping meetings include:

- Compensation for loss of private property affected by the project;
- Employment opportunities to be provided by the project;
- Electrification of Chief's palaces, schools, health facilities and surrounding areas;
- High connection fees to hinder electrification of residential houses and commercial buildings;
- Spread of communicable diseases, like HIV/AIDS, due to influx of people in the project area.

The Identified Significant Impacts of the Project

One of the major negative impacts of the project to the area is damage to crop fields and resettlement of people. The project will also affect the general physical, biological and socio-economic environment in the project area. A project of this magnitude could trigger an influx of job seekers in the area thereby creating stress on the social amenities in the area. An influx of labour force could also be associated with the introduction of diseases not prevalent in the area.

The project has an inherently positive impact in the economic aspects as provision of firm and reliable power supply to the area would lead to economic expansion and growth in the industrial sector. In addition, there will be creation of jobs not only by the project but also by other industries, such as mining, fruit cannery and honey processing, which will be enabled by the availability of electricity.

Mitigation Measures

The envisaged relocation plan for the affected properties shall involve payment of adequate compensation in accordance with the relevant national legislation as well as the ZESCO compensation Policy.

Site restoration works and clean-up shall form part of the Construction Contracts with clear guidelines on environmental issues. In order to avoid an influx of job seekers to the project area, it is common practice for ZESCO to employ (or recommend to the Contractor) unskilled labour locally through their respective village headmen.

Recommendation

The growth in the national economy over the years has led to significant increase in power demand. This compelled the government to embark on projects to increase the power generation capacities of most of the power stations as well as to build new ones. This increase in generation will enable ZESCO to extend the grid to most parts of the country thereby providing sufficient and reliable power to various sectors of the national economy such as mining. Grid extension also provides a solution to the phasing out of diesel run power plants that are not only very costly to operate and are unreliable but also not environmentally friendly. Taking into account the available options, the identified negative and positive impacts and recommended mitigation measures, the implementation of the project to connect Northwestern Province to the National Grid should be considered favorably by the Authorizing Agency (ies).



**ERNEST R. MUPWAYA
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ACRONYMS AND SYMBOLS

°C	Degrees Celsius
AIDS	Acquired Immuno Deficiency Syndrome
ECZ	Environmental Council of Zambia
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPPCA	Environmental Protection and Pollution Control Act
ERB	Energy Regulation Board
GMA	Game Management Area
GRZ	Government of the Republic of Zambia
HIV	Human Immuno Deficiency Virus
km	Kilometers
kV	Kilo Volts
kWh	Kilo Watt Hour
KNBPS	Kariba North Bank Power Station
m	Meters
MW	Mega Watts
NHCC	National Heritage Conservation Commission
NW	Northwestern
NWASCO	National Water and Sanitation Council
RAP	Resettlement Action Plan
REA	Rural Electrification Authority
RGCs	Rural Growth Centers
STIs	Sexually Transmitted Infections
VIPs	Ventilated Improved Pit Latrines
ZAWA	Zambia Wildlife Authority

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The Environmental Impact Assessment (EIA) study team for the proposed connection of Northwestern province to the National grid at 132kV wish to thank all the Traditional Leaders, District Commissioners, Government Departments and the Councils in Kasempa, Mufumbwe, Kabompo, Zambezi, Chavuma Solwezi and Mwinilunga for providing information and guidance necessary for planning and implementing the project. Special thanks also go to the local settlers, individuals, farmers and property owners in the preferred power line corridor.

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.

AUTHORS DETAILS AND TASKS

This EIA study was undertaken by a team of staff from the Environment and Social Affairs Unit of ZESCO Limited. The team comprised the following:

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1.0 INTRODUCTION

1.1 Brief Country Profile

Zambia is located in the Southern African Region. It has a land surface of about 752,610km² with various open water bodies such as; Lake Tanganyika (2100km²), Lake Bangweulu (2700km²) and Lake Kariba (5580 km² at maximum retention). Zambia is landlocked and lies between latitudes 8⁰ and 18⁰ South of the equator and between longitude 22⁰ and 34⁰ east. It is surrounded by eight neighbours, namely: Angola, Botswana, Democratic Republic of Congo, Malawi, Mozambique, Namibia, Tanzania and Zimbabwe. Most of its land lies on a plateau with an average altitude between 1000 and 1300 meters though with some high spot (the Muchinga escarpment) standing at 2000 meters above sea level. The vegetation can be broadly described as woodland, forest and grassland. Administratively, the country is divided into nine provinces with 72 districts and has a population of about 10.3 million people.

The country has a mild climate with three distinct seasons: warm rainy summer (November – April) with temperature ranging from 27⁰C to 34⁰C, cool dry (May-July) with temperature varying from 4⁰C to 25⁰C and a hot dry season (August – October) with temperatures between 26⁰C and 38⁰C. The country receives rainfall ranging from 600 mm in the south (agro ecological region I) to 1500 mm in the north of the country.

1.2 Project Background

The Government of the Republic of Zambia (GRZ) seeks to improve the foundation for economic development, and one of the fundamental elements is to provide sustainable energy to all parts of the country.

In pursuit of this objective, GRZ through ZESCO Limited commenced electricity supply to the Northwestern Province in 1971 by installing diesel generation plants in Mwinilunga, Kasempa, Kabompo, and Zambezi; the then key Districts of the Northwestern Province. In due course, additional diesel power plants were installed at Mufumbwe and Chavuma while the one at Kasempa was decommissioned after Kasempa was connected to the grid in 2004.

Thus, in the Northwestern Province, ZESCO has been operating diesel power stations for about 40 years now and for the better part of these 40 years, electricity supply from these stations has been characterized by:-

- a) Inadequate capacity. Due to high investment and running costs, the installed capacity has remained more or less stagnant over time. Any capacity increment has been small and not sized to match rising demand. This has curtailed new connections, thereby limiting access to electricity.
- b) Low reliability of supply. It is not uncommon for the limited supply to be available for only a few hours per day due to fuel rationing in order to conserve the expensive fuel. In the rainy season, it becomes impossible to deliver fuel to some stations due to impassable road conditions. Additionally machine breakdowns are frequent with long repair times and it is not unusual to have a total power supply failure lasting several weeks. This has a tailing effect on vital services such as water supply.
- c) Very high operational costs. High maintenance costs, high machine replacement costs, and the very high fuel costs due to the ever rising price of oil result in very high operating costs. In today's terms diesel generation costs are of the order of 35Cents/kWh while grid electricity costs are of the order of 6Cents/kWh. The result is that ZESCO spends about US\$4 Million per year on fuel alone to operate the five diesel stations in the Northwestern Province. The corresponding revenue is less than 10% of the generation fuel cost.

These power supply constraints are a major hindrance to improving the quality of life in the Northwestern Province and other rural areas. They have hindered the emergence of local small businesses which are important for poverty reduction and improvement of the quality of life for rural men, women and children.

An Environmental Impact Assessment (EIA) Study for the proposed project shall be undertaken by ZESCO Limited in accordance with the Environmental Protection and Pollution Control Act of 1991, Statutory Instrument No. 28 of 1997 - The Environmental Impact Assessment Regulations. The EIA study will identify potential impacts and recommend measures to mitigate adverse impacts while maximizing positive impacts. An Environmental Project Brief (EPB) for the first phase of this project, which involves the connection of Mufumbwe District to the grid from Kasempa Turn Off (Nselaue), was approved by the ECZ in 2009.

The second phase of the proposed project therefore shall involve the connection of Kabompo, Zambezi and Chavuma districts to the national grid. Another segment of the project shall comprise the construction of a transmission line from Lumwana to Mwinilunga. A scoping exercise was undertaken to meet

stakeholders in the proposed project area to explain the project to them and to get their input regarding key issues that needed to be addressed in the EIA study.

Scoping meetings were held all the Districts within which the project shall be executed. This report contains comments and concerns from residents and stakeholders in the project area as well as the local leadership and government representatives.

2.0 LEGAL AND INSTITUTIONAL FRAMEWORK

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: (d) 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 (MTENR) through 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, and operates under the Water Act, Cap 198 (1948). The Act empowers the Board to control the use of water resources by charging abstraction fees.

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 132kV transmission line network in NW Province 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 foregoing. 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 Forests 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 and could impact 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.

2.7 The National Water and Sanitation Act

National Water and Sanitation Act No. 28 of 1997 established the National Water and Sanitation Council (NWASCO) and defines 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.*)

2.8 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.

2.9 The Public Health Act

Public 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.

2.10 The Zambia Wildlife Authority Act

The National Parks and Wildlife Act (No.10 of 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. All power lines traversing through National Parks are governed by this Act in order to ensure that wildlife is not negatively affected by the installations.

2.11 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. ZESCO Limited therefore will be guided by this Act in acquiring land for the

way-leaves, substations and other installations associated with the proposed power line.

2.12 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.

2.13 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 sites (such as significant water 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

2.14 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 those relating to 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 on Climate Change (UNFCCC)
- United Nations Convention to Combat Desertification

2.15 Institutional Arrangement

ZESCO Limited is wholly owned by the Government of the Republic of Zambia and the Ministry of Energy and Water Development (MEWD) hold the shares on behalf of the government. The MEWD is responsible for the overall energy supply and utilization in the country. Under MEWD, the Department of Energy conducts the energy planning and formulates the national energy policies.

ZESCO Limited generates and distributes more than 90% of the electricity in the country and is currently the implementation agency for the national rural electrification programme. Kariba North Bank Company (KNBC) was been re-integrated with ZESCO and a new company was established to rehabilitate and expand the Kariba North Bank Power Station (KNBPS). The Copperbelt Energy Corporation (CEC) and Lunsemfwa Hydro Power Company (LHPC) produce and distribute the balance. In 2001, the Government outlined steps for the divestiture of Government's interest in ZESCO. The steps included: (i) Zambia Privatization Agency (ZPA) undertaking the necessary studies to enable the operations and management of ZESCO to be carried out by a private sector operator, (ii) identification and establishment of suitable modalities for peri-urban and rural electrification, and (iii) regulatory capacity building. However, given its past experience in dealing with privatization of other enterprises, the Government changed its focus to the commercialization of ZESCO's operations instead of privatization.

All ZESCO operations are regulated by the Energy Regulations Board (ERB). ERB also plays a pivotal role in controlling the electricity tariffs. Currently ZESCO charges a uniform tariff for the entire nation.

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 proposed connection of NW Province to the National Grid 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 power line network is intended to supply firm and reliable electric power to the five Districts of NW Province that are currently being supplied by diesel generated electricity. A.

The EIA is undertaken by ZESCO Limited 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 network 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 project to connect NW Province to the national grid will not only help improve living conditions in the stated five Districts but also incorporate and reflect the principles of sustainable development and mitigating climate change.

3.2 Scope of the Environmental Impact Assessment

The study was concerned with the environmental and social aspects through route corridor of the project, particularly the possible negative effects such as pollution, disturbance of natural habitats for wildlife, truncation of land uses, relocation of people and other forms of social distress, loss of buildings and restricted use on fields and dangers to people and animals. In addition, the study highlighted the potential positive impacts and how the positive aspects shall be enhanced for the environmental and socio-economic benefits.

Specifically, the EIA:

- describes the nature of the project and identify and characterize the environment through the project area;
- provides a description of the regulatory framework applicable to the project under consideration;
- Identifies potential physical, biological, socio-economic and cultural impacts related to the construction and operation of the transmission line.
- describes 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;
- describes the consideration given to comments received from the public during the environmental assessment study; and
- proposes 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 allowed 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 Location

The proposed project designated as the –connection of Nothwestern Province to the National Grid at 132kV will originate from the substation at Kasempa T-off (Nselaue) and will connect Mufumbwe, Kabompo, Zambezi and Chavuma. A second line will start from Lumwana substation to Mwinilunga. The main Chiefdoms in the immediate project area include Chizela, Sikufele, Ishindi, Ndungu, Mukumbi, Musele and Sailunga. Figure 1 below shows the location of the project area.

The proposed power lines will have a way-leave size of 32meters wide (thus, 16m on either side of the power lines).

Refer to Appendix 2 which gives a sketch a map of the proposed line route.

4.2 Project Objectives

The main objective of the proposed project is to replace the diesel power stations in the five districts of NW Province with clean, efficient and more reliable form of electricity by connecting them to the national grid. The replacement of diesel generators by hydro power will have a number of benefits such as:

- increasing access to electricity to other remote areas in the districts;
- reduction in pollution from gaseous emissions;
- provisions of sufficient and firm power for other developments in the areas;
- general improvement in the living conditions of the areas

4.3 Power Transmission Project Scope

The proposed grid connection project shall consist of the following scope of works:

- a) Upgrading of the substation at Kasempa Turn Off (Nselaue) to create a source substation for the132kV transmission line to Chavuma
- b) Construction of a total of 450 km of 132kV sub-transmission lines from Nselaue (Kasempa Turn Off) through Mufumbwe, Kabompo and Zambezi up to Chavuma.

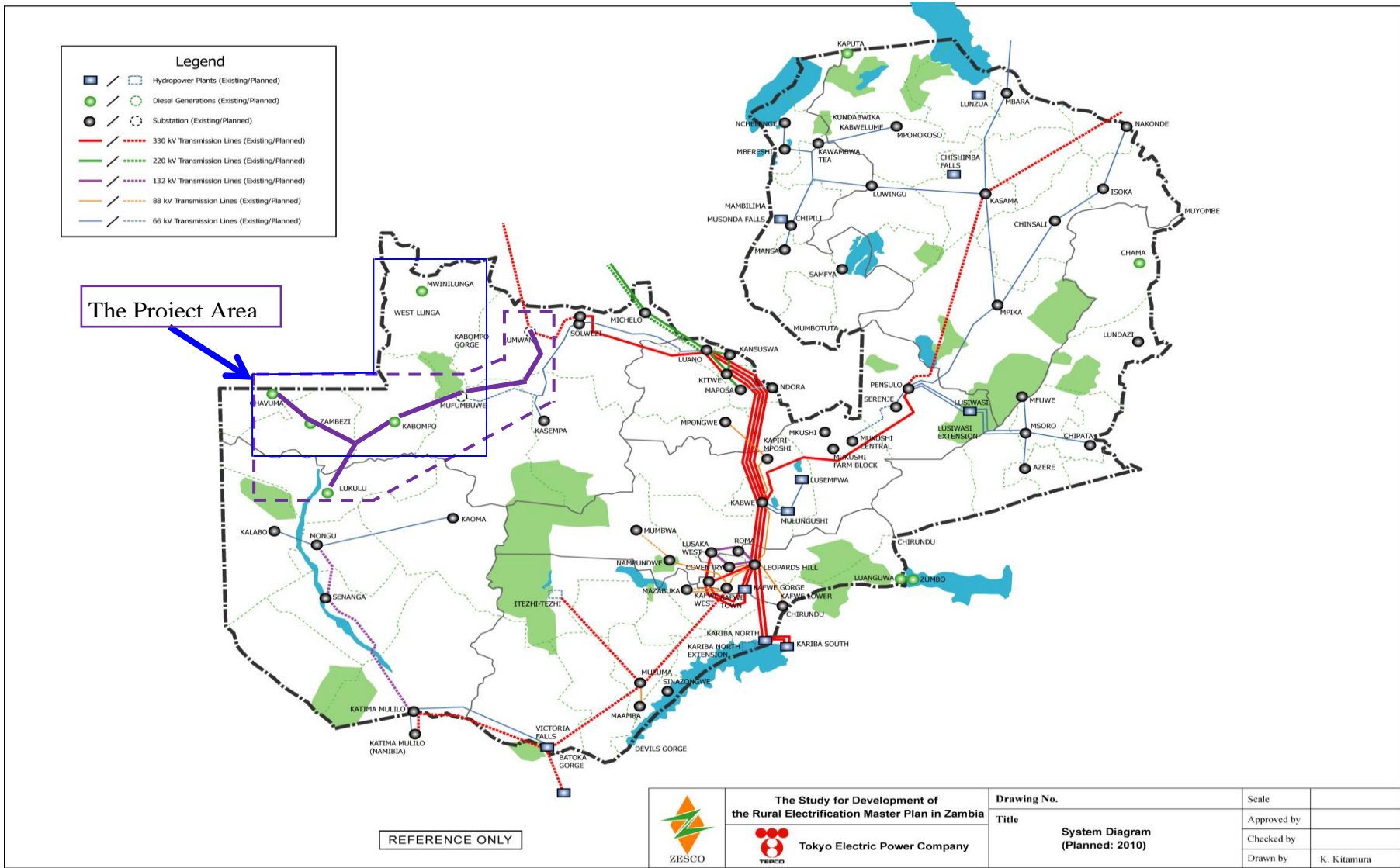


Figure 1: Location map for the project area

A separate environmental impact study was conducted for the above two scopes of work. The EPB was approved by the ECZ and work on the project is underway.

- c) The connection of Mwinilunga to the grid shall be done through the construction of a line from Lumwana substation.
- d) Construction of five 132-66/33/11kV tap down load centre substations, one at each of the five sites of diesel generation; viz Mufumbwe, Kabompo, Zambezi, and Chavuma plus another at Mumbeji and finally a 132kV switch station at Nselauke.

4.4 Project Cost

The estimated capital cost of the project is USD49.4 Million as summarized in the table below:

Table 1 : Cost Estimate of grid connection project

Item	Description	Line Distance (km)	Line Cost (MUSD)	Substation Cost (MUSD)	Total Cost (MUSD)	Cumulative Totals (MUSD)
1	Connection of Mufumbwe from Kasempa T-off	-	-	-	-	-
2	Connection of Kabompo from Mufumbwe	115	10.35	2.0	12.35	12.35
3	Connection of Mumbeji	70	6.75	-	6.75	19.10
4	Connection of Zambezi	70	6.30	2.0	8.3	27.40
5	Connection of Chavuma	80	7.2	1.2	8.4	35.80
6	Connection of Mwnilunga from Lumwana	130	11.6	2.0	13.6	49.4
8	TOTALS	465	42.2	7.2	49.4	49.4

4.4 Project Design and Implementation Timeframe

The proposed power lines will be of the standard 132kV structure which will be on steel towers. Each tower covers a base area of approximately 1.8m x 1m. Detailed tower specifications for 132kV are given in appendix 4.

The project is expected to be implemented over a period of approximately 18months running from July 2011 to December 2012.

4.6 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
- Tendering process and awarding of contract(s)

4.7 Project Construction Activities

The following is the description of typical line construction activities. Specific environmental protection measures and standard construction specifications are included in the ZESCO way-leave clearing guidelines.

During the detailed way-leave selection process, the center line and the boundaries of the way-leave was established within 32m wide preferred corridor, based on the results of the field work. The construction will be done by an independent contractor supervised by ZESCO.

4.7.1 Clearing

It is the practice of ZESCO to clear all the way-leave by removing standing vegetation with the exception of vegetation around watercourses. This practice is employed to ensure that sufficient clearance is maintained between the conductor and the ground, and to facilitate maintenance of the line should repairs be required.

Clearing of ZESCO lines is normally conducted through tender to contractors. The contractor is responsible for completing the work as outlined in the tender document.

Merchantable timber within the clearing zone is salvaged where practical, according to the requirements outlined in all relevant contracts. Some wood waste may be used by the local communities as wood fuel as well as for erosion and sedimentation control. No burning of wood waste shall occur.

Personnel from ZESCO will be on site during the clearing operation to provide quality control and supply the contractor information that may be required.

4.7.2 Erecting Structures

Where possible, structure sites are established with minimal grubbing. However, in particularly steep terrain, a flat area may be constructed for the structure site. The structures may be assembled horizontally on the ground and set in place by a crane. An alternative method which may be used is to assemble the structure vertically one piece at a time at the structure location.

4.7.3 Stringing Conductor

Once the structures are erected, a tractor (or equivalent vehicle) strings the conductor and overhead shield wires through pulleys attached to the insulators. The conductor wires are attached by hand to the insulators. The shield wires provide a path to the ground for lightning strikes.

4.7.4 Installation of Counterpoise

Counterpoise is installed in areas where ground resistance is high in order to improve grounding, and reduce the number of lightning caused outages on the line.

4.7.5 Substations

The load centre substations shall be of the one transformer type, again for reasons of cost optimization. These transformers may be of the three winding type in order to provide two outputs of 33kV and 11kV respectively. 11kV supply shall feed into the existing 11kV distribution networks within the Bomas, while 33kV shall be for supply to load centers that are far from the Bomas. The tentative transformer sizes are 12.5/8/2.5MVA, 132-66/33/11kV for the 3 winding type and 3.16MVA, 132-66/33kV for the two winding type.

HV switchgear for each of the above substations shall be of the air insulated type, conventional or compact or modular depending on market prices. The MV and LV switchgear at the load centre substations shall be of the indoor compact gas insulated type. The substations shall be complete with a control building, guard house, water and sanitation.

To guarantee acceptable security of supply, a trailer mounted mobile transformer shall be supplied as part of the spares and be kept at a centrally located place that minimizes emergency deployment time.

4.7.6 Clean-up

Clean-up activities shall be on-going as construction progresses, and involves the removal of all work materials from the construction site, and installation of erosion control and stabilization techniques, where required.

4.7.7 Re-vegetation

The way-leave will be allowed to re-vegetate naturally, under the vegetation control program. An active re-vegetation program shall be implemented in erodible areas (i.e. road crossings, watercourse crossings), areas of critical wildlife habitat, etc.

4.7.8 Access

The proposed power line way-leave will traverse and intersect several existing public and private roads and forest roads. Existing roads will be used as much as practical to access the way-leave. Existing roads and trails used by forestry department and ZAWA will be used where appropriate. In more remote areas, access roads will be built or constructed during the clearing and construction

phases as required. It is anticipated that few new access roads will be constructed for this project.

4.7.9 Project Operation and Maintenance Activities

The proposed power lines will be operated and maintained by ZESCO in accordance with standard procedures designed to ensure the integrity of the power line system.

Routine inspections will be conducted on the power lines to ensure line security and public safety. During operation, routine maintenance of the proposed line will be carried out every year during annual way-leave maintenance by ground patrol.

The vegetation along the way-leave will be controlled to minimize conducting power to the ground and ground clearances are not to be exceeded. ZESCO currently uses a combination of mechanical bush control and manual cutting for vegetation according to the ZESCO way-leave guidelines.

4.7.10 Decommissioning and Abandonment Activities

ZESCO facilities are designed and will be operated and maintained to provide safe and efficient service over the long-term. If some facilities need to be decommissioned or abandoned, appropriate technology will be used to ensure that regulatory requirements are met. Decommissioning and abandonment of facilities shall be carried out in a safe, efficient and environmentally sound manner.

Decommissioning and abandonment plans shall be developed after consulting with the ECZ and other government agencies. Site decommissioning shall meet legislative standards and sites shall be left clean.

The Diesel Power Stations in the 5 Districts shall be left as standby power supply for a certain period before they are decommissioned.

4.7.11 Waste

The following sections provide a summary of emissions/waste anticipated to be generated during project construction, operation and maintenance.

4.7.11.1 *Air and Noise Emission*

Air emissions during construction of the power lines will generally include carbon monoxide and carbon dioxide emissions from construction equipment exhaust (trucks, dozers, graders). Exhaust emissions will also result from maintenance of vehicles and equipment during operations.

The majority of noise emissions during construction will be associated with the operation of construction equipment and construction activities, including blasting, if required. Noise emissions during operations will be associated with vehicles and maintenance activities.

4.7.11.2 *Liquid Waste*

Liquid waste generated during construction (and to a lesser degree, operation and maintenance) shall include oils, greases and various products from the equipment (petroleum, oil, and other lubricants). These wastes are considered hazardous and shall be collected and disposed off in accordance with applicable regulatory requirements. Liquid wastes from construction crews, including sewage and grey water, shall be collected and disposed in a manner consistent with applicable regulations.

4.7.11.3 *Solid Waste*

Solid wastes generated during construction (and to a lesser degree, operation and maintenance) shall include mainly wood waste from vegetation, material carrying crates, drums, paper, concrete form structures and slash from clearing activities. These wastes shall be disposed off in a manner consistent with applicable standards. Materials that can be re-used or recycled shall be taken to appropriate facilities.

4.7.12 *Project Labour Requirements*

Construction of the proposed power line will occur over a period of 18 to 24 months. During this period the contractor will employ the necessary labour force, in addition to inspectors from ZESCO, which will include environmentalists.

4.7.13 Training of Construction Personnel

Environmental training will be given to appropriate contracted personnel prior to construction of the proposed power line. The level of training will be commensurate with the type of duties of the personnel. The training program will cover plans and procedures specific to the project and may include ZESCO environmental policy, way-leave clearing guidelines, waste management and general environmental education.

4.7.14 Safety and Contingency Planning

ZESCO operates transmission lines country wide and related infrastructure, and has earned an exceptional safety record. Transmission line safety and reliability are achieved primarily through prudent design, construction and maintenance practices. The proposed power line is being designed and will be operated by personnel employed within ZESCO. The procedures adopted for construction will be based on recommended national and international standards as well as on extensive experience on similar projects in ZESCO.

4.8 Raw Materials

The main construction materials on the project shall include but will not be 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
- Fencing wire for substation

4.9 Products

The main product of the project is electric power that will be transmitted on the proposed line. Hydropower is one of the clean forms of energy that does not cause significant environmental degradation during the operation phase.

4.10 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.

4.11 Operation Phase

The transmission lines 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 power lines.

4.12 Route Selection

The process of route selection involved the selection of an environmentally, socially, technically and economically acceptable corridor for the proposed power line project from the substation at Kasempa turn off to Chavuma through Mufumbwe, Kabompo, and Zambezi and from Lumwana substation to Mwinilunga.

The corridor selection exercise process relied on input from specialists from a wide variety of disciplines from within ZESCO Limited. This was complimented by input from the local communities within the project area.

The corridor selection included the following elements:

- Selecting an acceptable corridor in consideration of environmental, technical, land use, social and cost factors;
- Minimising the length/ distance of the proposed line;
- Minimising land purchase requirements, disturbance to settlers and relocation of households, where possible.

4.12.1 Alternative Transmission Options

The route selection process relied upon comprehensive constraint mapping of the study areas to identify possible routes for the proposed power line network. Physical features and the social setup of the area were among the main considerations in the route selection process.

Two transmission routes for each of the power line segment were considered:

Kasempa T-off (Nselauke) to Chavuma

The first alternative for this segment was to construct the line from Kasempa T-off (Nselauke) up to Mufumbwe on the left side of the road and then as the line leaves Mufumbwe, it crosses to the right side of the road through Kabompo, Mumbeji, Zambezi until it reaches Chavuma.

The second alternative was to construct the line from Kasempa T-off on the left (eastern) side of the road and keep it to this side until it reaches Chavuma.

The first alternative was the preferred alternative because the settlements along this route are located close to the road making it possible for the proposed project to utilize the area farther away from the road. The area for the second option is characterized by wetlands and several streams behind the settlement. Therefore, it does not allow for the construction of the line further away from the road as most areas are water logged.

Lumwana to Mwinilunga

The first alternative was to run the line from Lumwana to Mwinilunga on the eastern side of the road then allow the line to cross over to the opposite side just before the proposed site for the substation. This alternative route was found not to be suitable because the Lumwana mine is located on the same side and its boundaries extend from the road to several kilometers inside. It was also observed that there are a number of settlements and shops located along this proposed route.

The second alternative for this segment was to construct the line from the substation at Lumwana and let it run on the left side of the road to Mwinilunga until it reaches the proposed site for the substation. This route was found to be the most suitable because it allowed for the line to shift up to 1-2 kilometers into the bush to avoid settlements, farmland and other private property.

5.0 STUDY METHODOLOGY

5.1 Study Phases

The study consisted of three phases, as follows:

- Phase 1:** Baseline Data collection and Features Mapping
- Phase 2:** Route Selection Process
- Phase 3:** Environmental Impact Assessment

This study process is summarized in Figure 5, and described in detail under the following headings.

5.1.1 Phase 1: Baseline Data collection and Features Mapping

The initial step to study consisted of collecting baselines data, reviewing available information and then mapping environmental features. Environmental data was collected from various sources of literature. General route surveys, review of background documents and stakeholder consultations aided in developing a database and maps depicting environmental features and constraints.

In addition previously completed project reports around the study area which are relevant to the proposed study area were reviewed in order to identify potential environmental issues and features.

5.1.2 Phase 2: Route Selection Process1

Phase 2 of the study identified and evaluated alternative routes and the selection of a preferred route for the proposed lines. The criteria used to identify and evaluate alternative corridors included those suggested in previous way-leaves and professional judgement of the project team. A detailed description of the corridor selection process, ultimately resulting in selection of the preferred corridor, is provided in Section 4.12.1.

The team conducted an assessment of alternative corridors and selected a preferred route through an evaluation of identified environmental constraints.

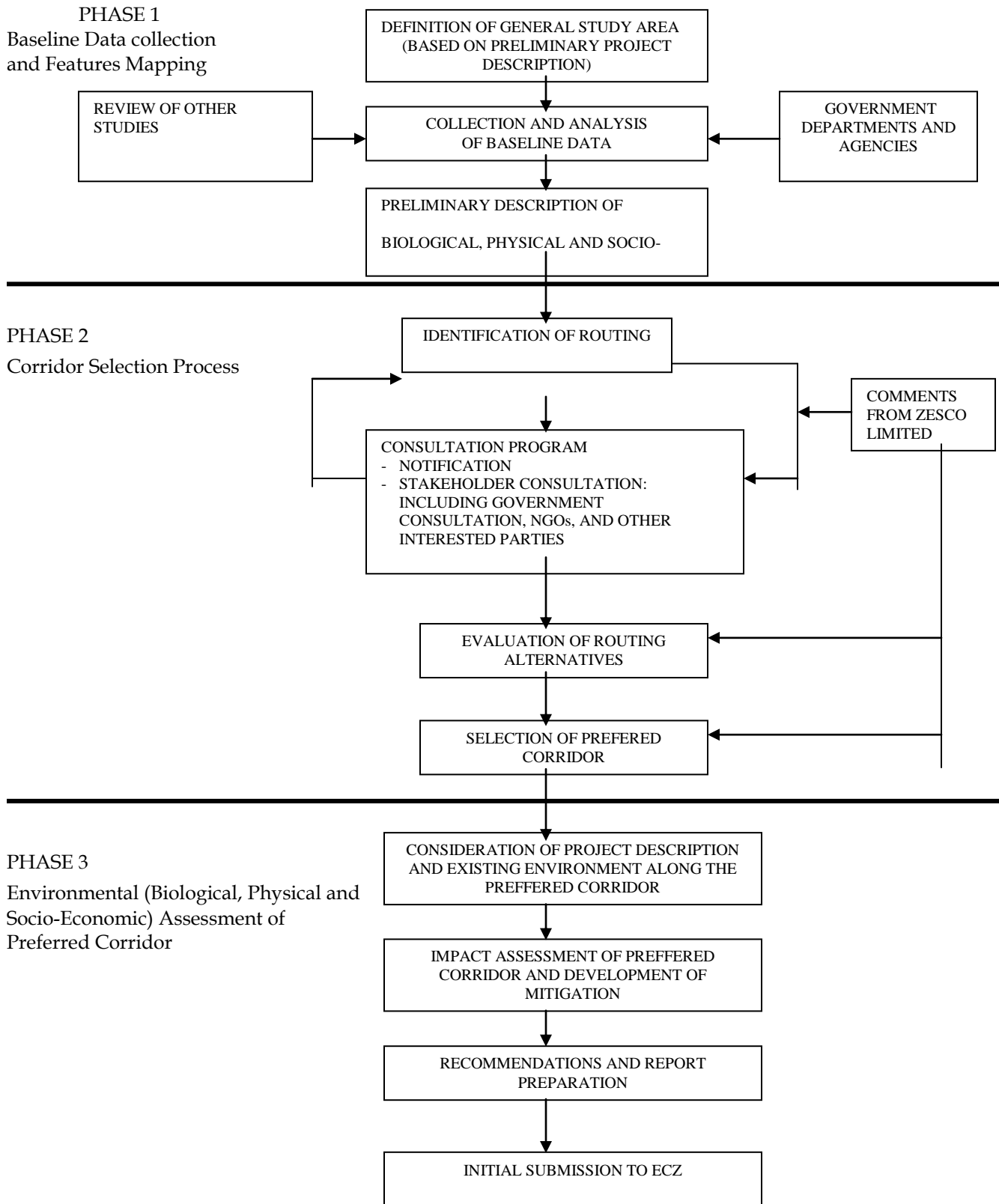


Figure 2: Environmental Impact Assessment study process

5.1.3 Phase 3: Environmental Impact Assessment (Physical, Biological and Socio-Economic environments)

Phase 3 involved completion of detailed EIA of the proposed line, focusing on the 32m wide preferred corridor. The EIA considered the proposed project in the context of the existing environmental conditions within the preferred corridor. The team identified potential environmental impacts and developed appropriate mitigation measures. The mitigation measures were based on ZESCO's standard construction and environmental protection measures as well as legal requirements. The team prepared the EIA and a Social Action Plan.

5.1.3.1 Assembling Project Base Information

The team analysed baseline environmental information relevant to the 32m wide preferred corridor. Thereafter, the team prepared a description of existing conditions within the general study area to support the assessment of potential environmental effects of various project activities on the environment.

5.1.3.2 Scoping

The EIA for the proposed connect of NW Province to the National Grid at 132kV provided guidance of significant issues and reasonable alternatives for the power line network EIA Study.

Various line route options described in the previous chapter were analysed and compared. Several households along the proposed corridor were interviewed to provide information on household characteristics and economic activities. Interviews were conducted with settlers along the preferred line corridors in all the five districts. Meetings and discussions were also held with the Local Chiefs, District Commissioners, Councils, representatives from the Departments of Forestry, Fisheries, Agriculture, Education, Health and Community Development. Figure below shows stakeholders in Kabompo analyzing the proposed line route during a Scoping meeting. Various other agencies and individuals listed in Appendix 3 were also consulted. Appendix 3 gives the list of individuals, agencies and groups of people consulted during the study.

To make best use of the time available, the EIA Study Team concentrated on priority areas, namely the settlements, the forest, heritage sites (such as burial sites) and places with erodible soil likely to be directly affected by construction activities.



Figure 3: A ZESCO representative explains the proposed line route to stakeholders at Kabompo

5.1.2.3 Public Consultations

Public consultation is one of the most important aspects addressed in this EIA. Various procedures and techniques were employed to facilitate the involvement of the public in this project. The main method was by way of conducting interviews with stakeholders (affected people, government officials etc.)

During the EIA Study, explanation to households in local languages was also done.

Comments on the proposed project by the stakeholders during the one to one consultations were incorporated into the recommendations of this document. (Refer to Figure 3)

5.1.2.4 Identification of Valued Environmental Components

Where clear environmental concerns for any project activity were identified and potential effects seen, the team designated the environmental concern as a valued environmental component upon which the EIA study was focused. The valued environmental components were determined, in part by perceived public concerns related to physical, biological, socio-economic, or aesthetic values and by scientific and professional knowledge.

5.1.2.5 Assessment of Effects

The study team assessed the potential environmental effects of construction, operation and decommissioning of the proposed line as well as accidental events for each valued environmental component. The categorization of environmental effects in terms of whether they were adverse or positive, and if adverse, their significance and, if significant their likelihood were assessed. The assessment was done using defined rating criteria shown in Table 2.

The team recommended mitigation measures for identified effects, assessed residual effects after considering mitigation measures, and predicted potential environmental effects using a combination of objective and subjective experience and professional judgment.

5.1.2.6 Environmental Management

Environmental management tools included environmental management plans, environmental guidelines, construction standards and specifications, environmental mitigation measures, contingency plans and recommended monitoring initiatives.

5.1.2.7 Approach to Cumulative Impact Assessment

The effect of the project on the environment may not be fully understood by individual activities of the project and their interactions with environmental concerns. In many cases individual projects environmental effects are not significant in themselves. However, when these are combined with the effects of other project activities or other projects, these effects may become important. For assessment purposes, the term cumulative environmental effect used in this report means “the effect on the environment which results from the effects of Project activities when combined with those of other past, existing, and likely future projects and activities”.

The study team based its assessment on cumulative effects on previous cumulative effect assessment experience and knowledge of other linear corridor projects. The objective of the cumulative effects assessment is to consider the potential cumulative effects resulting from the relationship between project related effects and those of other activities, including general land uses of the area.

5.1.2.8 Determination of Significance

The study team used the Environmental Impact Assessment Regulations as a framework for prevention and management of adverse environmental effects potentially resulting from the proposed line.

Table 2: Criteria considered in the assessment of Potential Environmental Effects

Key Terms	Criteria
Adverse	<ul style="list-style-type: none">• Loss of species of a special status• Reductions in species diversity• Loss of critical habitat• Transformation of natural landscapes• Toxic effects on human health• Reductions in the capacity of renewable resources• Loss of current land use• Loss of property due to the project• Relocation of affected households
Significant	<ul style="list-style-type: none">• Magnitude• Geographical extent• Duration and frequency• Reversibility• Ecological context
Likely	<ul style="list-style-type: none">• Probability of occurrence• Scientific uncertainty

5.1.2.9 Public Hearing Meetings

Early consultation with the public, government agencies and other stakeholders was part of the study. The objective of the consultation process was to:

- Identify stakeholders
- Provide information to stakeholders on the importance of the project
- Obtain input from potential stakeholders
- Integrate the information received into decision making process

The study team used a number of methods to achieve the objectives which included:

- Identification of the key community members during the study area categorizing process
- One to one consultative meetings within the project area
- Formal permission from public through consent.

The list of stakeholders and other people contacted is given in Appendix 3.

6.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

6.1 *Physical Environment*

The physical environment on the route refers to the natural environment associated with the construction of the proposed 132kV power line network in the five districts of NW Province that are currently supplied by Diesel generated electricity. Mufumbwe, Kabompo, Zambezi and Chavuma will be connected from Kasempa t-off whereas Mwinilunga District will be supplied from Lumwana. The physical environment then includes: the geology, topography, soils, climate and hydrology of the project area.

6.1.1 *Geology and Soils*

The geology of the area is of complex nature. The basement rocks are overlaid by the Muva, Lower and Upper Roan, Mwashia and Upper and Lower Kundelungu series. Large parts of these have been irregularly deposited and irregularly eroded over time.

The soils in the area are of two different types depending on the elevation. Soils on the plateau are highly leached, very strong acid, red to reddish clayey and slightly silty soils (oxisols): coarse loamy, clayey soils poorly drained.

The soils of the plateau are ferrallitic in nature and are derived from various parent rocks, including granite, gneiss, sandstone and schist. These are old soils and are heavily leached due to high rainfall with lower base saturation of pH between four and five, having a red or reddish-yellow colour. The clay content is generally high: Soil textures change from clays to sandy clays or sandy loams as you descend from the plateau to Zambezi valley. In the project area, the soils are sandy loamy and are well drained

6.1.2 *Topography*

Most parts of the project area are generally flat with average altitudes of between 1000m and 1200m above sea level. The area in Chavuma district has two distinct geomorphologic features. Part of the area falls within the upper Zambezi valley and is generally flat with an average elevation of about 1,100m above sea level. The area near the Zambezi River is covered by a plateau with altitudes between 1200m and 1300m above sea level. The plateau area is gently undulating rising to low hills of about 1300m above sea level. The plateau is broken by isolated low ranges of hills in few places.

6.1.3 Climate

The project area, like any other parts of the Province, has a tropical climate with three distinct seasons: the warm-wet season, stretching from November to April with mean temperature of 26°C; cold dry season from May to August with mean temperatures varying between 14°C and 24°C. The hot dry season is experienced during the months of September and October with mean temperature of 32°C. The minimum temperatures are also at their lowest in June and July, averaging between 5°C and 8°C degrees, and they, too, show a fairly rapid rise into October. They continue to rise until December and January, when they are maintained at about 17°C degrees until the end of the rains.

The rains in the project area are caused by the convergence of the Northeast and South-east Trade Winds that form the Inter-tropical Convergence Zone (ITCZ). The area experiences early rains before most parts of Zambia and the late rains, as the Inter-Tropical Convergence Zone moves northwards later than the southern part of the country, so that the rainy season is relatively long and the mean annual rainfall relatively high. The average length of the rainy season is just over five months with December, January and February experiencing highest rainfall while November and March have less. The annual rainfall averages 1240mm.

6.1.4 Hydrology

North Western Province is endowed with a lot of surface water and is drained by several rivers and numerous streams. The Zambezi, Kabompo and Lunga are the largest rivers in the project area. A number of waterfalls also exist among different rivers in the province. Figure 3 below shows the Chavuma falls on the Zambezi River.

Table 3 Watercourses crossed by the preferred corridor

Crossing Number	Watercourse
1	<i>Chifuwe</i>
2	<i>Mukundwiji</i>
3	<i>Chikonkwelo</i>
4	<i>Mumbeji</i>
5	<i>Kawilo</i>
6	<i>West lunga</i>
7	<i>Nyambwezu</i>
8	<i>Nyavisonga</i>

The table above gives the list of water courses to be crossed by the proposed power line network.



Figure 4: Chavuma falls on the Zambezi River

6.1.5 Wetlands

Dambos form the main type of wetlands in the project area. There are two types of dambos, the head water dambos and the side stream dambos. The headwater dambos are mainly found at the sources of the streams and the various tributaries while the side stream dambos are found in low laying areas of the river systems. The headwater dambos act as temporal storage for runoff at peak flows and recharge the streams slowly through out the year. The side stream dambos areas are key for flood control as they are able to act as temporal storage for peak flood river flows.

The Zambezi and Busanga plains which are wetlands of international significance (Ramsar) are also located in the NW Province.

6.1.6 Air Quality

Solwezi District hosts two large copper mines, namely Kansanshi and Lumwana. There are some emissions from mining activities into the atmosphere. Dust from gravel roads also contributes to air pollution in the district. However, most of the project area is basically rural and has no industries, except for small hammer

mills for grinding maize and other foods. Hence, there is no air pollution. Air quality in the project area is equally good since there are no industries and other possible sources of air pollution. Motor vehicle traffic is low hence pollution from vehicle emissions is low.

6.1.7 Noise

The main activities that could emit noises are concentrated in the mining areas. These activities are away from settlements. The proposed project area has no industries and motor vehicle traffic is low, there are no major sources of noise pollution.

6.1.8 Waste Management

In the rural parts of the province general household waste is disposed of in rubbish pits. Pit latrines are commonly used for human waste. In the Bomas waste is disposed of in designated places allocated by the councils.

6.2 Biological Environment

6.2.1 Fauna

(a) Mammals

Owing to human population increase resulting in opening up of new areas for settlement, mining and cultivation and the resultant illegal hunting of wildlife, most species of wildlife do not exist in open areas, except rodents and rabbits. Common mammals in protected areas of NW Province include monkeys (*Cercopithecus aethiops*, *Papio ursinus*), antelopes (*Tragelaphus scriptus*, *Sylvicapra grimmia*, *Cephalophus monticola*, *Tragelaphus oryx*, *Tragelaphus strepsiceros*, *Aepyceros melampus* and *Hippotragus equinus*), Zebra, Lion (*Panthera leo*), Leopard (*Panthera pardus*), Spotted hyena (*Crocuta crocuta*), Wild dog (*Lycaon pictus*), Wild cat (*Felis silvestris*), Otter (*Aonyx capensis*) and Honey Badger (*Mellivora capensis*).

(b) Birds

Since the area covers both the plateau and the valley, both waterfowl and woodland bird species are common. Woodland bird species common in the area include kites, Sparrowhawks, doves, and vultures.

Common waterfowl species include a wide variety of wild ducks, herons, egrets, and geese.

(c) Reptiles

Reptile species that occur in the area include representatives of the lizards, chameleons, tortoise and various species of snakes, such as Black mamba (*Dendroaspis polylepis*), Black-necked spitting cobra (*Naja nigricollis*), Boemslang (*Dispholidus typus*), and Puff adder (*Bitis arietans*).

The Nile crocodile (*Crocodylus niloticus*) and water monitor (*Varanus niloticus*) are also present in some rivers.

(d) Fish

The streams and rivers in the area have a variety of fish species which are caught by fishermen, although the fish stocking levels are not as high as the Barotse plains and the Lower Zambezi. Common fish species include Barbel fish (*Clarias gariepinus*), red breasted bream (*Tilapia rendalli*), dwarf bream (*Taplochromis philander*) and green headed bream (*Oreochromis macrochir*).

The Department of Fisheries in the Province is also running a fish farming project in the province funded by the European Union (EU).

6.2.2 Flora

(a) Vegetation

According to the 2000 Status of the Environment Report, NW Province has the highest forestry growth rate compared to other provinces. In 1996, a total of 14.2m³ of wood cover was found in NW Province out of the total 50.4m³ for the whole country.

The main type of vegetation in the province is *Miombo* which is characterized by *Brachystegia*, *Julbernardia* and *Isobertinia* species. Other common tree species among the NW *Miombo* are the *Parinari* (*Mupundu*), *Marquasia* (*Museshi*), and *Dyplorinchus* (*Mwenge*).

Grass species are prevalent in the *Miombo* Woodland. The common species include *Eragrostis brizoides*, *Aristida adscensionosis*, *Sporobolus rhodesiensis*, *S. pyramidalis*, *Chloris gayana*, *Digitaria scalarum*, *Brachiaria brizantha*, *Pennisetum purpureum*, *Erythrophloeum africanum*, *Andropogon sp.* and *Hyparrhenia cymbaria*, *H. filipendula*, and *H. rufa*.



Figure 5: *Vegetation in a section of the proposed project area*

(b) Protected Areas

The Province is rich in wildlife and therefore the Forestry Department and the Zambia wildlife Authority strive to maintain the wildlife status of the area. There are about seven (7) Game Management Areas (GMAs) in the Province, namely; Kasonso-Busanga, Musele-Matebo, Lukwakwa, Chibwika-Ntabo, Chizera, Lunga-Luswishi and Machiya-Fungulwe. West Lunga and part of the Kafue National Parks are also located in NW Province.

There are about thirty two (32) Protected Forest Reserves and twenty three (23) Local Forests in the province. However, there are no National Parks and Forest Reserves in the immediate project area.

6.2.3: Forest Resources

A number of forest resources and products are derived from the forests in the project areas. These include wild fruits and vegetables, mushrooms, caterpillars and other edible insects, timber for construction purposes and wood for fuel. Grass and other fibrous plants for thatching roofs and weaving baskets and brooms are also derived from the forest.

6.3 Socio-Economic Environment

6.3.1 Population

According to the 2000 Population census by CSO, NW Province has a population of 583,350 people. The table below shows the population of the Province in each District.

Table 4: Population of Northwestern Province Districts

DISTRICT	MALE	FEMALE	TOTAL
CHAVUMA	14,815	15,126	29,941
MUFUMBWE	35,286	35,952	71,238
KABOMPO	25,810	26,094	51,904
KASEMPA	21,875	22,127	44,002
MWINILUNGA	58,543	58,962	117,505
SOLWEZI	102,241	101,556	203,799
ZAMBEZI	32,286	32,677	64,963
TOTAL	290,856	292,494	583,350

Source: CSO, 2000 Census of Population and Housing, Preliminary Report, April 2001

6.3.2 Settlement Patterns and Traditional Authority

NW Province has both urban and rural area. In urban areas located at the district centers (commonly referred to as Bomas), urban areas are planned and zoned into residential and commercial/offices areas. Houses are built in designated residential areas. However, in the rural parts of the district the people in the project area live in villages. Most of the houses are constructed of mud bricks with grass thatched roofs, but a few houses are made of burnt bricks with modern designs.

At the village set up, the Chief is the highest authority who is assisted by village headmen. At household level, the man is the head of the family even though female – headed households are common. Kaonde, Lunda and Luvale are the mostly spoken languages in the project area.

6.3.3 Social and Cultural Set-up

Settlements in the rural part of the project areas are organized in form of villages. A village is made of many of households living in a defined geographical area under the leadership of the 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 chiefs in the area. The chiefs in the immediate project area include; Senior Chiefs Sailunga, Mukumbi and Musele from Lumwana to

Mwinilunga, Senior Chief Sikufele in Kabompo and Senior Chiefs Ishindi and Ndugu in Zambezi and Chavuma. Townships in the project area have modern types of settlement with facilities associated with urban area such as houses with electricity and water.

6.3.4 *Local Economy*

Mining, trade and agriculture are the dominant economic activities in NW Province. First Quantum Minerals Limited and Equinox Limited own the Lumwana and Kansanshi Mines in Solwezi District. Other Copper mining Districts are Kasempa, Mufumbwe and Mwinilunga. Agriculture produce such as beans, cassava and groundnuts are sold both locally and to other parts of the country.

6.3.5 *Land Tenure*

Most of the Land in the Bomas is under the control of the Municipal Councils and developers who need land for residential, commercial or industrial purposes can apply to the Councils. The land in the outskirts of towns is customary, hence under the jurisdiction of Traditional Chiefs. The proposed project will pass through traditional land, under Chiefs Chizela, Sikufele, Ishindi, Ndunga, Sailunga, Musele and Mukumbi. All the substations for the proposed project shall be located within Council land. Some land is state land while small portions belong to private farmers who have title deeds.

6.3.6 *Land Use*

In the rural parts of the province, subsistence farming is the major land use. Other land uses in the province include business/ commercial facilities, public institutions such as schools and hospitals and mining.

6.3.7 *Agriculture*

Due to the presence of fertile soils and good rainfall, crop yields in the province are generally high. The major crops grown on a subsistence scale include beans, maize, groundnuts, cassava, sweet potatoes, sorghum, rice and millet. Fruits such as oranges, tangerines, bananas and avocado pears are commonly grown in Zambezi and Chavuma Districts.

6.3.8 Employment

The project area has substantial employment opportunities. The main providers of formal employment are the Copper Mines and the Government which employs professionals such as teachers, health workers, community development officers, social workers, Agricultural Extension Officers, Fisheries officers, Police officers and Immigration officers. Parastatals include ZESCO Limited, ZANACO, Zambia Telecommunication Corporation (Zamtel) and Northwestern Water and Sewerage Company. Private companies are lodges and small scale mining firms. Subsistence farming and trading are the most common occupations in rural parts of the project area.

6.3.9 Education

Access to Education is an important indicator for levels of poverty as it affects and is affected by other areas of life such as health, nutrition, employment and earnings. It is emphasised that a school system should provide high quality education to all those entitled to it, and also high quality education above what is compulsory, is one of the most important preconditions for development.

In NW Province, the biggest role in formal education is played by the Ministry of Education. Others who play a role include the Ministry of Community Development and Social Welfare, Trades School and Private school owners. The formal education system is comprised of three levels: basic schools (grades 1 to 7), upper basic schools (grades 8 to 9), high schools (grade 10 to 12) and tertiary level. There is compulsory education from grades 1 to 7 and in theory all children should attend school up to grade 7. There are competitive selection examinations at grades 7 and 9. Plans are under way, however, to phase out the grade 7 examinations with the creation of Basic schools as a result of the inception of the National Policy on education in 1996 which emphasises liberalisation and decentralisation. This will make formal education compulsory up to grade 9 and in theory all children will have to attend school up to this grade. Not all children however will attend school up to grade nine as some children will not manage for economic and other reasons. Figure below shows part of the facilities at the Farmers training Center in Mwinilunga.



Figure 6: *A block of hostels at the Mwinilunga Farmers Training Center*

6.3.10 Health

There are a number of health facilities available in NW Province. Each District has a district hospital which acts as a referral hospital to all the other rural health centers.

Common diseases in the area include malaria, diarrhea, skin infections, pneumonia, respiratory tract infections, malnutrition, anemia and intestinal worms. Due to an influx of people from other places and having border towns, the province is a risk area for HIV/ AIDS and STIs.

6.3.11 Water Resources and Sanitation

In the Bomas most residents have access to clean and safe piped water supply provided by Northwestern Water and Sewerage Company. The Province also has developed sewage systems operated by the utility company mentioned above. In the rural areas, people rely on streams and boreholes provided by Water Affairs Department for drinking water. In many areas, some households have made their own wells. The water from wells and rivers is also used for washing and other domestic uses. Residents in the villages use uncovered pit latrines or have no formal toilet facilities. There are no covered pit latrines or ventilated improved pit latrines (VIPs) in the area.

6.3.12 Industries

There are no industries in the immediate project area. However, industries in other parts of NW Province include pineapple cannery (currently not operational), small rice polishing mills, pit sawing mills, and mines.

6.3.13 Minerals/Mining

Northwestern Province has a large amount of mineral reserves. It is home to two large mines namely Kansanshi and Lumwana in Solwezi District. Major minerals in the area are Copper, Cobalt, Iron and Gold. Other minerals are Uranium and more recently there have been explorations for Petroleum in the Zambezi valley.

There are also various types of semi-precious stones such as Emerald, Ruby and Amethyst. However most of them remain unexploited and a few are mined by private small scale miners.

Small scale mining of copper using picks and shovels by individuals is common in the Province. The ore is sold to Copper dealers mainly from the Copperbelt.

6.3.14 Tourism

Tourist resources in the province include archaeological and historical sites, water falls and rivers, national parks and GMAs. The tourism industry in the province is under developed due to poor road network and underdeveloped infrastructure.

6.3.15 Transport and Communication

Most of the transport and infrastructure in the project area is underdeveloped. Four out of seven districts are accessed using gravel roads. Most bridges are also old and in poor condition. People commonly use public transport to move from one district to another.

6.3.16 Goods and Social Services

Most of the goods and services are obtained from the Bomas. Basic household commodities are available in shops in the districts. Shops, butcheries, hair salons and a post office, among others, are also available at market centres with electricity supply. There are also open market places where an assortment of

agricultural products and second hand clothing are sold. The biggest supermarkets located at Solwezi.

6.3.17 Planned Development Activities

There are many planned developments in the Districts. There are plans to build more schools, office blocks, residential houses, restaurants, expand the hospitals and other social facilities. Other major projects in the area include the tarring of the Mutanda-Cahvuma road, resurfacing of the Mutanda- Mwinilunga Road, resuscitation of the Pineapple cannery in Mwinilunga and opening up of new mineral and gemstone mines in the province.



Figure 7: A section of the newly tarred road between Kasempa t-off and Mufumbwe

6.3.18 Archaeological and Cultural Heritage

Archaeological and Paleontological materials (artifacts) are very important as they give an insight into Zambia's ancient past. Hence, the need to preserve them whenever and wherever they may be discovered. The artifacts may be in forms of:

- Rock paintings or engravings
- Pottery
- Ironworks, slag or other metal-craft
- Beads, bangles or other personal adornments
- Stone implements
- Human bones
- Fossils

- Or any other thing that seems to be records of the past life.

Most parts of NW Province still remain pristine with rich cultural and ethnic resources. The main tribes in the Province are the Kaonde, Lunda and Luvale. These groups of people share common cultural practices such as the celebration of seasonal feasts and initiation of young people into adulthood. Great honour and recognition is also given to their traditional leaders.

Although the province has a number of heritage sites such as the Nyambwezu Rock Shelter at Nyambwezu Falls, the Zambezi source and the Kabompo House No. J11a, they do not lie within the immediate proposed project area. However, there are graveyards and burial sites located close to villages in the project area.

7.0 POTENTIAL IMPACTS

This section of the report discusses the anticipated interactions of the project with the physical, biological and socio-economic environment. It gives a description of the potential environmental impacts which are likely to arise from the proposed transmission power line project. The methodology used to analyse the existing environment and predicted environmental changes that may occur, either directly or indirectly from project shall be as described in the methodology section of this report.

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. It also makes it 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 Environmental Impacts*

7.1.1 *Geology*

The provision of high voltage electricity shall lead to the establishment of more mines in the province. This could lead to further environmental degradation during the process of opening up of mineral pits. New mining activities could also lead to an influx of new miners creating further social impacts in the area.

7.1.2 *Topography*

The study area is generally flat with a few undulating places making it easier to work through. Disturbance to the natural cover, especially in steep places, could lead to accelerated water induced soil erosion during the rainy season.

7.1.3 *Soils*

Northwestern province usually receives very heavy rainfall. Line construction activities might open up areas that could be exposed to water erosion. The variability in soil texture in the study area entails that certain sections of the route could be exposed without any serious threat to water induced erosion. For instance, clayey top soils are highly prone to water erosion once exposed.

7.1.4 Climate

Opening up of the area by way of way-leave clearing and creation of access roads could lead to changes in micro-climates localized in nature. For instance, if any swampy area is drained leading to drying up of local areas the influence of wet grounds could be lost hence leading to rise in local temperatures.

7.1.5 Hydrology

The drainage density comprising mainly several perennial streams in the area makes the route prone to water erosion. Opening up of the area could also lead to the disturbance in the natural flow of some of the streams especially in trying to make appropriate crossing points.

7.1.6 Wetlands

In order to ensure the stability of the towers and for ease of access, most of the wetlands in the area shall be avoided. The 132kV towers shall have a base area of about 1.825m x 1m; therefore, no significant negative impact is expected to occur.

7.2.7 Air Quality

The current Diesel Stations are characterized by smoke emissions, thereby contributing to air pollution. The connection to the national grid shall therefore have a positive impact on air quality since hydropower has no emissions and a clean form of energy. Pollution in form of dust and engine exhausts shall be confined to the construction period and during maintenance. Other construction activities that may cause air pollution during construction are equipment operation and movement, clearing and grubbing and excavation activities.

7.2.8 Noise

Noise pollution shall be created during construction especially since heavy-duty equipment shall be used in excavating, stringing and tower erection. Noise pollution shall however, be limited to the construction and routing maintenance period.

However, during operations transmission conductors will produce noise under certain conditions because of corona discharge. Corona discharge is the ionization of the air next to the conductor by the electric field which is related to

the voltage on the conductors. The loudness of the noise depends on conductor conditions, voltage level, and weather conditions under these conditions the power lines will make a hissing, popping or cracking sound.

7.1.9 *Visual Impact*

The steel towers will be taller than the trees in some places. Therefore, the power lines will cause visual protrusion in a few places.

7.1.10 *Waste Management*

Construction will produce large quantities of rubble from the blasted rocks which if not well managed can adversely affect areas where it will be dumped. Additional waste such as concrete, steel bars, bolts, nuts, cables, cable drums, waste oils, paper, plastics, metal and woody vegetation, which have adverse impacts on the environment, will also be generated. The project is also expected to generate domestic waste such as left over foodstuffs and human waste, especially at the camping sites for workers.

7.2 *Ecological Environment*

This section covers aspects of the biological environment that will be impacted upon by the project.

7.2.1 *Fauna*

7.2.1.1 *Mammals*

The way-leave for the proposed transmission line network could open or truncate some migratory routes for wild animals. However, open areas under the way-leave could provide new grazing grounds for some animals especially antelopes. Poaching would be the major adverse impact on the large mammals by construction workers.

Foundation construction could disturb habitats for small rodents such as rats.

7.2.1.2 Birds

The transmission lines may traverse routes for some migratory birds. Migratory birds fly from one ecological region to another and they follow certain established routes every year. Some of these birds (especially big 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 the way-leaves and may lead to the damage of eggs or newly hatched chicks. Poaching of birds by workers is also likely to take place during construction.

However, there is likely to be positive impact on the Raptors which use power line towers for nesting. Other birds also use the power lines for perching and use way leaves for roosting.

7.2.1.3 Reptiles

Small reptiles such as Geckos, Chameleons, Skunks and Monitor Lizards and snakes may lose habitats during foundation excavations. Some could be killed due to use of heavy duty construction equipment. Small reptiles, however, are quick to adapt to changes in the habitat. The edge effect created by the way-leave may create habitat requirements for certain species thereby improving population status of those species.

7.2.1.4 Aquatic Life

If towers are located near the river banks, the excavated soils and other forms of waste may enter the water courses and cause water pollution. This may adversely affect the fish and other forms of aquatic life in the river and some may end up dying. Indiscriminate fishing by construction workers may pose danger to endangered fish species.

7.2.2 Flora

7.2.2.1 Vegetation

Construction will involve cutting of vegetation to create a way-leave of 32m width (16m from the centre of the line on either side) and this could induce soil erosion. It may also lead to the destruction of trees of medicinal value and those of commercial value for timber. However, the beneficial attribute for flora would

be the creation of a fire break by the way-leave, which will be maintained yearly by ZESCO. This will stop fire from crossing from one side of the forest to the next and vice versa especially in the Local Forests and Reserves.

7.2.2.2 Protected Areas

During route selection, efforts were made to avoid traversing any protected areas such as forest reserves or GMAs. However, this may not be possible in a few places. Where the lines traverse a protected area such as a forest reserve, trees which can be used for timber and other uses shall be cut. Some of the trees have medicinal properties and other can be used for different construction purposes. Cutting of trees can also cause soil erosion in the Forest Reserve and the surrounding areas.

By constructing power lines through an open or forest reserve, people may be attracted to burn charcoal using the trees which will be cut. However, there is a possibility that after trees which will be cut during bush clearing have been depleted, charcoal burners may start cutting standing trees to produce charcoal and this may result in deforestation and soil erosion will set in as a consequence. Valuable trees for timber and other uses may also be depleted.

7.2.2.3 Grasslands

The proposed transmission lines will traverse through some grasslands. 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. The way-leave which will be created will encourage growth of more grass leading to expansion of the existing grasslands in the area.

7.3 Socio-Economic Impacts

7.3.1 Population

During construction, there will be an influx of people in the project area from other districts outside the project area. Most of these will be unskilled and semi-skilled people searching for jobs. The contractor(s) is also expected to come with a team of skilled personnel from various parts of the country and some from outside the country to carry out various skilled tasks during the entire construction phase. However, this influx will be restricted to the construction phase. Once construction is completed, workers are expected to go back to their places of origin or any other place they may choose to settle in. A few may opt to settle in the project area.

7.3.2 Settlement Patterns and Traditional Authority

There will be no significant impact on settlement patterns in the project areas. Although a few houses in some villages will be demolished, the affected people will still be able to build new houses within their villages after being compensated.

During construction, the contractor will build temporary camps in different places along the proposed route for the power lines. They will not alter the settlement patterns in the areas as the camps shall be demolished once construction activities are completed in an area.

7.3.3 Social and Cultural Set-up

The coming of construction workers from other places can create conflict with the local dwellers especially if the workers are morally weak. Social strife may be created in the project area and may affect the progress of the project.

The influx of people into the project areas may also breed social problems such as theft, prostitution and drug abuse. Some of the people coming into these areas could be people with questionable characters and may bring their bad habits into the areas and some of the local people may imitate the bad behavior of the newcomers.

7.3.4 Local Economy

Some people in the project area will be employed on the project during construction and this will lead to an improvement in the income levels and, in turn, in the standard of living. From the improved incomes, people will be able to buy foodstuffs, groceries, clothes and other essential commodities and this will have a multiplier effect. Some of the income will be used for paying school fees, medical expenses and other domestic needs. Some materials, such as sand and crushed stones may be bought locally within the project area and this will benefit the local economy.

In addition the provision of firm and reliable electricity will lead to the establishment of more small, medium and large business enterprises such as sawmills, hammer mills, mines, shops, irrigation farms, lodges and other activities that require electricity.

7.3.5 Land Tenure

There are no anticipated impacts on land tenure. The existing land tenure will not be disturbed. Chiefs, local authorities, the state and farmers will maintain their land ownership both during the construction and operation phases of the project.

7.3.6 Land Use

Utilization of the land under the power lines and within the way-leave will be restricted. Building of houses, planting of fruit and other trees and similar activities under the power lines will not be allowed. However, growing of low crops such as groundnuts, beans, sweet potatoes sorghum and maize is permitted. Ploughing at the foot of towers shall not be allowed as this could destabilise the foundations of the towers.

7.3.7 Agriculture

There will be no anticipated significant impacts on agriculture. The line will also traverse a few agricultural fields where low lying crops are cultivated. Farmers will continue with their usual farming activities and will be allowed to utilize even the land under the power lines. The way-leave cleared of vegetation will provide good grazing grounds for cattle, sheep, goats and other live stock. During construction, the workforce will provide a ready market for various agricultural produce and will boost farmers' incomes.

There is a possibility that some crops in the fields will be damaged during construction, especially when making the access road along the power lines.

7.3.8 Employment

There will be temporary employment opportunities to the local communities during the period of construction, especially during bush clearing and construction of foundations for the towers. When recruiting workers, the contractor shall ensure that the local people are given priority. Some construction materials, such as crushed stones and sand will be obtained within the area and this will indirectly contribute to employment creation for those engaged in crushing stones and mining of sand.

7.3.9 Education

Most of the workers who will come from outside the project area will not bring their children along since the period of construction is short. The children and their wives are likely to remain in their usual places of residence. Hence, there will be no added pressure from the project workforce on the existing education facilities in the project areas.

7.3.10 Health

The interaction of construction workers from outside the project area with the local people may lead to the spread of HIV/AIDS and other communicable diseases. This interaction can also lead to spread of water borne diseases such cholera, dysentery and typhoid. The workers may be exposed to the risk of accidents during construction phase which may result in injuries.

7.3.11 Water and Sanitation

There is likely to be more pressure on the existing water and sanitation facilities with an increase in the population during the construction phase. It is envisaged that appropriate and adequate sanitary facilities like pit latrines and places to bath shall be constructed for workers during the construction phase of the project.

Domestic waste generated at the camps for workers can adversely affect the sanitation in the area. Domestic waste such as left over foodstuffs and human waste can pollute the environment if not well managed.

7.3.12 Industries

No industries will be required to relocate as a result of this project. The project will make more power available to the Province to support the establishment of new industries such as pineapple canneries at Mwinilunga, rice processing plants in Zambezi and Chavuma, mine and mineral smelters.

7.3.13 Minerals/Mining

Mining is the major economic activity of the Northwestern province. In recent years, some explorations for minerals, oil and gas have been carried out in the Province. The proposed project shall allow for more explorations to be conducted. The establishment of new small scale mines shall also be possible with the power that will be available in the districts.

7.3.14 Tourism

The project has no negative impacts on tourism. The availability of electricity will lead to the establishment of better accommodation facilities for tourists coming to these areas.

7.3.15 Transport and Communication

When construction commences, project vehicles will lead to an increase in traffic on the main roads and feeder roads in the project area and this in turn may lead to an increase in road traffic accidents.

7.3.16 Infrastructure and Social Services

Construction workers will provide a customer base for goods and services. Business people will be encouraged to build more and even bigger shops and other social amenities.

During project implementation, some feeder roads will be graded and some culverts and small bridges repaired to facilitate the movement of construction equipment. The improvements in some of the roads shall benefit the local people.

7.3.17 Planned Developments

The project once completed will make more power available to the area and this will make it possible to implement the planned developments in the five districts. The proposed project shall create employment opportunities, improve other sectors such as health and education, provision of water and sanitation, as well as other modern facilities that require electricity such as refrigeration for perishable foods.

7.3.18 Archaeological and Cultural Sites

The proposed power line shall not affect any known archaeological or cultural sites. Any artifacts that shall be discovered during the implementation of the project shall be reported to the NHCC.

7.3.19 Safety

During construction, surveyors and construction workers may be exposed to some risks such as snake bites and injuries from various construction activities. There are also risks of road traffic accidents for both construction workers and other road users. Some trees may fall on the road and obstruct traffic.

Table 5: Summary of Potential Sources of Impacts for the Project

Source of Effects	COMPONENT POTENTIALLY AFFECTED										
	Physical Environment				Biological Environment			Socio-cultural Environment			
	Air Quality	Noise	Geology & Soils	Water Quality/Wetlands	Aquatic Life	Vegetation	Wild life	Settlements	Public Health\Safety	Employment	Cultural Heritage
Surveying						•	•				•
Bush Clearing			•			•	•	•	•	•	•
Access Road	•	•	•			•	•	•	•	•	•
Tower Foundation	•	•	•	•	•		•		•	•	•
Tower Erection		•							•	•	
Stringing		•							•	•	

8.0 MITIGATION MEASURES

The section below is cardinal to the EIA process as all identified significant impacts are assigned mitigation measures. The section also includes an attempt to formulate a budgeted monitoring and auditing plan in order to fulfill implementation of the proposed mitigation measures.

8.1 Physical Environment

8.1.1 Location

At route selection stage, care was taken to select the route corridor in such a way that it avoids ecologically sensitive areas and settlements. Even at construction stage, some sections of the power lines may be slightly deviated to avoid archaeological sites that may be discovered or any other significant environmental discoveries.

It is for this reason that two alternative routes for each segment were considered and the corridors with fewer adverse impacts were selected as the preferred routes.

8.1.2 Geology

In order to avoid geological disturbance in rocky areas, use of controlled blasting by qualified and licensed blasters shall be used. Appropriate warnings shall be given to the general public and blasting locations shall be appropriately secured before blasting.

To avoid soil erosion, mudslides and rock falls in hilly areas, trees along the proposed line route shall be stamped as opposed to uprooting.

8.1.3 Topography

Use of heavy equipment such as bull dozers on steep slopes and very close to rivers shall be restricted or prohibited to avoid soil erosion. All trees along the proposed line routes shall be stamped as opposed to uprooting.

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 (s) in order to avoid soil erosion. Where the line passes in an area with existing access roads, no new access shall be opened up. All trees along the proposed line routes shall be stamped as opposed to uprooting.

8.1.5 Hydrology

At stream and river crossings, low level vegetation shall be maintained to ensure bank stability and to prevent bank erosion. Given the minimal amount of excavation required to construct the proposed power lines, disturbance of groundwater resources is not anticipated. Appropriate towers for the transmission line shall be used and placed at least 30-50m away from river banks. In order to control river bank erosion, an access road shall be opened up and at stream crossings, appropriate crossing structures such as culverts, shall be constructed where feasible.

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.

8.1.6 Water Quality

Some of the construction materials or the waste that may remain after construction may pollute the water in the streams and this would have adverse effects on water quality and forms of aquatic life. In order to control pollution in areas that get flooded during rainy seasons, only materials which are known to have no pollutants shall be used. To avoid oil spills into the environment from the machinery, camp sites and workshops, appropriate oil containment facilities such as oil interceptors or drums shall be used.

During construction, no barricades of any form shall be placed in the streams to ensure smooth flow of surface water.

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

8.1.7 Air Quality

During construction, it is recommended that surface particulates near sensitive areas (e.g. villages) be controlled by the use of water sprays and dust suppressants, as required. Where blasting of anthills must be conducted, all blasting activities shall be conducted according to strict guidelines designed to control energy release. Charges shall be kept to the minimum required to break up the rock.

While a certain level of gaseous emissions from construction equipment will be unavoidable during the construction phase, certain operational practices shall be employed to reduce or mitigate emissions to acceptable levels, including ensuring that equipment is kept in good repair and operates efficiently.

Lower speed limits shall be maintained in residential areas to ensure that construction vehicles slow down to minimize dust emissions.

8.1.9 Noise

Use of heavy duty construction equipment on the transmission lines will produce noise. However, in order to reduce noise impact, the equipment shall be maintained in good working condition at all times. Blasting noise shall also be minimised through introduction of blasting mats over blasting areas. To avoid disturbing the people at night, blasting shall be done during the day and people in the proximity area shall be informed in advance. In extreme case, construction workers shall be provided with ear protectors as stipulated in the Factories Act and other relevant construction related legislation.

8.1.10 Visual Impact

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

8.1.11 Waste Management

Construction activities will produce some waste such as concrete, steel bars, bolts, nuts, cables, cable drums, waste oils, paper, plastics, metal, woody vegetation and domestic waste which could have negative impacts on the environment.

The waste shall be sorted according to types. Plastics and empty cement bags shall be collected from site and disposed off in designated places. Leftover metal pieces (such as steel bars, bolts, nuts, conductors and cables) shall be removed from site and stored for reuse. Those which cannot be re-used shall be sold as scrap metal or be donated to the local blacksmiths. Waste oil shall be put in drums and stored or sold to licensed companies that recycle used oil. All machinery shall be kept in good working condition to avoid oil leakages. Dumping of collected waste shall be done at designated sites approved by the ECZ or the local Councils. All the oil to be used in transformers and other electrical equipment shall be PCB-free.

The woody vegetation cut shall be given to the local people to use as firewood and construction poles. Cable drums shall also be given to the local people to use as firewood. Pit latrines shall be constructed in designated areas for use by construction workers. Rubbish pits shall also be provided for the disposal of domestic waste such as leftover foodstuffs and shall be buried when they are no longer in use.

Fire, if not well managed, can cause bush fires and can cause damage to forestry resources, houses and other property. Use of fires shall be monitored and shall be restricted to residential camps.

Construction will produce large quantities of rubble from the blasted rocks. Some of the rubble can be used for various construction activities. The rubble that cannot be used in construction shall be disposed in dumping sites approved by the local authorities.

Simplified Waste Management Guidelines shall be given to all project staff.

8.2 Biological Environment

8.2.1 Fauna

8.2.1.1 Mammals

Anti-poaching and general sensitization programmes shall be conducted in the study area for both the workers and the local community. During construction, care shall be taken to rescue any animal that will be found by taking them to safe areas within the same locality.

8.2.1.2 Birds

On the transmission line section that will traverse potential bird flying routes, some bird diverters shall be placed on such conductors to prevent bird collision with conductors. During construction, care shall be taken to rescue any bird that will be found by taking them to safe areas within the same locality. Anti-poaching and general sensitization programmes shall be implemented in the study area for both the workers and the local community.

8.2.1.3 Reptiles

Workers and the local community shall be sensitised about the need to conserve wildlife. During construction, care shall be taken to rescue any reptiles that will be found by taking them to safe areas within the same locality. Indiscriminate killing of snakes shall be discouraged.

8.2.1.4 Aquatic life

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

In order to avoid polluting streams, the contractor shall develop a construction activity schedule that will outline methods and appropriate locations to carry out certain activities. Equipment maintenance and camp site locations shall be monitored to avoid pollution of the streams.

8.2.2 Flora

8.2.2.1 Vegetation in Open Forest and Woodlands

Cutting of vegetation during bush clearing can induce soil erosion. The construction team shall, therefore, exercise care to preserve the natural landscape as much as possible. Trees and other forms of vegetation which do not interfere with construction works shall be left standing to provide shade and some vegetation cover to the ground to prevent soil erosion. Where only some branches, and not the whole tree, are in the way-leave, the affected tree shall only be trimmed instead of cutting it down. During construction, trees along the proposed line routes shall be stamped as opposed to uprooting.

Bush clearing to create the way-leave on the proposed transmission lines way-leave shall be restricted to the 32m swath. All cut trees shall be left for use by local communities in the project area. Debris from vegetation shall be removed from the way-leave.

Careless use of fire by the workers can cause bush fires resulting in damage to vegetation, houses and other property. Use of fires shall be monitored and shall be restricted to residential camps.

Way-leave clearing for the lines 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. The workers and the local community shall be sensitized on the need to preserve the trees and other forms of vegetation.

8.2.2.2 Protected Areas (Local Forest Reserve)

Bush clearing in the Forest Reserve shall be restricted to the 32m swath and shall comply with the Forests Act and the Statutory Instruments that defines the costs of replacement for the removed trees. Trees shall be stumped as opposed to uprooting to avoid soil erosion. Collection of firewood and charcoal burning shall not be allowed in the Forest Reserve. The workers and the local community shall be sensitized on the need to preserve the trees and other forms of vegetation in the Forest Reserve.

8.2.2.3 Grasslands

The proposed power lines shall not traverse large spans of grassland, however grasses shall be managed in way leaves by way of slashing and any bush fires shall be prohibited. Since dry grass is prone to bush fires, all the grass to be cut that could be used by local communities for thatching or fishing baskets, shall be immediately surrendered to such communities.

8.3 Socio-Economic

8.3.1 Population

The influx of people into the area will be temporary and will only happen during the construction period. Once construction is completed, the workers shall be laid off and they shall return to their respective home areas.

Adequate compensation shall be paid to the households affected by the project by the developer to enable them build new houses. Compensation shall be paid in good time to give people enough time to build new houses. An independent property valuation surveyor shall be hired by ZESCO Limited to assess the affected property and recommended compensation for each of the affected households.

8.3.2 Settlement Patterns

During construction, the Contractor(s) may build temporary camps in different places along the proposed routes for the power lines. Once the workers have shifted from the camps, the temporary structures built shall be demolished by the Contractor(s) and general clean up undertaken. Rubbish pits shall also be buried to avoid polluting the environment.

8.3.3 Social and Cultural Set-up

When employing workers, the contract shall carefully scrutinize the potential workers so that people with questionable character are left out. Those with criminal records and those with bad habits shall not be employed.

Burial places and graveyards are respected by the Zambian people. Therefore, the lines shall avoid passing through such places. Local people shall be interviewed to facilitate the identification of places where graveyards are located.

8.3.4 Land Use

Even after ZESCO Limited acquires the way-leave, the local people shall still be allowed to grow low crops such as groundnuts, beans, sweet potatoes and maize in the way-leave, however, ploughing at the foot of the tower shall not be allowed to avoid destabilizing the foundations.

8.3.5 *Agriculture*

In order not to disturb agricultural production, farmers shall be allowed to grow low crops such as groundnuts, beans, sweet potatoes and maize in the way-leave. However they shall not be allowed to erect any structures under the way-leave or to plough close to the towers as this could be dangerous and could destabilize the foundations of the towers.

To minimize damage to crops in the fields, the construction period shall be well timed. Construction shall commence after harvest so that the crops are not destroyed. Written consents shall be obtained from the owners of the farms where the power line will pass to authorize the developers to pass the line through the respective properties.

8.3.6 *Employment*

In order to maximize benefits to the local community, local people shall be given priority when employing workers during the construction of the power line as well as during annual way-leave maintenance. The Contractor(s) shall collaborate with the local leadership when recruiting workers. The headmen, chiefs, councilors and other community leaders who know the people better shall play a role in the recruitment process.

8.3.7 *Health*

In order to prevent the spreading of communicable diseases, health education on the dangers and prevention of communicable diseases shall be given to the construction workers and the local community at regular intervals throughout the construction period. First Aid and Safety training shall be given to the workers and First Aid kits shall be available on site for emergencies.

8.3.8 *Water and Sanitation*

Pit latrines shall be constructed in designated areas for use by construction workers. Rubbish pits shall also be provided for the disposal of domestic waste such as leftover foodstuffs and shall be buried when they are no longer in use.

8.3.9 Mining

There are no mining activities in the immediate project areas except at Lumwana. However, all the mining activities there are carried out far away from of both the proposed and the existing power lines.

8.3.10 Transport

Road signs shall be put on the major and feeder roads in the project area to warn road users about the presence of heavy trucks and equipment on the road. Drivers of vehicles involved in the project shall be educated on road safety so that they drive carefully to avoid accidents.

8.3.9 Archaeological and Cultural Sites

Archaeological and Paleontological materials are very important as they give an insight into Zambia's ancient past. The proposed power lines shall not traverse through any known archaeological or cultural sites. The NHCC shall be informed if any of such sites or materials are discovered during the construction process.

All burial places and shrines shall be avoided.

8.3.10 Safety

To reduce the risks of snakebites and injuries, surveyors and construction workers shall wear gumboots, helmets and other appropriate protective clothing. To prevent road traffic accidents, road signs and speed limit signs shall be placed in appropriate places to warn people.

All machinery and equipment shall be maintained regularly to ensure they are kept in good running condition.

8.4 Summary of Potential Impacts, Mitigation Measures and Evaluation of Significance

Table 7 gives a summary of potential impacts and the recommended mitigation measures which have to be adhered to by ZESCO during the construction and operational phases of the power lines. An attempt has been made to evaluate the significant of the impacts. Table 6 below shows the criteria employed in assessing the significance of the impacts.

Table 6: Criteria considered in the assessment of Potential Environmental Effects

KEY TERMS	CRITERIA
Adverse	<ul style="list-style-type: none"> • Loss of species of a special status • Reductions in species diversity • Loss of critical habitat • Transformation of natural landscapes • Toxic effects on human health • Reductions in the capacity of renewable resources • Loss of current land use • Loss of property due to the project • Relocation of affected households
Significant	<ul style="list-style-type: none"> • Magnitude • Geographical extent • Duration and frequency • Reversibility • Ecological context
Likely	<ul style="list-style-type: none"> • Probability of occurrence • Scientific uncertainty

Scores: 1. Very High 2. High 3. Moderate 4.Low 5.Very Low

Table 7: Potential Impacts and Mitigation Measures

ENVIRONMENTAL ASPECT	TYPE OF IMPACT	SIGNIFICANCE	MITIGATION MEASURES AND COMMENTS
1.0 PHYSICAL ENVIRONMENT			
1.1 Geology and Soils	Soil erosion and mudslides	High	<ul style="list-style-type: none"> • Stamping as opposed to uprooting shall be employed; • Blasting shall be controlled.
1.2 Hydrology	Erosion of banks	Moderate	<ul style="list-style-type: none"> • Towers shall be planted at least 50m from the stream banks
1.3 Water quality	Pollution of surface and ground water	Low	<ul style="list-style-type: none"> • Hazardous waste such as oil and fuel from vehicles shall not be drained in water channels, but shall be put in containers for possible re-use or disposal.
1.4 Air Quality	Air pollution	Low	<ul style="list-style-type: none"> • Speed limits shall be set in order for vehicles to slow down to minimize dust emission; • Water shall be sprinkled in dusty areas, especially near villages.
1.5 Noise	Noise disturbance to the community	Low	<ul style="list-style-type: none"> • Vehicles shall slow down to minimize noise; • Blasting shall be done during the day and local people shall be informed.
1.6 Waste Products	Pollution from Cable drums and cement bags	Low	<ul style="list-style-type: none"> • Cable drums shall be removed from site and stored for reuse; • Empty cement bags shall be collected from site for disposal.

Waste Products Continued	Pollution from Leftover pieces of metal	Low	<ul style="list-style-type: none"> Leftover pieces of metal shall be removed from site and stored for reuse or sold as scrap metal.
	Pollution from Transformer oil	Low	<ul style="list-style-type: none"> Transformers to be procured for the project shall be PCB-free.
	Pollution from liquid waste	Low	<ul style="list-style-type: none"> Oil leakages shall not be allowed; Non-reusable oils shall be put in drums and transported to a suitable storage site and shall be disposed of according to the governing environmental regulations.
	Pollution from domestic waste	Low	<ul style="list-style-type: none"> Pit latrines shall be built in designated areas for use by the workers Rubbish pits shall be provided for disposal of domestic waste and shall be buried when they are no longer in use.
	Pollution from concrete waste	Low	<ul style="list-style-type: none"> Leftover concrete shall be removed from site.
	Soil, gravel and aggregates	Low	<ul style="list-style-type: none"> Burrow pits shall be buried and trees Grass shall be planted in some areas to facilitate ecological restoration.
1.7 Visual	Scenic beauty distortion	Moderate	<ul style="list-style-type: none"> Power line shall be built away from main roads to reduce the inevitable visual impact.
2. BIOLOGICAL ENVIRONMENT			

2.1 Fauna	Disturbance to wildlife	Low	<ul style="list-style-type: none"> • Poaching of wild life is prohibited. • Bird diverters shall be installed on the power line in areas where flocks of flying birds pass. • Any wildlife found shall be rescued and placed in an area of similar ecological characteristics. • Workers shall be sensitized on the need to conserve wildlife.
2.2 Flora	Bush clearing debris	Low	<ul style="list-style-type: none"> • Stamping as opposed to uprooting shall be used to clear vegetation along the power line • Trimming as opposed to cutting the whole tree is encouraged for trees at the edge of the wayleave. • Debris from vegetation shall be removed from the wayleave. • Local people shall be allowed to use the debris for firewood and charcoal, except in the Forest Reserve. • Fire shall not be used for bush clearing. • Workers shall be sensitized on the need to conserve vegetation.
3. SOCIO-ECONOMIC ENVIRONMENT			
3.1 Population	Relocation of people	Moderate	<ul style="list-style-type: none"> • Care shall be taken to ensure that all houses, shops and other buildings are avoided • All households that will be affected shall be adequately compensated
3.2 Land Tenure and Land use	Disturbance to Land tenure and land use	Low	<ul style="list-style-type: none"> • The existing land tenure system shall be maintained. • Written consent shall be obtained from land and property owners allowing to pass the line.
3.3 Agriculture	Encroachment on agricultural land	Low	<ul style="list-style-type: none"> • Care shall be taken to avoid agricultural fields and fruit trees

			<p>as much as possible.</p> <ul style="list-style-type: none"> • In case there are damages to fruit trees and crops, owners shall be adequately compensated.
3.4 Employment	Employment opportunities	Moderate	<ul style="list-style-type: none"> • Local people shall be given priority when recruiting workers during construction of the power line as well as during annual wayleave maintenance. • Headmen and chiefs shall be consulted when recruiting workers.
3.5 Health	Spreading of communicable diseases	Moderate	<ul style="list-style-type: none"> • Health education shall be provided to the workers and local people on how to protect themselves from communicable diseases. • First Aid kits shall be on site all the time for emergencies.
3.6 Water and Sanitation	Sanitation problems	Low	<ul style="list-style-type: none"> • Pit latrines shall be constructed in designated areas for use by construction workers. • Rubbish pits shall be provided for the disposal of domestic waste such as leftover foodstuffs and shall be buried when they are no longer in use.
3.7 Archaeological and Heritage sites	Disturbance to Archaeological and Heritage sites.	Low	<ul style="list-style-type: none"> • There are no known archaeological sites along the line, but if found National Heritage Conservation Commission will be contacted for advice on how to conserve them. • All graveyards shall be avoided.
3.9 Safety	Accidents from work and attacks from animals and snakes	Moderate	<ul style="list-style-type: none"> • To prevent snake bites and injuries, workers shall wear gum boots, helmets and other protective attire. • To prevent road traffic accidents,

			road signs shall be placed in places where the construction team is working to warn motorists and other road users.
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9.0 ENVIRONMENTAL MANAGEMENT PLAN FRAMEWORK

9.1 Introduction

An Environmental Management Plan (EMP) shall be developed to facilitate the implementation of 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 the EMP.

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/or archeological sites, protection of infrastructure and property, anti-poaching, 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 environmental mitigation measures through the Environmental Management Plan. 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 Health Department, Forestry Department and in consultation with community leaders in the project area.

9.3 Monitoring Programme

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

- Camp site selection
- Labour recruitment approaches and manning levels
- Construction practices
- Effectiveness of health awareness programme
- Effective of environmental protection awareness campaigns
- 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. The total mitigation budget is estimated to be US \$265,000. Estimates of these costs are presented in the table below.

Table 8 Mitigation Budget and Responsible Agency

ACTIVITY	IMPLEMENTING AGENCY	ESTIMATED COST US\$
1.0 Land acquisition & Resettlement	ZESCO Limited	20,000.00
2.0 Health Education	Ministry of Health	10,000.00
3.0 Access and Roads	Contractor(s)	50,000.00
4.0 Natural Resources Management	Forestry and National Heritage Conservation Commission (NHCC)	50,000.00
5.0 Heritage Assessment	National Heritage Conservation Commission (NHCC)	5000.00
6.0 Monitoring & Auditing	ZESCO and Forestry	30,000.00
7.0 Statutory Fees payments	ZESCO	100,000.00
Estimated Total Mitigation Budget		265,000.00

10.0 RECOMMENDATIONS AND CONCLUSION

Diesel generated electricity is not only costly but also not a clean form of energy. The current machines at the five diesel power stations in northwestern province are obsolete and therefore do not give the desired out put. In addition to that, their capacities can not meet the growing demands for electricity in the Province.

The Environmental Impact Assessment (EIA) for the proposed connection of NW Province to the national grid at 132kV followed 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 in order to identify potential environmental impacts and recommend mitigation measures for the negative impacts as well as to enhance the positive impacts.

Routes which avoid sensitive ecological areas were selected to minimize adverse environmental impacts. In order to minimize resettlement, the line routes were selected away from the main road and away from villages. The proposed project has few adverse environmental and social impacts and appropriate mitigation measures have been recommended to address them.

To ensure implementation of the proposed mitigation, monitoring and positive impact enhancement aspects, it is recommended that environmental costs shall be included in the total project cost. Further, the actual implementation of the various environmental aspects recommended in this report will be guided by an Environmental Management Plan for the different project components and will be strictly monitored by the project developers.

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12.0 APPENDICES

Appendix 1: Terms of Reference for the EIA for the Proposed Project

TERMS OF REFERENCE FOR THE ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED CONNECTION OF NORTH WESTERN PROVINCE TO THE NATIONAL GRID AT 132kV

1.0 INTRODUCTION

In the Northwestern Province (NWP) ZESCO Limited supplies electricity to five districts namely Mwinilunga, Mufumbwe, Kabompo, Zambezi and Chavuma from isolated Diesel Generation Stations located in each district. The older districts (Mwinilunga, Kabompo, and Zambezi) have been on diesel power stations for some forty years now. Solwezi and Kasempa are the only two districts in the province supplied from the national hydro power grid.

Power supply from the diesel generation stations is characterized by high operational costs, inadequate capacity and very low reliability. ZESCO Limited has therefore long sought to replace diesel generated supply with reliable and cost effective power from the national grid by connecting all the diesel generation stations to the grid. By the year 2000, ZESCO Limited was operating ten diesel stations country wide, but by 2007, four such stations had been replaced by grid supply while two new stations were installed in two newly designated districts.

Despite having great potential for mining and agricultural development, NWP generally remains underdeveloped due to insufficient and unreliable power supply. It is against this background that the Government of the Republic of Zambia through ZESCO Limited, intends to connect the 5 NWP Districts on diesel to the National Grid at 132 kilo Volts (kV) through a transmission line from Kasempa T-Off (Nselaue) to Chavuma and another line from Lumwana to Mwinilunga.

In accordance with the Environmental Pollution and Protection Control Act (EPPCA) of 1990, Statutory Instrument No. 28 of 1997- The Environmental Impact Assessment (EIA) Regulations, a complete EIA study has to be undertaken to facilitate commencement and implementation of this important proposed national project.

These Terms of Reference (TORs) present the first phase in undertaking the said EIA study with the main purpose of providing a guide for the undertaking and preparation of an EIA for the proposed 132kV power line network project.

The Terms of Reference contain the following information; a brief description of the proposed project, scope and intent of the EIA, a detailed description of the baseline information and the likely impacts which may arise from the proposed development.

2.0 BRIEF DESCRIPTION OF THE PROPOSED PROJECT

2.1 LOCATION

The proposed project designated as Connection of North Western Province to the National Grid at 132kV will originate from two substations:

- a) Kasempa T-Off Substation for the transmission line (through Mufumbwe, Kabompo and Zambezi substations) to Chavuma
- b) Lumwana Substation to Mwinilunga

Both power lines shall be energized at 132 kV, with a way-leave of 32 meters leaving 16 meters on either side of the power line.

2.2 CONSTRUCTION ACTIVITIES

Line construction, like any other power project, requires preliminary surveys, line route "fixing," way-leaves acquisition, detailed line survey, soil survey and other subsequent activities. Once a contract has been awarded, the contract would embark on such activities like bush clearing, line pegging, foundation excavation and construction, tower erection, fitments and line stringing among others.

The construction will involve several phases which include bush clearing, erecting structures, stringing conductor, installation of counterpoise, substation construction at Mwinilunga, Mufumbwe, Kabompo, Zambezi and at Chavuma, clean-up and re-vegetation. The construction of the line will be done by an independent contractor that will be hired by ZESCO.

2.2.1 Clearing

It is a practice in ZESCO to clear all the way-leave issues before line construction can commence. Bush clearing/ vegetation removal is carried out prior to the commencement of construction works. This practice is employed to ensure there is sufficient clearance for construction works and that clearance is maintained between the conductor and the ground, and to facilitate maintenance of the line should repairs be required.

2.2.2 Foundations

During detailed line surveys, line pegging is carried out depending on tower spacing and foundation spots excavated. Foundation excavation is followed by foundation construction and some concrete curing period (usually 21 days) before tower erection can commence.

2.2.3 Tower Structure and Equipment Erection

Tower structures maybe assembled horizontally on the ground and set in place by a crane. An alternative method which may be used is to assemble the structure vertically one piece at a time at the structure location. Other equipment especially in substations are erected and assembled in the same manner.

2.2.4 Conductor Stringing

Once the structures are erected, a pilot wire is strung first then a stringing vehicle (such as tractor or equivalent vehicle) strings the conductor and overhead shield wires through pulleys attached to the insulators. The conductor wires are attached by hand to the insulators. The shield wires provide a path to the ground for lightning strikes.

2.2.5 Installation of Counterpoise

Counterpoise is installed in areas where ground resistance is high in order to improve grounding, and reduce the number of lightning caused outages on the line.

2.3.6 Substations

The transmission lines will originate from the Substation at Kasempa Turn-off (Nselauke) linking Mufumbwe, Kabompo, Zambezi and Chauma. A second line will originate from Lumwana substation to Mwinilunga.

3.0 INTENT AND SCOPE OF THE EIA

3.1 INTENT

The intent of preparing an EIA for this project will be;

- To describe the connection of North Western Province to the National Grid and characterize the environment in which the project will be.
- Provide a description of the regulatory framework within which the proposed project will be planned, built and operated
- Identify potential bio-physical, social-economic and cultural effects related to the proposed project.
- Describe the scientific analysis of ecosystem effects, local knowledge and the experience of locals in the project area and other sectors of the public that are to be used by the study team in the assessment of the environmental effects.
- Describe how the analysis of potential effects to valued ecosystem components (VEC's) contributed to judging the significance of the effects on the well being of the environment and the communities within the area affected by the project.
- Provide a summary of regional, provincial or national objectives, standards guidelines and relevant land and resource related agreements which are used in the evaluation of the significance of the environmental effects;
- Describe the consideration given to comments received from the public during the environmental assessment; and

- Propose mechanisms for follow-up to identify and manage the effects of the project and to confirm the effectiveness of mitigation measures employed.

3.2 SCOPE

3.2.1 The Project

The environmental assessment for the connection of North Western Province, that shall involve two transmission lines, shall include consideration of the environmental effects associated with construction of the power line and substations including any other required infrastructure developments. The assessment must consider the purpose of the project and alternative means of carrying out the project that are technically and economically feasible.

3.2.2 The Environmental Assessment

The scope of the environmental assessment shall include examination of:

- Potential changes to the environment that may result from construction of a network of 132kV power lines and substations to connect the North Western Province to the National Grid, including consideration of effects to:
 - Land, water and air – including all layers of the atmosphere;
 - Aquatic environment;
 - The biological environment, including terrestrial and aquatic ecosystems – all organic and inorganic matter and living organisms;
 - Present and planned resource use, including land and water;
 - Human health, socio-economic and cultural conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance that will be affected by any changes to the environment caused by the project;
- The significance of the environmental effects;
- The implications of the North Western National Grid Connection Project in terms of land and resource-related agreements;
- The environmental effects of potential malfunctions or accidents that may occur in connection with the project;
- The environmental effects of any alternative means of carrying out the project that will be considered as part of the assessment;

- Cumulative environmental effects of the project that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- The effects of the influx of workers, equipment and materials on residents, land and resources of the area;
- The technically and economically feasible measures that would mitigate any significant adverse environmental effects of the project;
- The adequacy of measures proposed to mitigate adverse environmental effects of the project and to compensate for residual adverse effects, where appropriate;
- Any change to the project that may be caused by the environment;
- The need for, and requirements of any follow-up programme in respect of the project; and
- The capacity of renewable resources, if any that are likely to be significantly affected by the project.

3.2.3 The Study Area

The study area, i.e. the geographic scope of the investigations, shall include those local areas directly impacted by the construction of the transmission line and also the zones within which there may be environmental effects that are regional or global in their nature.

4.0 REGULATORY FRAMEWORK

The Environmental Impact Assessment shall identify the legislation, policies, necessary approvals, land and resource related agreements and current planning initiatives to the review of the project. The report shall discuss the primary focus of each regulatory or policy requirement, such as resource allocation, environmental protection, land-use designation or development control.

5.0 PUBLIC CONSULTATION AND INVOLVEMENT

Throughout the EIA process and during construction there will be public consultation and involvement of the public. Generally, the public shall include but not limited to: local residents; community groups; environmental groups; the private sector; municipal governments; and other interested parties. Public involvement shall be included in the Environmental Impact Assessment (EIA) and the results of the public's input reported and evaluated.

The EIA shall describe the proponents' community consultation program that will have been undertaken with respect to the project, including the following:

- The role of community contacts in the consultation program;
- the use of any communication tools employed to provide information to other communities, including newsletters, television broadcasts and briefing documents.

The TOR's, shall also plan for on-going consultations with the affected public even after completion of the environmental assessment.

The environmental impact assessment shall describe how concerns and issues raised by the public were incorporated into the development of the project including its design, impact, mitigation and monitoring. Any unresolved issues that were raised by the stakeholders during the assessment process shall be discussed. In addition, efforts made to involve organizations and persons residing beyond the project area in issue identification and problem resolution shall be documented and evaluated in the EIA.

6.0 PROJECT DESCRIPTION

The environmental impact assessment shall provide an overall description of the construction of the power transmission lines and the substations as well as all other associated infrastructure. The description shall mainly be based on the components of the construction of the substations and the power lines.

6.1 PROJECT ALTERNATIVE AND SITE SELECTION

The environmental impact assessment shall include a discussion of the alternative means of carrying out the project that were considered technically and economically feasible. A discussion of the potential environmental effects that were considered relative to any such alternative means shall also be included. Consideration of alternative means for achieving the goals of the project, for the purpose of the environmental impact assessment, will include discussion of other processes that could have been implemented or other alternatives that could have been chosen to achieve a similar end result. The purpose of and the rationale for selection of the route shall be presented.

In addition, the transmission lines route and substation sites selection shall be discussed in the EIA. The information presented will include the rationale for selection of the proposed sites and routes along with how the technical, geotechnical and environmental criteria were considered in the decision making.

6.2 OVERVIEW OF THE CONNECTION OF THE NORTH WESTERN PROVINCE TO THE NATIONAL GRID

The Environmental Impact Assessment shall provide an overview of the connection of the North Western Province to the National Grid, including a general description of the line route and substation site selection processes, construction, operation and maintenance of the facilities, and the final disposition of all components of the project. Included in this overview shall be the designed location of the towers on a route development plan, phasing and sequencing of the various undertakings associated with the components, a description of activities relating to the project that have been undertaken to date, and a description of how the developer has incorporated consideration of traditional ecological knowledge in the project's design.

6.2.1 Site Preparation

The Environmental Impact Assessment shall describe all undertakings associated with preparing for construction along the selected route as well as sites for substation establishment. Detailed descriptions of timing and the methods associated with the various undertakings that were and are required including surveying, clearing, test drilling, and establishing dump and borrow areas, setting up camps and work areas, and the development of the infrastructure requirements to access and service the selected route. This will include providing:

- topographical maps of suitable scale showing the location of the proposed generating station, related access road, work camp, borrow and disposal sites, power source and utility corridors with inclusion of the local topography, watercourses, wetlands and lakes; and
- a description of the extent of clearing, excavation, quarrying and earthworks required to prepare for, identification of borrow sites for construction materials such as sand, gravel, clay and stone, and the proposal for removal of waste materials including transportation methods.

6.2.2 Construction

The Environmental Impact Assessment shall describe all elements of the construction of the proposed project to connect the Northwestern Province to the National Grid. Detailed descriptions of timing and the methods proposed for the various undertakings related to the construction of the transmission power line, substations and related facilities shall be required including the following:

- plans and descriptions of any existing works, temporary works including work areas, and the proposed permanent facilities like buildings and infrastructure.
- a description of the proposed construction methods that could have an effect on the environment such as those requiring large scale clearing, grading or earth removal and disposal, including a discussion of possible alternative construction methods;
- an estimate of the size and composition of the workforce required during different times of construction;

- a description of measures that will be taken to protect the health and safety of workers and the general public in and around the construction areas;
- a description of the living accommodations and servicing required for camps provided for the construction workers, including water supply (location of source and intake), and waste disposal;
- an analysis of the need for a construction-phase, waste disposal ground, and the specific site requirements, including access;
- a description of the character and volumes of waste streams generated during the construction phase of the project and how each waste stream would be managed, consistent with best industry practices, with specific references to waste oil and other potentially hazardous or recyclable material;
- a description of the proposed environmental surveillance and monitoring proposed during construction along with proposed contingency plans that consider the effects associated with serious malfunctions or accidents;
- a description of the proposed construction schedule including sequencing of the various undertakings; and.
- subsequent removal of camp facilities and clean up of construction infrastructure.

6.2.3 Operation and Maintenance

The environmental impact assessment shall describe how the power line project would be operated and maintained.

The environmental impact assessment shall:

- describe waste disposal practices and long-term facility recycling practices in-place during the operation of the project along with the operation of any waste disposal facilities planned to accommodate the project;
- provide a description of the progressive decommissioning practices that will occur during the operation of the project, with specific reference to infrastructure that would no longer be required after the construction phase; and
- describe the size and composition of the proposed labour force involved in the operation and maintenance of the transmission line, along with a description of measures that will be taken to protect the health and safety of workers and the general public along the proposed project route.

6.2.4 Final Disposition

The environmental impact assessment shall provide a general description of plans for decommissioning the proposed transmission line at the end of its operational life.

7.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The Environmental Impact Assessment shall describe the existing environmental setting for the proposed project area. This will include a broad overview of the local area and the zones within which there may be environmental effects that are regional or global in their nature. This description is intended to provide a context for a detailed understanding of the potential effects of the project. A description of any deficiencies or limitations in the existing environmental database shall be reported.

The environmental impact assessment shall provide a discussion of the rationale for the determinations taken regarding the spatial and temporal boundaries chosen for the study areas used for the assessment.

7.1 PHYSICAL ENVIRONMENT

The physical environment on the route refers to the natural environment associated with the construction of the 132 kV lines from Kasempa Turn off to Chavuma and Lumwana to Mwinilunga

The physical environment section in the EIA shall be described under the following headings;

- Geology
- Topography
- Soils
- Climate
- Hydrology
- Wetlands
- Air Quality
- Noise

7.2 BIOLOGICAL ENVIRONMENT

The Environmental Impact Assessment shall describe the existing biological resources including the flora and fauna of the area. The Environmental Impact Assessment shall describe;

7.2.1 Fauna

- Mammals
- Reptiles
- Birds
- Fish

7.2.2 Flora

- Woody plants
- Understorey plants
- Protected areas; these include National parks and forest reserves.

7.3 SOCIO ECONOMIC ENVIRONMENT

- Population
- Settlement patterns and Traditional Authority
- Local Economy
- Land Tenure
- Land Use
- Agriculture
- Planned development activities
- Employment
- Goods and Services
- Recreation
- Public Health
- Water Resources and Sanitation
- Education
- Transport
- Communication
- Industries
- Minerals/ Mining
- Tourism

7.4 CULTURAL ENVIRONMENT

- Archeological Resources
- Cultural Heritage

8.0 ENVIRONMENTAL & SOCIO-ECONOMIC EFFECTS & MITIGATION

The environmental impact assessment shall provide information on all environmental effects associated with a power line transmission project. Both positive and adverse environmental effects shall be described. The following criteria will be used to evaluate the significance of adverse effects:

- nature of the effect;
- magnitude of the impact;
- duration of the impact;
- frequency of the impact;
- reversibility of the impact;

- temporal boundaries (short or long term);
- spatial boundaries (project site, local area or regional); and
- ecological context (sensitivity of valued ecosystem components (VEC) to environmental disturbance).

The following criteria will be used to determine the likelihood of significance of the effects:

- probability of occurrence; and
- scientific uncertainty

The environmental and socio-economic effects and associated mitigation shall relate to each phase of the project including site preparation, construction and post construction, operation and maintenance, and eventual decommissioning and shall assess all components of the environment in the context of section "DESCRIPTION OF THE EXISTING ENVIRONMENT" of this document. The assessment shall consider scientific analysis of ecosystem effects, local knowledge and available experience in determining the significance of potential effects. Mitigation and habitat enhancement measures to manage or avoid adverse effects shall be described for these components and for each undertaking in relation to the project.

Cumulative effects assessment (CEA) shall form an integral part of the environmental and socio-economic assessment. The cumulative effects assessment shall look at all effects that are likely to result from the project when they are anticipated to occur in combination with other projects or activities that have been, or will be carried out.

All assessment conclusions shall be supported by technical information based on experience elsewhere as well as traditional ecological and local knowledge. Any deficiencies in the information about potential effects shall be clearly noted and addressed as stated in section "ENVIRONMENTAL MONITORING" of this document.

9.0 RESIDUAL EFFECTS

The environmental impact assessment shall describe the nature and extent of any residual environmental effects of the project, and include a characterization as to whether residual environmental effects are significant or insignificant, and the rationale for such characterization. It shall provide a detailed plan for responding to any known or predicted residual effects, and provide a procedure for identifying and responding to effects that were not predicted or foreseen.

10.0 ENVIRONMENTAL MONITORING

The environmental impact assessment shall provide a detailed description of the proposed monitoring activities of effects of the project on the physical, biological, socio-economic and cultural environments arising from the site preparation, construction, operation, and eventual decommissioning of the power transmission project. It shall describe the equipment to be used, the parameters to be measured, the methodology and frequency of measurement and the mechanism for reporting results of proposed monitoring of the environmental conditions affected by the project. The design of the environmental monitoring proposal and its implementation shall incorporate scientific, ecological, and local knowledge.

The environmental impact assessment shall describe how the proposed monitoring activities will help to verify and manage environmental effects and confirm the performance of mitigation and habitat enhancement measures to be employed.

If regulatory approval for the project is provided, and prior to construction, an Environmental Management Plan (EMP) shall be developed. The EMP will be designed to commit the proponent to a long term monitoring program, including accountability and reporting, that would encompass both the construction and operational phases of the project in order to confirm predictions of effects and to determine whether unexpected effects are occurring. The EMP shall be developed to accomplish the following goals:

to facilitate the mitigation of environmental effects throughout the full-life cycle of the project by providing field construction and operating personnel with clear instructions on the mitigation measures to be implemented and on the appropriate lines of communication and means of reporting to be followed;

- to incorporate issues and concerns identified, including protocols put in place.
- to identify modifications to construction methods or schedules, summarize environmental sensitivities and mitigation actions, list emergency response plans and reporting protocols, describe a closure plan for aggregate quarries, including mitigation of potential hazards to public safety and mitigation to address land reclamation concerns;
- to provide specific information on waste management practices to be utilized during the construction phase of the project, including consideration of all liquid and solid wastes generated; and
- to monitor construction practices to ensure that the work proceeds in accordance with the EMP

11.0 SOURCES OF INFORMATION

All assessment conclusions shall be backed up by credible technical information and traditional ecological and local knowledge. The environmental impact assessment shall describe the primary sources of information used to conduct the environmental assessment of the proposed project. This information shall include:

- technical studies of similar facilities and processes which are operating elsewhere;
- original studies performed by qualified engineers or scientists commissioned by the proponent specific to the power transmission line project;
- identification of facility design documents prepared by qualified engineers as they become available;
- scientific reports and papers on topics relevant to the power transmission project; and
- scientific, ecological and local knowledge.
- Credible analysis and documentation shall support all conclusions of "no or insignificant effect".

12.0 REPORT FORMAT

The Environmental Impact Assessment for the proposed project shall include:

- An executive summary
- Introduction
- Need for proposed action
- Regulatory framework
- Project description
- Project construction activities
- Description of present environment (Physical, Biological, Socio-economic, and Cultural)
- Potential impacts of the proposed project
- Mitigation measures
- Environmental monitoring and follow programmes
- Environmental mitigation budget
- References
- Appendices of important field data and public consultation supporting the assessment

In addition to the above, the information in the environmental impact assessment shall maximize the use of maps, charts, diagrams and photographs for presentation. To the extent possible, maps and diagrams shall be presented at a common scale, appropriate to represent the level of detail considered, and where possible, allowing for direct overlay for ease of reference. Specifically, maps indicating zones of effect on land and water use and habitat areas shall be on maps of a common scale.

The report shall as much as possible follow the way the information requirement is outlined in these TORs.

13.0 THE STUDY TEAM

The EIA study team for the Connection of North Western Province to the National Grid project shall comprise the following:

No.	NAME	PROFESSION	POSITION ON THE TEAM
1.	Mrs. Elenestina Mwelwa BSc., MSc, PhD Student	Environmental Scientist	Team Leader
2.	Mr. Mellon H. Chinjila BSc., MSc	Environmental Scientist	Project Environmental Manager
3.	Ms. Lwanda Kahongo BSc.	Ecologist	Environmental Coordinator/ Ecologist
4.	Mr. Ackson Mwale, BEng.	Electrical Engineer	Transmission Engineer
5.	Mr. Silwembe Mwalimu, BEng.	Civil Engineer	Civil Engineer
6.	Ms. Brenda M. Chizinga, BA, MA	Social Scientist	Social Scientist
7.	Ms. Cholwe H. Chanda Diploma	Environmental Technologist	Social Economic and Fisheries Expert
8.	Mr. Christopher Kaniki Adv. Diploma	Environmental Technician / Hydrology	Physical Environment, Water expert
9.	Mr. Kelvin Mutunga Diploma	Way-leave Officer	Way-leave Issues and Land Expert
10.	Mr. Simon Chanshika Diploma	Way-leave Officer	Way-leave/ Survey and Settlements
11.	Mr. Justin Mumba Certificate	Way-leave Officer	Land Acquisition / Survey Issues
12.	Mr. Fredrick Mbesuma Diploma	Information Specialist	Social/ Awareness Issues

Appendix 3: List of People Consulted During the Study

LIST OF PEOPLE CONSULTED IN THE PROJECT AREA

NO.	NAME	OCCUPATION	ADDRESS/ VILLAGE
1.	JAMES KUNGA	BUSINESS MAN	KAKOMA
2.	GIVEN KAMALAMBA	PASTOR	CHINGANDU
3	CEPHAS SITENGE	BUSINESS MAN	KAKOMA
4.	KAKOMA MAPULANGA	BUSINESS MAN	MALUKUCHILA
5.	KAMALAMBA CHARLES	BUSINESS MAN	COURT COMPOUND
6.	MARTIN MELIKA	BUSINESS MAN	COURT COMPOUND
7.	STANELY LUYAKA	MANAGER	SUKULUKA LODGE
8.	E K SAKABUNGO	-	-
9.	NIXON SONEKA	MALE NURSE	LOLOMA MISSION HOSPITAL
10.	GEORGE MUKONDA	RESIDING MAGISTRATE	MANYINGA LOCAL COURT
11.	LIKASHI KAYOMBO	TEACHER	CHILUMBA BASIC SCHOOL
12.	JOHN LUNETA	BUSINESS MAN	COURT COMPOUND
13.	WILLIAM KANYANGA	BUSINESS MAN	CHINGANDU
14.	PRISCA CHINOYA	BUSINESS WOMAN	SAMAFUNDA
15.	RUTH KASANGA	BUSINESS WOMAN	KALEMA
16.	HETTY KANDUMBA	BUSINESS MAN	KASHOTA
17.	GRIVER MUYOYU	BUSINESS MAN	SANDANDU
18.	ROBERT LUNEFU	BUSINESS MAN	CHINGANDU
19.	KAKOMA KALUKANGO	BUSINESS MAN	KAKOMA
20.	JOYCE AKATOKA	BUSINESS WOMAN	KAKOMA

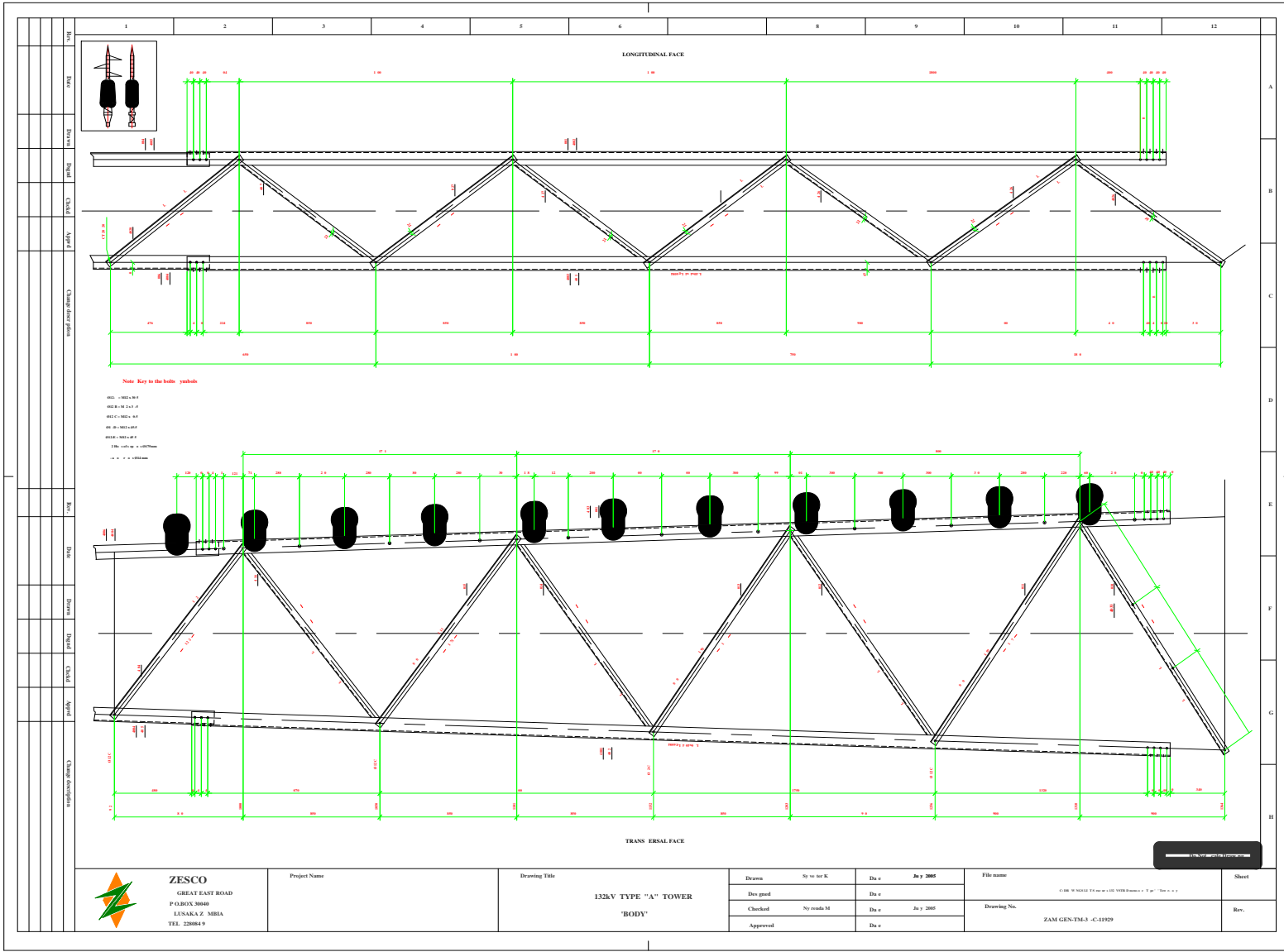
21.	PAUL MUHANGA	FARMER	CHINGANDU
22.	MUNDEMBBA KAZENENE	NEIGHBOURHOOD WATCH	CHINGANDU
23.	COUNSELLOR KALUJIKA	BUSINESS MAN	BILEMBULUKA
24.	LUSIKA MWANGALA	COURT WORKER	MANYINGA LOCAL COURT
25.	JOSEPH MASUMBA	FARMER	LUBELENGA
26.	ROBERT MASHATA	DRIVER	CHINGANDU
27.	BARODY KESNGOMBA	CHIEF'S RETAINER	KAKOMA
28.	RICHARD KABANDA	CHIEF'S RETAINER	KAKOMA
29.	RODNE KAPEND MBUNDU	COUNCIL SECRETARY	ZAMBEZI
30.	CLEMENT FERDINAND CHINYNDU	GENERAL MANAGER	ZAYO LIMITED
31.	FRANK MUZAZA	BUSINESS MAN	BOX 150020, ZAMBEZI
32.	ROBINSON MUKENA	AG/ OPC POLICE	ZAMBEZI POLICE
33.	EDWARD GAMA	COMMUNICATIONS OFFICER	ZAMBEZI POLICE
34.	KAWAMA TITUS M	JUDICIARY	ZAMBEZI
35.	STANELY CHIKOPA	ZESCO BRANCH MANAGER	ZESCO LIMITED
36.	NONGE PAUL	CHAIRPERSON	ZAMBEZI
37.	LUWAILE B N	DISTRICT COMMISSIONER	ZAMBEZI
38.	KAPWACHA MERCY N	DGCC	BOX 150014, ZAMBEZI
39.	ROBINSON IKWENA	JUDICIARY	ZAMBEZI
40.	SOMEKI ABEL	ZAMPOST	ZAMBEZI

41.	NELSON NEBA	NAPSA	ZAMBEZI
42.	KAZUNGO JULIUS	TEACHER	ZAMBEZI
43.	MANYIKA SIANSOBANDA	REGISTRATION OFFICER	NATIONAL REGISTRATION
44.	SOVI GEORGE	COURT CLERK	ZAMBEZI
45.	KAPUMO MORTON	SD – EDUCATION	ZAMBEZI
46.	YOHANE ZULU	OIC – OOP (SD)	ZAMBEZI
47.	AMOS KAHUMUNA	OIC - PRISONS	ZAMBEZI
48.	MUYUTU REUBEN	STAKEOLDER	INDECO
49.	KATANGOSI DAVID	STAKEHOLDER	RIVERSIDE
50.	NDAU COLLINS	AIPIO EDUCATION	CHISOKONE
51.	MALITI SANGAZI T	SENIOR CITIZEN	KABOMPO
52.	SAMAKAI F	BUSINESS MAN	KABOMPO
53.	MAXIMILLIAN MUBANGA	KABOMPO PRISON	KABOMPO
54.	RONALD KAJIMBALA	STAKEHOLDER	SITE AND SERVICE
55.	GILPIN MUHANDU	HONEY FACTORY	TOWNSHIP
56.	DAVID K. KAPWEPWE	BUSINESS MAN	RIVERSIDE
57.	B M SIMONDA	DEPUTY HEAD	KABOMPO HIGH SCHOOL
58.	VINCENT C HANYAMA	FORESTER	FD BOX 140047 KABOMPO
59.	MOSES M CHIPILI	AG DISTRICT SUPERVISOR	WATER AND SEWERAGE
60.	DAVID BANDA	OOP	RIVERSIDE
61.	HAMOONGA MOOYA	AG DACO	MAYARD
62.	PATRICK MUKOMONGO	AREA DEVELOPMENT CHAIRMAN	CHAPUZUKA

63.	FREDRICK NDUMBA	NAZ OFFICE	KABOMPO WEST
64.	DUNCAN CHIMBILA	HEALTH	KABOMPO DHMT
65.	RODGERS L M CHINYEMBA	BUSINESS MAN	BOX 140029 KABOMPO
66.	KALULU TIMOTHY HARVEY	ACCOUNTANT	NWBKA
67.	GLORIOUS SAVIYE KAPWEPWE	DEPT OF COMMUNITY DEVELOPMENT	RIVERSIDE
68.	MUTANDA HAMOOMBA	MANAGER	BOX 140019, KABOMPO
69.	WEBSTER MUNAKAMPE	ACTING DC	BOX 46 KABOMPO
70.	NEVANIDA MAKELETA	BRANCH MANAGER	ZESCO LIMITED KABOMPO
71.	ERNEST JACOB MWAMBA	ZANIS	BOX 62, KABOMPO
72.	BOB MALICHI	RETIREE	BOX 140025, KABOMPO
73.	KAKKOMA EDWIN	SELF EMPLOYED	BOX 140018, KABOMPO
74.	SAMUSUNGA MOSES	DISTRICT REGISTRATION	TOWNSHIP
75.	CHIPAWA LEONARD	BUSINESS MAN	TOWNSHIP
76.	LOLOJI CHRISTOPHER	BUSINESS MAN	TOWNSHIP
77.	GILBERT MACHAYI KANJUNGU	DRIVER	ZANIS
78.	R KAMIJI KAUMBA	BUSINESS MAN	INDECO
79.	MASAWA RICHARD	RESIDENT	TOWNSHIP
80.	GODWIN SAKATENGO	RESIDENT	TOWNSHIP
81.	DENNIS KALUME	ELECTRICIAN	TOWNSHIP
82.	K CHISAMBWE	FORESTER	INDECO
83.	MAYIMBA PETER	PASTOR	KALAMBO

84.	JOHN PHIRI	AGRIC OFFICER	MACO
85.	CHEWE EMMANUEL	VETERINARY ASSSSTANT	MLFD
86.	JOHN KAYULA	FARMER	INDECO
87.	CHISENGA CHANGWE	K.A.W KABOMPO EAST	TOWNSHIP
88.	LUVWEYI S. MORGAN	BUSINESS MA	KDB ASSOCIATION
89.	CHISAMBWE C D	REGISTRY OFFICER	DEBS OFFICE
90.	CHINYANGA HUBERT	STAKEHOLDER	BOX 140055
91.	GEORGE M MUNYINGU	RETIREE	TOWNSHIP
92.	WEBSTER SAMAKESA	DISTRICT COMMISSIONER	BOX 160055
93.	H.K. CHITONENA	STAKEHOLDER	MWINILUNGA
94.	F. KABOLESHA	RADIO TECHNICIAN	MWINILUNGA
95.	C. KAYAMBA	EXECUTIVE OFFICER	MWINILUNGA
96.	L. MAKODZA	ZANIS	MWINILUNGA
97.	FRANCIS NSOFWA	PUBLIC HEALTH OFFICER	MWINILUNGA
97.	MORGAN CHUUNGA	HOSPITAL ADMINISTRATIVE	MWINILUNGA
98.	DESMOND HAMAAMBA	SCHOOL MANAGER	MWINILUNGA HIGH SCH.
99.	BEAUTY UTANGA	UZP COORDINATOR	MWINILUNGA
100.	BISHOP L.L. MATABISHI	DACA	MWINILUNGA
101.	THOMAS MUKOSHA	DISTRICT PLANNING OFFICER	MWINILUNGA
102.	DAYSON KAFWAYA	DESO	MWINILUNGA
103.	JULIUS MUSESA	MDFCU	MWINILUNGA

104.	BWALYA PONGA	MACO	MWINILUNGA
105.	CHRISTIAN NAWEJI	AGRI. BUSINESS	MWINILUNGA
106.	D. I. DAKA	O.O.P. SP	MWINILUNGA
107.	M. CHIYOBE	ACTING PRINCIPAL MTTC	MWINILUNGA
108.	PAUL KABENGELE	DISTRICT FOREST OFFICER	MWINILUNGA



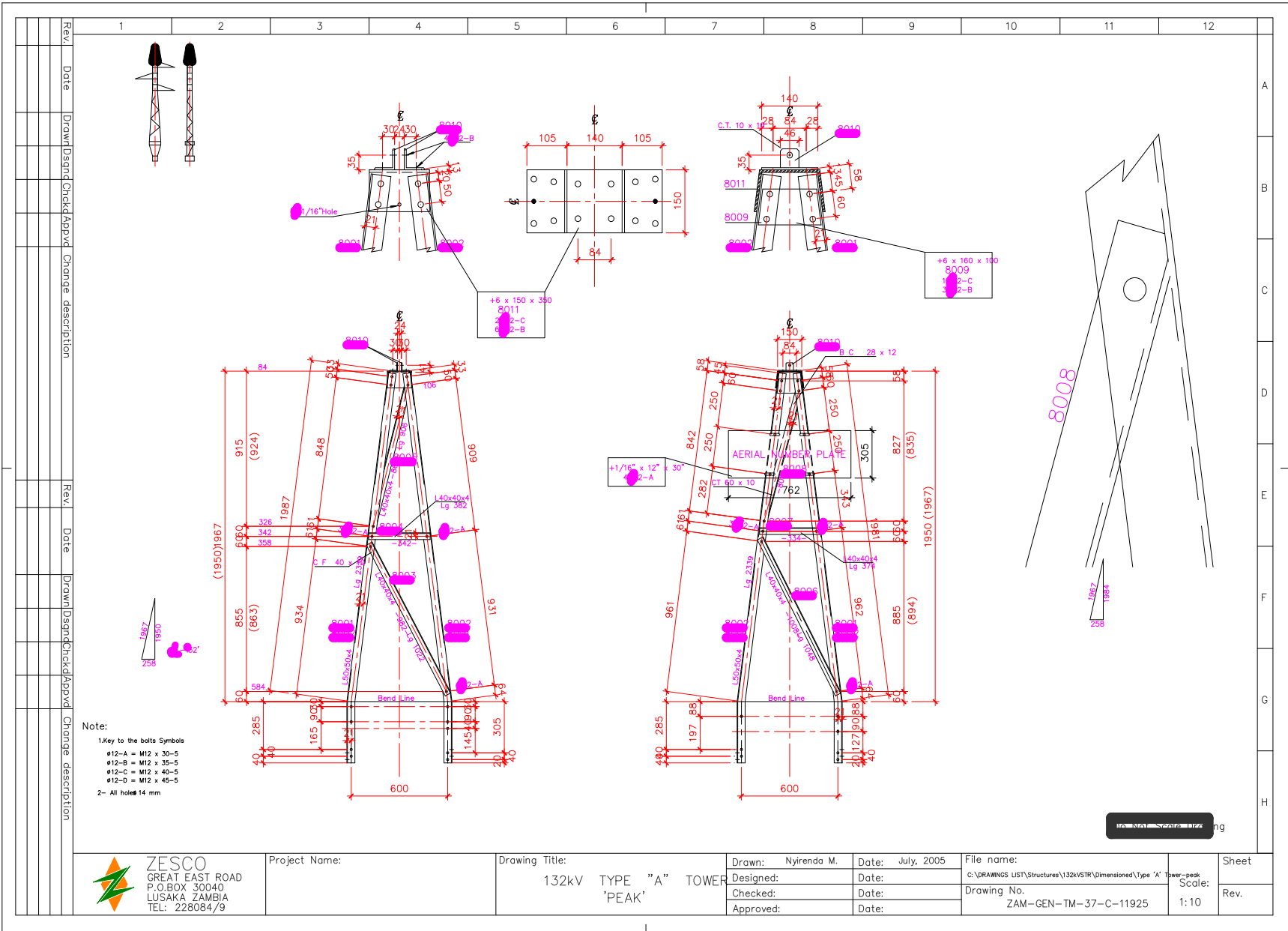
Project Name: _____

Drawing Title: **132kV TYPE "A" TOWER "BODY"**

Drawn	Sy to the K	Date	July 2005
Designd		Date	
Checked	Ny vanda M	Date	July 2005
Approved		Date	

File name: _____
Drawing No: **ZAM GEN/TM3 -C-11929**

Sheet: _____
Rev: _____



Note:
 1. Key to the bolts Symbols
 #12-A = M12 x 30-5
 #12-B = M12 x 35-5
 #12-C = M12 x 40-5
 #12-D = M12 x 45-5
 2- All holes 14 mm



Project Name:

Drawing Title:
 132kV TYPE "A" TOWER
 'PEAK'

Drawn: Nyirenda M. Date: July, 2005
 Designed: Date:
 Checked: Date:
 Approved: Date:

File name:
 c:\DRAWINGS LIST\Structures\132KVSTR\Dimensioned\Type 'A' Tower-peak
 Drawing No.
 ZAM-GEN-TM-37-C-11925

Sheet
 Scale:
 1:10
 Rev.

Appendix 5: Social Survey Questionnaire

ZESCO LIMITED

ENVIRONMENT AND SOCIAL AFFAIRS UNIT

DEMOGRAPHIC & SOCIO-ECONOMIC SURVEY

HOUSEHOLD QUESTIONNAIRE

Serial No:..... Name of interviewer:.....

Name of respondent (interviewee):.....

Township/Village:..... District.....

SECTION A: HOUSEHOLD CHARACTERISTICS

List of household members

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Serial No.	Household members (usual members)	Member 1. Present 2. Absent	Relationship to head of household	Sex 1. M 2. F	Age	Level of education	Still in school 1. Y 2. N	Tribe
1.								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								

Q3 Relationship to Head of household:
 1. Head 2. Spouse 3. Son/Daughter 4. Grandson/daughter
 5. Brother/Sister 6. Father/Mother 7. Other relative 8. Unrelated

Q5 State years completed or months in the case infants under 1 year

Q6. Highest level of education attained:

1. None. 2. Lower primary 3. Upper Primary 4. Junior Secondary
5. Senior Secondary 6. College 7. University 8. Other (Specify)

Q8. Tribe: 1. Tonga 2. Ila 3. Bemba 4. Lozi 5. Ngoni 6. Kaonde 7. Luvale
8. Tonga 9. Other (specify)

List of household members

		Q9	Q10	Q11	Q12	Q13	Q14	Q15
	Household members	Employed 1. Y 2. N	Name of Employer	Source of income	Average monthly income	Marital status	Length of stay in the village (area).	Previous place of residence
1.								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								

Q10 Name of employer:
1. Ministry of Health 2. Ministry of Education 3. other GRZ departments (specify)
4. parastatal company (specify) 8. private company (specify) 9. Others (specify)

Q11 Main source(s) of household income: 1. Fishing 2. Subsistence farming
3. Commercial farming 4. Casual work 5. Trading 6. Hunting 7. Handcrafts making 8. other informal employment (specify) 9. formal employment

- Q12 Average family monthly income:
 1. Below K100,000 2. K100,000-500,000 3. K500,000-1,000,000
 4. K1,000,000 -1,500,000 5. K1,500,000-2,000,000 6. 2,000,000 – 3,000,000
 7. K3,000,000 -5,000,000 8. Above K5,000,000 (specify amount)
- Q13 Respondent's marital status:
 1. Never married 2. Married 3. Separated 4. Divorced 5. Widowed
- Q14 Number of years or months stayed in township / village.
- Q15 Indicate previous place of residence (township, village, chief, district)

SECTION B: HOUSEHOLD FACILITIES

- Q16 Household source of drinking water:
 1. Pipe borne water 2. Lake, River or stream 3. Well 4. Borehole 5. Other (specify)
- Q17 Toilet facility type:
 1. Waterborne 2. Pit latrine 3. VIP* 4. Other (specify)
 (* Ventilated Improved Pit latrine)
- Q18 Sources of energy for domestic use:
 1. Kerosene 2. Woodfuel 3. Charcoal 4. Electricity 5. Gas
- Q19 Household have/use:
 1. Radio 2. Television 3. Refridgerator 4. Vehicle 5. Hammermill 6. land phone
 7. Cellphone
- Q20 Where do you seek medical assistance from?
 1. Hospital 2. Health Centre 3. Clinic 4. Dispensary 5. Witch Doctors
 6. Other (specify)
- Q21 Distance from the nearest medical facility:
 1. Less than 1km 2. 1-5km 3. 5-8km 4. 8-12km 5. 12-20km
 6. More than 20km
- Q22 Distance from the nearest primary school:
 1. Less than 1km 2. 1-5km 3. 5-8km 4. 8-12km 5. 12-20km 6. More than 20km
- Q23 Distance from the nearest secondary school:
 1. Less than 1km 2. 1-5km 3. 5-8km 4. 8-12km 5. 12-20km 6. More than 20km

SECTION C. MOVEMENT FROM HOUSEHOLD

- Q24 Do you know whether people have been leaving other places to come and leave in this area?
 1. Yes 2. No (if no skip to Q29) 3. Don't know
- Q25 What are the main reasons for coming into this area?
 1. Education 2. Marriage 3. employment 4. Social amenities 5. Agricultural land
 6. Joining their families 7. Transfer 8. Better job 9. Other (specify)

Q26 Do you know whether people have been moving out of this area in the last 10 years?
1. Yes 2. No 3. Don't know

Q27 What are the main reasons why people move out of this place?
1. Lack of education facilities 2. Lack of health facilities
3. Poor social amenities (specify) 4. Unemployed 5. Marriage 6. Transfer
7. Family differences 8. Other (specify)

Q28 What do think should be done to stop people from moving out of this area?
1. Provision of employment opportunities 2. Provision of better social amenities
3. Provision of marketing services for agricultural produce 4. Other (specify)

SECTION D: HEALTH

Q29 What are the most common health problems (sicknesses) people complain about in the order frequency?

Q30 What were the most common health complications (sicknesses) experienced by the family five years ago?

Q31 What were the most common health complications (sicknesses) experienced by the family ten years ago?

SECTION E: HAND CRAFTS

Q32 What are the handcrafts made by the family?

Q33 What are the sources of raw materials?

Q34 What were the sources of raw materials for handcrafts five years ago?

SECTION F: HOUSEHOLD STRUCTURES

Please list all the structures belonging to this household. Other structures not mentioned below, but belong to the household, should also be included. Other characteristics (descriptions) of the structures not listed below, but deemed important, should also be indicated.

Type of structure	Type of wall	Type of roof	Type of floor		
Main house					
Kitchen					
Toilet					
Grain barn					
Chicken run					

SECTION G: AGRICULTURAL ACTIVITIES

Crop output should be based on the 2008/2009 season. If the output is given in bags, the weight of the bag should be indicated, e.g. 20 x 90kg bags. For livestock, absolute numbers should be indicated and, where possible, effort should be made to see some of them to avoid cheating on the part of the interviewee.

(a) Crops Grown

Crop	Output (kg)
Maize	
Cassava	
Millet	
Beans	
Groundnuts	
Cotton	

(b) Livestock Population

Livestock	Number
Cattle	
Goats	
Sheep	
Pigs	
Chicken	

Vegetables grown:

Location of vegetable gardens:

Source of water for irrigation of vegetable gardens:

What are the main problems experienced in vegetable growing?

(c) Number of Fruit trees

Indicate the type and number of fruit trees belonging to the household.

1. Mango =
2. Orange =
3. Lemon =
4. Banana.....
5. Guava =
6. Any other (specify)

What are the crops you used to grow 5 years ago?

What are the crops you used to grow 10 years ago?

What were the yields 5 years ago?

What were the yields 10 years ago?

Have there been changes in yields?

What do you think are the reasons for the change in yields?

What do you think should be done to improve the yields and agricultural production in general?

SECTION H: FISHING

Do you do any fishing in the lake, rivers or streams near the area ?

Are there some people in your neighbourhood who catch fish in the area?

What types of fish are caught?

What is the approximate how much fish is caught by a fisherman per day?

Have catches been declining or increasing?

What are the main reasons for catches declining or increasing?