LAKE AGRO INDUSTRIES LIMITED

FINAL

ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED INTEGRATED FARMING PROJECT IN MAPEPALA/NABOWA AREA CHITAMBO/SERENJE DISTRICTS.

Submitted to ZEMA

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Overview

It has always been the desire of the Government to ensure food security through sustainable utilization of natural resources at both local and national levels. One of the potential areas is via the development of the agricultural sector. Further, the government has been encouraging investors to develop rural areas inoder to reduce poverty and enhance job opportunities. It is against this background that Lake Agro Industries Limited (LAIL) intends to establish one large commercial farming unit in Chitambo district of central province. The proposed LAIL agriculture project is located near Mapepala and Nabowa villages about 91 km from Serenje town, close to the Democratic Republic of Congo (DRC) border.

The Project

LAIL intends to establish a 7,000 hectares commercial farming unit with associated infrastructure such as centre pivots, silos, workshop and offices. The proposed project will be fully integrated into a commercial irrigated agriculture scheme for food crops and its ancillary infrastructure. The project will include introduction of irrigated fields within the farm boundary (centre pivots). The operations will involve land clearing, tilling, levelling and construction of an irrigation system to provide the necessary water required for crop production. The other component will include construction of necessary infrastructure such as storage silos, workshops, fuel and chemical storage facilities, offices and housing units for workers. Although certain trees would be retained wherever possible, the area excluding land already cleared will have to be prepared for cultivation land. It is thus anticipated that the land preparation and construction works will take place in phases. The project will involve cultivation of crops such as wheat, soya and maize.

The main activities of the project will include:

- Land clearing for center pivots as well as rain fed farming;
- Sinking of boreholes of irrigation water;
- Water abstraction;
- Construction of farm buildings and field access tracks;
- Installation of the power and water reticulation system;
- Building of staff housing units, offices, workshops, petroleum storage tanks and storage barns;
- Establishing waste disposal site in close collaboration with Chitambo District Council
- Planting of crops

The project will cover site preparation, planting, tendering and harvesting of crops. The project envisages planting of crops on an estate of 3,000 hectares (considering dambos and space for infrastructure).. The project will use the centre pivot system which will be designed in and around the project area to maximize the utilization of water from the Luwombwa River. Other facilities (support infrastructure) on the project area will be located at the farm centre. Many of the facilities such as workshops, storage facilities and fuel tanks will be built. Associated infrastructure such as pump stations and a network of distribution feeder pipes will be constructed.

Project objectives

The main objective of the project is to increase crop production through irrigation to meet ever increasing demand for soya, wheat and maize products. A well-managed irrigation system guarantees proper planning and sustainability of crop production at all times of the year. In addition, the project is aimed at contributing to the strengthening of food security in Zambia. The specific objectives include the following:

- To develop sustainable farming assets in sub-Saharan Africa taking shareholder value, community improvement and increased food production into consideration.
- Increasing summer and winter crop production i.e. Soya, maize and wheat.
- To install Centre pivots system and associated irrigation infrastructure
- To optimize use of available water resources and avoid wastage

The objectives of the study were to:

- To take environmental factors into consideration from the inception in order to enhance the functions of the project in the landscape.
- To examine the project from a liberated environmental and socio-economic perspective so as to identify and assess its potential positive and negative impacts and to recommend mechanisms to remove, or mitigate negative impacts.
- To provide baseline data and forestall project outcomes in a manner that permits a full assessment of the acceptability of the project to Zambia Environmental Management Agency (ZEMA), other regulatory agencies and to the general public.
- To develop monitoring tools to optimize project operations that assist in minimizing environmental, social, environmental extreme event and hazards.
- To provide an emergency preparedness and response decision pathway when accidents or extreme events occur.

Location

The project site is located approximately 91 km north of Serenje Central Business District. It is accessible via Serenje – Mapepala route going north west wards towards Kabundi. About 46km from the Serenje, there's a split in the road with the main gravel road leading to Mapepala – Nabowa feeder road to the right at this junction. Approximately 46km from Serenje the road leads to the Luwombwa river. The project site is just across the river. The designated GPS coordinates for the site are presented in the table below:
The project site is

Corner point	Latitude	Longitude	Elevation (m.a.s.l.)
A	12°30'24.0"S	30°01'53.62"E	1234
B	12°33'43.68"S	30°05'44.18"E	1188
C	12°37'57.54"S	30°01'32.00"E	1200
D	12°34'42.82"S	29°57'47.68"E	1212

Legal Framework

This EIS was prepared in accordance with the legal framework on Environmental Management enshrined in the Environmental Management Act of 2011 of the Laws of Zambia, read together with the Environmental Impact Assessment Regulations S.I. No. 28 of 1997. Section 3 (1) of the EIA Regulations 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 the environmental impact statement has been concluded in accordance with these regulations and the Zambia Environmental Management Agency has issued a decision letter."

The proposed project is outlined in the Environmental Impact Assessment Regulations S.I. No. 28 of 1997, Second Schedule (Regulations (7)(2)) Section 5(a) under the heading: Forestry Related Activities and read with Section 6(a) under the heading: Agriculture. Regulation 7(2) Section 5(a) states that Clearance of forestry in sensitive areas such as watershed areas or for industrial use 50 Ha or more shall require an Environmental Impact Assessment while Regulation 7(2) Section 5(a) states that Land clearance for large scale agriculture shall require an Environmental Impact Assessment before the undertaking commences. Therefore, the proposed project qualifies for a full EIA.

Project Cost

The proponent proposes to inject an investment of about Nine Hundred Ninety-Nine Thousand Dollars.

ESIA Study Methodology

To describe the existing environment appropriate standard methodologies were used. These included undertaking inventory of physical and biological environments, conducting interviews with local community and reviewing of relevant literature. Information on names of geographical features were checked from the maps and confirmed by interviewing locals who were conversant with the area.

The inventory of the existing physical and biological environment such as vegetation in the vicinity of the proposed project site for the farm focused on quality, quantity, density, and distribution. Interviews were conducted and mainly targeted local community, developers and their employees, relevant public and private officials and civil society. The interviews focused on the natural resource management practices in the area with reference to what used to be obtaining decades ago. Sources of literature that was reviewed included public and private offices, libraries and reports on past studies in the area.

The mapping of the area was undertaken to map out the surroundings of the project areas in order to determine the location of the proposed area in relation to any existing critical installations that would be affected by the project. In doing so, the existing environment was categorized into physical and biological environments.

Project Environment

The project area lies in Zone III of the agro-ecological regions of Zambia. The area experiences three main types of seasons namely; wet season, cool dry season, and hot dry season. The area receives mean annual rainfall of about 1100mm, January being the wettest month, with temperatures ranging from 24˚C to 30˚C. The Annual minimum temperatures range between 11˚C and 15˚C. The range between daily maximum and minimum temperatures is about 7˚C. The relative humidity has its maximum value occurring in January and February and is equal to 70% where, as the minimum value of 33% and 55% is reached in the month of October.

The project site is dominated by prevailing easterly winds during the dry season with fresh winds experienced in the months of July and August. The rains experience light variable winds predominantly northerlies and north-easterlies in January and February. Mean wind speed ranges from 4.0m/s to 9.0m/s.

The average annual evapotranspiration for Serenje is 734 mm whilst the average annual potential evapotranspiration is 1,571m. At the peak of summer (i.e.; October), the sun is expected to shine for an average of 10 hours per day. This represents the average number of hours in the daytime that the sun is visible and not obscured by cloud e.g. the average number of hours the sun is actually out and shining. In winter (i.e.; June and July), the sun shines for an average of 8 hours per day. There is more sunshine during the dry season than during the wet season. Sunshine hours decrease from December to March and then start to increase in April and May.

The soils at the project site are primarily ultisols and oxisols from non-basic rocks, weathered, strongly leached with low cation exchange capacity, high base saturation, low phosphorus availability, low aggregate stability and micro-nutrient deficiencies. These soils comprise deep, well-drained sandy loam to sandy clay soils having a clear clay increase with inclusions of well-drained sandy clay loam to clay.

The vegetation of the project area is predominantly miombo, a deciduous woodland dominated by the leguminous tree genera *Brachystegia*, *Julbernardia* and *Isoberlinia*. The other vegetation type often occurring in mosaic with miombo is 'chipya', a wooded grassland dominated by fire resistant woody species such as *Terminalia mollis*, *Erythrophleum africanum* and *Combretum* spp., and tall grasses of the sub family Andropogonae. The Chipya woodland which is normally maintained by frequent fires, could be floristically distinquished from miombo because it does not contain *Brachystegia*, *Julbernardia* or *Isoberlinia* species or any of the other miombo dominants. Chipya occured in small parcels throughout the site. The riverine grassland occupied about 22% of the land mass on the site. It is located near the Luwombwa River and on the central parts of the site. These grassy and seasonally waterlogged depressions which can also be called dambos were characterised by poorly drained acid vertisols and dominated by the nutritionally poor grasses *Loudetia simplex* and *Hyparrhenia* spp, *Seteria* and sedges including *Cyperus papyrus*.

Potential Impacts and Mitigating Measures

The likely major negative environmental impacts have been identified as:-

- Impact on fauna diversity and terrestrial loss
- Air Quality, Noise and Dust – movement of vehicles on site and access roads, creation of dust through excavation and vehicle movements.
- Traffic and Transport – Construction traffic movements, air pollution, noise and dust, risk to safety.
- Surface and underground water pollution – Pollution during construction phase.
- Soil Contamination and Erosion
- Hazardous waste generation
- Occupational and Public health safety
- Storage, management, use and disposal of agricultural Chemicals and containers impacts
- Water abstraction

The following positive impacts are anticipated:-

- Creation of employment opportunities during the construction phase.
- Increased trade opportunities in the community with increased population (occupational).
- General improvement in local livelihoods due to synergistic impacts of positive effects of the project such as locals benefiting from supplying, economic boom. Increase in revenue to local authorities and institutions from land rates, licences and personal levy.

The following major social negative impacts are anticipated as a result of this project:-

- Increase in sexually trasmited diseases.
- Pressure on limited social facilities such as health care centres.
- Changed human settlement patterns due to increased population by people who may be attracted to the area.

None of the negative environmental or social impacts identified relating to operations at the proposed farm can be considered critical, irreversible or unprecedented. In general, the overall environmental and social risks were found to be manageable and of low significance. The following is the summary of the main identified impacts and mitigation measures that will be put in place:

Impact	Mitigation Measures
Impact on faunal diversity and terrestrial loss	• Avoid clearing or damaging intact habitats • Prevent exploitation of sensitive reptiles, e.g. monitor lizards, chameleons conduct sensitization on sustainable resource use. • Conduct employees (induction training) and local villagers about the necessity of protecting wildlife • Maintain habitat connectivity, particularly to protected areas, via habitat corridors (through the offsite biodiversity offset • Undertake habitat clearance only during winter when birds are not breeding. • Ensure strips of land with undisturbed woodland are preserved when clearing land for agricultural fields and centre pivot installation.
Air Pollution	• All the sand or soil heaps will be removed as soon as possible to avoid nuisance dust arising from prevailing wind. • All earth materials will be transported moist and/or covered with appropriate material to suppress dust emission. • All equipment and machinery will be regularly serviced • Water bowsers will be employed on site to suppress dust on all site roads. • Designated routes will be established on site for motor traffic. • Site workers will be issued with personal protective attire (PPE)
Noise Pollution	• All mobile vehicles and equipment will have noise reducers • All land preparation activities will take place during the day and any work during night-time will be communicated to the state authorities and local community
Surface and Underground Water Pollution	• All maintenance will be done in workshops. Hydrocarbon traps shall be installed in the workshop drainage system to treat effluent prior to release to the farm surface drainage. • LAIL will ensure that no waste and other substances will be discharged into the Luwombwa river or any nearby stream. • No clearing will be done in dambos and sensitive areas
Soil Contamination and Erosion	• Regular servicing and maintenance of equipment and vehicles. • Several strips of vegetation will remain between fields to prevent soil erosion

Occupational and Public health safety	• Awareness and training of its employees on safety procedures as well as providing protective clothing and equipment. • Continue ensuring that labour and working conditions of contractors, subcontractors and LAIL itself as well as the supply chain are within the requirements of the labour laws of Zambia and International Standards
Storage, management, use and disposal of agricultural Chemicals and containers impacts	• All cautions/recommendations with respect to storage and use of hazardous chemicals shall be carefully followed and implemented. • Contaminated containers shall be disposed through well-established disposal companies registered with ZEMA. Chemical stores (including fuel, insecticides, etc) are bonded and locked at all times. • Access to such stores is controlled at all times. • Inventories of stored chemicals are maintained, and their use regulated.
Water abstraction	• LAIL will obtain water rights for irrigation from the necessary regulatory authorities. • Adequate technology to sensor flows • A good and effective monitoring system will be put in place during operations.
Increase in sexually trasmited diseases and Pressure on limited social facilities	• Implementing an extensive HIV/AIDs and STI education campaign among the local population, and workers • Implementing a comprehensive HIV/AIDS and STI education campaign targeting all workers hired for the project, both local and international. • LAIL work hand in hand with relevant local leadership government departments and local authorities in identifying health development needs.
Hazardous waste generation	All chemicals that will be used will be those approved by Zambian law. All wastes that cannot be recycled on the farming unit will be taken to the council designated dump sites in Serenje.

Environmental & Social Mitigation and Management Plan (ESMMP)

Mitigation measures will be devised to eliminate or offset these adverse environmental and social impacts to acceptable levels and on the other hand reinforce measures for enhancements. The strategies employed for impact mitigation are avoidance, reduction and remedy.

Environmental Management and Monitoring Plan

The study has proposed an Environmental Management and Monitoring Plan (EMP) to address the management of the identified environmental issues associated with the project. The plan consists of implementing the following:-

- Implementing the Impact Mitigation Plan;
- Monitoring the implementation of the EMP; and
- Institutional Framework for Monitoring, Reporting and Supervision of EMP.

Environmental monitoring and enforcement are stated along with the output from such monitoring activities. Monitoring responsibilities are specified for the responsible authorities and the Contractor.

Project Life Span

The project's span is entirely dependent on demand. As long as agricultural activities exist the project will continue.

Public Consultation

There has been continuous Public Consultations by LAIL staff in the area since February 2019. Stakeholder consultations specifically on the project site have unrelentingly been done. In line with the Environmental Management Act of 2011 of the Laws of Zambia, read together with the Environmental Impact Assessment Regulations S.I. No. 28 of 1997 and as part of the transparent consultative process aimed at taking public views, scheduled meetings were held at Mapepala Basic School near the project site on the 6th September 2019 respectively. Employed also were household consultative meetings. The project description, potential environmental and socio-economic, mitigation measures and benefits were presented to stakeholders for their feedback. The meeting provided an opportunity for capturing of any other relevant issues for inclusion in the ESIA document. The meeting allowed stakeholders to air their views on all possible environmental and socio economic impacts and best practical mitigation measures. Attendance list, project presentation and minutes taken during the meeting are annexed to the report.

The method adopted during the EIA process involved a consultative meeting with key stakeholders at Chitambo Council Offices and a detailed discussion with relevant stakeholders. Responses from the consultations and discussions provided the relevant background information and helped identify major environmental concerns of the project area for the detailed ESIA process. The process also included initial environmental survey of the project site.

Information regarding the proposed project was reviewed and an investigative site visit was conducted of the project area by GLEC Consultants and representatives of LAIL in order for the study team to obtain an initial appraisal of the environmental issues involved. The EIA study team took note of preliminary identification of environmental impacts that could potentially arise as a result of implementation of the project.

Conclusion

According to the results of the community consultations and baseline studies conducted, it is evident that implementation of the proposed project will result in overall economic growth and development as a result will contribute to overall improvement of food security. The potential negative impacts can be easily mitigated without any major effect to the environment. However, some important resources may be affected negatively such as flora, fauna and air quality.

Recommendations

- Ensure minimum destruction of vegetation. If possible, all project –related activities should be done within the designated project alignment areas.
- Regular environmental audits should be carried out on the project in order to ensure compliance of the project with the mitigation measures outlined in the Environmental and Social Management Plan (ESMP).
- All activities concerning the project such as, work execution and site inspection should be strictly monitored by experts or a designated official.
- Ensure that worker's occupational health and safety standards are maintained through capacity building, proper training, providing protection, clothing and managing their residential camps up to the required health standards.

NON-TECHNICAL SUMMARY IN LOCAL LANGUAGE (BEMBA)

Ukupifya

Akampani ka ba Lake Agro limited kalefwaya ukuitumpa mu mulimo wa ku lima ifilimwa mu nchende ya Chitambo district mupepi ne nchende ya Mapepala na Nabowa. Uyu mulimo ukakwata ifilimwa ifyapusana pusana ngomuli amataba, umupunga, na soya fikekala pancende ukulingana na menshi yakafuma mumumana. Balefwaya amabala ayakalamba ayakuti abantu kuti baingilako ncito mu chipendwa ce kana limo (1000) pakutila icalo ca Zambia cicefyeko ubwafya bwa filimwa nabantu kubulilwe ncito. Bakampani balefwaya ukuleta ifya ku sanshilako amenshi (centre pivot), ifyakuliminako, nafyonse fifwaikwa ku mubulimi.

Akampani ka Lake Agro Limited kalishibikwa mumibombele ya bulimi ubwapusanapusana. Akampani aka kalilembeshiwa na ku Patents and Companies Registration Office of Zambia.

Iyi nchende yaba kwishilya ya mumana wa Luwombwa ukufuma pa maliketi ya Serenje pali ntamfu amakumi pabula nakamo (91Km) ukulola ku kapinda kakukuso. Umusebo wayanguka kulola kwa Mapepala nangula Nabowa kwati muleya ku Kabundi. Akampani kalefwaya ukubomfya incende ukulingana na 7,000 hectares.

Uyu mulimo teti utendeke ngatabalolekeshe pa filengwa ifisangwa panvcende ilya kabili kwalibe funde mu Zambia Environmental Management Act No. 12 of 2011 ukubelengela pamo na Environmental Management Act (Environmental Impact Assessment) Regulations S.I. No. 28 of 1997. Aya mafunde yakutungula ukuti incende ikalamba pafwile paba ukupanga iyo beta ati Environmental Impact Assessment ilolekesha pafisuma ne fibi ifingafuma muli uyu mulimo. Ukupitila mu kabungwe aketwa Zambia Environmental Management Agency ubuteko bulafwaya ukuti incende shasungwa bwino pa nshita yamakule.

Ba Lake Agro bali abaipangasha ukuposa ulupiya lwa **US$ 18,000, 000** muli uyumulimo wafilimwa.

Fimo ifilingile ukuposako amano ifingaleta ububi ngata baposeleko amano nifi:

- Ukutema kwa fimuti
- Ukulufyanya ifitekwa mu nchende
- Ulukungu umulandu wa milimo;
- Icushi ukufuma ku mamotoka;
- Ifisoso;
- Amenshi ayakubomfya mukutapilila
- Imisungile nemibomfeshe ya muti wa filimwa
- Icongo ukufuma mufyakubomba bomba;

Uyu mulimo muli ili buku naulokesha pali fyonse ifi no kumono kuti incende akampani kokonke funde ilyo uyu mulimo ulebombwa. Kanshi akampani nakaipelesha ukumona pali fyonse ifibi no kubikako amano. Ukubomba munshila iyakukonke funde no kubula ifili mwibuku no kufikonka bwino bwino.

Umulimo uyu uli nokuleta ubusuma mu fingi. Abengi bakasanga incito mumpendwa ukulungana nangula ukupitilila ikana limo. Umulimo uyu ukalete nshila ya Cuma ukufula ku ncede ya Nabowa nama Pepepala. Ifingi filimwa fikalabalila muncende cilepilibulo kutila abengi bakalakwata ififyakulya nama kwebo.

Mukulekelesha ili buku nalilosha pali fyonse ifi ngafwa abekala calo ukwishiba ububi no busuma bwa milimo iyi.

Developer's Statement

We trust that the above provides a fair and accurate Executive Summary of the Environmental Impact Statement for the proposed development by Lake Agro Limited, presented to the Zambia Environmental Management agency (ZEMA) for consideration for approval.

Director
LAKE AGRO LIMITED

EIA TEAM

An inter-disciplinary team of well qualified and seasoned consultants has been proposed to carry out the EIA study and preparation of an Environmental Impact Statement (EIS). Table below present each consultants' assigned study responsibility. Detailed curriculum vitas are in Appendix.

Name of Consultant	*Aspect*	*Responsibility*	
Gillan Simfukwe	Team Leader – EIA Process Specialist Ecological/ Fauna	Responsible for coordinating the input of the EIA study team members and ensuring timely project implementation; Contact person for Developer, ZEMA and other stakeholders in the EIA process. Assessing ecological/social characteristics of project site. Assessing baseline studies on Waste, Noise, Air & other aspects	
Chisanga Siwale	*Hydrology & Hydrogeology Specialist*	*Characterizing the geological/hydrological resources.*	
Philip Chikasa	*Soil studies, Botany (flora) and Fauna Expert*	*Assessing Flora/Fauna/Soil characteristics of project site.*	
Wisdom Chasaya	*Socio - Economist*	*Social economic & cultural settings of the project*	
Mubanga Mwansa	*Air/Noise Specialist*	*Assessing baseline studies on Noise, Air & other aspects*	

The EIA team will work in close collaboration with the following:-

Name	**Position**
Surya	LAIL Agricultural Development Manager

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ABBREVIATIONS AND ACRONYMS

AOI	Area of influence
BOD …….	Biochemical Oxygen Demand
CBOs	Community Based organizations
DAO	District Administrative Officer
Developer	Lake Agro Industries Limited
DNPW	Department of National Parks and Wildlife
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMA	Environmental Management Act
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
FD	Forestry Department
GDP	Gross Domestic Product
GLEC	Global Environmanagement Consulting firm
IAPs	Interested and Affected Parties
LAIL	Lake Agro Industries Limited
MACO	Ministry of Agriculture & Cooperatives
MCDSS	Ministry of Community Development and Social Services
OM	Organic matter
PACRA	Patents and Companies Registration Agency
RDA	Roads Development Agency
SARO	Senior Agricultural Research Officer

SOM	Soil Organic Matter
STIs	Sexually transmitted infections
TORs	Terms of Reference
WDB	Water development Board
WRA	Water Resources Authority
ZAWA	Zambia Wildlife Authority
ZEMA	Zambia Environmental Management Agency
ZESCO	Zambia Electricity Supply Corporation

WEIGHTS AND MEASURES

km	Kilometre
mg	Milligram
Kg	Kilogram
Kv	Kilovolts
M	meter
dB	Decibel
ha	Hectare
km²	Square kilometre
m	Metre
M	Million
m²	Square metres
m³	Cubic metres
mg/ℓ	Milligrams per litre
Mm³/a	Million cubic metres per year
µg/l	micrograms per litre
µm	micrometer (micron)

1 INTRODUCTION

1.1 Project background and Brief Description

Agriculture contributes significantly to social and economic development of the country. National statistics show that majority of the population is reliant on agriculture with a significant percent of the country's labour force being employed in the sector. However, agricultural production in Zambia is vulnerable to seasonal rainfall variability. Drought occurrences over the past decades have continued to affect agricultural productivity resulting into food insecurity thereby threatening the mainstream population.

Lake Agro Industries Limited (LAIL) intends to establish a 7,000 hectares commercial farming unit with associated infrastructure such as centre pivots, silos, workshop and offices. The proposed project will be fully integrated into a commercial irrigated agriculture scheme for food crops and its ancillary infrastructure. The project will include introduction of irrigated fields within the farm boundary (centre pivots). The operations will involve land clearing, tilling, levelling and construction of an irrigation system to provide the necessary water required for crop production. Exploiting this potential will enable Lake Agro Industries to contribute to increased overall national production levels of cash crops such as wheat, maize and soya beans which are far short of meeting demand at national and regional level. Lake Agro farms geographical location in the northern part of Serenje gives it a competitive edge given that this part of the country is near to the equatorial region and less vulnerable to rain variability compared to the southern part.

In order to ensure that operations at Lake Agro Industries are done in a manner that is environmentally sustainable, an environmental impact assessment study has been prepared. The aim of the study is broad in terms to identifying social economic and environmental impacts (positive and negative), extent and significance of these impacts and propose measures to either mitigate or enhance the impacts.

The EIS has been prepared in line with the Environmental Management Act of 2011 as read in conjunction with the Environmental Management (Licensing) Regulations, 2013 (Statutory Instruments No. 112 of 2013). The project falls under the Second Schedule, Section 29 (EIA regulations) of the Environmental Management Act No. 12 of 2011 under the category of Agriculture subsections (a) "Land clearance for large scale agriculture" and (b) "Irrigation schemes covering an area of 50Ha or more" which requires a full Environmental Impact Assessment study and preparation of an Environmental Impact Statement.

This document, therefore, is the result of analysis of environmental factors by several specialists approved by Zambia Environmental Management Agency (ZEMA). The implementation of the findings and recommendations of the document will ensure that the proposed development is carried out in a manner that will prevent, and where prevention is not possible, minimize adverse environmental and social impacts.

1.2 Project Area and Location

The project site is located approximately 91 km north-west of Serenje Central Business District. It is accessible via Serenje – Mapepala route going north west wards towards Kabundi. About 46km from the Serenje, there's a split in the road with the main gravel road leading to Mapepala – Nabowa feeder road to the right at this junction. Approximately 46km from Serenje the road leads to Mapepala/Nabowa.

To the north of the project site is the Kasanka National Park which is about 2.8km away from the Project area. The Luwombwa River is the major river draining the Project area on the eastern fringes. The site is in the development zone of the Department of National Parks and Wildlife Plan.
The closest settlements to the site are the villages of Mapepala and Nabowa. These settlements form part of the Lala tribe under the leadership of Chief Chitambo.

The designated GPS coordinates for the site are presented in the table below:

Table 1: Boundary Coordinates

Corner point	Latitude	Longitude	Elevation (m.a.s.l.)
A	12°30'24.0"S	30°01'53.62"E	1234
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1.3 Legislation

This report has been prepared in line with the Environmental Management Act of 2011 as read in conjunction with the Environmental Management (Licensing) Regulations, 2013 (Statutory Instruments No. 112 of 2013). The project falls under the Second Schedule, Section 29 (EIA regulations) of the Environmental Management Act No. 12 of 2011 under the category of Agriculture subsections (a) "Land clearance for large scale agriculture" and (b) "Irrigation schemes covering an area of 50Ha or more" which requires a full Environmental Impact Assessment study and preparation of an Environmental Impact Statement. In the process of conducting the EIA, an initial requirement is that Scoping report is submitted to the Zambia Environmental Management Agency (ZEMA) for approval. This report therefore is an EIS Report.

1.4 Project Rationale and Justification

Zambia is a land locked country with vast potential for Agricultural and Livestock production. Agriculture in the country has the potential to pull many out of poverty. Good performance in the sector translates into overall improvement of the country's Gross Domestic Product (GDP), creates jobs and expands the tax base. The sector is the key engine for the anticipated growth both directly and indirectly through agricultural processing industries such as the beef processing plants. In view of the potential multiplier effects that the

sector has on the economy, restoring high and sustained agricultural growth is critical for reducing poverty in Zambia.

Over 80 per cent of the rural population directly depend on agriculture for food and income. However, most rural agricultural productivity is very low as most farmers are engaged in mere subsistence production. Finding additional cash crops with robust markets can be a means to raise their incomes substantially and reducing poverty. Zambia can drastically improve agricultural productivity and export competitiveness if she has to come out of income poverty by implementing large scale farming projects.

Zambia currently produces various crops, but the volume is insufficient to serve the domestic demand. This has necessitated the setting up of the project in addition to prepositioning itself for the upcoming market in Southern Africa due to booming population.

1.5 Objectives of the Project

The main objective of the project is to increase crop production through irrigation to meet ever increasing demand for soya, wheat and maize products. A well-managed irrigation system guarantees proper planning and sustainability of crop production at all times of the year. In addition, the project is aimed at contributing to the strengthening of food security in Zambia. The specific objectives include the following:

i. To develop sustainable farming assets in sub-Saharan Africa taking shareholder value, community improvement and increased food production into consideration.
ii. Increasing summer and winter crop production i.e. Soya, maize and wheat.
iii. To install Centre pivots system and associated irrigation infrastructure
iv. To optimize use of available water resources and avoid wastage

The objectives of the study were to:

i. To take environmental factors into consideration from the inception in order to enhance the functions of the project in the landscape.
ii. To examine the project from a liberated environmental and socio-economic perspective so as to identify and assess its potential positive and negative impacts and to recommend mechanisms to remove, or mitigate negative impacts.
iii. To provide baseline data and forestall project outcomes in a manner that permits a full assessment of the acceptability of the project to Zambia Environmental Management Agency (ZEMA), other regulatory agencies and to the general public.
iv. To develop monitoring tools to optimize project operations that assist in minimizing environmental, social, environmental extreme event and hazards.
v. To provide an emergency preparedness and response decision pathway when accidents or extreme events occur.

1.6 Project Description

The proposed project will be fully integrated into a commercial irrigated agriculture scheme for food crops and animal proteins and its ancillary infrastructure. This land acquired for the purposes of the project covers a total of 7,000Ha.

The project will include introduction of irrigated fields within the farm boundary (centre pivots). The operations will involve land clearing, tilling, levelling and construction of an irrigation system to provide the necessary water required for crop production. The other components will include construction of necessary infrastructure such as housing units, silos, workshops and accommodation units for workers. Although certain trees would be retained, wherever possible, the entire area will have to be prepared for cultivation. It is thus anticipated that the land preparation and construction works will take place in phases. Straps of intact forested lands to protect the environment will be left around the fields. The agricultural fields will be designed in relation to the general slope of the area, state of technology and the existing fields. The farm layout will thus facilitate easy production of the crops. This will lead to social economic development of the area through various benefits associated with such a project

The main activities of the project will include:

- Land clearing for center pivots as well as rain fed farming;
- Sinking of boreholes of irrigation water;
- Construction of farm buildings and field access tracks;
- Installation of the power and water reticulation system;
- Building of staff housing units, offices, workshops, petroleum storage tank and storage barns;
- Planting of crops;

In order to achieve the above project, a significant labour force of skilled, semi-skilled and casual workers will be employed during the site preparation, construction and operational phases of the project through direct and indirect job opportunities; priority will be given to locals.

1.7 Developer Details/ Track Record/Experience

Lake Agro Industries is a Zambian agribusiness company leveraging on local knowledge and expertise to secure its success. LAIL owners have been in agribusiness for more than 20 years. They have incredible experience in agricultural management and entrepreneurship with significant foresight. They have proven track records in commercial crop production and irrigation.

1.7.1 Contact Details of the Developer

Table 2: Project Developer's Details

Name of Developer	**Lake Agro Industries Limited**
Physical Address	Farm No 39, Chichele, New Airport, Ndola
Contact Details	Mr Gompa, Director
	Phone: 0973878598 Email: ramana.gompa@lakeagro.com

1.7.2 Shareholding and Track record

The shareholders in the company are:-

Table 3. Summary of shareholders

Shareholders				
No.	**Name**	**Nationality**	**% shares**	**Position**
1	AS Holdings Limited	Registration 148073	99.99	
2	Ally Edha Awadh	Tanzanian	0.01	Chief Executive Officer
Directors				
1	Robinson Malenji	Zambian		Directors
2	Ramana Gompa	Indian		Directors

1.8 Total Project cost

The proponent proposes to inject an investment of about Nine Hundred Ninety-Nine Thousand Dollars.

1.9 Proposed Project Implementation date

LAIL management are ready to implement the proposed project soon as all the approval requirements are met and done through the various relevant line organizations and institutions which include the EIA approval process by ZEMA.

1.10 Environmental Legislation

This ESIA Report was prepared in accordance with the legal framework on Environmental Management enshrined in the Environmental Management Act of 2011 of the Laws of Zambia and its subsidiary legislation, the Environmental Impact Assessment Regulations S.I. No. 28 of 1997. Section 3 (1) of the EIA

Regulations 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 the environmental impact statement has been concluded in accordance with these regulations and the Zambia Environmental Management Agency has issued a decision letter."

The proposed project is outlined in the Environmental Impact Assessment Regulations S.I. No. 28 of 1997, Second Schedule (Regulations (7)(2)) Section 5(a) under the heading: Forestry Related Activities and ready with Section 6(a) under the heading: Agriculture. Regulation 7(2) Section 5(a) states that Clearance of forestry in sensitive areas such as watershed areas or Irrigation schemes covering an area of 50Ha or more shall require an Environmental Impact Assessment while Regulation 7(2) Section 5(a) states that Land clearance for large scale agriculture shall require an Environmental Impact Assessment The proposed project qualifies for an EIA.

The ESIA was conducted in line with the provisions of these EIA Regulations.

1.11 Public Consultations

There has been continuous Public Consultations by LAIL staff in the area since February 2019. Stakeholder consultations specifically on the project site have unrelentingly been done. In line with the Environmental Management Act of 2011 of the Laws of Zambia, read together with the Environmental Impact Assessment Regulations S.I. No. 28 of 1997 and as part of the transparent consultative process aimed at taking public views, scheduled meetings were held at Mapepala Basic School near the project site on the 6th September 2019 respectively. Employed also were household consultative meetings. The project description, potential environmental and socio-economic, mitigation measures and benefits were presented to stakeholders for their feedback. The meeting provided an opportunity for capturing of any other relevant issues for inclusion in the ESIA document. The meeting allowed stakeholders to air their views on all possible environmental and socio economic impacts and best practical mitigation measures. Attendance list, project presentation and minutes taken during the meeting are annexed to the report.

The method adopted during the EIA process involved a consultative meeting with key stakeholders at Chitambo Council Offices and a detailed discussion with relevant stakeholders. Responses from the consultations and discussions provided the relevant background information and helped identify major environmental concerns of the project area for the detailed ESIA process. The process also included initial environmental survey of the project site.

Information regarding the proposed project was reviewed and an investigative site visit was conducted of the project area by GLEC Consultants and representatives of LAIL in order for the study team to obtain an initial appraisal of the environmental issues involved. The EIA study team took note of preliminary identification of environmental impacts that could potentially arise as a result of implementation of the project.

1.12 Approach and Methodology

The method adopted during the scoping process involved consultative meetings and discussions with relevant government institutions at national, provincial and district level, local communities, Headmen and community at large communities in the project area. The process also included initial environmental survey of the project site.

Responses from the consultations and discussions provided the relevant background information and helped identify major environmental concerns of the communities in the project area for this report.

The EIA study focussed on having an in depth understanding of how the project, its activities, processes and its waste management regime, the nature of the current status of the site and its surrounding environment and how the potential impacts of the project in its operational phase will be managed. The study gathered data on the different facets of the environment such as climatic conditions, geographical characteristics, biological characteristics, socio-economic characteristics and possible impacts such as the socio-economic environment, employment opportunities and effects on other land-uses that are important to the area's economy, etc. Emphasis shall be placed on impacts that will have been caused as a result of the operations of the project activities during all the three phases of project implementation.

The EIA involved:-

- Desk study and review of the available background information about the project proponent, the project operation and its nature., the environmental and legislation information, literature review concerning the project site, collection of secondary data, analysis of survey plans, stakeholder meeting and interviews;
- Collection of primary data and carrying out ground truthing on the information provided to the consultants and triangulation of important information during literature review in order to have an in-depth understanding of the current status of the project site and its surrounding environment;
- Evaluating the objective of the project against the current environmental status and project conceptualization;
- Identifying all potential social-economic, positive and negative impacts that may have arisen as a result of implementing the project and their impacts on the biophysical environment, their magnitude and significance;
- Prescribing the mitigation measures to all the identified potential negative impacts;
- Outlining a sustainable Environmental Management Plan (EMP) for the project.

Characterization of impact significance will involve consideration of the following factors:

- Beneficial or detrimental (Positive, Negative),
- Probability of impact occurrence (Unlikely, Possible, Probable, Certain),
- Frequency of impact occurrence (Continuous, Frequent, Infrequent, Occasional),
- Duration of the impact (Short-term, Medium-term, Long-term),
- Timing of the impact (Preparation, Construction, Operation, Post Decommissioning/Closure),

- Severity of the impact (Very High, High, Moderate, Low),
- Spatial extent of the impact (Localised, Project Area, Limited, Widespread) and
- Sensitivity of the element being impacted (High, Moderate, and Low).

Other considerations were included. Assessment of the value of the affected environmental component, risk posed by the impact to the human population and cumulative Effects. Impacts will also be characterized as direct or indirect in order to have a full appreciation of the impacts and facilitate effective management of the impacts.

The Environmental Management Plan (EMP) will seek to give a comprehensive plan on how proposed mitigation measures will be implemented during preparation, construction, operational and decommissioning phases of the project and as such will serve as a useful management tool to guide implementation of the proposed measures. The EMP will comprise of an Impact Mitigation Plan, Impact Monitoring Plan and Emergency Response Plan.

The EMP will outline the duties and responsibilities of the developer, contractor and other relevant parties with respect to environmental management to ensure successful implementation of these measures, monitoring and subsequent audits during all project phases.

2 POLICY, INSTITUTIONAL AND ORGANISATIONAL FRAMEWORK

2.1 General National Legal Framework

The National Environmental Policy of Zambia recognizes the need for any socio-economic development to be undertaken in such a manner that avoids environmental degradation. Provides environment and natural resources management policies to address current and future threats to environment and to human livelihoods and provides policy guidelines for sustainable development. As such construction needs to be done in a sustainable manner.

2.2 Institutional Framework

The Environmental Management Act (EMA) establishes the Zambia Environmental Management Agency (ZEMA). ZEMA is a statutory body within the Ministry of Land, Natural Resources and Environmental Protection and the following are the main functions of ZEMA:

- Integrated environmental management and the protection and conservation of the environment and sustainable management and use of natural resources;
- The prevention and control of environmental pollution and environmental degradation;
- Provide for public participation in environmental decision making and access to environmental information
- Undertaking environmental auditing and monitoring; and
- Facilitating the implementation of international environmental agreements and conventions to which Zambia is a party.

The proposed EIS will therefore be submitted to ZEMA, after which ZEMA which will undertake verifications and consultations with the interested and affected parties (IAPs) prior to making a decision.

This EIS was prepared in accordance with the legal framework on Environmental Management enshrined in the Environmental Management Act of 2011 of the Laws of Zambia and its subsidiary legislation, the Environmental Impact Assessment Regulations S.I. No. 28 of 1997. Section 3 (1) of the EIA Regulations 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 the environmental impact statement has been concluded in accordance with these regulations and the Zambia Environmental Management Agency has issued a decision letter."

The proposed project is outlined in the Environmental Impact Assessment Regulations S.I. No. 28 of 1997, Second Schedule (Regulations (7)(2)) Section 5(a) under the heading: Forestry Related Activities and ready with Section 6(a) under the heading: Agriculture. Regulation 7(2) Section 5(a) states that Clearance of forestry in sensitive areas such as watershed areas or for industrial use 50 Ha or more shall require an Environmental Impact Assessment while Regulation 7(2) Section 5(a) states that Land clearance for large scale agriculture shall require an Environmental Impact Assessment The proposed project qualifies for an EIA. Below is the summary of the relevant institutions and their respective roles: -

Table 4: Institutional Framework

INSTITUTION	CORRESPONDING ROLE
Zambia Environmental Management Agency (ZEMA)	ZEMA is the regulatory body responsible for enforcing the National Environmental Law in the land- the Environmental Management Act no. 12 of 2011. ZEMA controls the laws related to the proposed project such as environmental protection, pollution control, natural resources conservation and waste management.
Ministry of Agriculture	This Ministry controls the Agriculture sector in the country. The proposed project is agricultural related and thus directly falls under this ministry. The ministry is responsible for facilitating and developing mechanisms to ensure that the policies and objectives set for the agricultural sector are achieved and to recommend changes where necessary.
Ministry of Lands and Natural Resources	The ministry is responsible for the administration of land in the country. The departments under the ministry that will be directly concerned with the project activities include the Forest department (FD)).
Ministry of Water Development, Sanitation and Environmental Protection	The Ministry through the WARMA will regulate and control the use of water for the project activities as it has the sole responsibility of managing water resources in the country. Since ZEMA fall under MLNREP, the ministry is responsible for enforcing the provision under the EMA and the associated regulations/S.Is.

2.2.1 Local Authorities involved in the project

The project lies within the authority of Chitambo District Council. As Local Authorities, Chitambo District Council is a semi-autonomous institution operating as an agent of Central Government. They are authorized to perform specific functions on behalf of Government. The Councils are the highest decision making bodies at the district level. They formulate policies in the form of by-laws. The Local Authorities provide a forum for local representation of the public by electing their local representatives, the Councilors.

2.3 Legal Framework

The following Acts are relevant to the project:

2.3.1 The Environmental Management Act, No 12 of 2011

This Act continues the existence of the Environmental Council of Zambia and renames it as Zambia Environmental Management Agency (ZEMA); it replaces the repealed Environmental Protection and Pollution Control Act No. 12 of 1990; it also provides for integrated Environmental management and the protection and conservation of the environment through sustainable management and use of natural resources.

Relevance: *This law is the primary legal basis for undertaking environmental assessment for the proposed farm establishment project.*

Compliance there of: *Lake Agro Industries Limited shall fully comply with requirements of this national regulation during implementation of the EIA for Lake Agro Industries Limited.*

a) ***Environmental Impact Assessment Regulations, (SI No. 28 0f 1997 Part 2 and 3)***

The regulations state that a developer shall not implement a project for which a Project Brief or an Environmental Impact Statement is required under the regulations, unless a project brief or an Environmental Impact Assessment has been concluded in accordance with the Regulations and the Council has issued a Decision Letter.

Relevance: *Being a project of this magnitude, it falls under a project category requiring the preparation of the Environmental Impact Assessment (EIA).*

Compliance there of: *This EIA is being prepared in compliance with the above legal provisions.*

2.3.1.1 The Water Resources Management Act No. 21 of 2011

This new legislation on the management and development of water resources in the country has replaced the repaeled Act – Water Act of 1948. The Act addresses inadequacies of the old Act and aligns the management of water to the basic rule and principles relating to water and the environment. Issuance of water rights is clearly provided for in the new legislation similar to the 1948 Act. Unlike the repealed Act which mandated the Water Development Board (WDB) to issue water rights, the new one mandates the Water Resources Authority(WRA) to carry out the same function. Applications of the water right for commenrcial use is required considering that all water, in its natural state, vests in the president who holds it on behalf of and for the benefit of the Zambian people.

- Part I, Section 6 states that the State is the trustee of all water in Zambia and any rights thereto are subject to annual review in accordance with the Act.

- Part III sets out the composition and functions of Catchment and Sub-Catchment Councils to design and control the use of water resources in catchments and sub-catchments.
- Part IV sets out the functions and processes for Catchment Management Plans to manage catchment water resources.
- Part V sets out the requirements for the control and monitoring of environmental flows, levels and volumes and the steps that may be taken to maintain water quality and prevent pollution.
- Part VIII defines the use of water and the regulations for monitoring of that use.
- Part IX sets out the procedures for establishing water abstraction rights.
- Part X, requires the registration of those designing and constructing dams and other water structures.
- Part XI defines the need to make a request for the drilling or changes to a borehole.
- Part XII, sets out requirements for the registration, design, construction, construction supervision and maintenance of dams.
- Parts XIII and XIV establish easement conditions and provisions for flood,
- Drought or spillage emergencies.
- Parts XV and XVI define water charges and enforcement provisions.

Relevance: *being a farm establiment project water will be required for irrigation. This will entail establishing potential sources (including abstraction)of water and the developer will take necessary steps as per the reqiurement of the Act.*

Compliance there of*: Obtaining the relevant water rights requirements.*

2.3.2 Land Act and Land Acquisition Act of 1995 (SI 18 of CAP 184)

The Department of Lands administers the Lands Act for alienation of land under statutory leaseholds. Under the Land Act of 1995, land has been divided into the following categories: State, Local Authority and Traditional land. The proposed developments fall under state Authority.

Relevance*: It is relevant because the project site shall be titled for 99year lease in due course.*

Compliance there of*: Compliance with the provisions of the Act with regards to operating according to the requirements of State Land and Local Authority.*

2.3.3 The Local Government Act (Amendment) Act No. 17 of 2016

The Local Government Act provides for a system of local government administration in Zambia at city, municipality and district Council levels. Each local governance level has delegated statutory functions with respect to development planning. The Act also allows Councils to implement environmental protection and natural resources management functions which include prevention of pollution of water supplies and has some control in undertaking of mining operations. The Principal Act was amended in subsection (2) by the insertion, immediately after the word "Councils", of the words "to pay the salaries of principal officers and officers of a Council.

Relevance: *Management will have to abide by the Bye Laws established by the Local Authorities.*

***Compliance there of**: Acquisition of Local Authority permits and compliance with other environmental regulations as stipulated therein.*

2.3.4 The Urban and Regional Planning Act of 2015

The Act repeals the Town and Country Planning Act, 1962, and the Housing (Statutory and Improvement Areas) Act, 1975. It provides for development, planning and administration principles, standards and requirements for urban and regional planning processes and systems; it also provides for a framework for administering and managing urban and regional planning for the Republic of Zambia to ensure sustainable urban and rural development by promoting environmental, social and economic sustainability in development initiatives; the act ensures uniformity of law and policy with respect to urban and regional planning. The Act provides for the appointment of planning authorities whose main responsibilities are the preparation, approval and revocation of development plans. It also provides for the control of development and subdivision of land.

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***Relevance:** Being a site located in the Serenje local authority land, the project must have approved sketch plans of the proposed project.*

***Compliance there of**: Project implementation shall be feasible after obtaining approved developmental sketch plans from relevant Authorities of the proposed project.*

2.3.5 The Public Health Act of 1996

The Act empowers a Council to prevent unhealthy activities. It provides for the prevention of disease, drainage, latrine and disposal of sewerage and treatment systems.

***Relevance**: - The premises and surrounding environment of the development shall be managed based on the Public Health Act of 1996.*

***Compliance there of**: The project shall comply with the provisions of the Act in order to safeguard human life. The project shall also ensure that measures to prevent pollution dangerous to human health and to any water supply are taken into account through the provision of a drainage control system.*

2.3.6 The Foods and Drugs Act, Cap 303

This Act provides for the protection of the public against health hazards and fraud in the sale and use of food, drugs, cosmetics and medical services.

***Relevance**:- This Act is relevant to this project as it will be dealing with the use of feeds to produce chickens for public consumption.*

***Compliance there of**: The project shall comply with the provisions of the Act by ensuring that it uses feeds that comply with its provisions to protect the health of the public.*

2.3.7 Forest Act No. 4 of 2015

The Act provides for establishment, gazetting and de-gazetting of forests. It also provides for monitoring, forest inventories, management and regulation of forest areas and forest products, nationwide, and particularly in National and Local Forests. The Act is enforced by the Forest Department Specific to the general protection of forest resources, the Act provides for protection of Six (6) tree species in Zambia whether in a protected area or outside.

These tree species are:
1. *Afzeliaquanzensis* (Pod Mahogany)
2. *Baikiaeaplurijuga* (Teak)
3. *Entandrophragmacaudatum* (Mountain Mahogany)
4. *Faureasaligna* (Beech wood)
5. *Khayanyasica* (Red Mahogany)
6. *Pterocarpusangolensis* (African Teak)

Relevance to the Project: - *The site is covered by various vegetation species therefore its relevant to the act is relevant.*
Compliance – *The developer shall comply accordingly*

2.3.8 The National Heritage Conservation Act (Cap 173)

Enacted in 1989, the Act provides for the Conservation of Ancient, Cultural and Natural heritage, relics and objects of aesthetic, historical, pre-historical, archaeological or scientific interest. It establishes the Commission and sets out its functions.

The Act is the implementing legal framework in Zambia of the World Heritage Convention of 1972, under which the heritage sites (such as Victoria Falls) are included in the World Heritage List as World Heritage sites.

Relevance*: - This Act is relevant to this project as the project site. During construction and operation implementation phases any objects of prehistoric or archaeological interest may be found.*
Compliance there of*: The project shall comply with the provisions of the Act by particular attention is paid to establish the presence of any artefacts or objects of archaeological significance within the project area.*

2.3.9 The National HIV/AIDS/STI/TB Act of 2002

The Act provides for the establishment of the HIV/AIDS/STI/TB Council whose functions include the coordination and provision of support to development, monitoring and evaluation of multi-sectoral response for the prevention and combating of the spread of HIV/AIDs/STI and TB in order to reduce the personal, social and economic impacts of HIV/AIDS/STIs and TB.

Relevance: *Being a new investment of large scale it's bound to attract more people seeking for employment, thus putting LAIL Limited employees at risk of contracting HIV/AIDS and related STIs.*

***Compliance there of**: LAIL Limited shall develop measures to address the concerns of this Act.*

2.3.10 The Zambia Wildlife Act No 14, 2015

An Act to provide for the winding up of the affairs of the Zambia Wildlife Authority; establish the Department of National Parks and Wildlife in the Ministry responsible for tourism; provide for the appointment of a Director and other officers responsible for National Parks and Wildlife; provide for the transfer of the functions of the Authority to the Ministry responsible for tourism, Department of National Parks and Wildlife and Director of National Parks and Wildlife; establish the Wildlife Management Licencing Committee; provide for the establishment, control and management of National Parks.

Relevance: - *The site is within the development zone of the game management area. Lake Agro Industries shall therefore act in a manner consistent with defined protected area management plans and adhere to principles highlighted in this law during project implementation of the farm.*
***Compliance there of**: The project shall comply with the provisions of the Act by particular attention is paid to establish the presence of any significant wild fauna and flora within the project area that may require protection.*

2.3.11 The Fisheries Act No. 22 of 2011

The Act provides for the appointment of the Director of Fisheries and fisheries officers and provides for their powers and functions. It promotes sustainable development of fisheries and a precautionary approach in fisheries management, conservation, utilization and development. It establishes fisheries management areas and fisheries management committees and provides for the regulation of commercial fishing and aquaculture. It establishes the Fisheries and Aquaculture Development Fund. It has replaced the Fisheries Act of 1974. The implementing institution for this Act is the Ministry of Fisheries and Livestock. The Act regulates all fishing activities in Zambia undertaken in any kind of aquatic ecosystem. This includes lakes, rivers and streams. It also regulates activities that may interfere with fisheries.

***Relevance:** The project area has the Luwombwa River which form boundaries to the project site. Operations near the water body if not properly managed may affect the aquatic ecosystem (fish and other species) that may be found within the water body.*
***Compliance thereof:** LAIL will follow the guidelines in this Act to avoid the contamination of the stream which may result in adverse impacts on aquatic species.*

2.3.12 The Petroleum Act No. 10 of 2008

The Act was enacted to provide for the regulation of the importation, conveyance and storage of petroleum and other inflammable oils and liquids for the protection of the public and the environment.

***Relevance:** The project will have facilities for fuel storage, the project must have approved fuel storage licenses.*
***Compliance there of**: Petroleum products shall be stored on site in compliance with the provisions of the Petroleum Act.*

2.3.13 The Noxious Weeds Act of 1953 Cap 231

Enacted in 1953, it provides for the declaration and eradication of noxious weeds. The Noxious Weeds Act is the main legislative framework dealing with invasive species, generally referred to as 'noxious weeds. The Act provides for the eradication of noxious weeds. The Act places a duty on every occupier of land within any specified area to report the occurrence of and to eradicate noxious weeds. An occupier of land is further obligated to take reasonable steps to eradicate any noxious weed occurring within.

Relevance: *The Act is relevant to avoid the introduction of noxious weeds in the agriculture area although the farm will not be involved in cropping activities whose core operation will involve the application of pesticides and fertilizers.*
Compliance thereof: *LAIL will remove any noxious weeds as identified and instructed by an authorizing officer acting legally and in accordance with this act.*

2.3.14 The Plant, Pests and Diseases Act of 2005 CAP 233

The Plant Pests and Diseases Act is the enabling framework for the eradication and prevention of the introduction and spread of plant pests in Zambia. The Plant Quarantine and Phytosanitary Service implement this act. As in the case of eradication of noxious weeds under the Noxious Weeds Act, Section 7 of the Plant Pests and Diseases Act requires an owner of land or premises to take all measures prescribed and any additional or alternative measures as are reasonably necessary for the eradication, reduction or prevention of the spread of a pest which an inspector may by notice in writing order him to take.

Relevance: *In the cropping operations at the farm, pest infestation may occur and LAIL will take all necessary measures within the provisions of this act to eradicate and prevent the spread of pests within and outside the proposed project site.*
Compliance thereof: *Importation of any growing media, injurious organisms, invertebrates and plants will be controlled in accordance with the provisions of this act.*

2.3.15 Plant Variety and Seeds Act (Amended by Act No. 21 of 1995)

The plant, pests and diseases act gives provisions on administration, registration of seed importation and cleaning, seed certification, inspection of seeds, prescribed seeds, import and export of seed, offences related to seeds and miscellaneous issues regarding seeds.

Relevance: *In the farming process, pests and diseases may affect the crops to be planted at the farm. The possibility of disease outbreak may be there within the farm.*
Compliance there of: *LAIL will take all necessary measures within the provisions of this act to eradicate and prevent the spread of pests and disease within and immediate surrounding of the proposed project site. Importation of any growing media, injurious organisms, invertebrates and plants will be controlled in accordance with the provisions of this act.*

2.3.16 Agriculture (Fertilizers & Feed) Act No. 13 of 1994

The act provides for the regulation and control of the manufacture, processing, importation and sale of agricultural fertilisers and farm feed. It also provides for minimum standards of effectiveness and purity of such fertilisers and feed.

Relevance: *This act is relevant in that the cropping operations at the farm will involve application of fertilizers on the fields that will be irrigated and this may have been carried with water run-off into the stream affecting downstream users and leading to eutrophication.*
Compliance thereof: *LAIL will strictly follow the requirements and provisions in this act and prevent contamination of the stream bed.*

2.3.17 Biosafety Act No. 10 of 2007

The Biosafety Act established Zambia's position on 'the regulate the research, development, application, import, export, transit, contained use, release or placing on the market of any genetically modified organism whether intended for use as a pharmaceutical, food, feed or processing, or a product of a genetically modified organism'. The Act amplifies the provisions of the Plant Variety and Seeds Act.

Relevance: *It is relevant because the project will produce crops of which globally there are GMO varieties available. It is relevant because the project will require stiff measures on bio-safety to control diseases on the farm.*
Compliance there of: *Compliance with the provisions of the Act with regards to operating according to the requirements of the Bio-safety act.*

2.3.18 The Occupational Health and Safety Act No 36 Of 2010

The act provide for the establishment of health and safety committees at workplaces and for the health, safety and welfare of persons at work; provide for the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work; provide for the protection of persons, other than persons at work, against risks to health or safety arising from, or in connection with, the activities of persons at work; and provide for matters connected with, or incidental to.. For Example, Section 11 of the Act requires that all employers establish health and safety committees.

Relevance: - *The development will employ a large number of people and therefore the developer is mandated by law to put in place health and safety measures at the project site.*
Compliance: *The developer will ensure that the provisions of the Act are adhered to.*

2.3.19 The Employment Code Act No. 3 of 2019

An Act to regulate the employment of persons; prohibit discrimination at an undertaking; constitute the Skills and Labour Advisory Committees and provide for their functions; provide for the engagement of persons on contracts of employment and provide for the form and enforcement of the contracts of employment; provide for employment entitlements and other benefits; provide for the protection of wages of employees; provide for the registration of employment agencies; regulate the employment of children and young persons; provide for the welfare of employees at an undertaking; provide for employment policies, procedures and codes in an

undertaking; repeal and replace the Employment Act,1965, the Employment (Special Provisions) Act,1966, the Employment of Young Persons and Children Act, 1933 and the Minimum Wages and Conditions of Employment Act, 1982; and provide for matters connected with, or incidental to, the foregoing.

Relevance: *The Act is relevant considering that Lake Agro will have employees during the three stages of the project.*
Compliance thereof: *Lake Agro will comply with this Act by employing the required age, establishing contracts, conditions of service and settling disputes in accordance with this act. The relevance of this Act to the project will serve as guide to equal and formidable employment conditions.*

2.3.20 The Investment Act of 1993

The Act provides for a legal framework for investment in Zambia. The Act relates to the environment indirectly by providing incentives for tree planting, soil and water conservation activities. The Act further recognises the role of other agencies including those responsible for environmental protection in authorities' specific projects. Thus, no investment project can be implemented without giving due consideration to environmental protection.

Relevance: *The project is an investment and therefore the Act is very applicable.*
Compliance there of: *Obtaining the relevant Investment incentives*

2.3.21 International conventions

The Zambian Government is a party to a number of multilateral international environmental agreements. Being a signatory to such international devices imposes obligations on the host country to address the topics raised in those documents. Most of the Conventions have been customized through various statutory instruments and are already being enforced. Applicable Conventions are briefly described below.

Zambia is signatory to a number of international conventions and protocols aimed at addressing environmental concerns. Some of the conventions and protocols relevant to the project are:

The **Montreal Protocol** of 1987 for the control of ozone depleting substances; all refrigeration systems bought and installed at the farm will be CFCs free compliance.

The **Convention on International Trade in Endangered Species of Wild Flora and Fauna**; as a site within a pristine ecosystem care shall be taken to protect any endangered species of wild flora and fauna.
The **Convention on Biological Diversity**. The objective of the CBD is to foster international cooperation in the conservation of biological diversity and to promote sustainable use of natural resources worldwide. It also targets the sharing of the benefits arising from utilization of natural resources.

African Convention on the Conservation of Nature and Natural Resources (Algiers, 1968), (Maputo, 2003):-

The objective of the convention is to encourage individual and joint actions for the conservation, utilization and development of soil, water, flora and fauna for the present and future welfare of mankind. This must be done from an economic, nutritional, scientific, educational, cultural and aesthetic point of view.

Biodiversity Protocol/Convention

The Convention on Biological Diversity (CBD), the associated Catagena Protocol on biopiracy, and the African Forest Law Enforcement and Governance Agreement (AFLEG), are associated regulatory frameworks that have domesticated application through the Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (1994).

The Convention was adopted on 5th June 1992 and came into force on 29th December 1993. It was ratified by Zambia in 1993. The Ministry of Lands and Environment implemented the Convention in Zambia.

The objectives are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the use of genetic resources.1 State parties to the convention have committed themselves to identifying components of biological diversity of importance for conservation and sustainable use and that the policies and practices within individual jurisdictions should not cause damage to the environment of other states or to areas beyond their jurisdictions.

The Convention is the only globally applicable, legally binding instrument to address alien species introduction, control and eradication across all biological taxa and ecosystems.

Relevance/Compliance*: LAIL is required to be compliant with the provisions of the Convention on Biological Diversity as they are incorporated into domesticated documentation (including the EMA), and these provisions shall be incorporated in principle into the LAIL Policy.*

United Nations Convention to Combat Desertification

The United Nations Convention to Combat Desertification (CCD) established in 1994 emphasizes desertification and mitigation of drought, but also aims to encourage long-term integrated strategies for improved production of land and rehabilitation, conservation and sustainable management of land and water resources. The CCD emphasizes the need for local participation in strategic Programme implementation.

Zambia is a signatory to the CCD but has yet to ratify it. Among the obligations of the CCD relevant to Zambia and the project is the "encouragement of decentralization and local resource tenure to strengthen local participation" The Soil Conservation and Agro-Forestry Extension Project (SCAFE) is an example of an extension program in place which addresses the issues raised in the Convention and a number of other international conventions. Central to SCAFE, which is established through the agriculture extension services, is the promoting of community awareness of land management and conservation in order to prevent land degradation and establish rehabilitation of degraded land.

Relevance/Compliance: *The CCD will have implications for climatic and micro climate change around the project site through the promotion of climate adaptation measures that may impact on land clearing and land and water management. The CCD also has relevance to the mechanisms of land development and land use management.*

Pesticide and Hazardous Chemical Protocols

The Basel Convention on the Control of Transboundary Movement of Hazardous Waste and its Disposal, 1989

The Convention provides norms, rules and procedures governing movements and disposal of hazardous waste at international as well as national levels. The overall objective of the Convention is to protect, by strict control, human health and the environment against the adverse effects, which may result from the generation and management of hazardous wastes and other forms of waste.

Zambia acceded to the Convention on 15th November 1994. The Convention is implemented by ZEMA. Waste disposal, especially into water changes the nutrient load. In some cases this creates a favorable environment for the proliferation of certain invasive plant species.

Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

The Convention provides for promotion of shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm and to contribute to their environmentally sound use, by facilitating information exchange about their characteristics, by providing for a national decision-making process on their import and export and by disseminating these decisions to Parties. This Convention applies to banned or severely restricted chemicals and severely hazardous pesticide formulations**.** Zambia acceded to the Convention in 2000. The Convention is implemented by ZEMA.

Relevance/Compliance: *many of the chemicals listed under the Rotterdam Convention are still in circulation in Zambia and LAIL's attention is drawn to the requirements of this Convention and to periodic additions and changes to the list.*

Stockholm Convention on Persistent Organic Pollutants

The Convention provides for norms, rules and procedure governing accessibility and usage of persistent organic pollutants. It aims at protecting human health and the environment from persistent organic pollutants. Any party to the convention is expected to prohibit and/or take the legal and administrative measures necessary to eliminate its production and use of the chemicals listed in Annex A subject to the provisions of that Annex; and its import and export of the chemicals listed in Annex A in accordance with the provisions and restrict its production and use of the chemicals listed in Annex B in accordance with the provisions of that Annex. Further each Party is expected to take measures to ensure that a chemical listed in Annex A or Annex B is imported only for the purpose of environmentally sound disposal as set forth in

paragraph or for a use or purpose which is permitted for that Party under Annex A or Annex B. Zambia is a party to the convention and ZEMA is the implementing agency.

Relevance/Compliance: All three of these global conventions have been ratified by Zambia and are now largely domesticated into Zambian legislation, including the requirement to comply with utilisation frameworks established by these conventions and the periodic changes made to them. LAIL is required by law to abide by the restrictions of the Rotterdam and Stockholm Conventions and to attempt to attenuate or, if possible, remove traces of persistent chemicals from their properties.

Relevant International Finance Corporation (IFC) Policy Guidelines

The International Finance Corporation (IFC) is a member of the World Bank Group, which also includes the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), and the Multilateral Investment Guarantee Agency (MIGA). IFC's business is investment in private sector projects through loans, equity investment, and other financial instruments. It is IFC policy that all its operations are carried out in an environmentally and socially responsible manner.

In this regard, IFC projects must comply with applicable IFC environmental, social and disclosure policies. In addition, IFC applies World Bank Group environmental, health and safety guidelines to all projects.

IFC environmental and social policies are fundamental to the project appraisal, approval and supervision process.

Applicable operational policies are: *Environmental Assessment; Natural Habitats; Pest Management; Indigenous Peoples (forth coming); Safeguarding Cultural Property in IFC-Financed Projects; Involuntary Resettlement; Forestry;* and *Projects on International Waterways*.

Policy Guidelines

Pollution Prevention and Abatement Handbook

The World Bank Group's *Pollution Prevention and Abatement Handbook* apply to all projects directly financed by IFC. However, taking into account country legislation and local conditions, the Environment assessment may recommend alternative emission levels and approaches to pollution prevention and abatement for the project.

IFC applies provisions set forth in the World Bank Group's *Occupational Health and Safety Guidelines*, which cover those industries and pollutants most frequently encountered in IFC projects.

Other International and Regional Conventions

i. Convention on the Protection of World Cultural and Natural Heritage
ii. Convention on Migratory Species (CMS)
iii. The Ramsar Convention

iv. Convention on Wetlands of International Importance, e.g. Waterfowl Habitat,
v. Convention on International Trade in Endangered Species of Wild Flora and Fauna
vi. United Nations Convention to Combat Desertification

The above environmental laws, policy and regulations, as well as conventions and protocols, together provide the environmental legal framework which the EIA Team shall study in order to advise *LAIL* on compliance requirements during project implementation.

2.3.22 Institutional Tasks

2.3.22.1 The Zambia Environmental Management Agency (ZEMA)

The Zambia Environmental Management Agency (ZEMA) reports to the Ministry of Lands, Environment and Natural Resources. It is responsible for environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources. It has legislative responsibility for environmental impact assessment. It's responsible for enforcing environmental regulations and coordinating sectoral government agencies involved in environmental management in their sectors. It is empowered to among others to establish water quality and pollution controls standards and determine conditions for the discharge of effluents into the aquatic environment.

Under the Act ZEMA is responsible for preparation of the State of the Environment Report, environmental management strategies and other plans for environmental management and sustainable development; facilitation of strategic environmental assessments of proposed policies, plans and programmes likely to have an impact on environmental management; responsible for ensuring public participation in environmental decision-making and access to environmental information as well as facilitate the implementation of international environmental agreements and conventions to which Zambia is a party.

2.3.22.2 The Water Resources Management Authority (WRMA)

Water Resources Management Authority is responsible for promoting and adopting a dynamic, gender-sensitive, integrated, interactive, and participatory and multi sectorial approach to water resources management and development that includes human, land, environmental and socioeconomic considerations.

2.3.22.3 Chitambo District Council

The project lies within the authority of Chitambo District Council. As Local Authorities, Chitambo district are authorized to perform specific functions on behalf of Government. The Council will oversee the planning and other related aspects of the project.

2.3.22.4 Department of National Parks and Wildlife

Being a project in the development zone of the Game management area, DNPW will is a key player in the project.

3 PROJECT DESCRIPTION

3.1 Site Location

The project site is located approximately 91 km north-west of Serenje Central Business District. It is accessible via Serenje – Mapepala route going north west wards towards Kabundi. About 46km from the Serenje, there's a split in the road with the main gravel road leading to Mapepala – Nabowa feeder road to the right at this junction. Approximately 46km from Serenje the road leads to Mapepala/Nabowa.

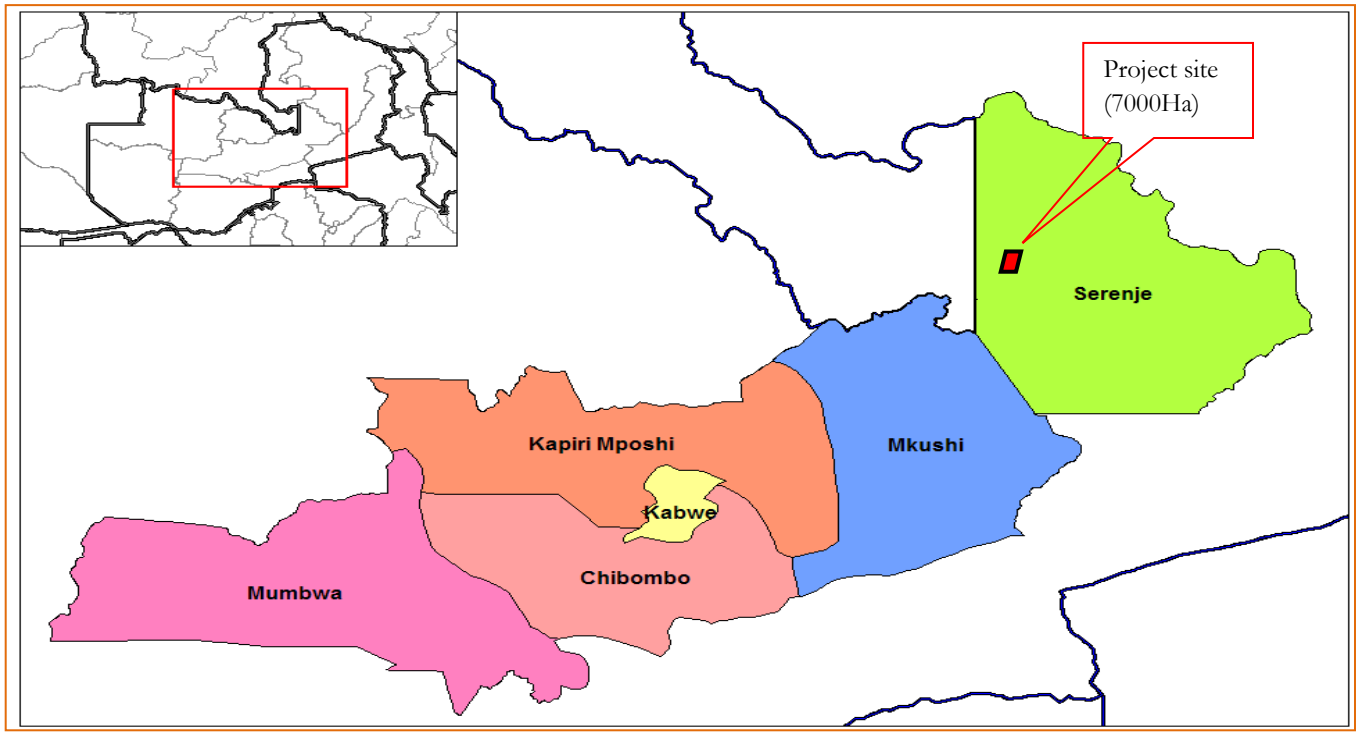


Figure 1. Location of project site in Chitambo District

To the north of the project site is the Kasanka National Park which is about 2.8km away from the Project area. The Luwombwa River is the major river draining the Project area on the eastern fringes. The site is in the development zone of the Department of National Parks and Wildlife Plan.

The closest settlements to the site are the villages of Mapepala and Nabowa. These settlements form part of the Lala tribe under the leadership of Chief Chitambo.

The designated GPS coordinates for the site are presented in the table below:

Table 5: Boundary Coordinates

Corner point	Latitude	Longitude	Elevation (m.a.s.l.)
A	12°30'24.0"S	30°01'53.62"E	1234
B	12°33'43.68"S	30°05'44.18"E	1188
C	12°37'57.54"S	30°01'32.00"E	1200
D	12°34'42.82"S	29°57'47.68"E	1212

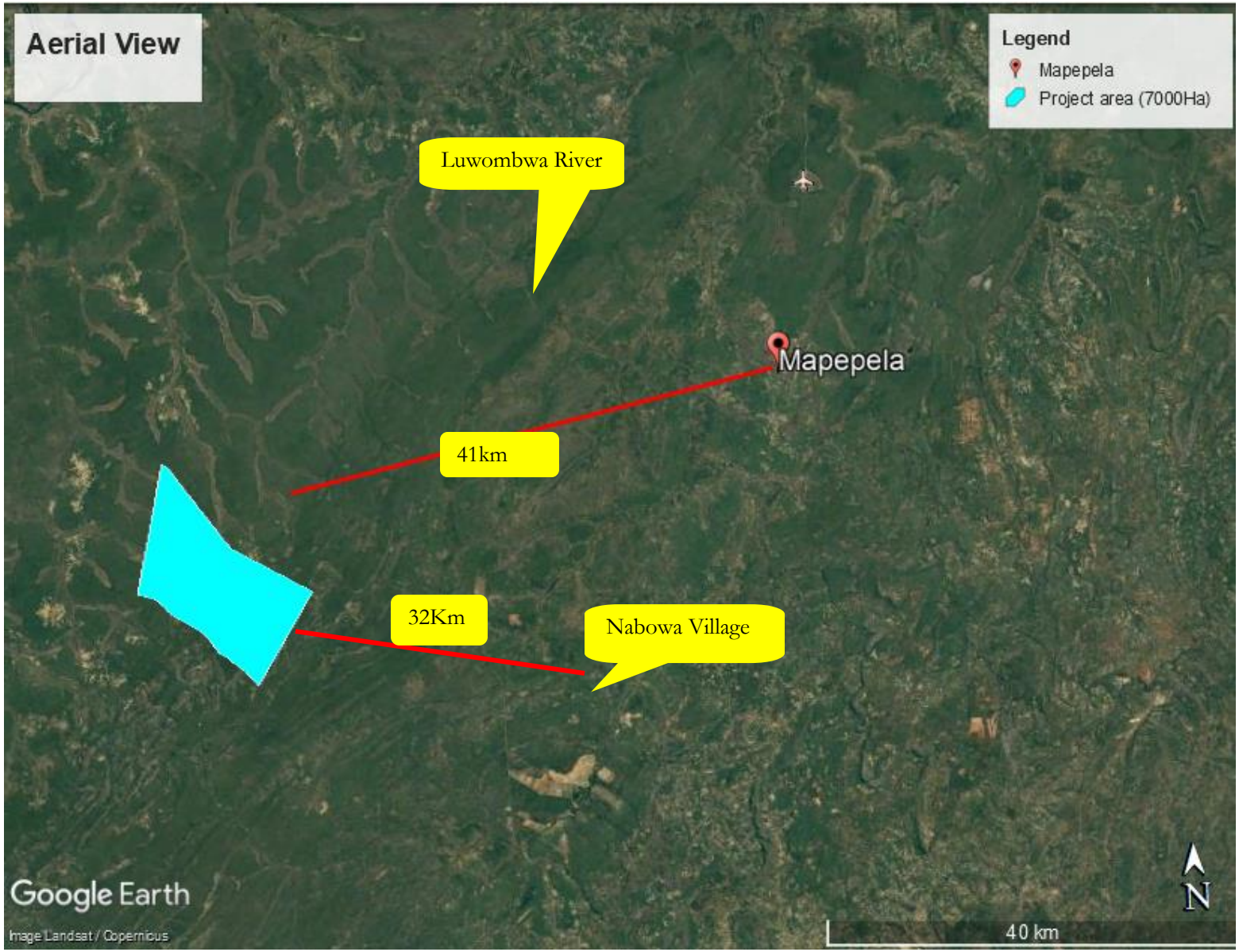
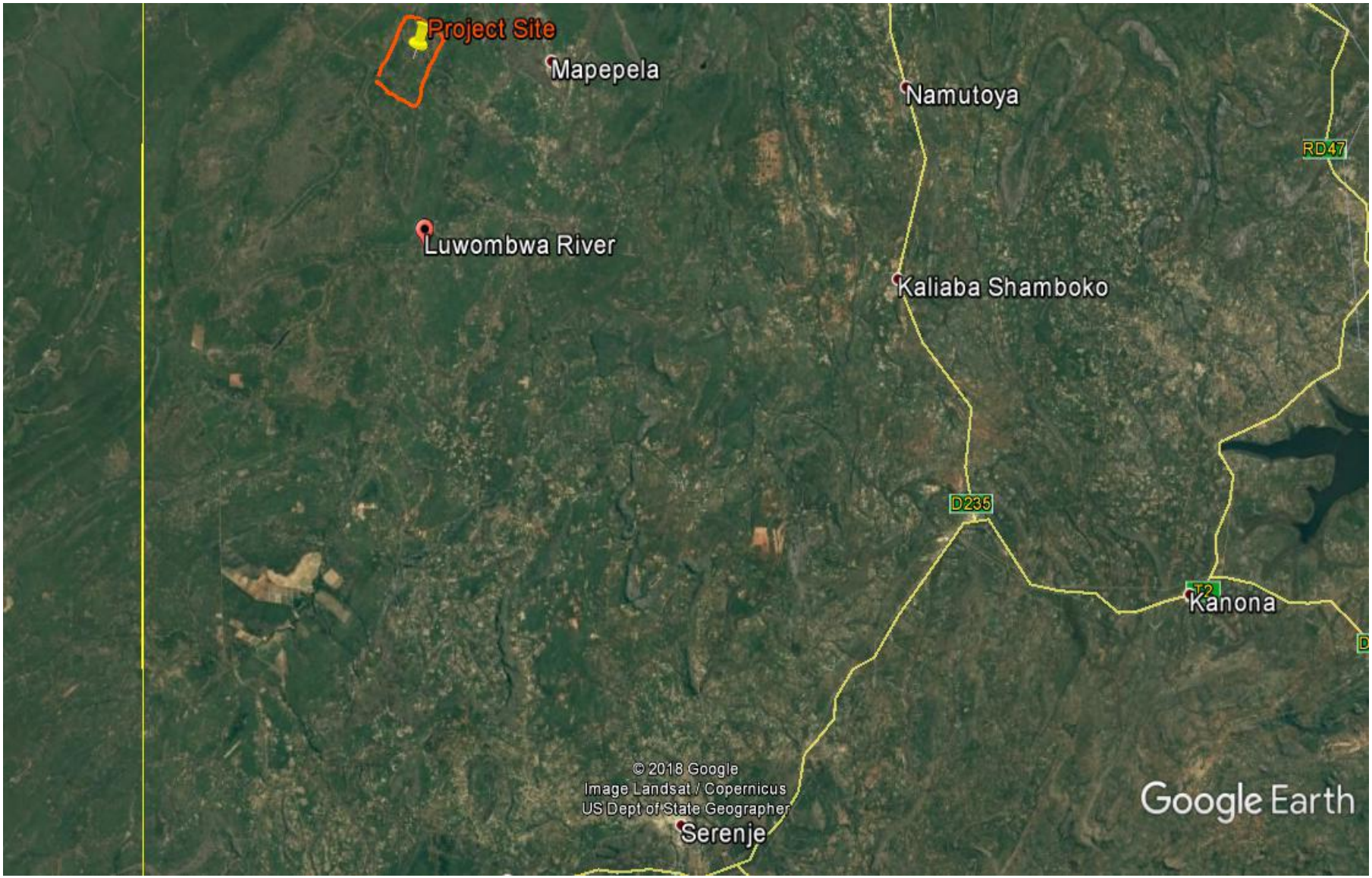


Figure 2.: Aerial view - Location of Project site



igure 3.: Site Location in relation to Serenje town

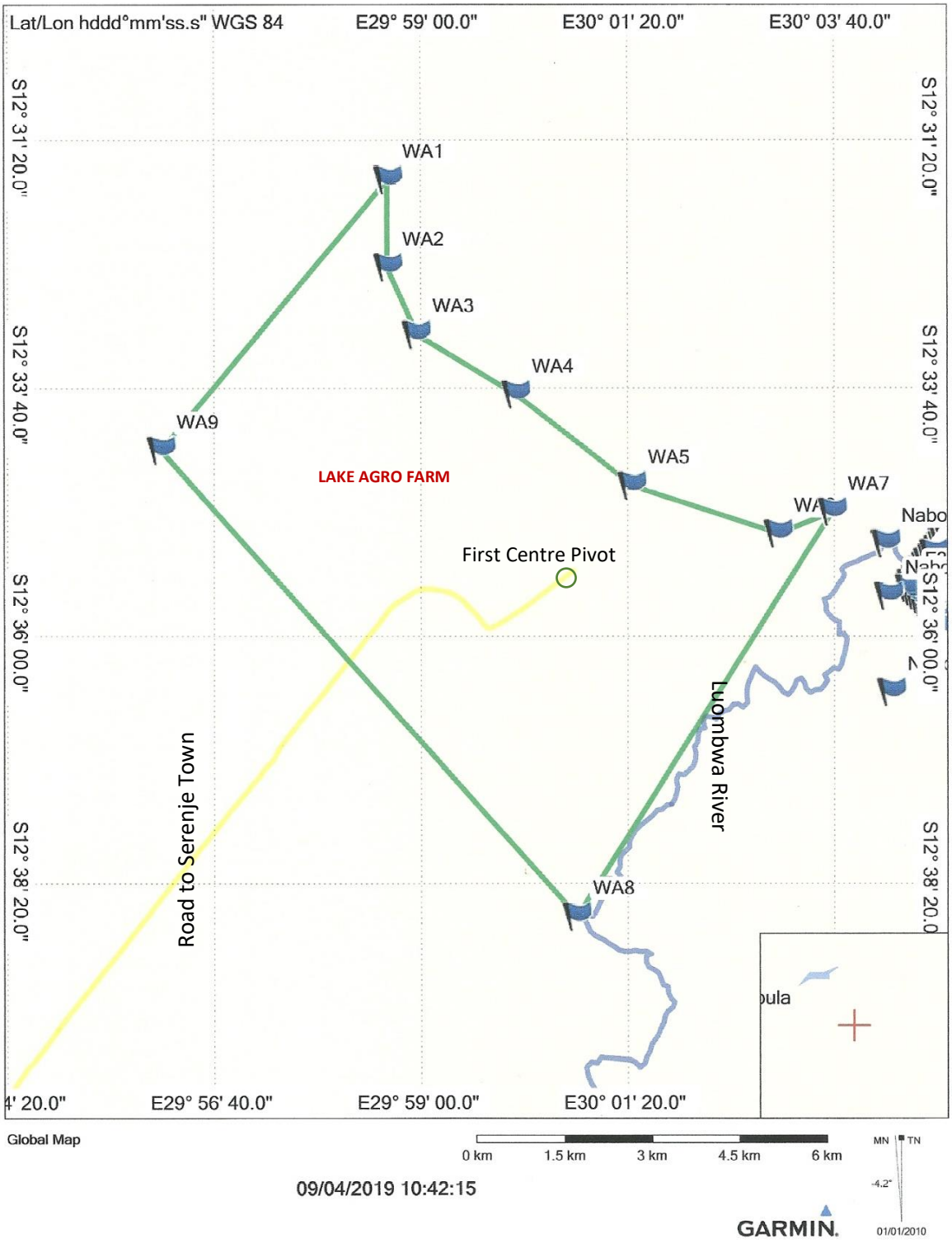


Figure 4.: Position of Lake Agro farm

3.2 Nature of the project

3.2.1 Objectives

The main objective of the project is to ensure crop production through irrigation to meet ever increasing demand for soya, wheat and maize products. A well-managed irrigation system guarantees proper planning and sustainability of crop production at all times of the year. In addition, the project is aimed at contributing to the strengthening of food security in Zambia. The specific objectives include the following:

v. To develop sustainable farming assets in sub-Saharan Africa taking shareholder value, community improvement and increased food production into consideration.
vi. Increasing summer and winter crop production i.e. Soya, maize and wheat.
vii. To install Centre pivots system and associated irrigation infrastructure
viii. To optimize use of available water resources and avoid wastage

3.2.2 Project Components

The proposed project will be fully integrated into a commercial irrigated agriculture scheme for food crops and animal proteins and its ancillary infrastructure. The land acquired for the purposes of the project covers a total of 7,000Ha. The project will involve cultivation of crops such as wheat, soya and maize. The main activities of the project will include:

- Land clearing for center pivots as well as rain fed farming 3,000Ha ;
- Sinking of boreholes of irrigation water;
- Water abstraction;
- Construction of farm buildings and field access tracks;
- Installation of the power and water reticulation system;
- Building of ten staff housing units (50,000m^2), offices (1000m^2), workshops (720m^2), petroleum storage tanks (80m^3 Diesel) and storage shed (2000m^2);
- Establishing waste disposal site in close collaboration with Chitambo District Council
- Planting of crops

The project will cover site preparation, planting, tendering and harvesting of crops. The project envisages planting of crops on an estate of 3,000 hectares (considering dambos and space for infrastructure).. The project will use the centre pivot system which will be designed in and around the project area to maximize the utilization of water from the Luwombwa River. Other facilities (support infrastructure) on the project area will be located at the farm centre. Many of the facilities such as workshops, storage facilities and fuel tanks will be built. Associated infrastructure such as pump stations and a network of distribution feeder pipes will be constructed.

LAIL will have principal components such as agricultural fields and grain storage facilities, water infrastructure and conveyance system, workshops and plant equipment, residential areas and social infrastructure. The operations at LAIL farm estate shall be supported by associated infrastructure such as

boreholes for domestic water, road network and electricity supplied by ZESCO Limited (transmission line from Kabundi), which is Zambia's power utility provider.

Project implementation during all phases will be undertaken by undertaken by specialized personnel in the innumerable fields relevant to the project. In order to achieve this, a significant labour force of skilled, semi-skilled and casual workers will be employed during the site preparation, construction and operational phases of the project through direct and indirect job opportunities; priority will be given to locals.

3.2.2.1 Land Preparation for Agricultural Fields

Land preparation will inevitably lead to clearing of flora and generation of biomass. The project site, as viewed during the visit to the area, is predominantly miombo woodland. This kind characterises thick and heavy trees which, for the planned scale of operation, require mechanical clearing. Vegetation will be cleared in a way to establish the required field radius for each crop field; several patches of undisturbed vegetation will be left between crop fields. Vegetation will also be cleared in the area designated for the pump houses and access roads and firebreaks. Vegetation clearing will also be necessitated to pave way for construction/establishing of farm tracks and to some extent electricity and water reticulation system.

The cleared biomass will be ferried to the outlying areas of the fields and the locals will be allowed to collect this for fire wood or construction materials. The leaves and grass debris will be left to decompose as organic materials. Care will be taken when clearing land, only flora in the radii of Centre pivots will be affected. The following areas will not be utilized for production:

- Dambo, riverine and other areas prone to flooding;
- Non-arable areas such as hills, steep slopes and rocky areas where natural vegetation is retained;
- Conserved land where there is little or no impact;
- Wooded areas between pivots which act as wind breaks and fauna habitat.

Site equipment and machinery will include bulldozers, crawler excavator, tractors, ploughs and other land tilling farm equipment, while raw materials will include cement, timber, iron sheets, steel bars, diesel fuel, seeds, and agriculture chemicals, among others.

3.2.2.2 Tillage

The process of cultivating crops begins with tillage of the soil. Although tillage can serve a number of functions within a crop production system, the most fundamental function is to create conditions that will ensure good contact between seed and soil at the time of seed planting and the ready availability of water to the seed during germination. LAIL will apply minimum tillage using a rotary disc mounted on a tractor. After primary tilling secondary operations will be carried out, before seed furrows are prepared. All stones will be removed from the field to prevent serious damage to implements.

Tillage is key because, apart from disease and the weed problem, poor tillage and consequent poor and uneven germination constitute one of the important limitations to good crop yields. Rushed and inadequate landscaping gives rise to problems that grower has to live with for full crop cycle. Good tillage ensures excellent yields and thereby improving the economics of cereal production. Tillage carries the following additional benefits:

- Creation of a seedbed or root bed;
- Control of weeds or the removal of unwanted crop plants;
- Incorporation of plant residues into the soil profile;
- Establishment of specific soil surface configurations for planting, irrigating, drainage, and/or harvesting operations

3.2.2.3 Planting

After phased tillage, mechanical planting using planters toppled by tractors will follow. The basal dressing of synthetic fertilizer will also be applied at this stage. The optimum number of seeds planted will vary with soil type, hybrid, irrigation, fertility, and other management practices. Irrigated crops require higher plant population than non-irrigated crops to fully utilize the potential of irrigation. Seeding rates depend on the hybrid, yield expectations, and row width. The number of seeds to be planted for rain-fed crops will be in the range of 15,000 to 23,000 seeds /acre. Seeding rates for irrigated production will range from 24,000 to 32,000 plants / acre. Seed companies normally provide a recommended population for each hybrid. Generally, 24,000–30,000 plants/acre are recommended for most early and medium maturing hybrids with irrigation. Plant populations for the later maturing hybrids should be 22,000–26,000 plants/acre. Excessive populations may increase seed costs and may reduce yield because of inadequate watering or rainfall and lodging, however, 10–15% more seed/acre will be planted as it is necessary to produce the desired plant population in case of die outs. It is expected that the seeds will germinate at the rate of about 95%, and another 5–10% may be lost to insects, disease, or other pests.

Increased yields can be obtained with more narrow rows at high plant populations. This allows plants to exploit more moisture, nutrients, and light due to greater space between them. Basal fertilisers may be added according to soil type but there is a risk that this can also be washed away by rain or irrigation water to river bodies if the fields are flooded with water.

3.2.2.4 Irrigation - Centre Pivot

The project is designed to use the centre pivot irrigation system which will have over 35 circular fields across the project site with varying areas covering about 80 –100 ha The centre pivot system was chosen due to its high proficiency in conserving water than other systems and it allows a significant amount of vegetation between the pivots to be retained. The amount of water required for each crop cycle will be optimally utilized without unnecessary losses in irrigation lines. All scheduling of irrigation cycles will be done using scientifically proven methods. In-field gauging rainfall figures and evapotranspiration ratios pertaining to each individual crop will be recorded. This will prevent any water loss. Associated infrastructure such as pump stations and network of distribution of feeder pipelines will be constructed.

Water from the Luwombwa river will be transported via hydro lines to agricultural fields constructed with a network of distribution pipes. Water shall be pumped to the respective agricultural fields from pumping stations located at appropriate points. The estimated water requirements (which will be applied for and obtained through WARMA) is 25, 000m^3 per annum.

Centre pivot pump houses shall be constructed of a mono pitched roof corrugated iron sheets resting on timber members devoid of ceilings. Each agricultural field shall have a Centre pivot system that irrigates the crop at given times and duration according to farm irrigation schedule.

Irrigation, when combined with other good production practices result in good yields usually around 150 bushels per acre and greater, non-irrigated crop yields can range from 5% to 75% of irrigated corn.

Total water needs for cereal crops shall vary from 500-610 mm during a season, depending on weather, plant density, fertility, days to maturity, and soil type. With normal rainfall events, about 300 mm of irrigation is often needed. Ample moisture should be available in the root zone until physiological maturity is reached (maximum dry weight of grain), which is about 60 days after tassel emergence.

Coarse-textured soils will need to be irrigated more frequently than fine-textured soils. In general, fine-textured (clay and silt loam) soils have a lower infiltration rate than coarse-textured (sandy and sandy loam) soils. Dambo soils would hold from about 18 mm of water per foot to about 40 mm of water. The main principle underlying the project is to irrigate and avoid excessive runoff.

3.2.2.5 Agricultural Chemicals

Storage

The storage and handling of agricultural chemicals is one activity that can contaminate the environment, especially ground and surface water. However, if stored safely in a secure location, agricultural chemicals (pesticides and fertilizers) pose little danger to the environment. LAIL will use the Best Management Practices (BMPs) for handling and storage of all the agriculture chemicals on the farm. The following will be done for proper storage of agriculture chemicals:

- Storage facilities will be built to keep pesticides and fertilizers secure and isolated from the surrounding environment. These storage facilities will be located down slope away from water bodies on the farm.
- Herbicides, insecticides, fungicides and fertilizers will be segregated and their respective labels kept during storage to prevent cross-contamination and minimize the potential for misapplication.
- All agriculture chemicals (pesticides and fertilizers) will be kept out of the way of activities that might rip open a bag or puncture a liquid storage container
- All chemicals will be maintained in their original well labeled containers, securely closed and regular inspections will be carried out for splits, tears, breaks, or leaks.

- Apart from handling chemicals, employees will also be trained on the BMPs of storing agriculture chemicals.

Fertilizers will be stored in a high head room steel framed structure. The shed will be constructed of a ridged roof of IT4 iron sheets resting on steel members with roof additionally supported on stanchion bolted on to concrete pad foundations.

Chemicals will be stored in a shed constructed of a mono pitched roof of corrugated iron sheets resting on timber members devoid of ceilings, concrete block infill walls plastered and painted internally and rendered externally and solid concrete floor finishes with cement and sand screed.

Handling

To ensure that there is minimal contamination of the environmental from handling of chemicals, the following measures will be put in place:

- LAIL will provide protective attire for all employees working with agriculture chemicals. Employees will be trained in the BMPs of handling and storage of agriculture chemicals.

- Extreme caution will be taken when handling concentrated chemicals as spills could result in expensive hazardous waste cleanups. The mixing and loading operations of pesticides will be located away from ground bodies and areas where runoff may carry spilled pesticides into surface water bodies. All mixing and loading areas will be placed close to storage facilities, to minimize the distance that chemicals are transported before filling the sprayers.

- All application equipment will be properly calibrated and kept in good repair. All calibration will be done according to the measure of the amount of pesticides per hectare.
- Chemical spills will be cleaned up immediately to avoid contamination of the water bodies.
- Before disposal, containers and bags will be cleaned and dried respectively. Liquid containers will be pressure rinsed and punctured. The container and bags will then be transported to approve disposal sites.
- LAIL will keep records of all chemicals used on the farm. These will include records of all chemicals available and those that have been used in the past, what they are going /were to be used for, where and how they will/were disposed off. Record keeping is intended to ensure that all chemicals used on the farm are accounted for as a measure towards BMPs of handling and storage of these chemicals.

Application

The application of all chemicals will be done using Boom Sprayers and Aerial Sprayers.

- *Herbicides:* these will include pre emergence and post emergence herbicides. Pre emergence will be applied to the soil to prevent all weeds and any other undesirable vegetation such as grasses from germinating. Post emergence herbicides will be used to kill weeds after they germinate.

- *Insecticides:* oil seed crops such as Soya bean and wheat are prone to attack from insects at almost any time of the season. To ensure that all crops are protected at all stages of their growth season, LAIL will procure only certified seed that will be purchased from accredited suppliers and all growing plants threatened by insects will also be sprayed.
- **F***ungicides***:** will be applied to kill or inhibit the growth of fungi that may cause age to the crops on the farm.
- *Fertilizers:* these will include booster/ liquid fertilizers, organic fertilizers and inorganic fertilizers. All fertilizers will be applied to ensure that maximum yield is achieved.

Chemical Use

Fertilizers will be used to grow the crop followed by chemical weeding and control of pests. At final harvest, chemicals will still be used in or to add port-life to the produce and further protection from pests. In the silos, fumigation or drenching will be used according to the state of technology preferences.

Harvest Storage

LAIL will carry out harvesting on time at the recommended moisture content to avoid losses for all crops that will be grown on the project site. Soyabeans, for instance, will be harvested as soon as the crop is ready, at moisture content of 13% to 15% because harvesting losses increase rapidly as soya beans dry out. Harvesting will utilize a combination of manual harvesting and a combine harvester. The company will employ combine harvester to avoid losses. The local people employed in harvesting operations will also be trained in the best harvesting techniques of all crops. All the yields from crops will be stored in silos. The company will implement the most effective measures to maintain quality in storage by ensuring that the silos are well ventilated, clean and sanitized before and during storage.

3.2.2.6 Farm Infrastructure

Expected infrastructure will include housing, office buildings, workshops, Silos, weighbridge and other support facilities for long term operational workers. Access roads to link the agriculture fields to other facilities on the farm and link the project area to the existing road infrastructure will also be constructed to establish an efficient network system. LAIL expects that some of the workers, especially the general workers from the local community, will be living in their own houses outside the project area.

3.2.2.7 ***Housing Area***

It is anticipated that several housing units will be located in various areas of the farm block; houses. Housing areas will be located in the vicinity of the farm centers for which provision will be made for medium cost houses for management staff and low-cost houses for skilled workers.

3.2.2.8 Fuel Storage Facility

Lake Agro envisages installing an 80,000 litre aboveground diesel tank at the project site. The tank shall be equipped with the following :

- Standard Mechanical Overfill, Anti Syphon valve;
- Fill point pipe work, valves and connections;
- Venting for both tank;
- Calibrated dipstick.
- Bund wall of 8m x 12m x 1m (height) with capacity of 110%;

The Firm shall receive diesel supplies from registered oil marketing companies for use in various operational fleet at the farm. The total area to be taken up is approximately 400m^2 (As annexed - bund wall and engineering)

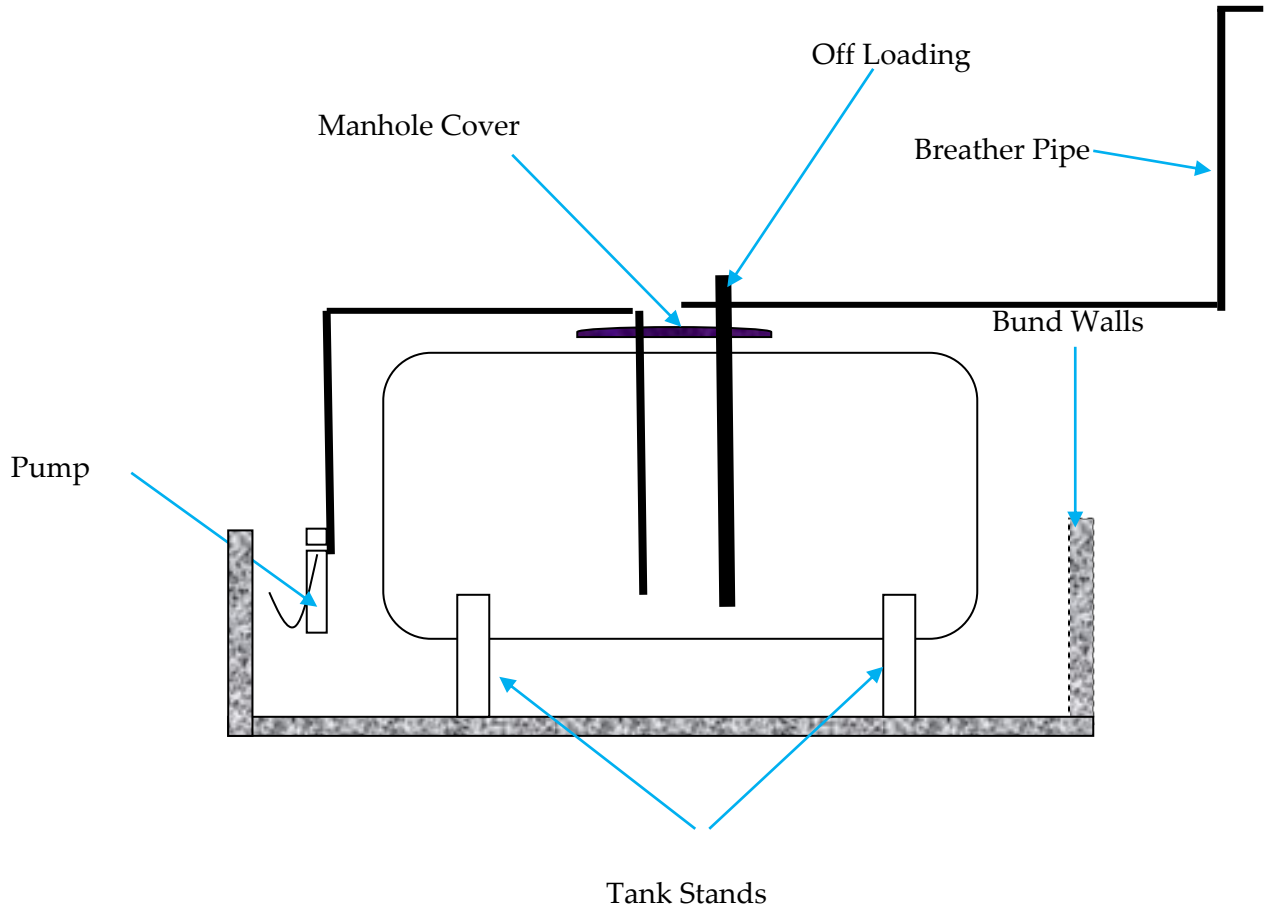


Figure 5: *Sketch plan for aboveground tank installation*

3.2.3 Raw Materials/equipment

3.2.3.1 Raw Materials/equipment – Construction/Preparation Phase

The following are among the raw materials that will be used for the works at the project site. The raw materials/equipment to be utilised at preparation and construction stages are given below.

Table 6.Materials to be utilised

Raw Materials
Cement to be delivered by road trucks
Metal components to be delivered by road trucks
Crushed stone and building/river sand to be delivered by road, and laterite;
Water on site – Luwombwa river and boreholes
Timbers to be delivered by road from local approved suppliers
Fuel and Lubricants for the operation and maintenance of various equipment/ Machinery on the farm. To be supplied by trucks from ERB approved suppliers
Equipment
Excavator
Bulldozers
Trucks
Generators
Graders

3.2.4 Products and by - Products

The proposed project will generate waste from the preparation, construction and operational phases.

3.2.4.1 Waste from the Preparation/Construction phase

The following waste is expected to be generated during the preparation and construction phases

- Biomass (tree logs, branches, leaves e.t.c) from land clearing activities.
- Rubble and dust resulting from site clearing operations (trenching, excavations, movement of vehicles and cut and fill activities)for land preparation
- Rubble resulting from excavation activities and lying of foundations.
- Sanitary waste generated by the construction workforce
- Construction waste resulting from rejected concrete, broken blocks and tiles, ceiling boards, roofs, scrap timber, steel rod and wires, etc.
- Solid waste resulting from discarded packaging materials (e.g. empty cement bags, carton boxes, plastic packs, and empty paint containers), leftover food stuff and food waste from workers' canteen, etc.

3.2.4.2 Waste from the Operation phase

The following waste is expected to be generated during the operation phase

- Biomass from crop harvest loses
- Waste from agriculture chemicals (e.g. chemical containers and empty fertilizer sacks) which may have hazardous properties
- Waste oils from farm machinery
- hygiene and biological waste (Sewage effluent and grey water)
- Domestic waste (e.g. food waste) to be generated from the housing area
- Storm water runoff from roofed or built areas
- Contaminated runoff from agriculture fields crop fields

The waste management system for the proposed project will be aimed at identifying the preferred options for waste management and/or disposal methods based on environmental principles, including necessary infrastructure.

3.2.5 Production Capacity

The main crops will be soya, wheat and maize. The production capacity for soy is expected up to 15,000 tonnes; wheat and maize up to 5,000 tonnes and 3,000 tonnes annually.

3.2.6 Schedule and Lifespan of the Project

Implementation of the project is scheduled to commence 1st Quarter 2020, with a twelve months' project cycle planned for the first development phase as in table below:

Table 7: *Schedule*

Activity	Description	Tentative Duration
Water Rights	Obtaining water rights through DWA	November , 2019
Agricultural fields topographical determination and clearing	Land Preparation/bush clearing/ topographical measuring	November, 2019
Centre Pivots	Installation and commissioning of centre pivots	January, 2020
Farm Infrastructure – e.g offices	Construction of offices, workshops, storage sheds,etc	January, 2020

The project's life span is entirely dependent on demand for harvested products.

3.3 Main Activities

The main activities of the proposed project will comprise three phases namely, the site preparation phase, construction phase and the operational phase, which will include monitoring and evaluation of project performance. The following are among the initial activities that will be undertaken before embarking on the construction works of the proposed development: -

- Engage a consultant to design architectural drawings for the project site - pipe layout, pump station location, centre pivot location;
- Engage a consultant to conduct the environmental assessment and produce the Environmental Impact Assessment. (done).

3.3.1 Main Activities during Site Preparation

- Marking off and beaconing of the abstraction site;
- Land Surveying on the Site Plan to pave way for the proposed project components;
- Land clearing;
- Procurement of all required materials, equipment and machinery; and
- Transportation and movement of all the equipment and machinery to the site.

3.3.2 Main Activities at construction Phase

This phase will involve electricians, fitters, welders etc. since the durability and sustainability of the structures and facilities depended on both the theoretical design and the actual installation works. During this phase of project implementation, the construction shall proceed based on the site plan, recommended specifications, measurements and standards of acceptable limits. The following are among the main activities that shall be undertaken during the construction phase:-

- Construction of water delivery infrastructure;
- Installation of centre pivots;
- Construction of offices;
- Construction of storage sheds;
- Construction of workshop and fuel storage facilities;
- Land clearing to pave way for pipe works;
- Installation of power and water reticulation system;
- Mounting of Transformers;
- Constructing of a water reservoirs;
- Installation of automated flow sensors;
- Land clearing for center pivots as well as rain fed farming
- Sinking of boreholes of irrigation water
- Construction of farm buildings and field access tracks
- Installation of the power and water reticulation system
- Building of staff housing units, offices, workshops, petroleum storage tank and storage barns

- Planting of crops;

LAIL will maximise the multiplier effects of the project by ensuring that other firms are engaged in carrying out specialised activities. It is anticipated that during this phase, between 150 to 200 people will be directly and indirectly employed to ensure successful implementation of the project; the workers that will be employed on site at any one time, will include general workers, skilled and semiskilled labour such as brick layers, concrete mixers, machine operators and supervisors

3.3.3 Main activities at operational phase

During the operation phase, it is expected that the project will create permanent job opportunities of which it is expected about 70% will come from surrounding villages. In addition to direct employment, it is expected that further employment will be stimulated by the project in other sectors related to agriculture such as the transport and agriculture input sectors. Local irrigation companies will be consulted to optimize water usage. The activities during this phase will include the following:

- Preparation of land for the next cycle after harvesting
- Planting of crops;
- Boom and Aerial spraying of agriculture chemicals (fertilizers, herbicides, fungicides, insecticides etc)
- Timely harvesting and storage of crop;
- Operation and maintenance of the irrigation systems on the farm;
- Ferrying of input materials to the farm and final products to storage facilities
- Repair and maintenance of equipment on the farm
- Management of waste generated from the farm;
- Contracting out to suitably equipped and qualified companies to handle any water related activities needing special handling;

In order to achieve the above project, a significant labour force of skilled, semi-skilled and casual workers will be employed during the site preparation, construction and operational phases of the project through direct and indirect job opportunities; priority will be given to locals.

4 PROJECT ALTERNATIVES

4.1 Identification of alternatives

4.1.1 Site alternatives

There were a number of possible locations of the project that were considered. The first was locating it away from the Luwombwa river. The second option was locating the project in other areas such as Mpika, Mkushi or Chisamba. The third was acquiring land from the chief and locating it near the Luwombwa river. The last option was assessed to be cheapest and least time consuming in terms of land acquisition process. Other areas such as Mkushi and Chisamba were considered but they are quite clogged and land is quite challenging to procure from such areas.

The chosen site was favorable as the land has suitable topographic characteristics. The proximity to water resources, and suitable climatic factors weighed in favour of the proposed site.

Other attractive factors were transportation network and proximity to the customers as well as availability of labour, both skilled and unskilled.

4.1.2 The Zero Option

If the project were not to proceed, all of the negative environmental and social impacts identified would be avoided and the potential economic benefits would be lost. This project is an important component intended to meet the protein nutritional need of the people of Serenje/Chitambo and Zambia in particular. The employment opportunities to be created by the project coupled with the contribution to the enhancement of the national economy through the paying of taxes and pay as remittances would also be lost.

4.1.3 Crop Production Alternatives

Two options were considered. These are as follows:

Rain-fed Agriculture Alternative

This option involved planting the crops just during the rainy season and suspend during the dry season. The area project site receives an average annual rainfall of about 1000mm from early November to April during which time 90-95% of the annual rainfall occurs with an average potential evapotranspiration of 1,400 mm per year and meteorological data suggests that on average the area has about 85 rainy days per year. This implies that any crop planted must be raised within this period. Given the variability of rainfall patterns experienced in recent years in the country, the rain-fed agriculture is not very reliable. The variability of rainfall also poses a serious risk of crop stress especially during those dry days or months. Rain-fed agriculture also implies a mono-cropping season which is usually unsustainable for commercial farmers and likewise less labour force and hence very limited resultant employment opportunities for the locals, this option was therefore left out.

Irrigated Agriculture Alternative

The irrigated agriculture scheme project was picked as the option that guarantees a lot of benefits both to the developer and the communities. In our day, irrigated agriculture has been shown to yield four-fold compared to rain-fed agriculture. It is usually a multi-seasonal cropping allowing growth of more than one crop within a year and more additional yield of crop field per annum.

4.1.4 Process/Technology Alternatives

The agriculture processes and technology (fertilizers, chemicals and machinery) to be used will be those commonly used in other commercial farms in the project area and in Zambia.

4.1.5 Irrigation Alternatives

A number of irrigation methods were considered. These methods include the following:

Drip Irrigation:

This method of irrigation is water efficient. However, this type of irrigation is not suited to grain crops, is very expensive to implement and is best suited to intensive cultivation of crops such as coffee and fruit trees. The method was not selected as the right method of irrigation.

Overhead Sprinklers:

This method, although a well tried and tested method, it is very expensive to operate and difficult to monitor as all aspects of management must be done manually. The method is considered inefficient and as old technology best suited to small holdings.

Flood Irrigation:

This method involves the construction of substantial infrastructure in terms of irrigation channels as well as major preparatory earthworks for fields in order to achieve the right levels and falls and therefore has a very high capital cost of development. The method is extremely wasteful in terms of water and the grading earthworks involved promote erosion and are not conducive to soil structure. The method also may result into a lot of environmental impacts if not handled well.

Centre Pivot:

This method is water efficient and erosion control friendly. The method is highly automated, easy to operate and monitor hence has the advantages stated above. Under this method the application of water is highly controlled and monitored.

4.1.6 Water Source alternative

LAIL proposes to draw water for use at the farm from the Luwombwa river. The possibility of drawing water from a surface water body was evaluated against the use of groundwater for irrigation. The nearest river is Luwombwa river which is fairly unutilized on this portion of it.

4.1.7 Power Source alternative

Alternative power supply includes the establishment of diesel generators, solar panels on site. The option of electricity via ZESCO on site is the most feasible.

4.1.8 Raw materials alternatives

Office blocks, accommodation and other site structures can be made from concrete blocks, clay bricks, hydra form bricks or a combination of them. The developer will prefer concrete blocks for most works.

4.1.9 Wastewater disposal alternative

Disposal of water on land would be an environmental nuisance while the option of reusing the water in crop irrigation makes economic and environmental sense as water would be saved while the nutrients in the effluent water will be used to fertilize the crops. The developer will engage waste water experts to design the reuse system.

4.1.10 Product/service alternatives

The option of setting up a farm far away from the project site would entail long hauling distances of products in Serenje. This would in turn make LAIL produce not only expensive but beyond reach of the majority people that need proteins. Thus, LAIL site is optimal for this kind of operations.

4.2 List of selected alternatives in order of preference

i. Construction of metal frameworks of warehouses than prefabs.
ii. Connecting to ZESCO power line grid than using generators.
iii. Compositing of manure than creating a dumpsite.

5 DESCRIPTION OF THE BASELINE ENVIRONMENT

5.1 Agro Ecological Zoning

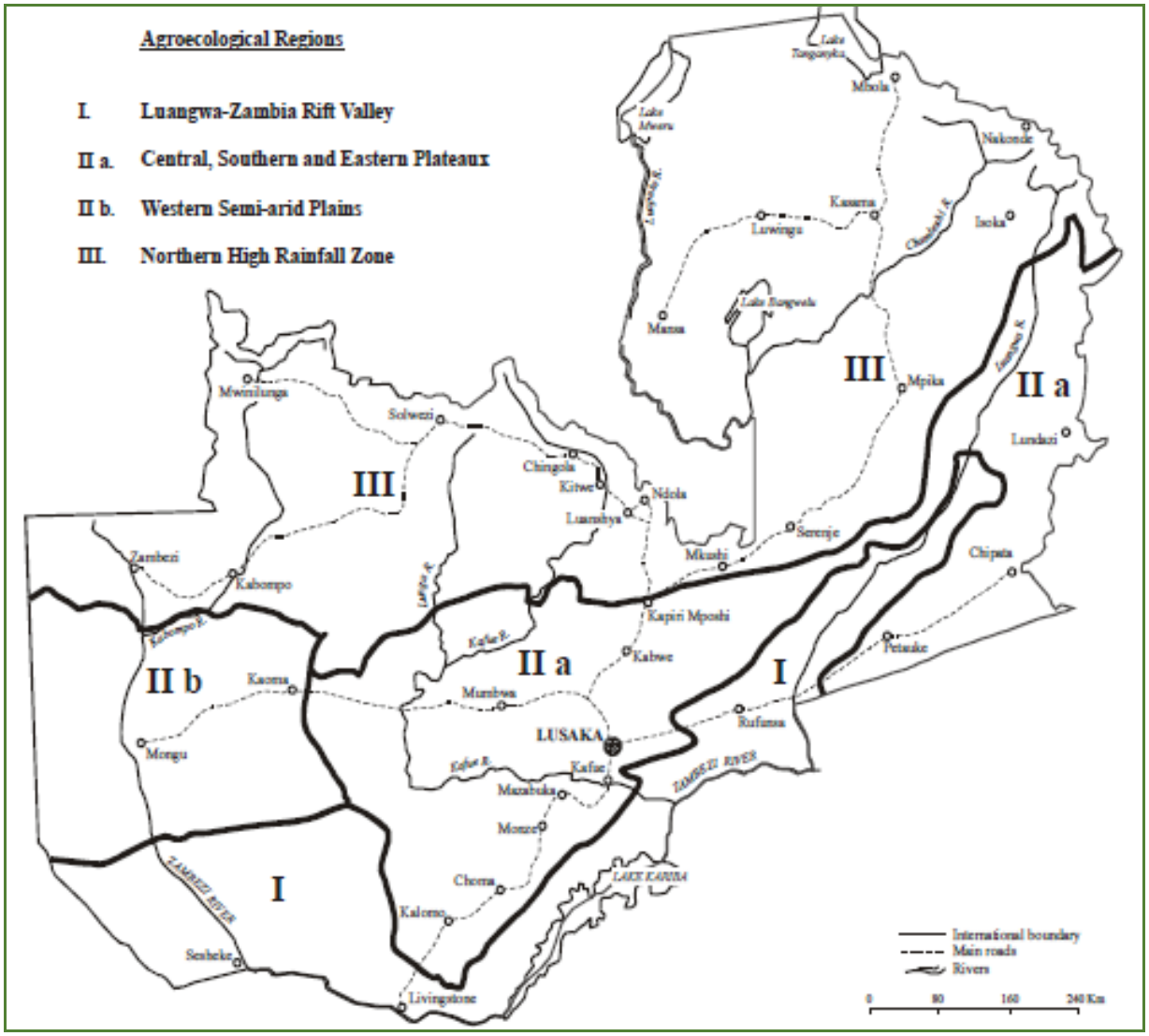
Approximately 48 million hectares (Mha) of land in Zambia are suitable for agricultural use. In most parts of the country, rainfall is sufficient for rearing livestock, wet-season crop production, and storage for irrigation during the dry season. Year-to-year variability in rainfall is an important determinant for crop output and household food security.

The country is subdivided into 36 Agro Ecological zones grouped into three Agro Ecological regions. They are defined as:

Table 8: Agro Ecological Zones of Zambia

Agro Ecological Regions
✓ **Region (Zone) I** Is a low rainfall area in the southern portion of the Southern and Western Provinces. It covers the country's major valleys; Gwembe, Lunsemfwa and Luangwa, and the southern parts of Western and Southern provinces. It is a drought-prone area characterized by low rainfall (< 800 mm/yr) and a short, hot growing season. However, there is potential for high-value vegetables, fruits and rice.
✓ **Region (Zone) II** is the medium rainfall belt (800 -1,000 mm/yr) covering the Sandveld Plateau of Central and Eastern Lusaka and Southern Province; Kalahari Sand Plateau; and Zambezi Floodplains of Western Province. It is an area with relatively good soils and receives more rainfall than Zone I. It has the most favorable agro-ecological conditions in terms of rainfall and soil quality. The region has a total area of 27.4 Mha of which 50% is available for agricultural use. Wetlands, dambos, rivers and lakes allow for agro activities and, with good market infrastructure, support high-value crops.
✓ **Region (Zone) III**, is a high-rainfall area in the north of the country in Copperbelt, Luapula, Central, Northern and Northwestern Provinces. With rainfall of 1,000-1,500 mm/yr and a growing season of 120-150 days, occupies 41% of the country including part of the Central African Plateau.

The proposed project site is situated in Zone III of the agro-ecological regions of Zambia as in figure below.



Source: FAO 2005

Figure 6.: : Agro Ecological Zones of Zambia

5.2 Climate

5.2.1 Climate

The climate in the area is typical of the Central Province characterised by three distinct seasons in the year: During the rainy season, extending from early November to April, maximum temperatures may vary from about 24˚C to 30˚C. The Annual minimum temperatures range between 11˚C and 15˚C. The range between daily maximum and minimum temperatures is about 7˚C. The mean annual rainfall for the area is about 1100mm, January being the wettest month. However, in rare occasions this area can record between 1200mm to 1250mm of rainfall in a year. Winds are light and variable.

The rains are followed by a cool dry season, from May to August, in which daytime temperatures may reach the twenties whilst at night the temperatures may fall to 4˚C. Winds are stronger than during the rains. During the hot season, lasting from September to the end of October, temperatures rise to between 27˚C and 32˚C.

The relative humidity has its maximum value occurring in January and February and is equal to 70% where, as the minimum value of 33% and 55% is reached in the month of October.

The project site is dominated by prevailing easterly winds during the dry season with fresh winds experienced in the months of July and August. The rains experience light variable winds predominantly northerlies and north-easterlies in January and February. Mean wind speed ranges from 4.0m/s to 9.0m/s.

The average annual evapotranspiration for Serenje is 734 mm whilst the average annual potential evapotranspiration is 1,571m. (Met. NWFR 2010). Sichingabula (1998) estimates loss of water through evapotranspiration and underground seepage for open water surfaces to be around 3.7% daily in northern Zambia.

At the peak of summer (i.e.; October), the sun is expected to shine for an average of 10 hours per day. This represents the average number of hours in the daytime that the sun is visible and not obscured by cloud e.g. the average number of hours the sun is actually out and shining. In winter (i.e.; June and July), the sun shines for an average of 8 hours per day. There is more sunshine during the dry season than during the wet season. Sunshine hours decrease from December to March and then start to increase in April and May.

5.2.2 Geology

The regional geology of the area is underlain by foliations and joints which consists of strongly folded meta-sedimentary rocks igneous and metamorphic rock formations of the late Precambrian to the lower Palaezeoic Katanga Super group that are found within synclinal structures, as well as metamorphic shale, silt and sand stones. The meta sedimentary sequence is underlain by granite gneiss, migmatite and granite domes from the Basement Complex. The basement rocks are overlaid by the Muva, Lower and Upper Roan, Mwashia Upper and Lower Kundelungu series. Large parts of these have been irregularly deposited and irregularly eroded over time. The Basement complex and the Muva system comprise a series of Schist, Quartzites, Gneisses and

intrusion of Granite. On the Muva and Basement rocks are sedimentary rocks of the Katanga system which are considered to be of the late Pre - Cambrian age.

These are divided into three groups, which have a fairly well-defined sequence throughout the study area. The lowest of the three is predominantly arenaceous and is formed of conglomerates, sandstones and quarzites, where all the mineral ore deposited are said to occur. The second and upper group comprises dolomites, shales and limestone with thin beds of sandstones while the upper most group comprises inter-bedded argillites and dolomites.

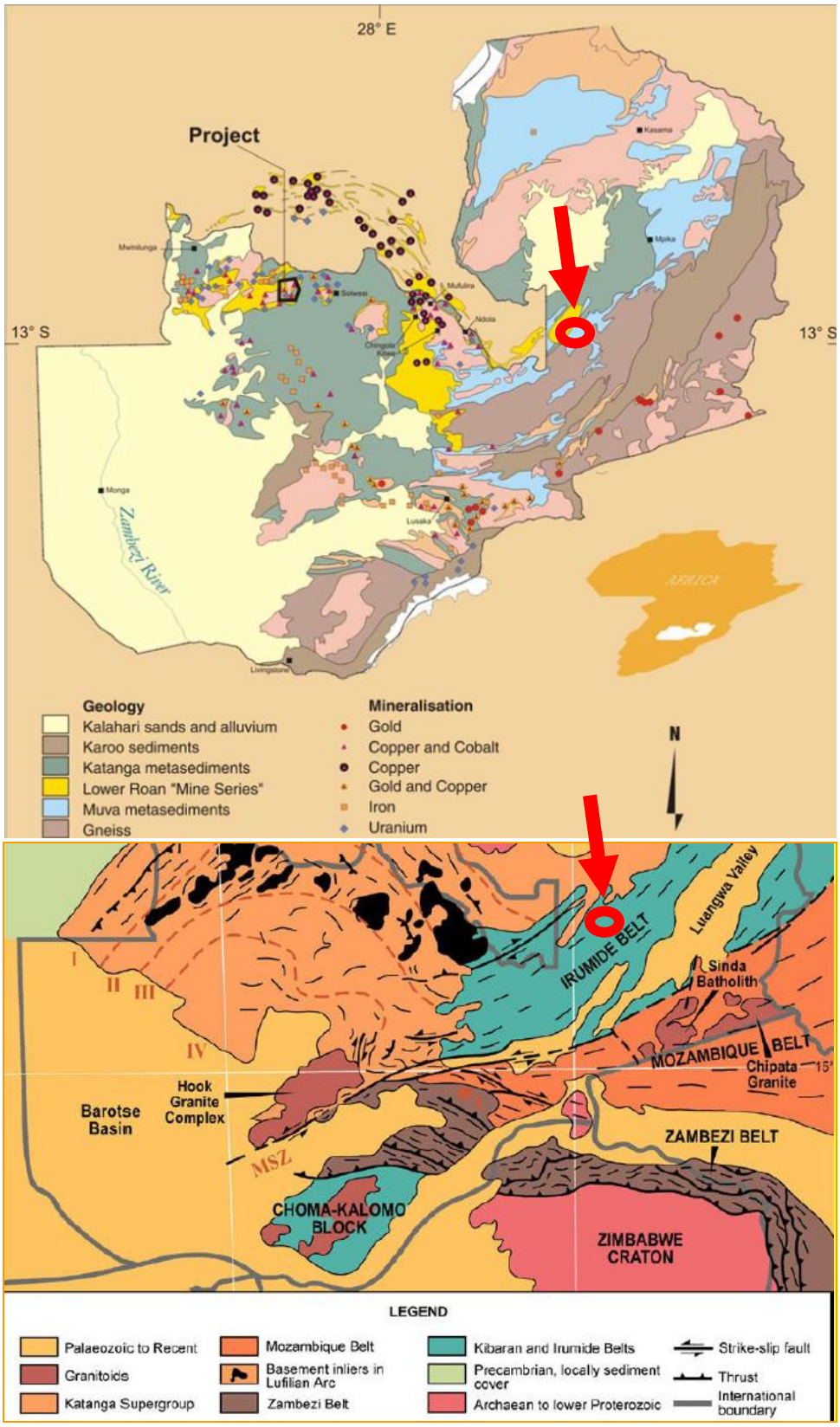


Figure 7. *Showing regional and project site geology*

The above mentioned rock groups have undergone the process of structural folding forming a series of north-west/south-east trending anticlines and synclines plunging generally to the north-west. The subsequent erosion has removed the higher parts of these structures and the Katanga sedimentary rocks are now represented by a series of pedi-plains composed of synclinal basins and anticlines. Field observations indicate that most of the hills of the area consist mainly of quartzitic sandstones. Fine grained phyllitic siltstones and shales were located as scattered occurrences. Frequent shallow areas with laterite beds or gravelly topsoil or sheets are observed in the whole project area especially towards the rivers at slope break. Quartzitic outcrops are common on hills. Due to tectonic movements, rock layers are typically tilted into steeply dipping formations which results in a high diversity of soils types over a short distance. The well-drained interfluve areas tend to develop lateritic formations, particularly where well drained. The river valleys and plain areas are widely covered by deep deposits of clay and sand.

5.2.3 Topography

The site falls within the Central Province of Zambia and the form of topography is characteristic of the midtertiary peneplain of Central Africa, which for the city stands at 1,280 m above sea level in the east and 1,240 m in the west. Land slopes are generally gentle approximately only 0.14% from the highest ground radiating outward and mainly towards the northwest, but also towards the southwest and northeast. The natural drainage pattern is therefore essentially radial. The gentle slopes towards the Luwombwa river also cause peripheral areas to experience flooding during the rainy season.

5.2.4 Air Quality

The air within the area where the proposed agriculture project will take place is clean. The're very little or no economic activity in the project site and absence of any polluting industrial activities (factories, power plants or any other emission producing activities) rendering the project area clean of any air pollutants with good air quality. However, to a minimal level the air quality in the project area can potentially be polluted by fumes from bush/forest fires and firewood and emerging dusty routes in general.

The air quality assessment conducted recorded that ambient dust fall within the project area falls within the Zambian standard. The ambient dust fall limit in Zambia is 7.5 tonnes/km^2 over 30 days. The results of the dust fall results for the site were below 0.32 tonnes/km^2 over 30 days.

All the sites where air quality assessment was monitored were below the limit. Air quality in the project area is fairly good though the introduction of the proposed agriculture project will impact on this aspect and may alter the current status. The impact will be low and mainly during the construction and land preparation phase.

Table 9: Respirable dust results

Sample area	First Reading	Second Reading	Average	ZEMA Limit	Comment
P1	21.13mg/Nm^3	21.91mg/Nm^3	21.52mg/Nm^3	50 mg/Nm^3	Below limit
P2	19.50 mg/Nm^3	19.46mg/Nm^3	19.48mg/Nm^3	50mg/Nm^3	Below limit
P3	22.03mg/Nm^3	22.79mg/Nm^3	22.41mg/Nm^3	50mg/Nm^3	Below limit

5.2.5 Noise and Vibration measurement

Noise monitoring was conducted for the purposes of establishing the existing ambient noise levels in the project area of the proposed farming project. This forms the pre-operational baseline facts on noise and vibration in the project area.

The baseline study involved actual measurements of the noise levels and vibration sources within the site and surrounding establishments in the area. Analysis of the results obtained in the study was carefully conducted in order to determine the levels and draw an accurate conclusion of the baseline environment of the project site.

5.2.5.1 Sampling methodology

Key areas of the project site were sampled over a total period of 24 hours using an integrated standard noise level meter (toptronic T325-IEC651 type II).

Figure 8.: Sampling in progress

The Noise level meter was placed at 1.5m above ground and 3m from any reflective surface *(adapted from the IFC noise level guidelines, April 2007)* during measurement. The noise level meter standards used in the collection of results are classified in table below:

Table 10:: Noise level guidelines (IFC)

Description	**Noise level guideline (dBA)**	**One Hour LAeq (dBA)**	
Low	32 to 80	Day time	Night time
Medium	50 to 80	55	45
High	80 to 130	70	70

Three (3) sampling points where identified on the boundaries and two (2) within the project site. One reading where obtained from each sampling point for the total duration of Thirty minutes per sampling point every 4 hour and an average result for each point was then tabulated as shown in the tables below

Table 11: Noise Levels at different areas

Village	**SPL (dB) 9 AM**	**SPL (dB) 1PM**	**Position**
P1	30.2	30.1	12°33'27.81"S 29°57'24.22"E
P2	31.4	31.0	12°35'14.61"S 29°59'28.08"E
P3	30.4	30.7	12°36'56.82"S 30° 1'28.76"E

5.2.5.2 Discussion of results

Noise levels in the area are very low. The noise levels in the area are consistent with the levels generally expected for rural Zambia especially where there are no major industrial or mining activities being undertaken.

The highest average noise level reading obtained was 31.4 dB (A while the lowest was 30.1dB (A). The highest noise level recorded are below the disruptive (85 dB) noise level standard of the International Finance Corporation (IFC) which was the benchmark used in the study.

5.2.6 Hydrology and Hydrogeology

The baseline survey on the hydrology and hydrogeology of the project area shows that the area is drained by the Luwombwa river and its tributaries such as Mulembo, Nyamanda, Musangashi, Musola, Ifuna and Kasanka. The entire project site lies in the headwaters of the Luwombwa River. The Luwombwa is the only river draining the sites, and it in turn joins the Luapula River downstream of Kasanka NP. Stretches of seasonally and permanently wet habitats are found along the river, while areas away from the river are predominantly covered by *miombo* woodland. There is sufficient water throughout the year to support irrigation and associated fauna and bird populations due to the perennial character of the river and the terrain characteristics of the area.

The Luwombwa sub-catchment at the project site covers an area of 4689 km^2 and lies in the Luapula catchment which is one of the six river catchments in Zambia. The Luapula River belongs to the Congo River Basin which is the smaller of the two internationally shared basin in Zambia, the bigger being Zambezi River Basin. The Luombwa river, a tributary of the Luapula, has its source in the Democratic Republic of Congo (DRC) as shown in Figure 1. Its main tributaries are Nyamanda, Ifuna, Musangashi, Musola, Mulembo, Kasanka, and Munte rivers. Downstream it passes through the Kasanka National Park before joining the Luapula River. The Luombwa catchment, which stretches about 119 km from DRC to the confluence with Mulembo River north of the project site, is ungauged but its mean annual runoff is estimated from the gauge station on the Luapula at Chembe Bridge. The Luwombwa river is perennial.

The Ng'answa, Muswhingashi, Munte, Nkulumashiba and Lube are major watersheds which support the Luwombwa River. Drainage is hill and plateau influenced and has highly dendritic river network patterns. The Luwombwa River is the main river located on the southern boundary. This will be the main water source for the proposed project. Water samples were collected from the Luwombwa River.

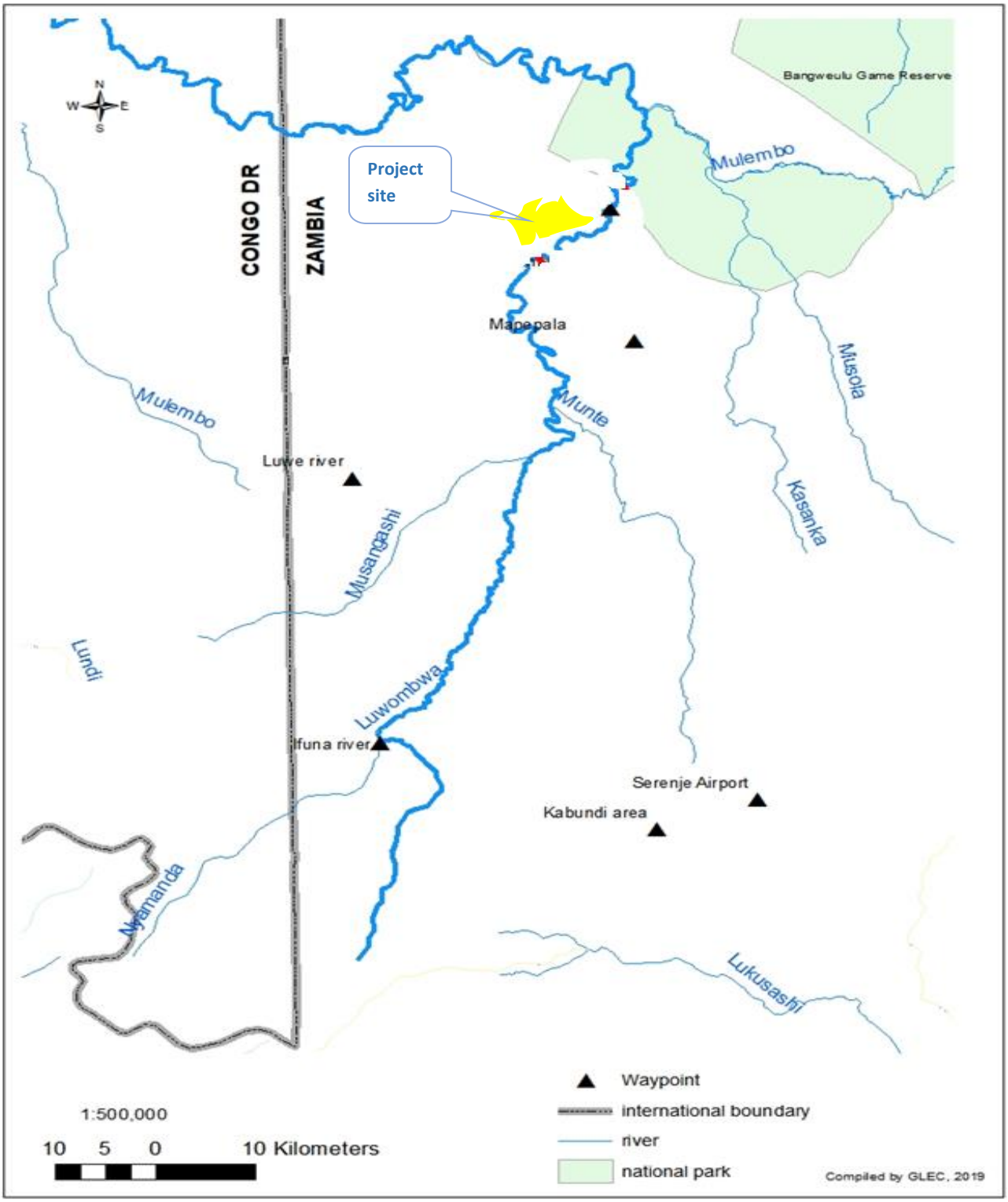
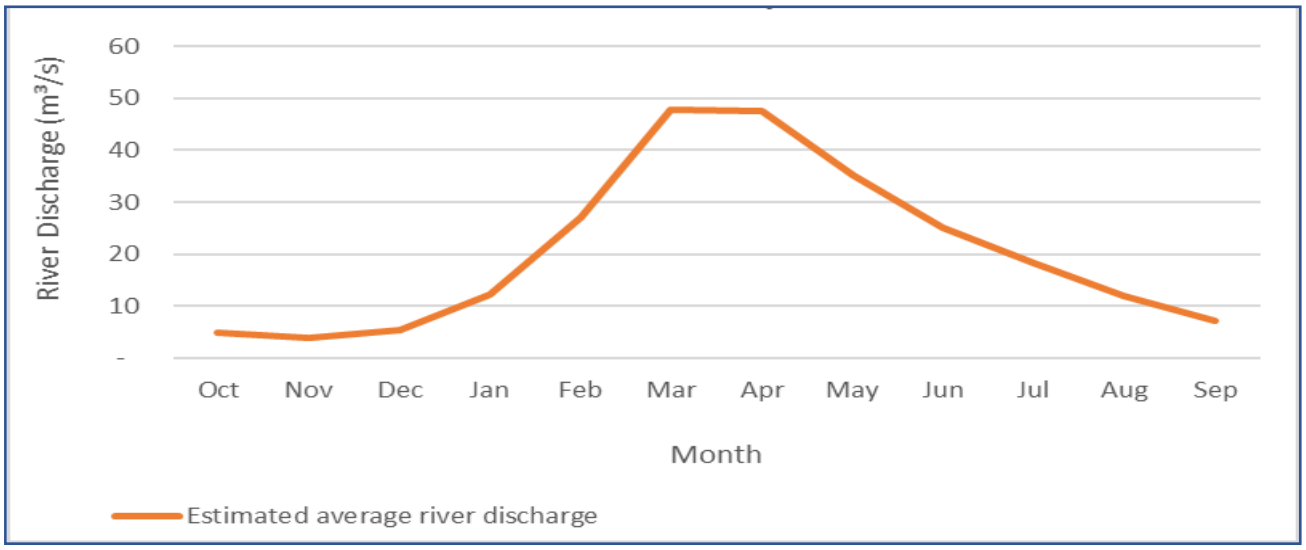


Figure 9.: Network of rivers and streams in the project area catchment

Using 30-year historical data (1963 to 1992)[1], the yield of the Luwombwa catchment at the project site, measuring 4,689 km² is estimated at 675 million cubic metres (MCM)/year. The annual water yield may vary due to the rainfall pattern in the catchment. The monthly mean discharge for Luwombwa river at the project site is highest in March and lowest in November as shown in the figure below. The median discharge is estimated as 15 m^3/s while the average is 19 m^3/s. The median flow is the discharge that is equaled or exceeded on 185 days in a hydrological year or 50% of the time. The highest and lowest annual yields would correspond to the high and low rainfall seasons respectively. On 6th September 2019, the river discharge at the project site was measured to be 5 m^3/s which is comparable to the calculated long-term mean monthly discharge for September of 7 m^3/s.



Data source: YEC (1995ₐ)

Figure 10.: Monthly mean discharge at the project site

The sub-catchment in which the project area lies annually yields sufficient amounts of water resources (both surface water [675 million cubic metres per year] and ground water [312 million cubic metres per year]) that can be harnessed for the implementation of this project and other economic activities including irrigated agriculture, industry, mining, tourism and recreation. The catchment water yield estimates above may significantly vary depending on the rainfall pattern and other climatic factors. The overall water quality status of the borehole and the river was found to be good as further indicated by the analysis using the Water Quality Index Calculator and the Diagramme tool.

Given the current level of development in Serenje District and particularly in the Luwombwa catchment, there is significant development space to accommodate the proposed project while taking into account, at the early stage of planning, the sustainability of the water and environmental resources of the catchment.

Groundwater flow direction generally follows the surface water flow pattern which is south-west to north-east towards the confluence with Mulembo River. In the two aquifer types (implied by the geology) above,

[1] YEC. (1995ₐ). National Water Resources Master Plan (for Zambia)

groundwater mainly flows through fissures, channels or other discontinuities. The undifferentiated Kundelungu and Muva sediment aquifer systems tend to be locally productive with a relatively low yield of boreholes ranging from 0.1 to 10 litres/second (l/s).

The available data indicate that the average depth of boreholes ranges from 55m to 60m; the average aquifer thickness is 15.5m (shale, mudstone) to 23m (sandstone); the average groundwater depth from ground surface is 8.4m to 8.7m; the median permeability coefficient of 0.16 - 0.28m/day; the median specific yield of 0.045 – 0.052 m^2/day; and specific capacity is estimated to be 5.7 - 10.5 m^2/day.

5.2.6.1 Water Quality

Water quality sampling involved collection of a groundwater and a surface water sample. Groundwater was collected in in a 1-litre plastic bottle, taking care not to allow bubbles. The river sample was obtained by scoop method at the centre of the river channel. As in the case of the borehole water sample, the river sample was placed in a 1-litre plastic bottle. Both samples were placed in a cool box and later transported to the University of Zambia Environmental Engineering laboratory. Laboratory analysis was carried out in conformity with "Standard Methods for the Examination of water and Wastewater APHA, 1998". *In-situ* water quality measurements were done using WTW portable water testing meters for the following parameters: pH, electrical conductivity, salinity, Total Dissolved Solids, redox potential, water temperature and dissolved oxygen.

The Water Quality Index Calculator developed by Brown *et.al* (1970) was used to rate the overall source water quality using both the field and laboratory generated data. The Diagramme tool was used to analyse water quality data and produce the piper diagram for presentation of the data and information.

ArcGIS 10.2, QGIS and Global Mapper were used to generate maps and analyse data for the project area including hydrological catchment delineation and river flow, hydrogeological and water quality data analysis. Mapping and measurement of distances between features to describe the project area was further enhanced by remote sensing using Google Earth. Satellite imagery data (Sentinel 2) was used in the assessment.

The estimation of river discharge was conducted using the float method. This was done by placing floats (10 in this case) in the river and measuring their travel time over a fixed measured distance along the river in order to calculate the average flow velocity (Velocity = Distance/Time). The depth of the cross-section was measured by using a dry long stick and measuring tape which was also used to measure the width of the cross-section. From these the cross-section area was calculated (Area = Depth x Width), assuming a rectangular cross-section shape. Finally, the river discharge (in m^3/s) was computed by multiplying the cross-section area (in m^2) and the average velocity (in m/s). Because of lack of gauge stations in the Luwombwa River Catchment, secondary flow data for the gauge station on Luapula River at Chembe (Levy Mwanawasa) Bridge was used to calculate the hydrograph for Luwombwa River at the project site.

The results of water quality tests carried out in September 2019 are shown in Table below and Annex. Apart from the high concentration of faecal and total coliform in both the groundwater and surface water samples, all other parameters were within the recommended limits for drinking water according to the World Health Organisation (WHO) drinking water guidelines and the Zambia Bureau of Standards (ZABS) drinking water standard. Both the borehole and the river are good sources of raw water for various uses including domestic, irrigation and industry. Before drinking, the water needs to be disinfected to kill off harmful pathogens.

The borehole water at the project site is characterized as hard (between 150mg/l and 300mg/l) and while the river water is soft (much less than 100 mg/l), according to Bauder *et al* (2008). The overall water quality status of the borehole and the river was found to be good as further indicated by the analysis using the Water Quality Index Calculator developed by Brown *et. al* (1970).

Table 12: Water quality test results of water sources in the project area

Parameter	**Borehole water**	**River water**	**WHO[w]**	**ZABS"**
pH	7.61	7.57	**6.5-8.5**	**6.5-8.0**
Conductivity (µS/cm)	416	81	**1500**	**1500**
Turbidity (NTU)	1.41	5.24	**5**	**5**
Total dissolved solids (mg/l)	208	41	**1000**	**1000**
Total hardness (as mg $CaCO_3$/l)	224	58	**500**	**500**
Calcium hardness (as mg $CaCO_3$/l)	122	30	**500**	**-**
Alkalinity (as mg $CaCO_3$/l)	220	48		**500**
Bacteriological Results				
Total coliform (Number/100ml)	98	85	**0**	**50***
Faecal coliform (Number/100ml)	80	75	**0**	**0**

**Occurring in an occasional sample but not in consecutive samples for un-piped water supplies*
[w]World Health Organisation (Drinking Water Guidelines)
"Zambia Bureau of Standards (Drinking Water Standard)

The piper plot below shows that that both water sources as sampled at the project site are of the type calcium-bicarbonate (Ca-HCO_3), where calcium and bicarbonate are the dominating cation and anion, respectively. It also shows that both sources have water with temporary hardness which can be easily removed by heating the water.

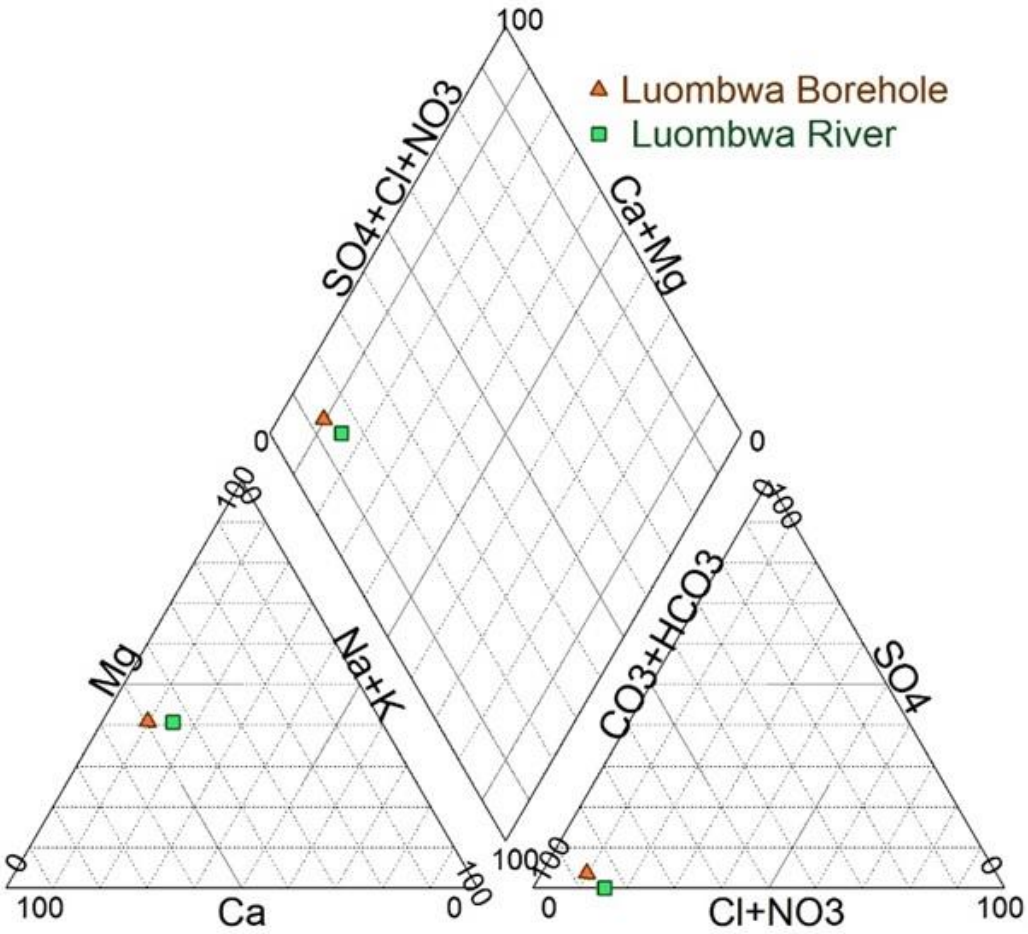


Figure 11.: Piper plot of water quality results

The figures below show features at points of sampling and measurement of on-site water quality parameters and river discharge. The river flow was observed to be significant with a depth of at least 1 m at the cross-section and a width of about 20 m. The water was clear in appearance.

Figure 12.: Water quality sampling point on Luwombwa River

Figure 13.: Discharge measurement point on Luwombwa River

5.2.7 Soils

5.2.7.1 Surveys

Two field surveys were conducted. The selection of soil sampling sites was based on a range of criteria. The criteria included the following; boundaries of the proposed project site, representativeness of each site based on vegetation community, spatial representativeness with regard to distances from one sample plot to the other within the project site and proximity to access road for ease of monitoring. Soil profile pits were dug down to the depth of 1m in order to study the different soil layers within the representative sample plots.

Photographs of selected soil profile pits are included. Photographs of soil profile pits were taken at each site within a particular vegetation community in order to provide a visual record of the soil layers/horizons. Soil samples were collected from three locations, i.e. from vegetation monitoring plots 1, 2, and 3. Soil samples were air dried by way of spreading them on a polythene sheet in a closed room.

5.2.7.2 Sampling

Soil samples were collected from the sides of a soil profile pit which was dug at selected locations in vegetation monitoring plots in the Project area. Research Assistants were engaged to assist in the mapping out of sample plots. In some cases, a soil auger was used in the collection of soil samples, which other situations (where the soils were a bit loose) called for collection of soil samples from the sides of the soil profile pits. Samples were collected at the 0 to 10 cm, 10 to 20 cm and 20 to 30 cm depths.

5.2.7.3 Sampling conditions

Soil sampling was done at the time when it was very dry. A soil auger was used in the collection of soil samples where soils were relatively compact whereas the sides of the soil profile pit also provided space for soil sample collection with the help of a trowel. Other tools used in the digging of the soil profile pit included the pick, an axe, hoe, shovel.

5.2.7.4 Sampling limitations

Coverage for soil sample collection was limited to the virgin land because cultivated or opened up land for any activities (if any) would have yielded varying results which would have been difficult to make any inferences from.

5.2.7.5 Field observations

Field observations focused on soil depth, texture, colours, slope and other physical properties as criterion to separate various soil units (much more to do with confirmation on certain parameters such as drainage and fertility) but not necessarily reclassifying the soil types.

5.2.7.6 Soil Analysis/results

Dried soil samples were placed in clear plastic bags, which were labelled and sent to the University of Zambia, School of Agricultural Sciences in the Department of Soil Science for both physical and chemical analysis. Each plastic bag contained a soil sample for a particular depth e.g., 0 to 10 cm. The soil samples were analysed for both chemical and physical properties. Chemical analysis included; Nitrogen (N), Organic carbon (OC), p^H. Physical analysis included the determination of the contents of sand, silt and clay for the determination of the soil texture.

*Baseline Survey***:** Most of the Project Area (approximately 99%) where the vegetation monitoring plots were selected were well vegetated and no subsistence farming was being practiced. It is virgin land with undisturbed forest.

At a larger scale, the dominant soil types of the project classified as Acrisols. The major part of the country is covered with Acrisols and Ferralsols.

These soils are highly weathered and strongly leached and are thus infertile soils, characterized by weakly structured, loamy topsoils, clayey sub soils. Acrisols display a marked clay increase with depth. Topsoil textures of Acrisols show loamy sand or sandy loam while Ferralsols show clayey textures. The cation exchange capacity (CEC) of Acrisols is less than 24 meq / 100g clay (the weight unit, 100g clay is abbreviated hereafter) and the base saturation is less than 50%. Soil pH (CaCl2) ranges 4 - 4.5, moderately to strongly acid (CaCl2 is abbreviated hereafter). Soils are unsuitable to most crops largely due to low soil nutrients levels. However, with regular liming and careful fertilization the soils are moderately suitable for maize, sorghum, groundnuts, cassava, sunflower, millet and coffee. Reduced rainfall in may adversely affect these soils' suitability to agriculture (JAICAF, 2008).

At semi-detailed level, the Project area has well drained, deep to very deep, yellowish red to strong, brown, friable, fine loamy to clayey soils having a clear clay increase with (chromii-haplicdepth; with inclusions (20%) of moderately well drained to imperfectly drained, deep to moderately shallow, gravelly clayey soils. ACRISOLS; with gleyl-haplic ACRISOLS, partly skeletic phase; dystric LEPTOSOLS) (Ministry of Agriculture, 1991).

At site level (i.e. the Project area), the classification follows the same pattern generally.

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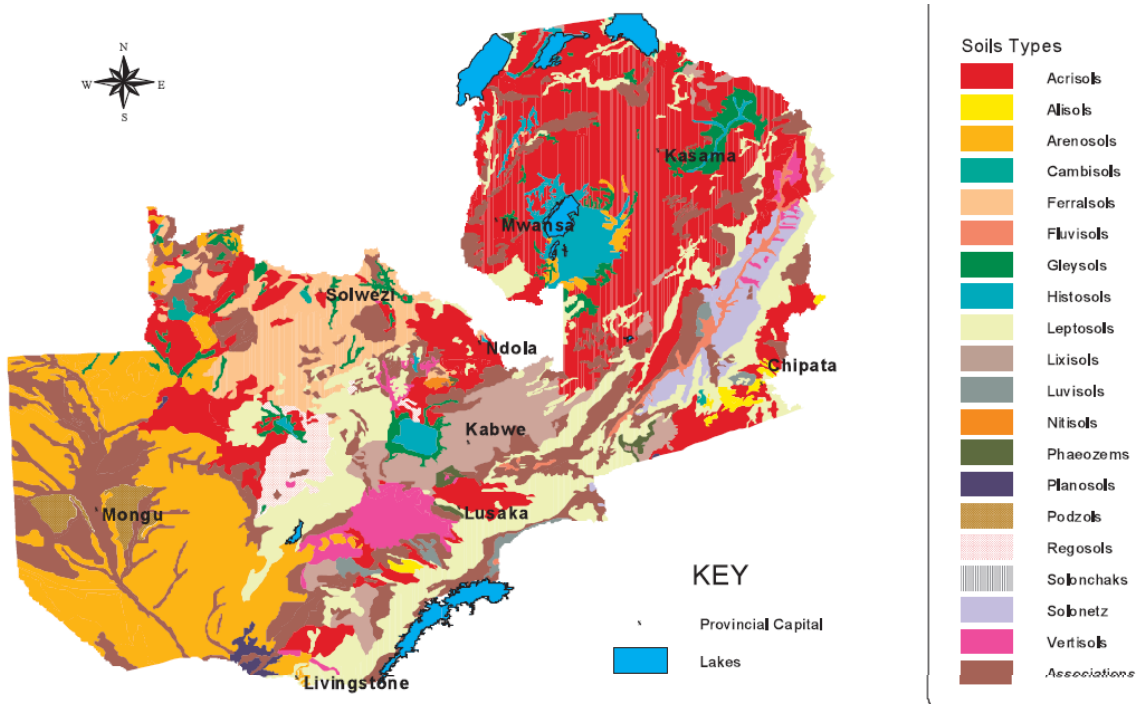


Figure 14: Soil Types of Zambia; source Mount Makulu Central Research Station

5.2.7.7 Soil physical and chemical analysis

Analysis of soil physical and chemical parameters was based on results obtained from a relatively nearby location as represented below: -

Table 13: Soil analysis results

Element/nutrient	Reagent/test	Result
pH	0.01M $CaCl_2$	4.82
OM	Walkley and Black (%)	1.84
N	Kjeldahl digestion (%)	0.4
P	Bray 1 (mg/kg)	8.27
K	Amm. Acetate (cmol/kg)	0.13
Na	Amm. Acetate (cmol/kg)	0.05
Ca	Amm. Acetate (cmol/kg)	0.62
Mg	Amm. Acetate (cmol/kg)	0.63
S	Sodium Acetate (mg/kg)	24.14
Cu	DTPA (mg/kg)	0.34
Fe	DTPA (mg/kg)	2.44
Mn	DTPA (mg/kg)	1.58

Zn	DTPA (mg/kg)	0.02
Sand	Hydrometer (%)	49
Clay	Hydrometer (%)	19
Silt	Hydrometer (%)	33
Texture	USDA Texture class	Loam

5.2.7.8 Interpretation of the soil analysis result

An interpretation of the soil analysis and a recommendation for general soil fertility management is based on maize production partly because of the fact that maize is a heavy feeder in terms of nutrient up take, meaning that the soil environment under which maize will thrive may equally be favourable for many other crops.

The major constraints on these soils are soil acidity (low pH) and general deficient plant available nutrients phosphorus, calcium, magnesium, potassium and zinc. The organic matter content is adequate for a loam soil.

The soil should be limed to ameliorate the soil acidity problem and enhance fertilizer use efficiency. Application of a dolomitic lime (supplies both Ca and Mg) at the rate of 3000 kg per ha and well incorporated in the top 0-20 cm of the soil should correct the problem. The soil should then be reanalysed after three seasons to monitor restoration of normal soil reaction (pH) for optimal plant growth with respect to this parameter.

The rates of application of fertilizer can be varied according to the yield targets set by Lake Agro farm i.e. higher fertilizer input for higher yields. For restoration and maintenance of soil fertility phosphorus needs to be applied at the rate of 60 to 80 kg of P_2O_5 per ha. Potassium which is also deficient can be corrected by applying at least 20 kg of K_2O per ha. These amounts of P and K can be met by applying a mixed fertilizer high in P and K such as D compound (10:20:10) at a rate of 200 – 300 kg per ha.

Zinc deficiency can be corrected by applying a zinc fertilizer, $ZnSO_4$ at the rate of 50 kg per ha. There are also some zinc-containing mixed fertilizers from some supplier in the country which can be used instead of the D compound formulations without Zn.

High organic matter content is especially desired on all soils including this loam soil. Therefore, land husbandry practices that increase soil organic matter content such as retention of crop residues on land, manuring and crop rotation, especially with legumes should be encouraged.

Acidic and alkaline soils will have effects on the availability of nutrients and soil biological activity

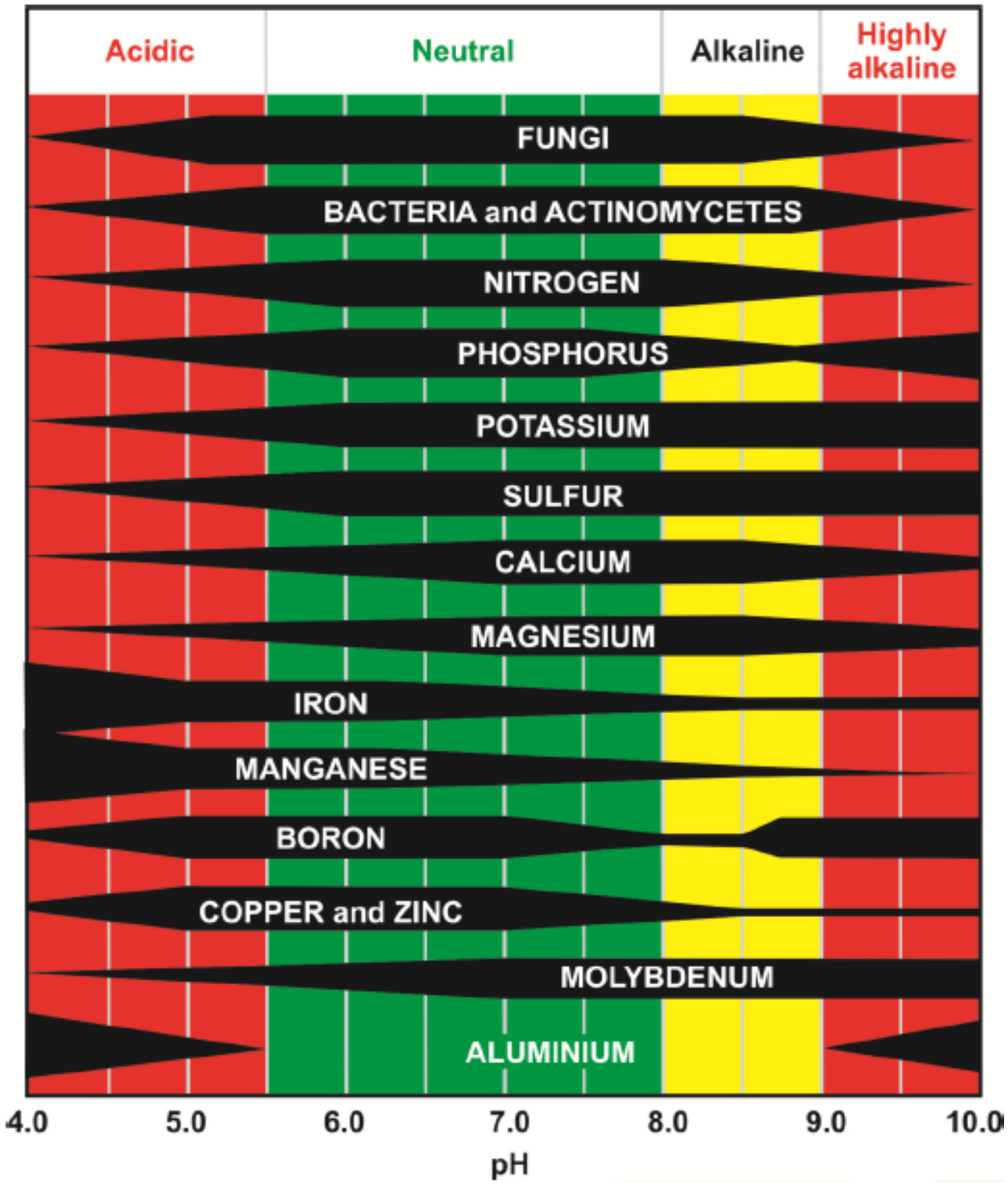
Table 14: pH and its effects on the availability of nutrients

pH (Water)	
pH	**Interpretation**

<5.4	Strongly acidic Aluminium (Al) or Manganese (Mn) toxicity Can have Molybdenum deficiencies Ca, Mg, and K deficiency (Due to possible leaching) Reduced microbial activity
5.5-6.4	Moderately acidic
6.5-6.9	Slightly acidic
7.0	Neutral
7.1-7.5	Slightly Alkaline
7.6-8.3	Moderately alkaline
>8.4	Strongly alkaline
pH ($CaCl_2$)	
<4.8	Strongly acidic Possible Al and Mn Toxicity and Mo Deficiency
4.8-5.2	Moderately high acidic Acceptable for acid tolerant species
5.2-5.5	Moderately acidic
5.5 -7.5	Moderately acidic to slightly alkaline Above 6.5 - Often high in Mg and calcium carbonate

The diagram below indicates the availability of nutrients to crops at various pH levels, with the widest bar representing availability.

Figure 15.:Availability of nutrients to crops at various pH levels



Carbon

Organic matter was 1.84%. The critical value is 3.4%. Therefore, soils at the Project site are deficient in organic carbon. However, the desire range of Organic Carbon (which constitutes Organic Matter) is 1 to 2% for general cropping. Going by this range, which is 1.7 to 3.84% of organic matter (OM), one may say that the project site is not deficient in OM.

Desired ranges of OC will vary with soil texture and rainfall zone. A lower CEC soil will have a lower organic carbon level. Increasing OC levels will increase the soils CEC and nutrient holding capacity resulting in increased productive capacity in some soils. Higher rainfall or finer texture will generally have higher OC levels. Levels should be higher when rainfall is >500mm. Organic carbon is not directly calibrated against yield but closely linked with soil health.

Soil carbon is part of the soil organic matter (SOM), which includes other important elements such as calcium, hydrogen, oxygen, and nitrogen. Understanding the types of carbon is important and this can greatly impact soil productivity as the amount of carbon varies significantly and different types can be altered through management practices. Some groups of carbon have been identified as follows;

Crop residues – shoot and root residues less than 2 mm found in the soil and on the soil surface

Particulate organic carbon – individual pieces of plant debris that are smaller than 2 mm but larger than 0.053 mm

Humus – decomposed materials less than 0.053 mm that are dominated by molecules stuck to soil minerals

Recalcitrant organic carbon – this is biologically stable; typically, in the form of charcoal.

According to Apal (2013), key function of each of these fractions of carbon have been identified as follows;

*Crop residues***:** readily broken down and provide energy to soil biological processes

Particulate organic carbon: broken down relatively quickly but more slowly than crop residues. It is important for soil structure, energy for biological processes and provision of nutrients

*Humus***:** plays a role in all key soil functions. It is particularly important in the provision of nutrients - for example the majority of available soil nitrogen derived from soil organic matter comes from the humus fraction

*Recalcitrant organic carbon***:** is usually charcoal - a product of burning carbon-rich materials. As 'biochar', it is attracting interest as both a carbon sink and, possibly, a source of soil benefits. It decomposes very slowly and is therefore unavailable for use by micro-organisms. Some soils have high levels of charcoal from millennia of burning.

The Walkley and Black method only measures readily oxidisable/decomposable carbon, not total SOC. The method on average will measure about 80% of the SOC.

Nitrogen

Nitrogen was generally deficient. It was 0.4%. According to Kalebe *et al.* (2010), the critical value for nitrogen is 1%.

The role of nitrogen in plant growth includes the following;

- Essential in formation of Amino Acids – the building blocks of protein
- Part of DNA molecule – responsible for cell division and reproduction and plant growth
- Part of Chlorophyll molecule (the light receptor of plants – turns light energy into plant energy)
- Aids in production and usage of carbohydrates
- Affects energy reaction in plants and is a key component of vitamins

In the soil, nitrogen can be supplied by commercial fertilizer, atmospheric, organic matter, crop residues and animal manures. It can be lost through; nitrification, denitrification, leaching and volatilization.

5.2.7.9 Soils as seen in different vegetation stands

According to the Munsell Soil Colour Chart, both surface and subsoil colour in vegetation monitoring plot 2 has a hue of 7.5, value of 5 and a chroma of 8 (7.5 5/8) representing a strong brown soil colour.

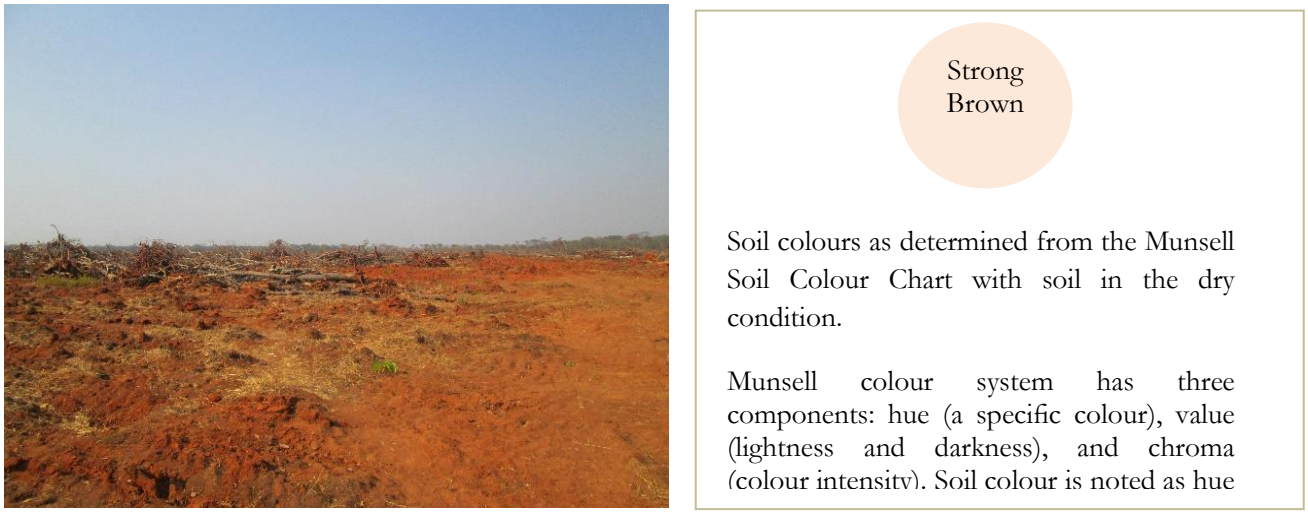


Figure 16.:Colours of surface and subsoil at the Project site

a) Mature stand (Miombo woodlands)

The soil layers in the soil profile pit as shown in Figure below were delineated as 0 to 1 cm Loose leaves and organic debris, largely un-decomposed, 1 to 3 cm Organic debris, partially decomposed or matted, 3 to 10 cm Dark coloured due to admixture of humified organic matter with the mineral fraction, 10 to 20 cm transitional from A to B but more like A than B, 20 to 100 cm was light coloured mineral horizon. Horizons follow the master horizon as shown.

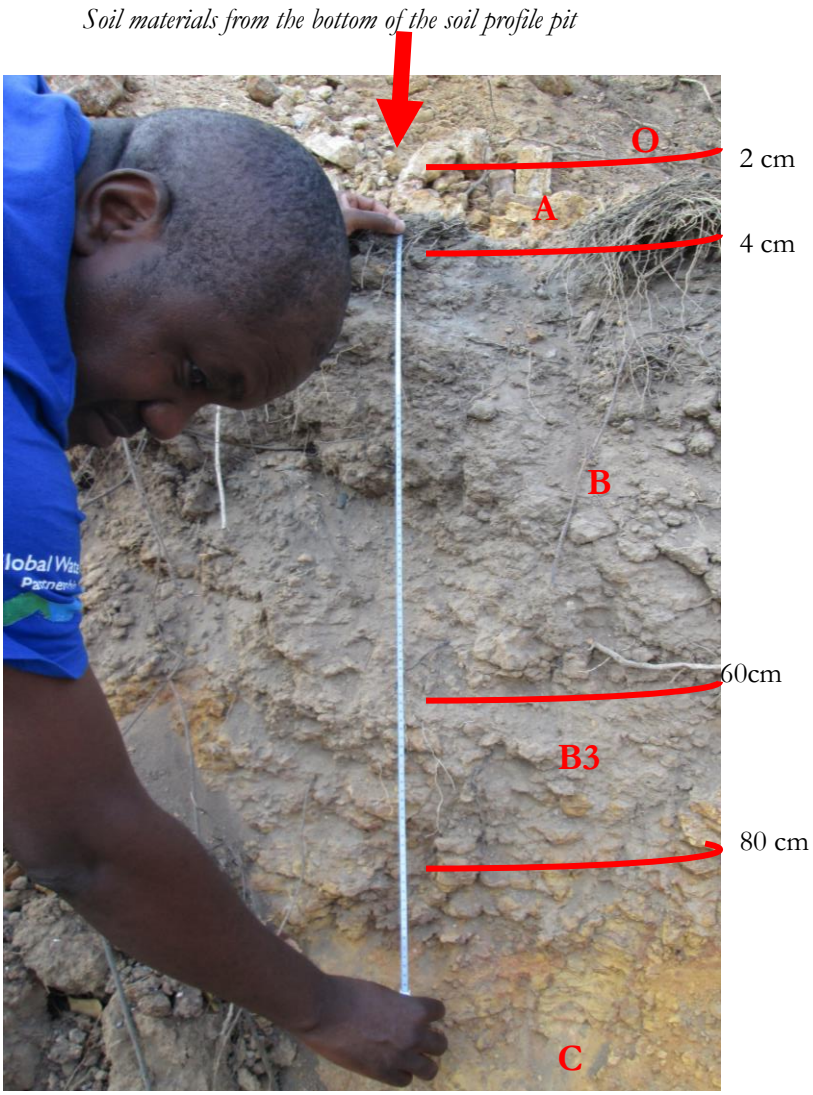


Figure 17: Marking horizons in the soil profile pit at the Project site

The cation exchange capacity (CEC) was what may be said to be within acceptable limits considering the textural class of the soil i.e. loamy sand.

Table 15: Presentation of general horizons of typical soil profiles

O	O1	Loose leaves and organic debris, largely un-decomposed
	O2	Organic debris, partially decomposed or matted
A	A1	Dark coloured due to admixture of humified organic matter with the mineral fraction
	A2 or E	Light coloured mineral horizon
	A3	Transitional to B but more like A than B
B	B1	Transitional to A but more like B than A
	B2	Maximum expression of B horizon character
	B3	Transitional to C
C		Unconsolidated material
R		Hard rock

5.3 BIOLOGICAL ENVIRONMENT

This study was based on a two-day field survey. On-land/ground visual observations were used to identify vegetation types. A vegetation monitoring plot was set up in distinct/major vegetation community. Flora was surveyed using random meandering transects through the vegetation community. Birds were surveyed and recorded by point counts while walking meandering transects through the vegetation community. Large mammals were surveyed and recorded by point counts and direct observation of foot prints and dug/faecal matter dropping while walking meandering transects through the vegetation communities and by asking questions about their appearance/existence from local community people. Reptiles were surveyed by active searching of terrestrial habitats as well as asking local people about their presence.

5.3.1 Fauna and Wildlife Resources

Reptiles

Apart from the lizards, no reptiles were seen. However, the following were recorded based on information obtained from the local people. Tree agama *(Acanthocerus atricollis),* rock monitor *(Varanus albigularis),* Leopard tortoise (*Stigmochelys pardalis*), the Black-necked Spitting Cobra (*Naja nigricollis*) the Tree-snake/Boomslang (*Dispholidus typus*), chameleons *(Bradypodion spp.)*.

Most of the reptiles could not be seen due to time limitations and partially because of their shy and hiding nature especially the snakes.

Mammals

Mammals recorded in the Lake Agro farm included the Angoni vlei rat *(Otomys angoniensis),* African grey rat, house rat *(Rattus rattus),* common mole rat *(Cryptomys hottentotus)* in the Miombo woodlands. Others included the blue duiker *(Cephalophus monticola)* whose presence in the farm block was noted by their faecal matter left behind. Others included the tree squirrel *(Paraxerus cepapi)*. Large mammals recorded included the Bushbuck *(Tragelaphus scriptus),* bushpig *(Potamochoerus porcus),* impala *(Aepyceros melampus melampus),*

Insects

A wide variety of insects were seen though most of them could not be identified. Among them were the; the praying mantis (oder Mantodea), grasshoppers (Family Acrididae, order Orthoptera, suborder Caelifera) and the African honeybee (*Apis mellifera scutellata*). Many more that were seen and recorded are presented in the table below.

Table 16:: Insects identified at project site

Family name	Scientific name	Common name
Mantidae	*Shodromantis lineola*	African Praying Mantis
Acrididae	*Caelifera spp.*	Grasshoppers
Apdae	*Apis mellifera scutellata*	African honeybee

Libellulidae	*Pantala flavescens*	Darner Dragonfly (Globe Skimmer)
Termitidae	*Reticulitermes flavipes*	Common Termites
Blaberidae	*Gromphadorhina portentosa*	Hissing Cockroach
Acanthosomatidae	*Acanthosoma haemorrhoidale*	Twig Wilter Bug
Gerridae	*Aquarius remigis*	Water Strider
Gyrinidae	*Gyrinus natator*	Whirligig Beetle (Water Beetle)
Scarabidae	*Scarabaeus viettei*	Dung Beetle
Culicidae	*Anopheles gambiae*	Mosquito
Muscidae	*Musca domestica*	Housefly
Vespidae	*Vespula spp.*	Social Wasp
Nymphalidae	*Danaus chrysippus*	African monarch

Avifauna (Birds)

The project site and surrounding areas are endowed with a number of wild birds. The ones seen at the time of field data collection included; the Spurfowl (*Pternistis* capensis), Turtle dove (*Streptopelia capicola),* nightjar *(Caprimulgus europaeus),* woodpecker *(Campethera abingoni*), African wood-owl (*Strix woodfordii*), common bulbul (*Pycnonotus tricolor*), marsh warbler (*Acrocephalus palustris*), sunbird (*Hedydipna collaris*), fork-tailed drongo (*Dicrurus adsimilis*), hornbill (*Tockus leucomelas*), sooty falcon (*Falco concolor*), bee-eater (*Merops hirundineus*), brown mannikin (*Spermestes cuculiatus*), black-collared barbet (*Lybius torquatus*), masked weaver (*Ploceus velatus*), black-billed wood-dove (*Turtur abyssinicus*), streaky seedeater (*Serinus striolatus*), red-faced mousebird *(Urocolius indicus),* the African pygmy-kingfisher *(Ispidina picta)* and the grey go-away-bird (*Conrythaixoides concolor*) were seen in the Riparian woodland.

Though not seen at the time of field data collection, however, evidence of the presence of wild guinea fowls (*Numida meleagris)* in the surrounding area was characterised by part of the plumage (feathers) left where they gather to play or bath in sand.

Other bird species not seen but recorded based on information from the local people included; the African wood-owl (*Strix woodfordii*) in the Miombo woodland vegetation.

Amphibians

Frogs (*Amietophrynus gutturalis*) were recorded in the Miombo woodlands of the Lake Agro farm. *Xenopus laevis* was recorded in the swampy areas of the farm (in the riparian woodlands). Frogs on the upland in the Miombo woodlands had rough skin while those seen in the pod waters of the Riparian woodlands had very smooth and slippery skin.

***Figure 18**: Frogs (Xenopus laevis) near the Luwombwa river*

Aquatic fauna

Crocodile (*Crocodylus niloticus*) was recorded because local people indicated that they have been seeing crocodiles in the Luwombwa River on several occasions. Fish was seen and recorded during the time of the field survey. The ones seen and recorded included tilapia (*Oreochromis Spp.*) and catfish (*Ictalurus Spp.*) However, local people reported that they do catch small breams and other types of fish in the Luwombwa River

Figure 19.: Part of the Luwombwa river near the project site

Fish

The Luwombwa river holds large populations of fish notably the Yellow fishe *Labeo spp.* and *Labeo barbus trachypterus*, Tiger fish (common only in the lower parts of the Luwombwa) and several Chiclidae ("bream") and Claridae (catfish).

Red Data List of fauna species

No animal or bird species on the Red Data List of Fauna species indicated by the species' conservation status as assessed by the IUCN (IUCN, 1996; Cotherill and Maree, 2008; Wikipedia, 2015),.were seen or recorded in the Project area.

5.3.2 Flora and Grasses

a) Regional Vegetation

The site falls with the Central Zambezian Miombo Woodland ecoregion, which covers about 50% of Zambia and predominates in the wettest parts of the country. The ecosystem of area can be considered typical for the plateau areas of central and northern Zambia, with a mixture of Zambezian elements and Congo Basin elements.

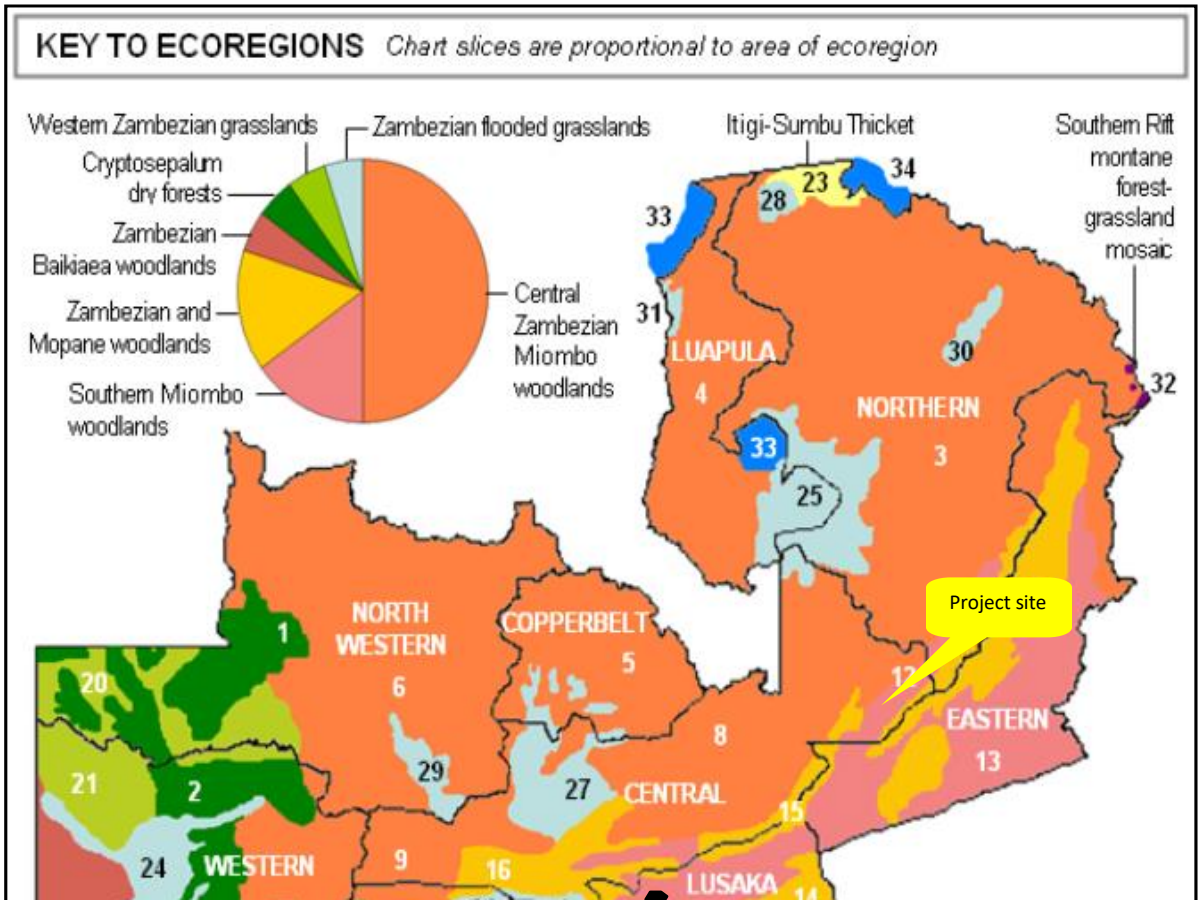


Figure 20.Agro Ecological Zones of Zambia

Survey and site selection

Two field surveys were conducted. They were carried out and three vegetation monitoring plots (plots 1, 2, and 3) were selected for use in the study. The selection of terrestrial sampling areas was based on a range of criteria. The criteria included the following; boundaries of the proposed development, proximity to access roads for ease of bio-monitoring, representativeness of the vegetation community, spatial representativeness with regard to distances from other vegetation communities (i.e. within the Project area).

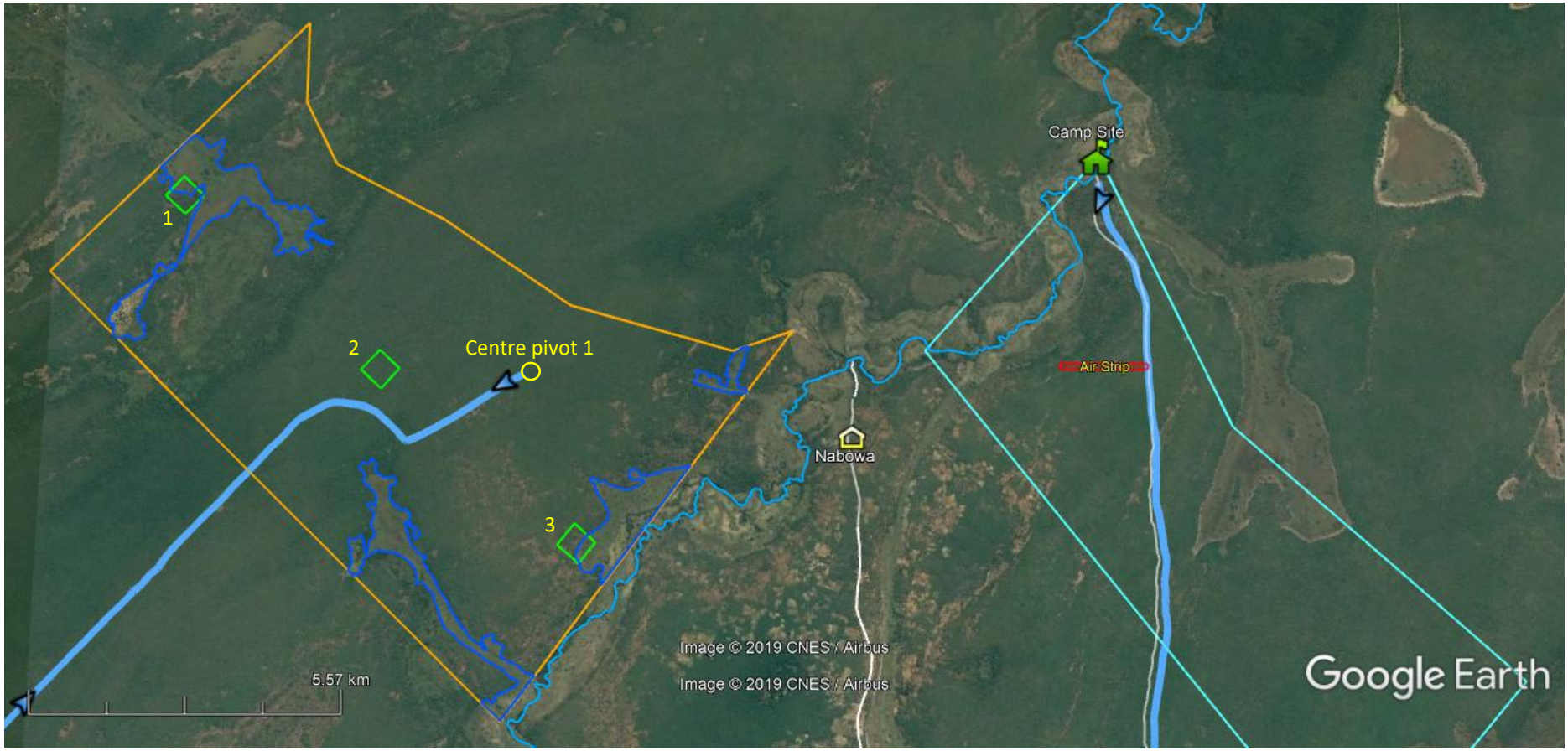
A Garmin Quest, Global Positioning System (GPS) Navigation instrument, was used by the study team to capture and record some of the geographical data in the project areas visited. Coordinates of the vegetation plot are presented below.

Table 17: Position of Terrestrial sampling plots at the Project Site

Sample plot	Position		Altitude (masl)
	Latitude	Longitude	
Plot 1	12°33'27.81"S	29°57'24.22"E	1192
Plot 2	12°35'14.61"S	29°59'28.08"E	1248
Plot 3	12°36'56.82"S	30° 1'28.76"E	1203

Position: - Grid: Lat/Lon hddd°mm'ss.s", Datum: Arc 1950 Source: Field survey

Waypoints, tracks and GPS coordinates were collected, recorded on the instrument and later exported to a web-based Google earth app. The photograph of the vegetation type is included in the appendices. They were taken in the vegetation monitoring plots. They were representing typical examples of the vegetation community. This was done during the walking transects.



Legend

Boundary of Lake Agro farm

Road to Serenje Town

Luwombwa River

Boundary of Swampy area

Vegetation monitoring plot

Road to Nabowa

Boundary of Gulf Sanctuary Farm

Figure 21.:Satellite image showing a vvegetation monitoring plot

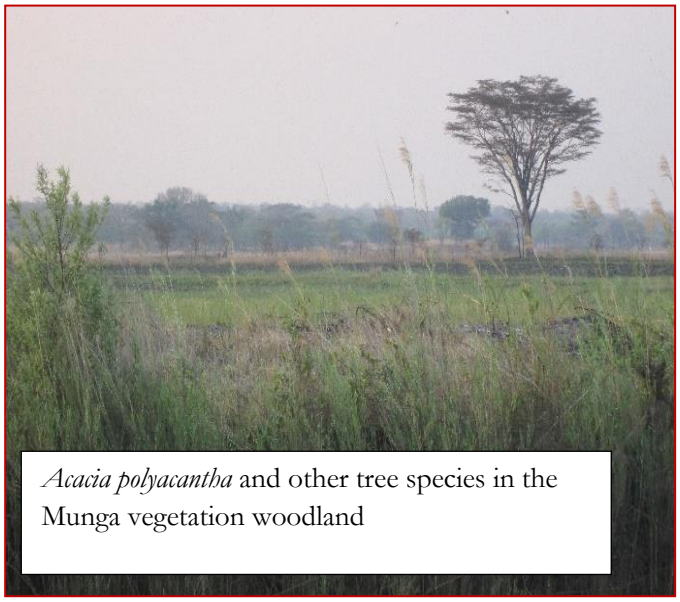
The preliminary study indicated four main vegetation types that can be floristically and physiognomically distinguished from each other – Miombo, Chipya, Riverine grassland and Mateshi woodlands.

Miombo Woodland

The vegetation of the project site is characterised by Miombo trees (*Brachystegia sp.*), a member of the legume family. Specifically, the woodland of the site is, dominated by *Brachystegia,* and *Julbernardia species.* Notable tree species include *Brachystegia spiciformis, Brachystegia boehmii, Ficus ingens, Ficus sycomorus, Combretum collinum* and *Diplorhynchus condylocarpon* on the upland while *Acacia polyacantha, Piliostigma thonningii* and *Dichrostachys cinerea* are prominent on lower lands i.e. the swamps and along the Luwombwa River.

In the Miombo woodlands, the upper storey was characterised by trees of *Brachystegia Spp.* while the lower one was characterised by a variety of few shrub species. The Munga woodlands was dominated by *Acacia polyacantha* and *Piliostigma thonningii* with *Hyparrhenia filipendula* as the dominant grass species. A deciduous woodland dominated by the leguminous tree genera *Brachystegia*, *Julbernardia* and *Isoberlinia*. Important non-leguminous genera in miombo are *Uapaca*, *Protea* and *Faurea* were also present. The structure of miombo was typically a two or three storeyed woodland in which the canopy attained a height of 15 m or more, largely depending on soil factors. The herbaceous layer was mostly sparse with tall grass.

Mature stand of *Brachystegia Spp. in the* Miombo woodland vegetation



Acacia polyacantha and other tree species in the Munga vegetation woodland

Figure 22.:Trees and shrubs in the flora monitoring plots

Chipya Woodland

The other vegetation type often occurring in mosaic with miombo was 'chipya', a wooded grassland dominated by fire resistant woody species such as *Terminalia mollis*, *Erythrophleum africanum* and *Combretum* spp., and tall grasses of the sub family Andropogonae. The Chipya woodland which is normally maintained by

frequent fires, could be floristically distinquished from miombo because it does not contain *Brachystegia*, *Julbernardia* or *Isoberlinia* species or any of the other miombo dominants. Chipya occured in small parcels throughout the site. About 17% of the land could be physiognomically classified as Chipya. Trapnell, 1943 and Trapnell *et al.*, 1947 in his studies, confirmed that *Aframomum alboviolaceum*, *Pteridium aquilinum* subsp. *centrali-africanum* and *Smilax anceps* are given as indicator species of chipya, and major constituents of the unusually dense herbaceous layer characteristic of this vegetation type.

Figure 23: Chipya woodlands with tall burnt trees

Riverine Grassland and Associated woodland.

The riverine grassland occupied about 22% of the land mass on the site. It was located near the Luwombwa River and on the central parts of the site. These grassy and seasonally waterlogged depressions which can also be called dambos were characterised by poorly drained acid vertisols and dominated by the nutritionally poor grasses *Loudetia simplex* and *Hyparrhenia* spp, *Seteria* and sedges including *Cyperus papyrus*. Also associated with water is the riverine forest known locally as 'mushitu'. This is a three storeyed forest found flanking rivers and streams, and sometimes extending to swampy areas. Mushitu is dominated by large trees such as *Khaya nyasica*, *Parkia filicoidea* and *Diospyros mespiliformis*, with climbers and under storey species forming more or less dense thicket. This vegetation type is an important grazing habitat associated with the GMA's perennial river the Luwombwa and their tributaries.

Trees: *Brachystegia longifolia, Brachystegia spiciformis, B. floribunda, B. boehmii, Julbernardia paniculata, Isoberlinia angolensis, Marquesia macroura, Parinari curatellifolia, Strychnos cocculoides, Albizia adianthifolia, A. anthelmintica, Erythrophleum africanum, Pterocarpus angolensis, Vangueria madagascariensis, Vangueria infausta, Vangueria lanciflora, Lannea discolor, Uvariastrum hexalobioides, Erythrina abyssinica. Diplorhynchus condylocarpon, Uapaca kirkiana, U. nitida, Phyllocomosus lemairei, Pseudolachnostylis maprouneifolia, Anisophyllaea boehmii, Baphia bequaertii, Monotes africana, M. katangensis, Strychnos innocua, Syzygium guineense ssp. macrocarpum, Garcinia huillense, Rothmannia engleriana, Ochna*

schweinfurthii. Euphorbia ingens, Acacia polyacantha, Azanza garckeana, Senna petersiana, Pericopsis angolensis, Markhamia obtusifolia, Steganotaenia araliacea, Ficus sycomorus, Strychnos cocculoides, Piliostigma thonningii. Combretum collinum.

Herbaceous plants: *Pteridium aquilinum ssp. Commelina benghalensis* and *Rhynchosia inignis* (O. Hoffm.) R.E. Fries are some of the common herbaceous plants found in the Lake Agro farm area i.e. based on information obtained from the local people.

Figure 24: Riverine grasslands within the project site

Mateshe woodland

Mateshe is invariably associated with chipya as small patches of relict 'mateshe' (or 'mateshi'), it is a two-storeyed, closed dry evergreen forest characterised by tall canopy species such as *Entandrophragma delevoyi* and *Parinari excelsa* and a diversity of climbers and understorey species which form a dense impenetrable thicket below the canopy. In this vegetation type the ground layer was extremely sparse, being confined to a few mosses, ferns and broad-leaved grasses. It occupied an area less than 7% of the total site.

Figure 25: Mateshe woodland within the project site

Findings

Vegetation monitoring plot 1 in the north western side and vegetation monitoring plot 3 on the southern side of the project area were composed of the Riparian (Munga) vegetation. Vegetation monitoring plot 2 in the central part of the project area was well vegetated and no subsistence farming was being practiced. At the time of conducting the field survey, the area was used by wild animals for grazing and browsing. Few small mammals were recorded during fieldwork. Large mammals were recorded based on information from the local people. Relatively large mammals such as the, impala (*Aepyceros melampus subsp. melampus*), common duikers (*Sylvicapra grimmia*), bush bucks (*Tragelaphus scriptus*), were reported to have been seen by some local people, these were also recorded as part of wild animals of the Project site. Evidence of their prevalence could also be seen from the dung.

Different terrestrial bird species were identified and recorded in the study area. Few aquatic bird species were recorded.

Reptile surveys did not yield sufficient data to describe the reptile communities of the study area, however, information on the prevalence and type of reptiles was obtained from literature review as well as the local people upon interviewing them. Snake in the area include the Black-necked Spitting Cobra (*Naja nigricollis*), Black Mamba (*Dendroaspis polylepis*), Green Mamba (*Dendroaspis angusticeps*), Rhombic Night Adder (*Causus rhombeatus*), Puff Adder (*Bitis arietans*) and the Tree-snake/Boomslang (*Dispholidus typus*) which are south-central African endemics, suggesting that a moderate level of endemism is present. Few frogs were seen, they included the *Xenopus laevis* in the swamps which is endemic to south-central Africa and the *Amietophrynus gutturalisin* the Miombo upland forest. Lizards recorded included the Striped Skink (Trachylepsis) and Bushveld Lizard (*Heliobolus lugubris*). Other reptiles reported to have been seen by the local people included the Dwarf Chameleon (*Bradypodion pumilum*).

A variety of insect species (Class Insecta) was also identified and record during the field survey as presented later in the report. The most conspicuous ones were the grasshoppers (Family Acrididae, order Orthoptera, suborder Caelifera). Others in smaller numbers were the praying mantis (order Mantodea) and African honeybee (*Apis mellifera scutellata*).

5.3.3 Services

- The power source to the proposed project site shall be by ZESCO limited. The main electrical installations where operations will occur shall be connected to the existing grid from Kabeta
- The water supply is envisaged to be from Luwombwa river.
- The developer will focus on local labour services at all stages of the project.

5.4 Socio - Economic Environment

5.4.1 Population and settlements

The total population of Serenje according to the 2010 CSO report, is 160,152. Settlements in project area are linearly aggregated in plateau area along the Serenje Mapepala road, with densely populated Mukomansala, Mapepala, Shindaila, and Nabowa villages and along Chimupati - Mutale - Kabundi - Kabeta and Masunga areas. The population in these villages estimated about 427 households with an average of six people per household. The area away from the road is sparsely populated. Other major settlements occur in the plateau areas close to Serenje where densely population also occurs. The main language group is Lala.

There are no settlements nor farming fields in the project site.

5.4.2 Local Economy

Central province is found in the central part of Zambia. The provincial capital is Kabwe. Administratively, the province is divided into 9 districts, of which Chitambo District is one.

Poverty within Chitambo District is rife. Subsistence farming is the most common means of livelihood in the area (80%) followed by charcoal burning (10%). Other economic activities in the area include petty trade (3.5%), hunting and gathering of game meat and wild fruits and vegetables (2%).

5.4.3 Education

Education is critical in enhancing a country's socio-economic development. Education in every sense is one of the fundamental factors of development. No country can achieve sustainable economic development without substantial investment in human capital. Education enriches people's understanding of themselves and the world. It improves the quality of people's lives and leads to broad social benefits to individuals and society. Education raises people's productivity and creativity and promotes entrepreneurship and technological advancement. In addition, it plays a very crucial role in securing economic and social progress and improving income distribution. Therefore, the importance of education cannot be overemphasized as it plays an important role in reducing poverty and social injustice by providing the underprivileged resources and opportunities for upward social mobility and social inclusion

However, in the immediate project area educational facilities are lacking and most of the children do not go to school. The nearest school to the project area is about 14km in Mapepala Basic School. There is no established school within the farm area.

5.4.4 Health

The health institutions in Chitambo include Serenje District Hospital, Malcom Moffat Health Centre located in town. The nearest health facility to the project area is the Chibobo health post which handles small cases. Most cases are usually referred to the district hospital.

The HIV epidemic in Zambia came to the fore in the 1980s. The HIV epidemic was generalized i.e. HIV was spreading throughout the population and not only in specific population groups. Most of the HIV transmission was by heterosexual contact and mother-to child transmission during pregnancy, at birth and through breastfeeding (NAC, 2012).

In the epidemiological synthesis of the epidemic, it was estimated that most of the new infections among adults were in individuals whose partners had casual heterosexual sex (37 per cent), followed by individuals reporting casual heterosexual sex (34 per cent), those reporting low risk heterosexual sex i.e. mutual monogamy (21 per cent), and clients of female sex workers (4 per cent). One per cent of new infections were estimated to occur in sex between men through unprotected anal sex and 3 per cent from other causes. About 10 per cent of babies born to mothers infected with HIV got infected with HIV. Other means of infection contributed an estimated less than 0.5 per cent each to the transmission of HIV among adults and children. Transmission through medical injections was estimated to contribute only about 0.2 per cent (ZNAC, 2009).

According to the Central Statistical Office (2010), the estimated HIV prevalence in Chitambo District is 9.60%, estimated number of People Living with HIV (PLHIV) is 8, 326 (both sexes) and of these 57.19% are females. The estimated total number of Orphans and Vulnerable Children (OVC) is 16, 308 (89.9% - single orphans and 10.10% - double orphans). The total population for Serenje is 160, 152 (78, 766 males and 81, 386 females).

5.4.5 Social Fabric and Structure of the project site

The project area has a diverse mix of ethnic or tribal groupings with their corresponding Bantoid languanges. The most predominant spoken language of communication in the area is Lala with the majority population using it. Other languages spoken in the area Bemba and Lenje.

5.4.6 Infrastructure

Serenje town has a relatively developed infrastructure consisting of road and transport, schools, tele-communications, markets, stores, electricity, hospital, clinics, input supplies and banking facilities. The district council provides services and facilities such as water supply, and residential areas. However, outlying areas away from Serenje such as Mapepala, Nabowa and Kabeta have poorly developed infrastructure. They lack infrastructural facilities telecommunications and markets.

5.4.7 Road Network

The project area has two feeder roads connecting it directly to Serenje Central Business District. One road runs from the Central Business District to Mapepala and another road passes through Kabeta and makes a loop route back to the project site. The settlement pattern is linear along the road. Land Use

5.4.8 Land Ownership and Zoning

The ownership of the project site is vested in the interest of Lake Agro Industries Limited.

5.4.9 Governance and Culture

Zambia's contemporary culture is a blend of values, norms, material and spiritual traditions of more than seventy (70) ethnically diverse people. Most of the tribes of Zambia moved into the area in a series of migratory waves a few centuries ago. They grew in numbers and many travelled in search of establishing new kingdoms, farming land and pastures. Major tribes in the project area include Lala and Bemba who generally have a common social and cultural set-up. The native people in the project area and surrounding areas are mostly of Lala ethnic background. Two features distinguish the culture of the Lala People. First is their economic dependence on ancestral land. This can be clearly seen in their sense of traditional ownership of land and unrestricted access to the use of the natural resources in the area through various traditional practices. Secondly is their strong decentralized traditional leadership hierarchy. The Chief is the head of a clan with the Chilolo (indunas) acting as advisors to the chief and the sulutanis (Headmen) acting at the ground level on behalf of the chief. Among other responsibilities, the Sulutanis are charged with the responsibility of administering land and the local people on behalf of the chief.

It is a common practice among these tribes that a greeting is always exchanged before any conversation. Many tribal customs are still being practiced in the study area. It is a tradition that gifts are often offered to visitors as sign of honour, friendship or gratitude. One should never refuse a gift and it must be accepted with both hands at the same time expressing thanks.

In the immediate project area, 'Lobola' the bride price is still widely practiced and is a token of appreciation to the parents of the girl. Another common practice among these tribes is that the bride is taken to the man's village the evening before the wedding. Large quantities of food are prepared and home-made beer is brewed to celebrate the marriage in a communal manner as even the contributions toward hosting a wedding are community based or within the village set-up.

Funerals are also big occasions in villages. During the time of bereavement, members of the village come together to provide emotional, spiritual and material support to the bereaved family. Traditionally, grief is shown through wailing and dancing and becomes quite an emotional affair which affects almost the whole village. During the funeral members of the affected community gather together at the funeral house and refrain from work, especially on the day of burial.

Most of the people in the project area are religious and belong to Christian denominations such as Jehovah's Witnesses, United Church of Zambia, Roman Catholic, Seventh Day Adventist, Baptist, Christian Missions in Many Lands (CMML), and various Pentecostal churches. On their days of worship, members of the aforementioned churches refrain from work and go to church to worship their creator.

5.4.10 Religious Practices and Beliefs

From a general socio-economic survey of the area, it is estimated that over 80% of the local people embrace the Christian faith. This implies that the church is a very important institution in Chitambo District and therefore plays an important part in the lives of most residents.

5.4.11 Household

Household refers to a place where several family members live together. However, for the purpose of this report household is defined in the context of land and refers to the number of people, related or not, living on given plot of land. The people in the area depend on farming and so their households are mainly that of the farming community. The study found out that the mixture of tribes in the area also brings diversity in the kind of life style people live here.

5.4.12 Population

The population of Central province stood at 1 267 803 in 2010 (Census 2010) and the Chitambo district had a population of 218,328 out of which 110,177 were women and men stood at 108,151. .The district has a 17.2% share of the population of central province. It had the second highest growth rate in the province. According to Zambian census report starting from the year 1990, 2000, and 2010 the population of the district has been growing steadily by 4% between 1990 – 2000 and 29.8% between 2000 – 2010 respectively. The contributing factors to this population growth in the area is as a result of increased economic activities in the area especially that of agriculture in nature. The agriculture sector in district has been growing steadily in the last decade causing an influx of people from elsewhere in the country to come and settle in search of green agriculture pastures.

5.4.13 HIV/AIDS

The Zambia HIV/AIDS epidemiological report of 1985 – 2010 shows that the prevalence rate of HIV stood at 9.60%. The district had 9,874 people living with HIV / AIDS and of this 52.65% were women; while OVCs stood at 16,852 and of this 91. 20% were single and 8.80% dual. The district had 14 stakeholders looking into the affairs of HIV/AIDS.

5.4.14 Archaeological and Cultural Environment

There are no heritage sites within the project area. The proposed project area does not have any features which have been confirmed and classified as one with cultural or heritage value. However, during site verification, any discoveries of possible ancient cultural, historical and natural heritage features will be reported to the NHCC for appropriate activation so that such can be classified.

Table 18: Epidemiological projections report 2010

Province	District	Total Population	Male Population	Female Population	Est.HIV Prevalence	Est. # PLHIV Both (Sexes)	Est.% PLHIV (Females)	Estimated # (OVCs)	Est. % Single (OVCs)	Est.Dual (OVCs)	Number of Stakeholders
Central	Chibombo	293,765	145,438	148,327	9.60%	14,840	52.53%	26,001	90.80%	9.20%	20
Central	Kabwe	202,914	99,561	103,353	19.60%	24,052	52.22%	25,242	84.30%	15.70%	26
Central	Kapiri Mposhi	240,841	118,843	121,998	15.30%	20,314	52.15%	29,558	87.10%	12.90%	21
Central	Mkushi	151,803	76,064	75,739	9.60%	6,916	52.72%	14,272	90.20%	9.80%	18
Central	Mumbwa	218,328	108,151	110,177	9.60%	9,874	52.65%	16,852	91.20%	8.80%	14
Central	Serenje	160,152	78,766	81,386	9.60%	8,326	57.19%	16,308	89.90%	10.10%	31

6 POTENTIAL ENVIRONMENTAL IMPACTS AND THEIR MITIGATION MEASURES

The following sub-sections highlight the key environmental, socio-cultural and economic impacts potentially associated with the proposed project. Significance of an impact is a function of the severity of the potential impact (in terms of actual consequence or severity, duration or frequency and spatial scale or extent of the impact, as well as the sensitivity of the element being impacted) and the probability of the impact occurring.

Impacts were assessed based on the on significance and likelihood following the information gathered during the scoping process, the environmental baseline study of the project area which included several field visits to the project site and its surroundings, as well as a desk study of relevant existing documents and information pertaining to the study and information describing the nature and design of the proposed project. The impacts are discussed according to the phases of the project i.e. preparation, construction, and operation phases. They are also classified whether positive or negative.

The environmental impact assessment revealed no serious adverse impacts of exceptional importance that would be considered unprecedented or irreversible in nature. The positive and negative impacts identified with due consideration to issues discussed in earlier sections were based on the development design, project details, environmental and socio-economic baseline studies as well as expert judgment.

6.1 Impact Criteria

In accordance with IFC Performance Standard 1 Assessment and Management of Environmental and Social Risks and Impacts, the methodology for this ESIA has been developed in accordance with good international industry practice and potential impacts have been identified in the context of the Project's area of influence.

Prediction and evaluation of environmental and social impacts within this of the ESIA are considered against the baseline (including its value/sensitivity). In addition to the Key Principles provided by ZEMA, and as a basis for assessing environmental impacts, the methodology applied to this ESIA has been developed using a combination of the criteria, methodology and guidance provided by international requirements/best practice.

The ZEMA key Principles are as follows:

- *Nature and magnitude of the intended activity and the existence of similar projects at the site or similar sites;*
- *Extent of the impact of the proposed project*
- *Location of the project and the nature of the surrounding environment and nearby residential clusters*

The international sources considered are as follows:

- IFC (2012) Performance Standard 1 IFC Performance Standard 1 Assessment and Management of Environmental and Social Risks and Impacts (and associated Guidance Note);
- Directive 2011/92/EU on the assessment of the effects of certain public and private projects (codified version of the initial Directive of 1985 and its three amendments 97/11/EC, 2003/35/EC and 2009/31/EC)5; and

- Impact Assessment Guidelines and the ES Review Criteria from the Institute of Environmental Management and Assessment (IEMA).

The assessment of the issues has been conducted according to a synthesis of criteria required by the integrated environmental management procedure defined below.

6.1.1 Nature of Impact

This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. Its description should include what is being affected and in what way.

6.1.2 Direct Impact

An impact that appears immediately as a result of an activity of the project. For example, the loss of ecological habitat is a direct impact.

The direct impacts would be experienced mainly during the site preparation and clearing, and include effects on the physical environment, health and safety of the workers during the developmental phase.

6.1.3 Indirect Impact

An impact that is related to the project but it's of secondary nature. It only shows in an indirect way. For example, the plant may cause indirect impacts on the local economy of a community by increasing accessibility to other markets.

The indirect impacts are primarily socio-economic and extend beyond the project implementation. The indirect impacts include changes in economic activities and long-term changes, such as increased land degradation due to developments at and around the project site.

Unlike the direct impacts, which occur in the immediate environment, the indirect impacts would be felt in the adjacent regions.

6.1.4 Spatial Extent

The physical and spatial size of the impact is a description of whether the impact would occur on a scale described as follows:-

- Site, the impact could affect the whole or measurable portion of the site. Whether it is limited to the immediate area of the proposed project;
- Local, the impact could affect the extended area adjacent to the site perhaps a neighbourhood or small town. Whether it would affect environs up to 15km outside the immediate environment;
- Regional, that impact could affect the area including the outlying areas of the city, the transport routes and the adjoining towns,

- National, the impact could be as far as reaching international boundaries.

6.1.5 Frequency

Frequency is the incidence, occurrence, regularity, rate or rate of recurrence of the source of impact. This is measured by the number of times of occurrence of the source of impact due to the proposed development.

- Occurs once, where the source of impact will either occur once and disappear with mitigation or will be mitigated through natural process after occurring once due to the proposed development;
- Occurs twice, where the source of impact will occur twice at any given phase of project implementation and thereafter it will be entirely negated; and
- Occurs more than twice, where the source of impact will continue or occur more than two times for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter.

6.1.6 Duration

The lifetime of the impact; this is measured in the context of the life-time of the proposed development.

- Short term, the impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the preparatory phase,
- Medium term, the impact will last for the period of the preparatory phase, thereafter it will be entirely negated,
- Long term, the impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter,
- Permanent, the only class of impact which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

6.1.7 Intensity

A description of whether or not the intensity (magnitude) of the impact would be high, medium, low or negligible (no impact). An attempt will be made to quantify the impacts on components of the affected environment to be described as follows: Is the impact destructive, or benign? Does it destroy the impacted environment, alter its functioning, or slightly alter it? These are rated as follows:-

- Low, where the impact will not have significant influence on the environment, and this will not be required to be significantly accommodated in the project design or implementation; the impact alters the affected environment in such a way that natural processes of functions are not affected in any significant way,

- Moderate, where it could have an adverse influence on the environment, which would require modification of the project design or alternative implementation schedules; the affected environment is altered, however, function and process continue, albeit in a modified way,

- High, where it could have significant influence on the environment but cannot be mitigated or be accommodated by the project environment by introducing alternative mitigation measures such as realignment at a particular stretch or adoption of different design measures. Function or process of the environment is disturbed to the extent where it temporarily or permanently ceases.

This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Note that some impacts have a high intensity and a short duration with no permanent audio effects.

6.1.8 Severity

This describes whether the severity (harshness / gravity) of the impact would be high, medium, low or negligible (no impact). The severity of the impact will be qualitatively determined on the components of the environment to be affected by taking into consideration the following questions. Is the impact harsh, serious or dangerous? Does it degrade the impacted environment, alter its functioning, or slightly modify it's natural state? These are rated as follows: -

- Low applies where the impact is very little and will not have significant influence on the environment. This will not be required to be significantly accommodated in the project design or implementation and the impact changes the affected environment in such a way that natural processes of functions are not affected in any significant way;
- Moderate, applies where the impact could have an adverse influence on the environment and would require some modification of the project design or alternative implementation schedules. In this regard, the affected environment is altered while the function and process continue, albeit in a modified way; and
- High, applies where the impact could have significant influence on the environment but cannot be mitigated or be accommodated by the project environment by introducing alternative mitigation measures such as realignment at a particular stretch or adoption of different design measures. In this regard, the function or process of the environment is disturbed to the extent where it temporarily or permanently ceases.

6.1.9 Probability

This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:-

- Unlikely, the probability of the impact occurring is very low, due to the circumstances, design or experience,
- Possible, the impact could possibly happen, and mitigation planning should be undertaken,
- Probable, it is most likely that the impact will occur at some or other stage of the development. Plans must be drawn up before the undertaking of the activity,
- Definite, the impact will take place regardless of any prevention plans, and only mitigatory actions or contingency plans can be relied on to contain the effect.

6.1.10 Sensitivity

The sensitivity of the element being impacted would be regarded as being high, medium, low or negligible (no impact). An effort will be made to determine the qualitative sensitivity of the element of the environmental components being impacted upon due to the proposed development. Is the reaction of the environmental component due to the impact acceptable or not? Does it destroy the impacted environmental component, alter its functioning, or slightly alter it?

- Low, where the sensitivity of the element being impacted will not have significant influence on the environmental component, and this will not be required to be significantly accommodated in the project design or implementation. The impact to the affected environment will be in such a way that natural processes of functions are not affected in any significant way;
- Moderate, where the sensitivity of the element being impacted could have an adverse influence on the environmental component, which would require modification of the project design or alternative implementation schedules. The affected environment is altered while the function and process continue and the albeit in a modified way; and
- High, where the sensitivity of the element being impacted could have significant influence on the environmental component but cannot be mitigated or be accommodated by the project environment by introducing alternative mitigation measures such as realignment at a particular stretch or adoption of different design measures. The function or process of the environment is disturbed to the extent where it temporarily or permanently ceases.

6.1.11 Determination of Significance

The community provides information on the characteristics of the impacts and the significance is determined based on this information.

Significance is an indication of the importance of the impact in terms of physical extent, intensity and time scale, and therefore indicates the level of mitigation required.

The classes are rated as follows:-

- Negligible, the impact is not substantial and does not require any mitigatory action,
- Low, the impact is of little importance, but may require limited mitigation,
- Moderate, the impact is of importance and therefore considered to have mitigation. Mitigation is required to reduce the negative impacts to acceptable levels or positive impacts maximised,
- High, the impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential. Positive impacts should be enhanced as a priority.

From the baseline information assembled in the previous chapter coupled with the information gained during the consultation stage, the expected environmental impacts can be categorised into positive and negative impacts.

In addition, it is important to consider the duration of the impact and at what phase of the project it occurs, i.e. impacts during site preparation phase or impacts over the life of the plantation (operational phase) and whether the impacts are direct (i.e. removal of vegetation) or indirect (increased sexual diseases as a result of the improved wages).

6.2 Positive Socio Economic Impacts during the operational phase.

6.2.1 Economic multiplier effects at the National Level

To sustain operations, more inputs such as seed, chemicals, farm equipment and associated services will be required. These will have to be out sourced from other firms and consequently provide increased opportunities for job creation. This will have an economic multiplier effect once successful and result in more income for government through various taxes.

6.2.2 Contributions to National food security from crop production

Out of the total territorial land area of 752,000 square meters, 60% is classified as medium to high potential for agricultural production given the abundance of water resources. However, less than 15% of the potential hectares is under cultivation (MAFF, 2010) and as a result the country has failed to attain total food security. This has been attributed to Zambia's heavy dependence on rain fed agriculture which most times have been unreliable. LAIL will therefore contribute positively to national food security through sustainable irrigated crop production.

6.2.3 Contributions to National Gross Domestic Product

The government has recognized agriculture as one of the priority sectors that is capable of contributing significantly to the country's Gross Domestic product (GDP). Zambia is also endowed with soils and climatic conditions favorable for grain production. Crop production shall significantly contribute to the country's diversification Programme of making agriculture one the main contributor to GDP.

6.2.4 Provincial and district impacts

Sustained crop production at LAIL will have positive socio-economic impacts in Chitambo District and the Central Province as a whole in the area of improved employment opportunities and increased income in the form of taxes for local authorities. Consequently, this will result in improved availability and access to social services. At district level, local people will benefit from improved opportunities for training in various agricultural-related jobs making them more employable. This will result in increased income and improved standards of living for local households.

6.2.5 Employment, skills transfer and human resource capacity development

Statistics show that 80% of the population is dependent on agriculture with about 70% of the country's labour force being employed in the sector. With the proposed project, more employment opportunities will be created at LAIL and this will directly improve the wellbeing of the local people.

6.2.6 Economic multiplier effects at the local level

The concentration of people as a result of the operations will lead to the creation of a large market for trade in various items including food stuffs. Consequently some families within the surrounding communities will make a decent living by trading in food stuffs, groceries and other items on demand by LAIL staff and their families.

6.2.7 Improved health and education facilities for employees

The project will positively impact on health conditions and literacy levels for employees and their families.

Table 19: Evaluation of Impacts on the Socio-economic and Cultural Environment during Construction and Operation Phases

	Environmental Aspects	Type of Impact	Spatial Extent	Frequency	Duration	Intensity	Severity	Probability	Sensitivity	Determination of Significance
Identified Socio-Economic Impacts										
	Economy and Society	Direct	Local	Once	Short to Medium	Moderate	Low	Probable	High	High
	Employment / Job Opportunities	Direct	Local	Twice	Short to Medium	Moderate	Moderate	Definite	High	High
	Peoples Health and Well Being	Indirect	Local	More than Twice	Short to Medium	Low	Low	Possible	Low	Low
	Revenue for the government	direct	local	More than Twice	Short to Medium	Low	Low	Possible	Low	Low
	Health Risk of Workers	Direct	Site	More than Twice	Short	Low	Low	Possible	High	High
	Safety and Risk of Workers	Direct	Site	More than Twice	Short	Moderate	Moderate	Possible	Low	Moderate
	Population Influx	Indirect	Local	More than Twice	Short to Medium	Moderate	Low	Probable	Moderate	Low
	HIV / AIDS / STDs and Malaria	Indirect	Local	More than Twice	Short to Medium	Moderate	Moderate	Possible	Low	Moderate
	Improved Educational / Literacy Levels	Indirect	Local	More than Twice	Short	Low	Low	Possible	Low	Low
	Improved Land Use	Indirect	Site	Once	Short	Low	Low	Definite	Low	Moderate
	Resettlement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	High

	Loss of Access Routes	Direct	Site	Once	Short	Low	Low	Definite	Low	Low
.	**Improved local capacity**	direct	Site	N/A	N/A	Low	Low	Probable	High	High
	Loss of Customary Rights	Indirect	Site	N/A	N/A	Low	Low	Probable	moderate	Low
	Loss of Amenity Values	Indirect	Site	N/A	N/A	Low	Low	N/A	Low	Low
	Loss of Ethnicity	Indirect	Site	N/A	N/A	Low	Low	Probable	Low	Low

6.3 Anticipated Negative Environmental Impacts

6.3.1 Impacts on terrestrial ecological and ecosystem services processes

The removal of vegetation for creation of agricultural fields and associated infrastructure development definitely causes loss of vegetation communities. These are dynamic ecosystems that provide habitats that support all forms of life. Flora removal will lead to the loss of some plant species thus disturbing the physical and biological characteristics of the mature closed *Miombo* woodland paving way to open Miombo (Chipya), young regeneration and finally to open grass lands or vice-versa. Therefore expected impacts include loss of miombo woodland, creation of riparian forest and dambos.

Another important impact on vegetation is fragmentation, especially when this creates breaks in previously continuous vegetation, causing a reduction in the gene pool and a decrease in species richness and diversity. However, this impact is expected to occur when large areas are cleared for agriculture fields without leaving patches of vegetation connecting to each other through the area.

The removal of existing vegetation creates 'open' habitats that will inevitably be colonised by pioneer plant and animal species. While this is part of a natural process of regeneration, which would ultimately lead to the re-establishment of a secondary vegetation cover, it may favour the establishment of undesirable species in the area Once established, these species are typically very difficult to eradicate and may then pose a threat to the neighbouring ecosystem.

6.3.2 Loss of species of special concern and biodiversity

Clearing land for agriculture has a potential for loss of species of special concern, and perhaps other species important to the functioning of the ecosystem functioning. This could result in a loss of biodiversity.

Loss and fragmentation of sensitive habitats

The clearing of land for agricultural fields and subsequent loss of the vegetation and surrounding areas, the development of road linkages and related infrastructure, including human habitations, workshops and dumps shall to some extent lead to loss and fragmentation of sensitive habitats:

Miombo habitat
Dambos habitat
Riparian habitat
Transformed habitat

Loss of faunal diversity

Farming activities have potential to lead to habitat loss and mortalities directly or indirectly associated with specific farming actions and loss of faunal diversity. This can vary between the vertebrate groups, depending upon their sensitivity

6.3.3 Impacts on climate change

The global phenomenon of the warming of the earth's atmosphere, once only conjecture, is now an observed reality. It is estimated that under current emissions trends, by 2100 average temperature will increase between 4° and 7° C, with potentially catastrophic social and environmental consequences, including rising sea levels, inundation of coastal cities, and large-scale ecosystem transformations (Moutinho and Schwartzman, 2011). Climate change issues are of both a local and global concern and all anthropogenic activities contribute to climate change. Agricultural activities have the potential to affect both the local and global climate due to clearance of woodland for agricultural fields.

The loss of natural habitat also results in the loss of carbon sink stocks, which in turn contributes to global warming. Thus, even relatively small changes in climate will lead, over time, to large changes in the physical, chemical and ultimately, the biological composition of an ecosystem. Activities such as the destruction of vegetation (which acts as a carbon sink), use of fossil fuel energy and the improper disposal of biological non-processed waste etc, all disrupt the natural atmospheric carbon balance by contributing excess atmospheric carbon dioxide (CO_2) and methane (CH_4) into the atmosphere.

6.3.4 Impacts of the storage, management, use and disposal of agricultural chemicals and containers

Lake Agro shall have well-designed infrastructure for storage of chemicals. Management and use of these chemicals will be done following laid down procedures in line with regulations set out by ZEMA. The developer will ensure that:

- Chemical stores (including fuel, insecticides, etc) are bonded and locked at all times.
- Access to such stores is controlled at all times.
- Inventories of stored chemicals are maintained, and their use regulated.
- All cautions/recommendations with respect to storage and use of hazardous chemicals shall be carefully followed and implemented.
- Contaminated containers shall be disposed through well-established disposal companies registered with ZEMA.

6.3.5 Aesthetic and landscape quality impacts of woodland removal

Woodland clearing for agricultural fields may lead to the loss of some plant species thus disturbing the physical and biological characteristics of the mature closed *Miombo* woodland and paving way to open Miombo (Chipya), young regeneration and finally to open grass lands or vice-versa. These impacts on the aesthetic affect conditions of the project area in the long run.

6.3.6 Aesthetic and landscape quality impacts of centre pivots and farm structures

Poorly designed farm structures may affect the aesthetic condition of the area. In addition improper layout of agricultural fields may cloud centre pivots causing a visual impact. However, this impact is insignificant at

because the layout of the agricultural fields will be well designed and separated by undisturbed strips of woodland that is habitat to wildlife. The farm structure shall be designed and located in a manner that maintains, as far as possible, the indigenous trees and leaves the natural environment undisturbed.

6.3.7 Air quality deterioration

Dust is an important factor of environmental pollution. The generation of dust from the roads and fields during land preparation may impact on the air quality especially during the dry season when wind speed is high. However, this is not a daily activity but periodic and therefore, the impact on air quality tends to be minimal. The use of inappropriate methods of disposing chemical waste through open air incineration of chemical waste/containers negatively impacts on air quality.

6.3.8 Noise pollution

Use of farm equipment and vehicles that are not regularly maintained can lead to noise pollution.. Normally accepted ambient noise levels are 50 dB (A).

6.3.9 Polluting impacts of the storage, management, use and disposal of agricultural chemicals and containers

Usage and storage of chemicals if not managed properly can impact on the environment.

6.3.10 Impacts on surface water bodies, stream flows and water quality

Abstraction of water for irrigation may lead to lower water levels in surface water bodies. Hydrological changes in the river system may lead to greater area of influenced both upstream and downstream. The morphological features of the Luwombwa River may also change overtime. However, the impact was found to be moderately insignificant since irrigated water eventually seeps through into the local aquifer and regenerates.

6.3.11 Impacts on ecological processes in dambos, streams and rivers

Unregulated usage of agricultural chemicals can be the source of water and soil pollution. This includes chemicals and fumigant materials used to control pests in the field and storage areas. These may negatively impact on both surface and ground water quality. Oil waste and scrap metal from the workshops is another source of environmental pollution in this respect. These may pose a risk to sustainability of the aquatic ecosystem thus- diminishing benefits from ecosystem services.

6.3.12 Impacts on terrestrial ecological and ecosystem services processes

The removal of vegetation for creation of agricultural fields and associated infrastructure development definitely causes loss of vegetation communities. These are dynamic ecosystems that provide habitats that support all forms of life. Flora removal will lead to the loss of some plant species thus disturbing the physical

and biological characteristics of the mature closed *Miombo* woodland paving way to open Miombo (Chipya), young regeneration and finally to open grass lands or vice-versa. Therefore expected impacts include loss of miombo woodland, creation of riparian forest and dambos.

Another important impact on vegetation is fragmentation, especially when this creates breaks in previously continuous vegetation, causing a reduction in the gene pool and a decrease in species richness and diversity. However, this impact is expected to occur when large areas are cleared for agriculture fields without leaving patches of vegetation connecting to each other through the area.

The removal of existing vegetation creates 'open' habitats that will inevitably be colonised by pioneer plant and animal species. While this is part of a natural process of regeneration, which would ultimately lead to the re-establishment of a secondary vegetation cover, it may favour the establishment of undesirable species in the area Once established, these species are typically very difficult to eradicate and may then pose a threat to the neighbouring ecosystem.

Loss of species of special concern and biodiversity

Clearing land for agriculture has a potential for loss of species of special concern, and perhaps other species important to the functioning of the ecosystem functioning. This could result in a loss of biodiversity.

6.3.13 Loss and fragmentation of sensitive habitats

The clearing of land for agricultural fields and subsequent loss of the vegetation and surrounding areas, the development of road linkages and related infrastructure, including human habitations, workshops and dumps shall to some extent lead to loss and fragmentation of sensitive habitats:

Miombo habitat
Dambos habitat
Riparian habitat
Transformed habitat

6.3.14 Loss of faunal diversity

Farming activities have potential to lead to habitat loss and mortalities directly or indirectly associated with specific farming actions and loss of faunal diversity. This can vary between the vertebrate groups, depending upon their sensitivity

6.3.15 Aesthetic and landscape quality impacts of woodland removal

Woodland clearing for agricultural fields may lead to the loss of some plant species thus disturbing the physical and biological characteristics of the mature closed *Miombo* woodland and paving way to open Miombo (Chipya), young regeneration and finally to open grass lands or vice-versa. These impacts on the aesthetic affect conditions of the project area in the long run.

6.3.16 Loss of Livelihood

The empirical findings from this study are that there are no settlements nor farming fields in the project site. Understandably, being a green field with various forms of vegetation, it would lead to loss of means of livelihood for various forested products such as firewood, mushrooms, and medicinal herbs among others.

The forest in area is quite homogenous and people will easily have access to such forest services and products from other nearby areas that will not be affected by the project.

6.3.17 Aesthetic and landscape quality impacts of centre pivots and farm structures

Poorly designed farm structures may affect the aesthetic condition of the area. In addition improper layout of agricultural fields may cloud centre pivots causing a visual impact. However, this impact is insignificant at because the layout of the agricultural fields will be well designed and separated by undisturbed strips of woodland that is habitat to wildlife. The farm structure shall be designed and located in a manner that maintains, as far as possible, the indigenous trees and leaves the natural environment undisturbed.

Table 20. *Evaluation of Impacts*

Phase	Description of Impact	Type of Impact	Spatial Extent	Frequency	Duration	Intensity	Severity	Probability	Sensitivity	Determination of Significance
Impacts on Soil										
Site preparation and construction	Clearing of vegetation for site preparation.	Direct	Site	Once	Medium term	Moderate	Moderate	Probable	Moderate	High
	Exposed soil is prone to erosion by water or wind.	Direct	Site	More than twice	Medium term	Moderate	Moderate	Probable	Moderate	Moderate
Operational	Soil compaction due to vehicular movements	Direct	Site	More than twice	Medium term	Moderate	Moderate	Probable	Moderate	Moderate
Impacts on Vegetation/fauna										
Site preparation and construction	Loss of vegetation and organisms.	Direct	Local	Once	Medium term	Low	Moderate	Unlikely	Moderate	moderate
Impacts on surface and underground water										
Site preparation and Construction	Contamination of water due to oils, soils.	Indirect	Local	More than twice	Long term	Moderate	Moderate	Probable	Moderate	low
	Pollution of ground water from fuels, oils	Indirect	Local	More than twice	Long term	Moderate	Moderate	Possible	Moderate	low

Impacts on Air Quality										
Site preparation and Construction	Air pollution due to dust generated by vehicle traffic and transportation of lime, stone aggregates, materials; and fumes from vehicles	Direct	Local	More than twice	Short term	Moderate	Moderate	Possible	Moderate	low
Operational		Indirect	Site	More than twice	Long term	Moderate	Moderate	Possible	Moderate	moderate
Impacts on Noise										
Site preparation and construction	Noise generated by vehicles, equipment and general activities.	Direct	Site	More than twice	Short term	Low	Low	Probable	Moderate	low
Operational		Indirect	Site	More than twice	Long term	Low	Moderate	Possible	Moderate	Moderate
Impacts on Landscape and Aesthetics										
Site preparation and Construction	Aesthetic view due to distorted natural landscape.	Direct	Local	More than twice	Moderate	Moderate	Moderate	Definite	Moderate	Moderate

Operational	Farm infrastructure	Direct	Site	Once	Moderate	Moderate	Moderate	Probable	Moderate	Low
Impacts on Land-Use and Surrounding Environment										
Site preparation and Construction	Decrease or Increase in land values	Direct	Local	More than twice	Long term	Moderate	Moderate	Probable	Low	Low
Impacts of Work Accidents										
Site Preparation and Construction	Lack of safety and health regulations could impact negatively on workers.	Direct	Site	Once	Short term	Moderate	Moderate	Possible	Low	Moderate
Operational	Workers could be in danger of accidents.	Direct	Site	More than twice	Medium	High	Moderate	Possible	Moderate	Moderate

Table 21: Positive Socio-economic Impacts during the Operational Phase

Potential Impact	**Mitigation and Enhancement Measures**
National and international level impacts	Increased crop production levels the land under irrigation
Impact national food security from crop production	Invest more in its farm equipment and support infrastructure
Employment and skills transfer and human resource capacity development	Develop a human resources development plan and systems to ensure human resources development is done at the right time for the right people based on capacity building needs assessment
Local area and site impacts	Engaging local leadership to sensitize and foster economic programmes
Household incomes and food security impacts	Deliberately employing more locals where appropriate
Resettlement and compensation	There are no settlements in the project site. There no compensation is anticipated
Community access to local natural resources	LAIL shall draw up management structures and guidelines on local natural resources use for sustainable livelihoods and conservation practices for the resource
Improved health and education facilities for employees impacts	LAIL work hand in hand with relevant government departments and local authorities in identifying needy areas.

Table 22: Environmental Impacts during the Operational Phase Potential Impact

Positive Environmental Impacts during the Operational Phase Potential Impact	**Mitigation and Enhancement Measures**
Biodiversity contributions to sustainable agriculture	Ensure that appropriate land management practices including preservation of strips of undisturbed vegetation are fully embraced
Contributions to ameliorating climate change	Engage communities in surrounding areas to preserve trees and practice conservation agriculture
Soil loss from inappropriate land use practices	Embark on community programmes to sensitize workers to use appropriate methods of farming
Air quality deterioration	Use of Dust suppress methods and avoid open burning. Have well-designed incineration facilities to avoid air pollution.
Noise pollution	Construction will be done during the day and workers operating machines will wear protective clothing
storage, management, use and disposal of agricultural	Chemical stores (including fuel, insecticides, etc) are bonded and locked at all times.

Chemicals and containers impacts	Access to such stores is controlled at all times. Inventories of stored chemicals are maintained, and their use regulated. All cautions/recommendations with respect to storage and use of hazardous chemicals shall be carefully followed and implemented. Contaminated containers shall be disposed through well-established disposal companies registered with ZEMA.
surface water bodies, stream flows and water quality impacts	LAIL will ensure that no waste and other substances will be discharged into the Luwombwa river or any nearby stream.
Impacts on aquifers and groundwater water quality	Ensure that no waste of any kind is indiscriminately disposed off
Potential Impacts	**Mitigation/ Enhancement Measures**
surface water bodies, stream flows and water quality impacts	LAIL will ensure that no waste and other substances will be discharged into the Luwombwa river or any nearby stream.
Impacts on ecological processes in dambos, streams and rivers	No clearing will be done in dambos and sensitive areas
Impact on faunal diversity loss	Avoid clearing or damaging intact habitats Prevent exploitation of sensitive reptiles, e.g. monitor lizards, chameleons conduct sensitization on sustainable resource use. Conduct employees (induction training) and local villagers about the necessity of protecting wildlife Maintain habitat connectivity, particularly to protected areas, via habitat corridors (through the offsite biodiversity offset Undertake habitat clearance only during winter when birds are not breeding.
Impacts on terrestrial ecological and ecosystem services processes	Ensure strips of land with undisturbed woodland are preserved when clearing land for agricultural fields and centre pivot installation.
Loss of species of special concern and biodiversity	Species of special concern in case they are found during construction, they will be conserved.
Loss and fragmentation of sensitive habitats	Avoiding clearing or damaging Miombo habitat where possible Avoid creating isolated 'islands' of Miombo habitat Avoiding clearing or damaging riparian vegetation where possible, and limit river and stream crossings as far as possible.

	Avoid blockage or diversion of rivers and streams where possible. Avoid indirect effect of run-off erosion and sedimentation from roads that may lead to loss of riparian habitats. Monitor and maintain riparian habitat corridors and waterways in adjacent areas to maintain faunal connectivity and migration.
Occupational Health	Awareness and training of its employees on safety procedures as well as providing protective clothing and equipment.
Impacts of the storage, management, use and disposal of agricultural chemicals and containers	• Well-designed infrastructure for storage of chemicals. Management and use of these chemicals is equally done following laid down procedures in line with regulations set out by ZEMA.
Water abstraction	• LAIL will obtain water rights for irrigation from the necessary regulatory authorities. • Adequate technology to sensor flows • A good and effective monitoring system will be put in place during operations.
Deterioration of Water quality down stream	• Stick to good practices of irrigation operation rules of ensuring regulatory conditions is followed.
Erosion/sedimentation.	Carryout proper construction activities. Limit movement of heavy machinery only to designated access routes and operational areas
Displacement of people	Carry out detailed RAP
Safety and Health Risk of Workers	• Implementation of safety and health policies designed to identify, evaluate, monitor and control health hazards and provide safety training; • Employees shall familiarize with safety techniques through training; • LAIL management shall ensure that all visitors are briefed on potential hazards and necessary safety precautions; • Implementation of emergency procedure on site; • Use of clearly labelled signage; • Ensuring that employees wear protective clothing at all times; • Proper control and directing of traffic during material delivery.

7 ENVIRONMENTAL MANAGEMENT & MONITORING PLAN

7.1 Management of Soil

Mitigation measures due to soil displacement include the following:

- Minimum displacement of soils will take place on the site

7.2 Management of Flora

Mitigation measures due to change of flora will include the following:

- Unnecessary cutting of trees on the project site will be avoided
- Planting trees to maintain the ecosystem.

7.3 Management of Emissions

Mitigation measures due to dust emissions will include the following:

- Watering of exposed soil and covering roadways with laterite.
- Exposure of soils shall be minimized to avoid generation of dust.
- The speed of vehicles on the farm shall be limited by putting speed humps on the roads

7.4 Management of Surface and Ground Water

Measures to mitigate surface and ground water contamination will include the following:

- An effective drainage system will be put in place
- Oil spillages from vehicles and machinery will be avoided and only vehicles in good working condition will be maintained on the farm. Compliance with the Hazardous Waste Regulations will be priority.
- Adequate drainage will be provided to capture all waste water especially at vehicle washing bay.
- A good and effective monitoring system will be put in place during operations.
- Regular surface and ground water samples will be collected and analysed. Results will be submitted to the ZEMA twice a year.

7.5 Management of Solid Waste

Measures to mitigate solid waste management include the following:

- All containers that may have contained chemicals will be triple rinsed, punctured buried at the disposal site.
- Solid waste generated from the plants will be dumped at the dumpsite located within the farm
- A waste management system will be put in place at the farm
- Composting of certain domestic e.g. garden waste will be encouraged.

- All workers on the farm will be provided waste management training.

7.6 Management of Sewer and Waste Water

Mitigation measures due to change of sewer and waste water will include the following:

- All septic tanks will be contracted to required standards and will be located at least 60 meters away from the nearest borehole.
- Whenever necessary only a registered transporter of waste water will be engaged to empty septic tanks and transport the waste water to the designated disposal site.

7.7 Management of Human Health

LAIL will provide basic health services in form of first aid to its employees and surrounding community. It will also facilitate easy evacuation to Mapepala Clinic in case of complicated illness.

7.8 Management of Health

Mitigation measures due to health risks to workers will include the following:

- Adequate toilet facilities are provided to workers at the project site;
- LAIL shall develop a policy on HIV/Aids which will be implemented during the life of the project;
- Workers will be sensitized on malaria prevention;
- A health scheme for workers will be put in place.

7.9 Management of Safety and Fire Risk

Mitigation measures due to safety and fire risk will include the following:

- All workers are provided with Personal Protective Equipment (PPE)
- Measures will have been put in place to ensure that workers use PPE
- Traffic rules will be observed by all drivers on the farm
- Provision of signage on site to avoid loss of access routes;
- Training of workers in health and safety as well as First Aid
- Regular maintenance of all equipment on site

7.10 Management of impacts on Land use

- The farm will be highly planned and avoid indiscriminate removal of vegetation.
- All access roads shall be planned and avoid unplanned settlements occurring near the farm.

Table 23::. Summary of Mitigation measures

Environmental Impact	Mitigation Measures
Impacts on Flora	• In comparison to surrounding areas, impacts on utilization of natural resources within the block are will be mitigated through good agricultural practices and conservation measurements resulting in increased population of wildlife due to the favorable habitat.
Occupational Health	• Awareness and training of its workers on safety procedures as well as providing protective clothing and equipment.
Air quality deterioration	• Equipment and plant machinery LAIL shall be well maintained and in good condition such that noise emitted is within an acceptable level. Any equipment or machinery producing abnormal noise will be fit with noise reducers and serviced for good noise performance. Workers operating in areas were noise is emitted are provided with protective equipment.
Impacts of the storage, management, use and disposal of agricultural chemicals and containers	• Well-designed infrastructure for storage of chemicals. Management and use of these chemicals is equally done following laid down procedures in line with regulations set out by ZEMA.
Abstraction of Water from the Luwombwa	• LAIL will obtain water rights for irrigation from the necessary regulatory authorities. • Adequate technology to sensor flows • A good and effective monitoring system will be put in place during operations.
Flow regime change	• Reduce noise impact by enclosing and insulating noise emitting equipment; • Provision of ear protective gears and appropriate clothing to workers operating during construction
Deterioration of Water quality	• Stick to good practices of irrigation operation rules of ensuring regulatory conditions is followed. • Installation of sewer system (septic tanks) and ensure proper operation and regular maintenance throughout the project construction phase
Erosion/sedimentation.	Carryout proper construction activities. Limit movement of heavy machinery only to designated access routes and operational areas
Change in Water quantity	Ensure reservoirs are filled during rainy season. Monitor flow downstream even in times of dry months. Apply standard operational rules. Observe water right permit regulations and requirements

Safety and Health Risk of Workers	• Implementation of safety and health policies designed to identify, evaluate, monitor and control health hazards and provide safety training; • Employees shall familiarize with safety techniques through training; • LAIL management shall ensure that all visitors are briefed on potential hazards and necessary safety precautions; • Implementation of emergency procedure on site; • Use of clearly labelled signage; • Ensuring that employees wear protective clothing at all times; • Proper control and directing of traffic during material delivery.
Employment	• Through advertising fairly • Ensure gender sensitivity in terms of employment

Table 26. Environmental Management Plan summary of key impacts

Aspect	Impact	Objective	Frequency of monitoring	Responsibility	Time frame	Performance indicator	Cost (U$)
Surface water contamination	Water contamination	To prevent surface contamination from effluent discharge.	daily	Farm Manager	Throughout project life cycle.	Low levels of BOD in the stream. No indiscriminately disposed chicken feathers sprawl around.	10,000.
land and soils	Land and soil contamination	To reduce land and soil contamination from effluent discharge	Monthly	Farm Manager	Throughout project life cycle.	Low levels of COD in the soils.	10,000.
Vegetation loss	Loss of vegetation from massive land clearing	To minimise the amount of vegetation removed	Monthly	Farm Manager	Throughout project life cycle.	Recorded hectarage	20,000.00
Air and dust pollution	Generation of dust and air pollutants	To reduce dust and air	Daily	Transport manager / All	During construction phase of the	Reduced dust emissions of 7.5 tonnes/km^2 in	12,000.

	from construction and operation vehicles	emissions.		Drivers	project.	30 days measurements.	
Noise generation & vibrations	High noise levels generated from farm animals & vehicles.	To minimise noise level and vibrations from animals & heavy machinery.	Daily	Farm Manager	During construction and operation phases of the project.	Records of complaints from local communities on animal noise and vibrations.	9,000.
Waste generation	Generation of solid waste and liquid waste.	To minimise waste generation from the ranch, poultry and offices.	Daily	Farm Manager	Throughout project life cycle.	Reduced amount of waste generated per month.	5,000.
Vision intrusion	Shine and bright coloured paintings of buildings.	To reduce on the visual impact and Aesthetic value of the project area.	Yearly	Farm Manager	Throughout project life cycle.	Records of complaints from the members of public on visual effect of the buildings.	6,000.

Vehicular accidents	Damage and fatal accidents occurring at the farm.	To reduce the risk of accidents.	Daily	Transport manager / All drivers	Throughout project life cycle.	Reduced records of fatalities	3,000.
Domestic waste	Generation of domestic waste	To reduce and recycle waste	weekly	Transport manager / Head cook	Throughout project life cycle.	Number of waste deposit bins supplied. No heaps of waste indiscriminately disposed	5, 000.
HIV/AIDS Infections	Loss of man hours leading to low staff productivity	To prevent infections of employees from HIV/AIDS , STIs and Malaria Occupational health risks	Daily	Farm Environmental officer/HR	Throughout project life cycle.	Records of HIV/AIDS infections Reduced absenteeism due to Malaria related sickness	11,000.

8 INSTITUTIONAL FRAMEWORK FOR MONITORING, REPORTING AND SUPERVISION

In order to ensure that the identified environmental issues are addressed throughout the life cycle of the project there will be need for all key stakeholders to collaborate. The main objective of this collaborating network is to ensure that mitigation measures outlined in contracts are being properly implemented by the Project owner. The main responsibilities of the collaborating network will be to:-

- Complement the efforts for continuous monitoring and assessment of the implementation of the environmental management plan.
- Liaise with respective local authorities on environmental issues which may arise during the operation of the project.

Monitoring arrangements

To avoid deliberate creation of gaps between what actually gets implemented on the ground, the contracts must spell out the sanctions for noncompliance with mitigation measures.

LAIL' is to compile an activity Environmental report that will form the basis for assessment of environmental performance.

Operational Phase

The local authority will be responsible for monitoring and management of all indirect impacts occurring in the project area.

The following table illustrates the different stakeholders and their monitoring responsibilities and reporting.

Table 27. Monitoring and Reporting Responsibilities

ZEMA	• Overall environmental performance of the Project	• Discussions with Farm Manager
LAIL	• Monitoring the implementation of EMP	• Regular environmental progress reports to stakeholders
	• Overall environmental performance of the Project	
Farm Manager	• Implementation of mitigating measures for air, water, etc.	• Regular environmental progress reports to ZEMA
	• Environmental management of worksites	
	• Develop Waste management Plan	
	• Rehabilitation of abandoned worksites	
	• Performance of equipment	
	• Accidents	
	• Negative social and environmental impacts	
	• Environmental performance of equipment	• Maintenance records • Accidents reports • Mitigating actions
	• Implementation of mitigating measures	
	• Occupational health and safety plan	
	• Traffic and worksite accidents report	
	• Air quality	
Local authorities	• Negative social and environmental impacts	• Complaints to Farm Manager

9 DECOMMISSIONING PLAN

The project being a farming project will not have adverse impacts in terms of land terrain. Flora and fauna shall be the most affected due to clearing of vegetation and use of pesticides and fungicides. Prior to farm closure, a number of activities will be lined up in order to successfully implement the decommissioning and closure plan. Farm closure will be preceded by progressive rehabilitation activities. The progressive rehabilitation plan will be implemented in order to balance the production and closure costs. Certain support services of the farm operation will cease first before the main production operations. As such certain areas of the farm will be successfully decommissioned before parts of the farm infrastructure are demolished and rehabilitated while the farm is still in operation.

However, prime objective will be to sell the farm as a going concern to investors to take over the management of the farm. If the package will not be taken as a whole, Farm Management may consider selling the farm in components. Those investors who will be interested in facilities will be allowed to buy off these components so that the remaining activity may just be growing crops. Eventually, all the farm activities may have to be sold out so that the designed environmental management plan continues to be improved upon and implemented effectively. In this regard, the farm will have been successfully handed over to new investors who will continue with the economic development of the country and the region as a whole.

In terms of social issues, LAIL will engage consultants to prepare its employees psychologically and also give them skills to survive outside formal employment.

General Site decommissioning and closure

A sum of US$58, 000 has been estimated in the reclamation cost for the general site breaking, levelling and reprofiling as elaborated in table below.

Aspect	Impact	Mitigation /Enhancement	Frequency of monitoring	Responsible	Time frame	Performance indicator	Cost (U$)
Fuel tank removal	Surface water contamination Water contamination	To prevent surface contamination from effluent discharge.	daily	Farm Manager	To be determined at closure	Low levels of BOD in the stream. No indiscriminately disposed chicken feathers sprawl around.	3,000.
Warehouse dismantling and transportation	Land and soil contamination by rubble	To reduce land and soil contamination from effluent discharge	Monthly	Farm Manager	Throughout project life cycle.	Low levels of COD in the soils.	5,000.
housing units,	Rubble	To minimise the amount of vegetation removed	Monthly	Farm Manager	Throughout project life cycle.	Recorded hectarage	35,000.00
Offices and workshops	Generation of solid waste and liquid waste Generation of dust and air pollutants from	To reduce dust and air emissions.	Daily	Transport manager / All Drivers	During construction phase of the project.	Reduced dust emissions of 7.5 tonnes/km² in 30 days measurements.	15,000.

	construction and operation vehicles						

10 EMERGENCY PREPAREDNESS PLAN (EPP)

LAIL shall implement an action plan in form of emergencies at the Farm. The ***progress review*** will answer the following questions: -

- Are activities being carried out according to the work plan?
- Are outputs being produced as scheduled?
- What changes have taken place, particularly, if any additions or deletions are made?
- What problems or difficulties have been encountered?
- What remedial actions have been taken or are planned?

The emergency plan shall include the following information;

- Prepare an Emergency Preparedness Plan
- Comply with Occupation Health and Safety Regulations under the Ministry of Labour
- Safety and emergency preparedness equipment will be installed
- Ensure that all the workers on the farm are trained in emergency preparedness procedures and adhere to the action plan.

11 CONCLUSION

The EIA brings out a number of associated benefits which includes among others increased productivity and improved efficiency adhering to Environmental laid down regulations. It is therefore recommended that the EIA is approved. This is due to the following reasons:

- The project is a continuation of the existing similar farm development by the proponent;
- More Jobs will be generated for the locals;.
- The project satisfies and meets the requirements of the Zambian laws and regulations governing the operations of the project.
- The identified environmental impacts have been fully mitigated against.

12 DECLARATION OF AUTHENTICITY OF REPORT CONTENTS

We do hereby attest that the information presented herein regarding the Environmental Impact Statement for the proposed Integrated Agriculture Project in Chitambo District by Lake Agro Industries Limited is correct and complete to the best of our knowledge.

Director
LAKE AGRO LIMITED

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APPENDICES

CONSULTATION AND PUBLIC PARTICIPATION

Consultations

In line with the Environmental Management Act of 2011 of the Laws of Zambia, read together with the Environmental Impact Assessment Regulations S.I. No. 28 of 1997 and as part of the transparent consultative process aimed at taking public views, scheduled meetings were held at Mapepala Basic School near the project site on the 6th September 2019 respectively. Employed also were household consultative meetings. The project description, potential environmental and socio-economic, mitigation measures and benefits were presented to stakeholders for their feedback. The meeting provided an opportunity for capturing of any other relevant issues for inclusion in the ESIA document. The meeting allowed stakeholders to air their views on all possible environmental and socio economic impacts and best practical mitigation measures. Attendance list, project presentation and minutes taken during the meeting are annexed to the report.

The method adopted during the scoping process involved a consultative meeting with key stakeholders at Chitambo Council Offices and a detailed discussion with relevant stakeholders. Responses from the consultations and discussions provided the relevant background information and helped identify major environmental concerns of the project area for the detailed ESIA process. The process also included initial environmental survey of the project site.

Key Presentations, Questions and Concerns from the Consultative Meeting.

These discussions were centred on:

The proposed project site for the works and its surroundings (land-use, natural resources, water, etc.);
Project Benefits to the entire chiefdom;
Sensitive areas (e.g., graveyards, historical sites, etc.);
Project boundaries in relation to Kasanka wilderness areas;
Employment opportunities to members of the general public; and
Negative impacts such as influx of people from different places across the country and fears of increased population outstripping the pace of development of the district and increased pressure on health facilities.

Public consultation meetings

The stakeholder concerns from the public consultative meetings are elaborated in the minutes contained in the annex.

Information regarding the proposed project was reviewed and an investigative site visit was conducted of the project area by GLEC Consultants and representatives of LAIL in order for the study team to obtain an initial appraisal of the environmental issues involved. The EIA study team took note of preliminary identification of environmental impacts that could potentially arise as a result of implementation of the project.

A scoping process was then conducted to determine potentially significant issues that would form the basis of the EIA study to be included in the Scoping Report. In order to guarantee that public views were taken into account in the preparation of the scoping report; a scoping consultation meeting was held in the vicinity of the project at Mapepala.

The agenda of this meeting included a presentation of the proposed project by the Developer outlining among others strategies and working examples of previous undertakings. This was detailed by GLEC presentations followed by an open public conversation. The general consensus of the meeting was that the project should go ahead.

A full attendance list and minutes of the meeting are attached in the Annexes.

Data Collection Methods

Approach and Methodology

The method adopted during the scoping process involved consultative meetings and discussions with relevant government institutions at national, provincial and district level, local communities, chiefs, headmen and community at large communities in Mapepala/Nabowa. The process also included initial environmental survey of the project site.

Responses from the consultations and discussions provided the relevant background information and helped identify major environmental concerns of the communities in the project area for this Scoping report.

The ESIA study will focus on having an in depth understanding of how the project, its activities, processes and its management regime, the nature of the current status of the site and its surrounding environment and how the potential impacts of the project in its operational phase will be managed. The study will gather data on the different facets of the environment such as climatic conditions, geographical characteristics, biological characteristics, socio-economic characteristics and possible impacts such as the socio-economic environment, employment opportunities and effects on other land-uses that are important to the area's economy, etc. Emphasis shall be placed on impacts that will have been caused as a result of the operations of the project activities during all the three phases of project implementation.
The EIA shall involve: -

Desk study and review of the available background information about the project proponent, the project operation and its nature., the environmental and legislation information, literature review concerning the project site, collection of secondary data, analysis of survey plans, stakeholder meeting and interviews;
Collection of primary data and carrying out ground truthing on the information provided to the consultants and triangulation of important information during literature review in order to have an in-depth understanding of the current status of the project site and its surrounding environment;
Evaluating the objective of the project against the current environmental status and project conceptualization;
Identifying all potential social-economic, positive and negative impacts that may have arisen as a result of implementing the project and their impacts on the biophysical environment, their magnitude and significance;

Prescribing the mitigation measures to all the identified potential negative impacts;
Outlining a sustainable Environmental and Social Management Plan (ESMP) for the project.

Characterization of impact significance will be done considering the following factors:

Beneficial or detrimental (Positive, Negative),
Probability of impact occurrence (Unlikely, Possible, Probable, Certain),
Frequency of impact occurrence (Continuous, Frequent, Infrequent, Occasional),
Duration of the impact (Short-term, Medium-term, Long-term),
Timing of the impact (Preparation, Construction, Operation, Post Decommissioning/Closure),
Severity of the impact (Very High, High, Moderate, Low),
Spatial extent of the impact (Localized, Project Area, Limited, Widespread) and
Sensitivity of the element being impacted (High, Moderate, and Low).

Other considerations will include assessment of the value of the affected environmental component, risk posed by the impact to the human population and cumulative Effects. Impacts will also be characterized as direct or indirect in order to have a full appreciation of the impacts and facilitate effective management of the impacts.

The Environmental Management Plan (EMP) will seek to give a comprehensive plan on how proposed mitigation measures will be implemented during preparation, construction, operational and decommissioning phases of the project and as such will serve as a useful management tool to guide implementation of the proposed measures. The ESMP will comprise of an Impact Mitigation Plan, Impact Monitoring Plan and Emergency Response Plan.

The ESMP will outline the duties and responsibilities of the developer, contractor and other relevant parties with respect to environmental management to ensure successful implementation of these measures, monitoring and subsequent audits during all project phases.

Annex 1: SCOPING MEETING

MINUTES OF THE SCOPING MEETING HELD AT MAPEPALA BASIC SCHOOL ON 6TH SEPTEMBER, 2019

In accordance with the legal framework on Environmental Management enshrined in the Environmental Management Act of 2011 of the Laws of Zambia, read together with the Environmental Impact Assessment Regulations S.I. No. 28 of 1997, a consultative meeting was held with interested parties and nearby communities Mapepala and Nabowa in Serenje at 9:00 hours.

AGENDA

9:00 Prayer then National Anthem
9:10 Introductions
9:20 Developer's Presentation
8:55 EIA Presentation- Expected Impacts
1030 Questions/Comments
10:58 Remarks-
11:00 Ending with Prayer

Opening Prayer

The meeting was called to order at exactly 9:00 hours by Mr Joseph Lungu, the social liaison officer for GLEC. The National Anthem was sung; followed by an opening prayer. Mr. Lungu then welcomed everyone to the consultative meeting which he said was a very important meeting. He thanked them for making effort to attend the meeting. He informed the meeting of the agenda for the meeting (as indicated above) and told the members present that the scoping meeting was mainly to collect their views concerning the project.

Rules of the meeting

The moderator then explained the rules of the meeting as follows:

- All attendees were to observe order during the meeting;
- During question and answer session; contributions were to be made by show of hand;
- No interjections during deliberations unless allowed by the moderator;
- A set of three question were to be asked before answers could be provided

Introductions

Introductions were made to general attendees. GLEC Team leader introduced the rest of the project team present. All attendees introduced themselves in turn.

Deliberations

Mr. Lungu explained the purpose of the meeting. He then called upon the people to listen attentively to the speakers and encouraged them to feel free to give their views on the project afterwards. He then asked Mr Simfukwe, from GLEC, to explain the purpose of the meeting

Figure 28. Pictures taken during the scoping meeting at Mapepala Basic School

Remarks by the Consultant

Mr Simfukwe in his introductory remarks acknowledged the presence of the representative to Chief Chitambo, the Headmaster of Mapepala Basic School, all leaders and everyone present at the meeting.

He said that the reason why the meeting was called was because the government of the Republic of Zambia had put in place a statutory law, the Environmental Management act No 12 of 2011, which is read together with the Environmental Impact Assessment Regulations S.I. No. 28 of 1997. He highlighted Section 3 (1) of the EIA Regulation stating that no developer is allowed to implement a project for which an environmental impact statement unless the environmental impact statement has been concluded and a decision letter issued.

Mr. Simfukwe told the members present that the scoping meeting was mainly to collect their views concerning the project. Furthermore he mentioned that the purpose of the meeting was aimed at forming of the Terms of References (ToRs) for the Environmental Impact Assessment of the proposed agricultural project in Mapepala and Nabowa area. He told the meeting that, the GLEC team and the developer were aware that there might be issues to be raised in the meeting which are always worth noting. He added it was imperative that all investors who wished to invest in any part of the country gave respect to the native people

found in the area. The legislation demanded that the investor should understand first of all who had settled in the area and what they had to say about the development. He however noted that the GLEC team had come all the way from Lusaka to carry out a scoping exercise, hear what people had to say, how they lived, what properties they had, the type of animals they reared, what water sources they depended on etc. He said, as he displayed the map, that all boundaries were well known and that the area across the Luwombwa river was the project site. He further added that considering the type of development which was being proposed by the developer, his team was going to determine the impacts on people, water resources, soils etc. He encouraged members of the meeting to welcome his team during data collection and provide all necessary information which was very important in coming up with the Environmental Impact Statement (EIS), a document which upon completion would be circulated to the public as well as relevant government institutions.

He encouraged the members to feel free and bring out issues that might be useful in the execution of the project. The meeting was further advised to focus their discussions on the agriculture project in order to help the developer to implement it in an environmentally and socially sound manner.\

DISCUSSION – Collection of views and concerns regarding the project

Question: Mr Davies Chapyelela (Village Chilolo) wanted to know the extent of the land and who the company will employ first.

Answer: 'The project site is just across the Luwombwa river as can be seen from the map. The the target for LAIL employment are the local people of Mapepala and Nabowa..

Question: Mr. Kenneth Miselo mentioned that he understood Lake Agro Industries had come to develop the area but wanted to know what would happen to their crops and the roads that lead to the area

Answer: In response, the consultant stated that was the essence of the Environmental and Social Impact Assessment (ESIA); it will cover all aspects pertaining to area. He said that GLEC team would take collect inventory data to feed into the ESIA. A section in the report will cover issues to do with current status of the site. Consultants will be in the area to ensure accurate information is gathered and provided to ZEMA and other stakeholders through the ESIA. Ideally the proponent would want to improve the road network for ease movement of farm products.

Question: Mr Chilimuna Sydney (Head teacher) asked whether there households in the project site or not and what would happen if there any.

Answer: Mr Lungu said that the initial understanding is that there no settlements in the project site but if any are found relocation action plan will be instituted and compensation triggered in the same.

Question: Mr. Pengele wanted to know how many people would be employed.

Answer: Lake Agro will employ over 2000 employees for a start and increase the number as farm grows.

Mr Kunda was not clear about the correct boundary line of the site.

Developer: The ESIA process is a detailed process that looks at all areas. The process has just begun; obviously boundaries will be availed through registered surveyors. He mentioned that the Luwombwa is the boundary from the Mapepala and Nabowa end and none of the households will be affected.

Most of the querries were based on employment and whether the developer will employ the locals.

Prayer and final remarks (Chilolo)

He noted that from the developer's presentation and the consultant, the key concern from the people was the issue of employment. He however expressed happiness that the matter was thoroughly handled through the question and answer session. The Chilolo assured the people that the leadership in the chiefdom would give total support to the project to ensure that people were employed. He thanked the people of Mapepala/Nabowai for attending the meeting.

Closing prayer

…… ..Secretary Lead Consultant

SIGNED LIST OF MEETING ATTENDEES

NAME	SIGNATURE	VILLAGE
CHILIMUNA SYDNEY (H Teacher)	[illegible]	School Comp
Chapyelela Davies (Chilolo)	[illegible]	Chapyelela
Marko Nkandu	[illegible]	Marko
Augustin Gwanga	[illegible]	Gwanga
Kenneth Miselo	[illegible]	Kenneth Miselo
Moses Mulubwa	[illegible]	Pambangela
Charles K. Chinungu	[illegible]	Pambangala
Gideon Kunda	[illegible]	Nyakanyaka
DAVIES MISELO	[illegible]	MISELO — Lwombwa
S. Chisenga	[illegible]	Miselo ''
Given Musonda	[illegible]	Miselo ''
Purity Miselo	PM	Miselo ''
P. Miselo	P.M	Miselo ''
Regina Chibuye	R. Chibuye	Miselo ''
Mofya Isaack	Mofya	Pengele ''
Joseph Pengele	[illegible]	Pandi ,
Laurent Mwape	[illegible]	P. [illegible] ''
ABEL Kalolo	AK.	[illegible]
P. Mukosha	PM	[illegible]
RUPE	Bupe.	Miselo ''
C. Mulenga	Miselo	[illegible] ''
N. Sesini	Sesini.	Mupenka ''
M. Mpundu	Mpundu	''
K. Chibesa	[illegible] Mpundu	Joseph
	AH	Mpundu
A. Mukosa	Mpatela	
L. Mpundu	Mpelenga	Mpetyel
[illegible]		

HOUSEHOLD COSULTATIONS

Public and focus household group meetings were also held with the Mapepala/Nabowa community in the area. They were informed two weeks in advance before the meeting was held with them. At these meetings with local communities were given the opportunity to comment and raise concerns. The programme to hold meetings with key stakeholders (such as the Council, DNWL, etc) is still ongoing. The focused group meetings were successfully held with the community. The was to give an opportunity to the all the people to give their concerns and demands, which have been incorporated into the ESIA process. During the ESIA study it was established that there are no settlements in the project area

Figure 29. Pictures taken during the household meetings

Annex 2: MINUTES - STAKEHOLDERS' MEETING AT CHITAMBO DISTRICT COMMISSIONERS' OFFICE 6th SEPTEMBER 2019

Venue	**Chitambo District Council DC's Office –Chitambo District,Central Province**
Date	Friday 6th September, 2019
Time	10:00hrs
Attendance	1. **Chitambo District Commissioner**, Ms Catherine Kunda 2. **Chitambo District Administration Officer**, Mr. Charles Anderson 3. **District Agriculture Coordinating Officer** (DACO); Mr Fred Simukonde 4. **Chitambo District Surveyor/planner**; Mr Mkali Keddy 5. **District Forestry Officer**; Mr Chishimba Chimpinde 6. **Kasanka Trust Community Liason Outreach Manager**; Mr James Mwanza 7. **GLEC socio – economic expert**; Mr. Wisdom Chasaya 8. **GLEC Lead Consultant**; Mr. Gillan Simfukwe
Communication	Self-introductions of the members present at the meeting were made and the deliberations were undertaken in English.

Meeting Proceedings:

AGENDA

- Project introduction and EIA presentation
- Contributions/Questions/Comments from participants

Remarks

The EIA Lead Consultant welcomed outlined the reason of the meeting and its significance. Then proceeded to explain the purpose of the meeting by indicating that the project was being proposed by Lake Agro Industries Limited who are intending to establish a commercial farming unit with associated infrastructure such as centre pivots and will invest about 18 million dollars in farming in an area near Mapepala and Nabowa across the Luwombwa river. He further reviewed that the main crops shall be wheat, maize and soya beans. He stated that it was mandatory that the Environmental Management Act No 12 of 2011 must be adhered to before a project of such magnitude was implemented. He emphasized that according to section 29 of the Act the planned EIA study shall identify both positive and negative impacts of the project together with recommendations to mitigate potential negative impacts and enhance the benefits. He also informed the stakeholders that it is a regulatory requirement that stakeholders are consulted for their contributions and inputs. He then invited for contributions.

The District Commissioner, Ms Catherine Kunda

The District commissioner, Ms. Catherine Kunda, welcomed the GLEC consulting team and meeting attendees. She explained that development or investment was welcome as long as it is done within the laws of the republic of Zambia. She emphasized that land in its entirety is important and as such all developers must

engage with her office first. She narrated that the district to welcomes investment not to the detriment of local people. She added that the district treasures its natural resources and would want proper utilization of the same.

District Administration Officer, Mr. Charles Anderson

The district administrative officer, Mr. Charles Anderson, thanked GLEC for organizing such an important meeting the meeting and was glad some progress could now be made. He commended the team for taking a step further in dealing with the matter given its background.

He mentioned that though the district welcomed investments of such magnitude the developer needed to follow the laid down regulations that guide projects in Zambia before any activity is done. He was however happy that the developer had done the right thing by engaging experts to commence the process of an Environmental Impact Assessment and also to consult the stakeholders on the project. He further disclosed that the district the district is in dire need of development and such ready to work with project developers.

Mr. Anderson revealed that when the district office learnt of the project in the area they were waiting to find out whether the developer had done all the paper work required for to carry out farming operations. He also unveiled that the district is aware that some preparatory activities had commenced so the district sent some officers to conduct verification. He was pleased that the presence of GLEC would help normalize the process.

Kasanka Trust Community Outreach officer, Mr. Mwanza

Kasanka Trust representative (community outreach officer), Mr. Mwanza expressed his concern regarding the closeness of the farm to the Kasanka National Park buffer zone. He said the buffer zone and Kafinda GMA are of global importance as the area attracts annual bat migration in October from across the region to Kafinda area. He added that the project might abstract water from the Luwombwa river which could pose a threat to the ecosystem of the area. He suspected the site had overlapped into the buffer zone. He employed the council to assist in the matter. He added that the Trust had received funding to put up beehives around the buffer zone to help communities produce honey.

District Agriculture Coordinating Officer (DACO); Mr Fred Simukonde

Mr. Simukonde informed the meeting that after his office was told about the development in the area, his office went to the project to verify the site and have a better understand of the site as is required by law. he mapping of the farm was done in relation to Kasanka National Park and other protected areas. He divulged that according to his measurements based on the closest coordinates the farm lies 2.5 km north of Kasanka buffer zone. He also mentioned that a 300m buffer was given between the Luwombwa river and the farm boundary.

He further assured Mr Mwanza that his apprehensions were considered by the team that visited the project area and worked with the developer to produce a map that took care the raised concerns.

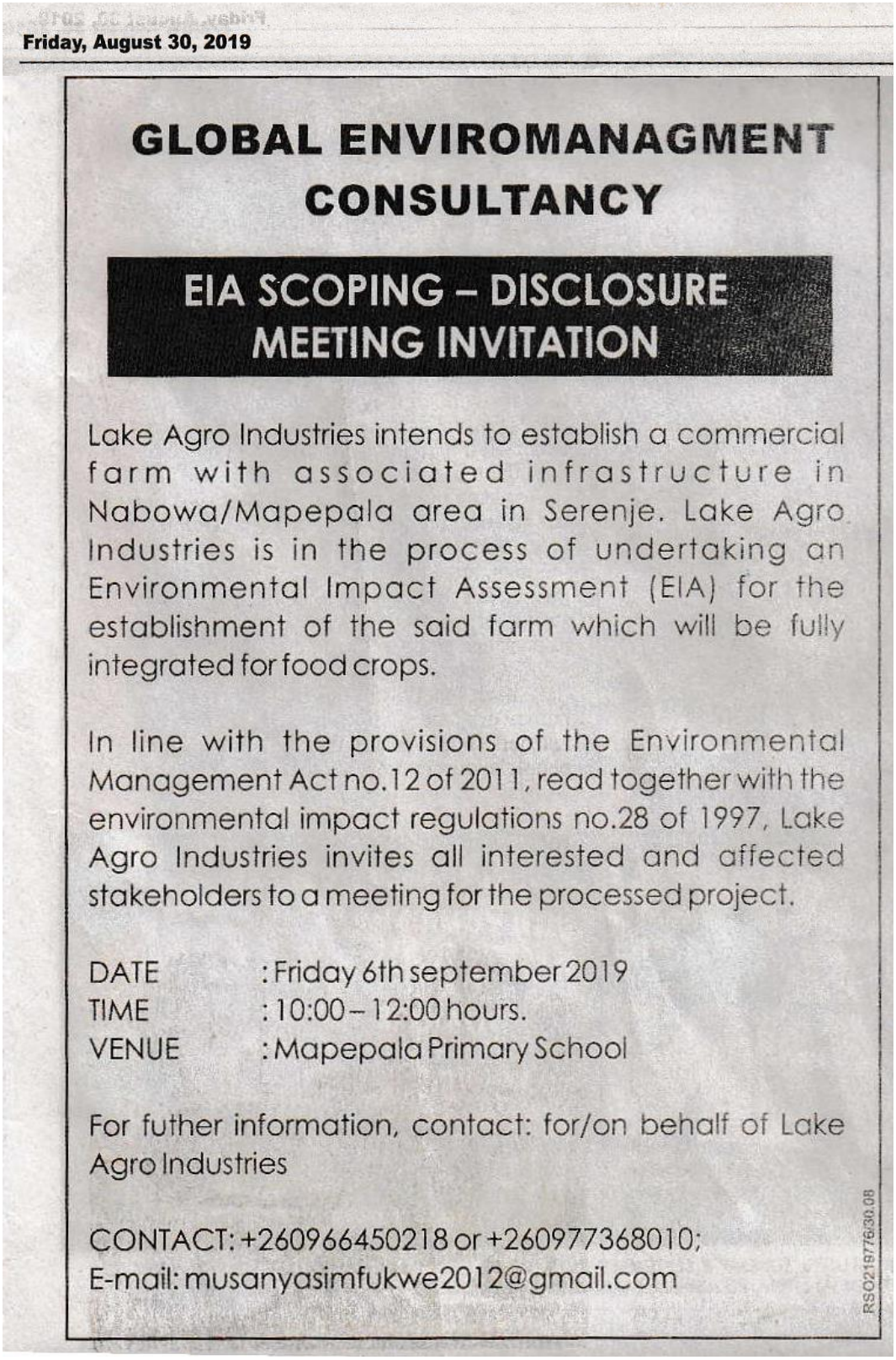
District Forestry Officer; Mr Chishimba Chimpinde

Mr. Chishimba Chipinde reminded the meeting that the forestry department was in charge of all forests whether protected or not and therefore, anyone who wants to develop an area that involves cutting down trees must first seek permission from the department so proper guidance is provided. He said he hoped that Lake Agro Industries would engage with the department from preparation to operation stage.

The Meeting closed with all stakeholder to continue to engage from time to time so as to avoid doing wrong things as the project progresses. The District Commissioner said her office was open anytime consultations are needed and asked if the developer would visit her office any time he would fill suitable. She said that communication must continue as the work is being undertaken through the contact numbers provided. The meeting Chairman declared the meeting closed at 11:30hrs.

Figure 30. Pictures taken during the stakeholders meeting at Chitambo District Commissioners' Office

Annex 3: ADVERTISEMENT (DAIL MAIL)



Friday, August 30, 2019

GLOBAL ENVIROMANAGMENT CONSULTANCY

EIA SCOPING – DISCLOSURE MEETING INVITATION

Lake Agro Industries intends to establish a commercial farm with associated infrastructure in Nabowa/Mapepala area in Serenje. Lake Agro Industries is in the process of undertaking an Environmental Impact Assessment (EIA) for the establishment of the said farm which will be fully integrated for food crops.

In line with the provisions of the Environmental Management Act no.12 of 2011, read together with the environmental impact regulations no.28 of 1997, Lake Agro Industries invites all interested and affected stakeholders to a meeting for the processed project.

DATE : Friday 6th september 2019
TIME : 10:00 – 12:00 hours.
VENUE : Mapepala Primary School

For futher information, contact: for/on behalf of Lake Agro Industries

CONTACT: +260966450218 or +260977368010;
E-mail: musanyasimfukwe2012@gmail.com

RSO219776/30.08

Annex 4: SIGNED LIST (PEOPLE INTERVIED)

Name	Signature	Village
C. Nkumbula	[illegible]	Mpanda
M. Mpundu	MP.	Mpanda
M. Kamfwa	[illegible]	Lisa
M. Kalunga	MK.	Mulonda
L. Kalunga	LKalunga	"
P. Mulusa	Mulusa	"
R. Mulosha	[illegible]	Rephai
Golden Lungu	[illegible]	Jonathan Chilabata
Gift	[illegible]	Kamwala
B. Musopa	BM	Lutte
A. Bunga	AB	Masiti
B. Bwalya	BJ	Masiti
A. Njombwe	AN	Mulete
J. Mulenga	J.Mulenga	Chitanda
K. Kunda	KK.	Mulenga
CHANGWE	Changwe	ALUV
Chabala	HBM	Feyday Kunda
Kalunga		Mpenzi
Totolo	ABS.	Shimito
M. Besa		Mulonga
M. Wasamu	Am	BOSTON
B. Mulenga	MB	
Mutolwa Chifi	[illegible]	Musonda
Mrs. Kwambwa	[illegible]	Chikatula
R. Chitambo		Nkausu
A. Mulosa	AMulosa	A [illegible]
B. Kunda	BK	

POSSIBLE ANALYSIS INFORMATION GAPS

In the main ESIA the team will consider undertaking detailed analyses of water flows and visit all relevant stakeholders.

CONCLUSION

The public consultation meetings and the discussions with the local communities and incorporation of the mitigating measures and implementation of the Impact Mitigation Plan and Environmental Monitoring Plan shall sum the main ESIA.

Annex 5: ENVIRONMENTAL CHECKLIST

A. BASIC INFORMATION ON THE COMMUNITY

1. Name of the Community----------

2. Location (Village)----------

3. District----------

4. Distance from the District Centre----------

5. Total Population of the Community----------

6. Type of propsed project, (e.g. Construction, rehabilitation, etc)-

---

7. Expected number of beneficiaries----------

B. ENVIRONMENTAL CONDITIONS OF THE PROJECT AREA/SITE

8. Climate of the area. (Seasons and related activities)----------

---

9. Topography (upland, wetland, rocky, etc)----------

---

10. Type of natural vegetation. (Grassland, type of trees, e.g. Miombo)

---

11. Air quality (Community perception as they inhale, presence of industries, etc)

C. SOCIAL-ECONOMIC STATUS

12. Current land-use of project site and surrounding areas (e.g. Forested areas, cultivated land, settlement, etc)
---

13. Indicate type of, availability, and source of the following:

Water supply----------

Energy source----------

Roads----------

14. List down sources of livelihood for the community. Include potential Income generating Activitie and their likely effect on the environment.

Source of livelihood----------

Expected effect on the environment----------

D. DESCRIPTION OF POTENTIAL IMPACT

List down type of material to be used, source and the environmental implications on the source of material.

Activity	**Type of material**	**Source of material**	**Resulting effect (soil erosio, deforestation, ditches, etc)**
1.			
2.			
3.			
4.			
5.			
6.			
7.			

Will the implementation of the project affect the surrounding of the project site ? If yes, in what ways. (Before you consideprovide information in the following table, consider in detail the resulting effect in the table above).

Activity	**Description of works**	**Potential impact on the surrounding environment during construction**	**Potential impact on the surrounding environment upon completion**
1.			
2.			
3.			
4.			
5.			

6			
7.			

F. ENVIRONMENTAL MITIGATION MEASURES

15. Summarise below identified environmental concerns and proposed mitigation measures. Please note that these should be derived form the tables above.

Activity	Identified Environmental Concerns	Propoed Mitigation Measures

16. List down the names of of people, institutions/organisations that you consulted during field work.

---

17. What are the project benefits to the area (positive benefits), e.g employment to the local community, easy access to markets, clinics, etc.

---

18. What are the likely social impacts (incidences of STDs and HIV/AIDS), due to interaction with camp workers.

---

19. Any other issues not covered above:

Annex 6: **COMPANY DOCUMENTS**

Companies Form 7
Companies Registration No. **120170007065**
Serial No. 1055746

SCAN TO VIEW OUR REGISTRATION DETAILS

Republic Of Zambia

CERTIFICATE OF INCORPORATION OF PUBLIC LIMITED COMPANY

(Section 10)

This is to certify that LAKE AGRO INDUSTRIES LIMITED is on and from the **15th day of September 2017** incorporated as a PUBLIC LIMITED COMPANY.

Given under my hand and seal at Lusaka, Zambia, this **15th day of September 2017.**

PATENTS & COMPANIES REGISTRATION AGENCY

P.C. Mwaba
Assistant Registrar of Companies

For further details relating to this business visit
http://www.pacra.org.zm

Companies Form 10
Companies Registration No. 120170007065
Serial No. 1055746

SCAN TO VIEW OUR REGISTRATION DETAILS

Republic Of Zambia

CERTIFICATE OF SHARE CAPITAL
(Section 10)

This is to certify that LAKE AGRO INDUSTRIES LIMITED has the nominal capital of **K** 15,000.00 divided into 15000 shares of **K 1.00** each.

Given under my hand and seal at Lusaka, Zambia, this **15th day of September 2017**.

COMPANIES REGISTRATION AGENCY, PATENTS & COMPANIES

P.C. Mwaba
Assistant Registrar of Companies

For further details relating to this business visit
http://www.pacra.org.zm

THE CHITAMBO TOWN Council
P.O-BOX 850016
CHITAMBO TOWN Council

CHIEF CHITAMBO IV
OWN PALACE, CHALILO
P.O. BOX 850013
SERENJE, ZAMBIA
APR 2000

Dear Sir/MADAM.

RE: LAKE AGRO INDUSTRIES LTD

The above company is given 500Ha of LAND in ALONG CHITAMBO/SANGA ROAD.

Chief Kanzombe Tembo
Chief Chitambo IV

CHIEF CHITAMBO IV
OWN PALACE, CHALILO
APR 2000
P.O. BOX 850013
SERENJE, ZAMBIA

Annex 7: INVITATION LETTER

GLobal Enviromanagement Consulting

Environment & Sustainable Development Consultants
P.O. Box 35958, Lusaka - ZAMBIA
Cell: (+260)-966450218
Email:-gillan_simfukwe@yahoo.com

Date:

To:.....
.....
.....

Dear Sir/Madam,

RE: INVITATION TO A SCOPING MEETING FOR THE PREPARATION OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROPOSED INTEGRATED FARMING PROJECT IN MAPEPALA/NABOWA AREA BY LAKE AGRO INDUSTRIES LIMITED

The above subject matter refers.

Lake Agro Industries is in the process of undertaking preparatory works for an Enviromental Impact Assessment (EIA) for the for the farming project in Mapepela/Nabowa area in Serenje. The proponent has contracted Global Enviromanagement Consulting to undertake this study In line with the provisions of the Environmental Management Act No.12 of 2011 (read together with the Environmental Impact Regulations No. 28 of 1997) and in order to ensure that stakeholders' concerns are considered in the EIA process.

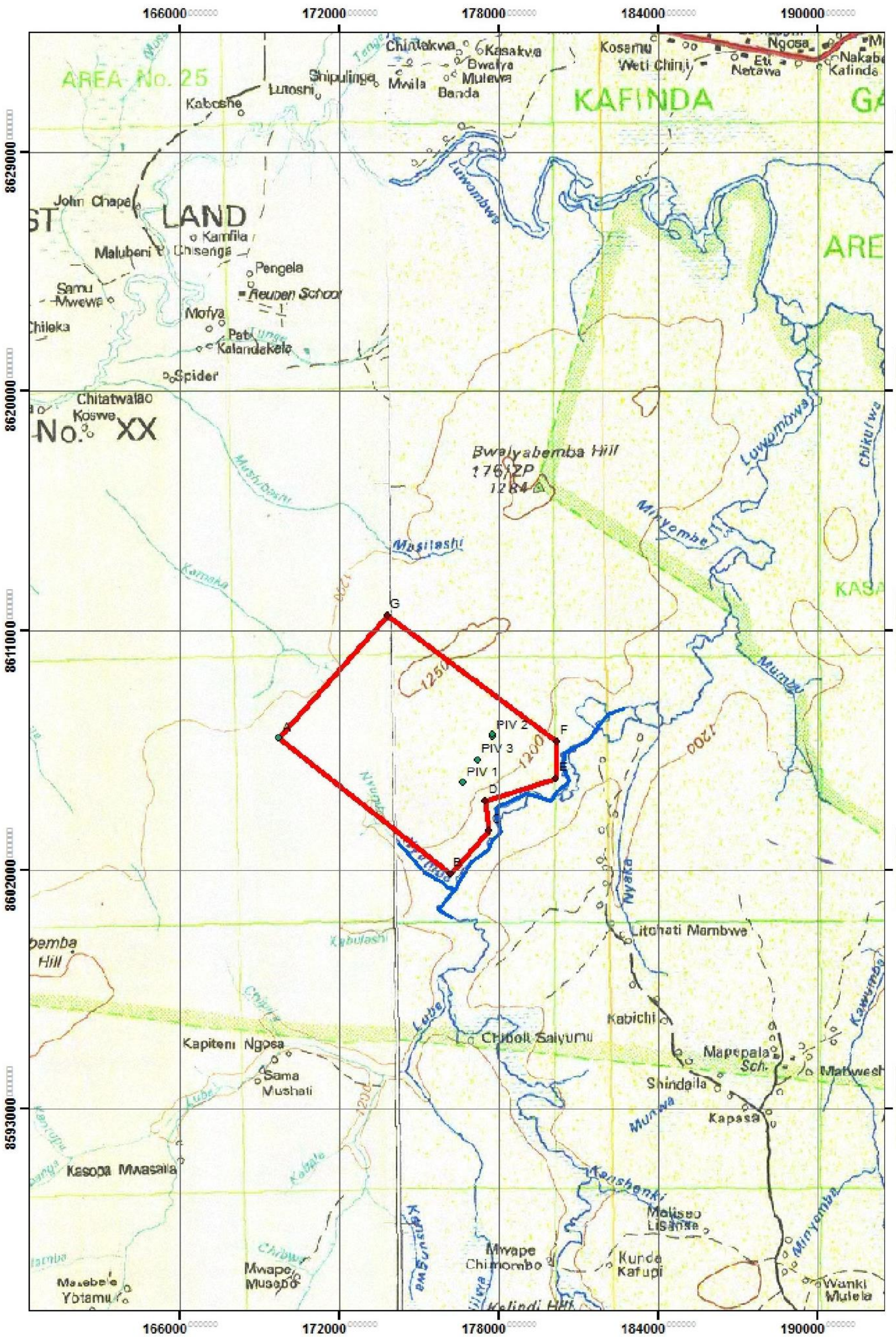
We hereby invite you to a scoping meeting for the proposed project to be held at MAPEPALA Basic School in Mapepala area on Friday 5th July 2019 from 9:00 hours to 11: 00 hours.

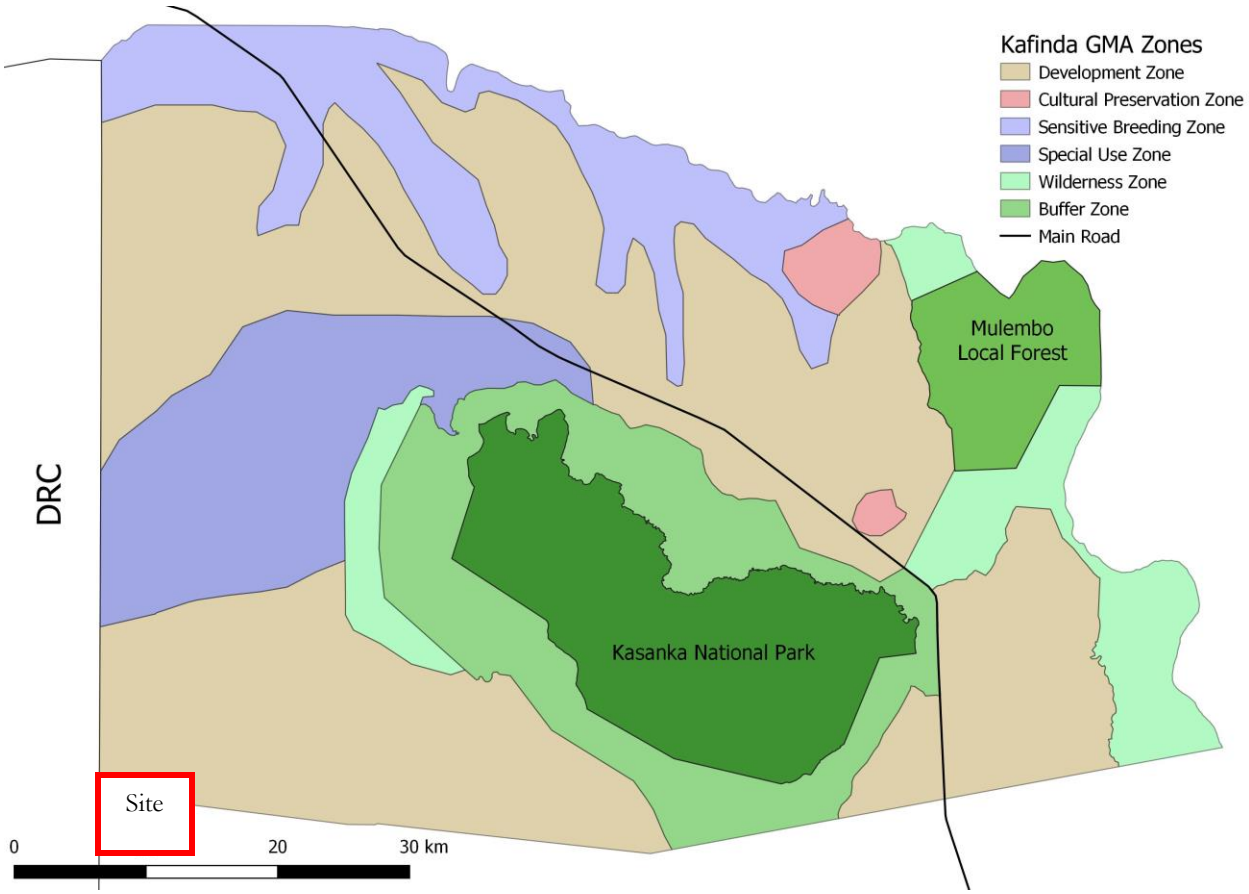
We thank you in advance for your time, cooperation and support and look forward to working with you.

For Further information, please contact the undersigned or Mr. Gillan Simfukwe of Global Enviromanagement Consultancy on Telephone number +260 966 450218 or +260 977 3680 and Email: gillan_simfukwe @yahoo.com.

Yours Faithfully,

Gillan Simfukwe
Managing Partner, GLEC


166000
172000
178000
184000
190000
8629000
8620000
8611000
8602000
8593000
AREA No. 25
KAFINDA
LAND
No. XX
Bwalyabemba Hill
1761ZP
1284
Masitashi
Luwombwa
Minyombe
Mumbu
G
F
E
D
B
PIV 2
PIV 3
PIV 1
1250
1200
Kabulashi
Litchati Mambwe
Kabichi
Chiboli Saiyumu
Kapiteni Ngosa
Sama Mushati
Mapepala Sch.
Shindaila
Kapasa
Kasopa Mwasaila
Kenshenki
Maliseo Lisanse
Mwape Chimombo
Kunde Kafupi
Mwape Musabo
Masebele Ybtamu
Wanki Mulela
John Chapa
Kamfila
Chisenga
Malubeni
Pengela
Reuben School
Samu Mwewe
Chileka
Mofya
Pati
Kalandakele
Spider
Chitatwalao
Koswe
Kaboshe
Lutoshi
Shipulinga
Mwila
Chintakwa
Kasakwa
Bwalya
Mulewa
Banda
Kosamu
Weti Chinji
Ngosa
Eti Netawa
Nakabe
Katinda


Kafinda GMA Zones
Development Zone
Cultural Preservation Zone
Sensitive Breeding Zone
Special Use Zone
Wilderness Zone
Buffer Zone
Main Road
Mulembo
Local Forest
Kasanka National Park
DRC
Site
0
20
30 km

Annex 8: Riparian woodland

Scientific Name	Common Name
Acacia polyacantha	White-stemmed thorn
Albizia adianthifolia	Rough-barked flatcrown
Albizia versicolor	Poisonpod false-thorn
Annona senegalensis	Wild custard-apple
Azanza garckeana	Azanza
Balanites aegyptiaca	Simple-thorned greenthorn
Combretum collinum	Bushwillow
Diplorhynchus condylocarpon	Hornpod/wild-rubber
Erythrina abyssinica	Red-hot-poker tree
Ficus sycomorus	Fig tree
Markhamia obtusifolia	Golden bellbean
Parinari curatellifolia	Mobola-plum
Pericopsis angolensis	Mubanga (B)
Phoenix reclinata	False Data Palm
Piliostigma thonningii	Monkeybread
Pseudolachnostylis maprouneifolia	Kudu-berry
Pterocarpus angolensis	Mukwa
Steganotaenia araliacea	Carrot tree
Strychos cocculoides	Corky-barked Monkey-orange
Terminalia sericea	Silver clusterleaf
Vangueria madagascariensis	Smooth-leaved wild-medlar

Annex 9: Miombo woodland vegetation

Scientific Name	Common Name
Afzelia quanzensis	Pod-mahogany
Albizia adianthifolia	Rough-barked flatcrown
Albizia versicolor	Poisonpod false-thorn
Anisophyllea boehmii	Mufungo (B)
Brachystegia boehmii	Ngansa (B)
Brachystegia floribunda	Musompa (B)
Brachystegia longifolia	Muombo (B)
Brachystegia spiciformis	Muputu (B)
Dichrostachys cinerea	Sicklebush
Diplorhynchus condylocarpon	Hornpod/wild-rubber
Euphorbia ingens	Giant Euphorbia or Cactus
Faurea intermedia	African Beech
Ficus sycomorus	Fig tree
Isoberlinia angolensis	Mutobo (B)
Julbernardia paniculata	Mutondo (B)
Kigelia africana	Sausagetree
Parinari curatellifolia	Mobola-plum
Pericopsis angolensis	Mubanga (B)
Piliostigma thonningii	Monkeybread
Protea caffra	Common sugarbush
Pterocarpus angolensis	Mukwa
Securidaca Longepedunculata	Violet tree
Steganotaenia Araliacea	Carrot Tree

Strychnos pungens	Spine-leaved monkey-orange
Strychos cocculoides	Monkey-orange
Swartzia madagascariensis	Snake bean
Syzygium guineense	Water pear
Uapaca kirkiana	Masuku (B)
Uapaca nitida	Narrow-leaved masuku
Vangueria infausts	Wild-medlar
Vangueria madagascariensis	Smooth-leaved wild-medlar
Vitex doniana	Black plum
Vitex mobassae vatke	Smelly-berry vitex
Ziziphus mucronata	Buffalo-thorn

Annex 10: WATER RESULTS

SCHOOL OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
ENVIRONMENTAL ENGINEERING LABORATORY

P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : Global EnviroManagement Consulting
Lusaka
Sampled by : Client
Sampling date : 06.09.2019
Report date : 11.09.2019

Laboratory Results

Parameter	**Serenje river water sample**	**ZABS** Guideline (Maximum Permissible value for drinking water)
pH	7.57	6.5- 8.0
Turbidity (NTU)	**5.24**	5.0
Conductivity (µs/cm)	81	1,500
Total Dissolved Solids (mg/l)	41	1,000
Total Suspended Solids (mg/l)	<1.0	-
Total hardness (as mg $CaCO_3$/l)	58	500
Calcium hardness (as mg $CaCO_3$/l)	30	500
Alkalinity (as mg $CaCO_3$/l)	48	500
Iron (mg/l)	0.04	0.30
Ammonia (as NH_4-Nmg/l)	<0.01	1.50
Sulphates (mg/l)	<0.01	400
Chlorides (mg/l)	6.0	250
Nitrites (as NO_2 –N mg/l)	<0.001	1.0
Nitrates (as NO_3 –N mg/l)	<0.01	10.0
Acidity (as mg $CaCO_3$/l)	Nil	500
Total phosphates (mg/l)	<0.01	5.0
Magnesium (mg/l)	6.72	150
Calcium (mg/l)	12.0	200
Fluorides (mg/l)	0.07	1.50
Potassium (mg/l)	1.28	-
Sodium (mg/l)	3.96	200
Manganese (mg/l)	<0.01	0.1
Bacteriological Results		
Total coliforms (#/100ml)	**85**	0
Feacal coliforms (#/100ml)	**75**	0

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

Comment: On the day of sampling the bacteriological quality of the water was bad.
The chemical quality of the water were within the ZABS standards for drinking water except for turbidity.

UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
14 SEP 2019
DEPT. OF CIVIL ENGINEERING
P.O. BOX 32379, LUSAKA

Dr. Ian Banda
Co-ordinator- Environmental Engineering Laboratory

SCHOOL OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
ENVIRONMENTAL ENGINEERING LABORATORY
P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : Global EnviroManagement Consulting
Lusaka
Sampled by : Client
Sampling date : 06.09.2019
Report date : 11.09.2019

Laboratory Results

Parameter	**Serenje borehole water sample**	**ZABS** Guideline (Maximum Permissible value for drinking water)
pH	7.61	6.5- 8.0
Turbidity (NTU)	1.41	5.0
Conductivity (µs/cm)	416	1,500
Total Dissolved Solids (mg/l)	208	1,000
Total Suspended Solids (mg/l)	<1.0	-
Total hardness (as mg $CaCO_3$/l)	224	500
Calcium hardness (as mg $CaCO_3$/l)	122	500
Alkalinity (as mg $CaCO_3$/l)	220	500
Iron (mg/l)	<0.01	0.30
Ammonia (as NH_4-Nmg/l)	<0.01	1.50
Sulphates (mg/l)	7.20	400
Chlorides (mg/l)	14.0	250
Nitrites (as NO_2 –N mg/l)	<0.001	1.0
Nitrates (as NO_3 –N mg/l)	<0.01	10.0
Acidity (as mg $CaCO_3$/l)	Nil	500
Total phosphates (mg/l)	<0.01	5.0
Magnesium (mg/l)	24.48	150
Calcium (mg/l)	48.80	200
Fluorides (mg/l)	0.15	1.50
Potassium (mg/l)	2.96	-
Sodium (mg/l)	9.24	200
Manganese (mg/l)	<0.01	0.1
Bacteriological Results		
Total coliforms (#/100ml)	**98**	0
Feacal coliforms (#/100ml)	**80**	0

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

Comment: On the day of sampling the bacteriological quality of the water was bad.
The chemical quality of the water were within the ZABS standards for drinking water.

UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
11 SEP 2019
DEPT. OF CIVIL ENGINEERING
P.O. BOX 32379, LUSAKA

Dr. Ian Banda
Co-ordinator- Environmental Engineering Laboratory

Annex 11 TERMS OF REFERENCES

INTRODUCTION

This report forms the Terms of Reference ("TORs") for the Environmental Impact Assessment for the integrated farming project by Lake Agro Industries Limited (LAIL). The company intends to establish a 7,000 hectares commercial farming unit with associated infrastructure such as centre pivots, silos, workshop and offices. The proposed project will be fully integrated into a commercial irrigated agriculture scheme for food crops and its ancillary infrastructure. The project will include introduction of irrigated fields within the farm boundary (centre pivots). The operations will involve land clearing, tilling, levelling and construction of an irrigation system to provide the necessary water required for crop production. Exploiting this potential will enable Lake Agro Industries to contribute to increased overall national production levels of cash crops such as wheat, maize and soya beans which are far short of meeting demand at national and regional level. Lake Agro farms geographical location in the northern part of Serenje gives it a competitive edge given that this part of the country is near to the equatorial region and less vulnerable to rain variability compared to the southern part.

The Terms of Reference have been prepared in line with the Environmental Management Act, No 12 of 2011 read together with the Environmental Impact Assessment Regulations, SI No. 28 of 1997 and the Zambia Environmental Management Agency (ZEMA) guidelines for preparation of Terms of References.

Purpose and Objectives of the TORs

The purpose of the report is to determine the environmental and social risks, impacts and opportunities of the proposed farming project. The TORs will consider the type, scale and location of the project which will ultimately guide the scope and level of effort devoted to the risks and impacts identification process. The scope of the risks and impacts identification process will determine the appropriate and relevant methods and assessment tools when considering mitigatory measures. Specific objectives are:

- To provide a synopsis of the proposed project;
- Define the proposed approach in conducting the Environmental Impact Assessment;
- List the obligatory specialist studies and identify the respective expert for each study;
- Provide an overview of the environment around the proposed project site and neighboring areas.
- To comply with legal requirement in the EIA Regulations for submitting the TORs Report for approval before proceeding with other stages of the EIA process.
- To provide the initial information about the project in order for a legal opinion to be made regarding the EIA process.
- To facilitate early consultation with the Zambia Environmental Management Agency (ZEMA) and other Interested and Affected Parties (IAPs).
- To facilitate effective planning and smooth implementation of the EIA process by the consulting team.

Project Study Area (Project Location)

The project site is located approximately 91 km north of Serenje Central Business District. It is accessible via Serenje – Mapepala route going north west wards towards Kabundi. About 46km from the Serenje, there's a split in the road with the main gravel road leading to Mapepala – Nabowa feeder road to the right at this junction. Approximately 46km from Serenje the road leads to the Luwombwa river. The project site is just across the river. The designated GPS coordinates for the site are presented in the table below:

Corner point	Latitude	Longitude	Elevation (m.a.s.l.)
A	12°30'24.0"S	30°01'53.62"E	1234
B	12°33'43.68"S	30°05'44.18"E	1188
C	12°37'57.54"S	30°01'32.00"E	1200
D	12°34'42.82"S	29°57'47.68"E	1212

Project Background

Developer Profile

Lake Agro Industries is a Zambian agribusiness company leveraging on local knowledge and expertise to secure its success. The owners have incredible experience in agricultural management and entrepreneurship with significant foresight. They have proven track records in commercial crop production and irrigation.

The company is leveraging on local knowledge and expertise to secure its success. In Zambia, Lake Agro has built a team of local Zambian specialists to execute the project. The team brings a wide base of expertise and experience in farm development, agriculture, and projects delivery in Zambia.

Lake Agro owners have incredible experience in agricultural management and entrepreneurship with significant foresight. They have proven track records in commercial crop production and irrigation. The company is a well-established company that shall operate on the continuum basis of crop farming with addition of cattle rearing.

Name of Developer	**Lake Agro Industries Limited**
Physical Address	Farm No 39, Chichele, New Airport, Ndola
Contact Details	Mr Gompa, Director
	Phone: 0973878598 Email: ramana.gompa@lakeagro.com

Shareholders				
No.	**Name**	**Nationality**	**% shares**	**Position**
1	AS Holdings Limited	Registration 148073	99.99	
2	Ally Edha Awadh	Tanzanian	0.01	Chief Executive Officer
Directors				
1	Robinson Malenji	Zambian		Directors
2	Ramana Gompa	Indian		Directors

Total Project Cost and Implementation Date

The cost of the project is estimated at US$ 999,000 with its implementation expected to commence upon acquisition of necessary permits from ZEMA and other authorizing agencies.

Brief History and Current Status

Zambia is a land locked country with vast potential for Agricultural and Livestock production. Agriculture in the country has the potential to pull many out of poverty. Good performance in the sector translates into overall improvement of the country's Gross Domestic Product (GDP), creates jobs and expands the tax base. The sector is the key engine for the anticipated growth both directly and indirectly through agricultural processing industries such as the beef processing plants. In view of the potential multiplier effects that the sector has on the economy, restoring high and sustained agricultural growth is critical for reducing poverty in Zambia.

Over 80 per cent of the rural population directly depend on agriculture for food and income. However, most rural agricultural productivity is very low as most farmers are engaged in mere subsistence production. Finding additional cash crops with robust markets can be a means to raise their incomes substantially and reducing poverty. Zambia can drastically improve agricultural productivity and export competitiveness if she has to come out of income poverty by implementing large scale farming projects.

Zambia currently produces various crops, but the volume is insufficient to serve the domestic demand. This has necessitated the setting up of the project in addition to prepositioning itself for the upcoming market in Southern Africa due to booming population.

REGULATORY FRAMEWORK AND CORPORATE REQUIREMENTS

The Environmental Management Act (EMA) establishes the Zambia Environmental Management Agency (ZEMA). ZEMA is a statutory body within the Ministry of Land, Natural Resources and Environmental Protection and the following are the main functions of ZEMA:

- Integrated environmental management and the protection and conservation of the environment and sustainable management and use of natural resources;
- The prevention and control of environmental pollution and environmental degradation;
- Provide for public participation in environmental decision making and access to environmental information
- Undertaking environmental auditing and monitoring; and
- Facilitating the implementation of international environmental agreements and conventions to which Zambia is a party.

The proposed EIS will therefore be submitted to ZEMA, after which ZEMA which will undertake verifications and consultations with the interested and affected parties (IAPs) prior to making a decision.

This TORs Report was prepared in accordance with the legal framework on Environmental Management enshrined in the Environmental Management Act of 2011 of the Laws of Zambia and its subsidiary legislation, the Environmental Impact Assessment Regulations S.I. No. 28 of 1997. Section 3 (1) of the EIA Regulations 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 the environmental impact statement has been concluded in accordance with these regulations and the Zambia Environmental Management Agency has issued a decision letter."

The proposed project is outlined in the Environmental Impact Assessment Regulations S.I. No. 28 of 1997, Second Schedule (Regulations (7)(2)) Section 5(a) under the heading: Forestry Related Activities and ready with Section 6(a) under the heading: Agriculture. Regulation 7(2) Section 5(a) states that Clearance of forestry in sensitive areas such as watershed areas or for industrial use 50 Ha or more shall require an Environmental Impact Assessment while Regulation 7(2) Section 5(a) states that Land clearance for large scale agriculture shall require an Environmental Impact Assessment The proposed project qualifies for an EIA.

Local Authorities Involved in the Project

The project lies within the authority of Chitambo district Council. As Local Authorities, Chitambo district Council is a semi-autonomous institution operating as an agent of Central Government. They are authorized to perform specific functions on behalf of Government. The Councils are the highest decision making bodies at the district level. They formulate policies in the form of by-laws. The Local Authorities provide a forum for local representation of the public by electing their local representatives, the Councilors.

The Local Authority is responsible to the Ministry of Local Government and Housing. According to the provisions under the Local Government Act No 22 of 1991, the ministry can amend or revoke by-laws issued

by the Council and make regulations that Council has to conform to, through circulars and statutory instruments.

The Environmental Management Act, No 12 of 2011

This Act continues the existence of the Environmental Council of Zambia and renames it as Zambia Environmental Management Agency (ZEMA); it replaces the repealed Environmental Protection and Pollution Control Act No. 12 of 1990; it also provides for integrated Environmental management and the protection and conservation of the environment through sustainable management and use of natural resources.

Relevance: *This law is the primary legal basis for undertaking environmental assessment for the proposed farm establishment project.*
Compliance there of: *Lake Agro Industries Limited shall fully comply with requirements of this national regulation during implementation of the EIA for Lake Agro Industries Limited.*

a) ***Environmental Impact Assessment Regulations, (SI No. 28 0f 1997 Part 2 and 3)***

The regulations state that a developer shall not implement a project for which a Project Brief or an Environmental Impact Statement is required under the regulations, unless a project brief or an Environmental Impact Assessment has been concluded in accordance with the Regulations and the Council has issued a Decision Letter.

Relevance: *Being a project of this magnitude, it falls under a project category requiring the preparation of the Environmental Impact Assessment (EIA).*

Compliance there of: *This EIA is being prepared in compliance with the above legal provisions through the Environmental Management (Licensing) Regulations, SI No. 112 of 2013, controls and regulates the following areas, relevant to the present study:.*

The Water Resources Management Act No. 21 of 2011

This new legislation on the management and development of water resources in the country has replaced the repaeled Act – Water Act of 1948. The Act addresses inadequacies of the old Act and aligns the management of water to the basic rule and principles relating to water and the environment. Issuance of water rights is clearly provided for in the new legislation similar to the 1948 Act. Unlike the repealed Act which mandated the Water Development Board (WDB) to issue water rights, the new one mandates the Water Resources Authority(WRA) to carry out the same function. Applications of the water right for commenrcial use is required considering that all water, in its natural state, vests in the president who holds it on behalf of and for the benefit of the Zambian people.

- Part I, Section 6 states that the State is the trustee of all water in Zambia and any rights thereto are subject to annual review in accordance with the Act.

- Part III sets out the composition and functions of Catchment and Sub-Catchment Councils to design and control the use of water resources in catchments and sub-catchments.
- Part IV sets out the functions and processes for Catchment Management Plans to manage catchment water resources.
- Part V sets out the requirements for the control and monitoring of environmental flows, levels and volumes and the steps that may be taken to maintain water quality and prevent pollution.
- Part VIII defines the use of water and the regulations for monitoring of that use.
- Part IX sets out the procedures for establishing water abstraction rights.
- Part X, requires the registration of those designing and constructing dams and other water structures.
- Part XI defines the need to make a request for the drilling or changes to a borehole.
- Part XII, sets out requirements for the registration, design, construction, construction supervision and maintenance of dams.
- Parts XIII and XIV establish easement conditions and provisions for flood,
- Drought or spillage emergencies.
- Parts XV and XVI define water charges and enforcement provisions.

Relevance: *being a farm establiment project water will be required for irrigation. This will entail establishing potential sources (including abstraction)of water and the developer will take necessary steps as per the reqiurement of the Act.*

Compliance there of*: Obtaining the relevant water rights requirements.*

Land Act and Land Acquisition Act of 1995 (SI 18 OF CAP 184)

The Department of Lands administers the Lands Act for alienation of land under statutory leaseholds. Under the Land Act of 1995, land has been divided into the following categories: State, Local Authority and Traditional land. The proposed developments fall under state Authority.

Relevance*: It is relevant because the project site shall be titled for 99year lease in due course.*

Compliance there of*: Compliance with the provisions of the Act with regards to operating according to the requirements of State Land and Local Authority.*

The Local Government Act (Amendment) Act No. 17 of 2016

The Local Government Act provides for a system of local government administration in Zambia at city, municipality and district Council levels. Each local governance level has delegated statutory functions with respect to development planning. The Act also allows Councils to implement environmental protection and natural resources management functions which include prevention of pollution of water supplies and has some control in undertaking of mining operations. The Principal Act was amended in subsection (2) by the insertion, immediately after the word "Councils", of the words "to pay the salaries of principal officers and officers of a Council.

Relevance: *Management will have to abide by the Bye Laws established by the Local Authorities.*

***Compliance there of**: Acquisition of Local Authority permits and compliance with other environmental regulations as stipulated therein.*

The Urban and Regional Planning Act Of 2015

The Act repeals the Town and Country Planning Act, 1962, and the Housing (Statutory and Improvement Areas) Act, 1975. It provides for development, planning and administration principles, standards and requirements for urban and regional planning processes and systems; it also provides for a framework for administering and managing urban and regional planning for the Republic of Zambia to ensure sustainable urban and rural development by promoting environmental, social and economic sustainability in development initiatives; the act ensures uniformity of law and policy with respect to urban and regional planning. The Act provides for the appointment of planning authorities whose main responsibilities are the preparation, approval and revocation of development plans. It also provides for the control of development and subdivision of land.

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***Relevance:** Being a site located in the Serenje local authority land, the project must have approved sketch plans of the proposed project.*

***Compliance there of**: Project implementation shall be feasible after obtaining approved developmental sketch plans from relevant Authorities of the proposed project.*

The Public Health Act of 1996

The Act empowers a Council to prevent unhealthy activities. It provides for the prevention of disease, drainage, latrine and disposal of sewerage and treatment systems.

***Relevance**:- The premises and surrounding environment of the development shall be managed based on the Public Health Act of 1996.*

***Compliance there of**: The project shall comply with the provisions of the Act in order to safeguard human life. The project shall also ensure that measures to prevent pollution dangerous to human health and to any water supply are taken into account through the provision of a drainage control system.*

The Foods and Drugs Act, Cap 303

This Act provides for the protection of the public against health hazards and fraud in the sale and use of food, drugs, cosmetics and medical services.

***Relevance**:- This Act is relevant to this project as it will be dealing with the use of feeds to produce chickens for public consumption.*

***Compliance there of**: The project shall comply with the provisions of the Act by ensuring that it uses feeds that comply with its provisions to protect the health of the public.*

Forest Act No. 4 of 2015

The Act provides for establishment, gazetting and de-gazetting of forests. It also provides for monitoring, forest inventories, management and regulation of forest areas and forest products, nationwide, and particularly in National and Local Forests. The Act is enforced by the Forest Department Specific to the general protection of forest resources, the Act provides for protection of Six (6) tree species in Zambia whether in a protected area or outside.

These tree species are:
1. *Afzeliaquanzensis* (Pod Mahogany)
2. *Baikiaeaplurijuga* (Teak)
3. *Entandrophragmacaudatum* (Mountain Mahogany)
4. *Faureasaligna* (Beech wood)
5. *Khayanyasica* (Red Mahogany)
6. *Pterocarpusangolensis* (African Teak)

Relevance to the Project: - *The site is covered by various vegetation species therefore its relevant to the act is relevant.*
Compliance – *The developer shall comply accordingly*

The National Heritage Conservation Act (Cap 173)

Enacted in 1989, the Act provides for the Conservation of Ancient, Cultural and Natural heritage, relics and objects of aesthetic, historical, pre-historical, archaeological or scientific interest. It establishes the Commission and sets out its functions.

The Act is the implementing legal framework in Zambia of the World Heritage Convention of 1972, under which the heritage sites (such as Victoria Falls) are included in the World Heritage List as World Heritage sites.

Relevance*:- This Act is relevant to this project as the project site. During construction and operation implementation phases any objects of prehistoric or archaeological interest may be found.*
Compliance there of*: The project shall comply with the provisions of the Act by particular attention is paid to establish the presence of any artefacts or objects of archaeological significance within the project area.*

The National HIV/AIDS/STI/TB Act of 2002

The Act provides for the establishment of the HIV/AIDS/STI/TB Council whose functions include the coordination and provision of support to development, monitoring and evaluation of multi-sectoral response for the prevention and combating of the spread of HIV/AIDs/STI and TB in order to reduce the personal, social and economic impacts of HIV/AIDS/STIs and TB.

Relevance: *Being a new investment of large scale it's bound to attract more people seeking for employment, thus putting LAIL Limited employees at risk of contracting HIV/AIDS and related STIs.*

***Compliance there of**: LAIL Limited shall develop measures to address the concerns of this Act.*

The Zambia Wildlife Act No 14, 2015

An Act to provide for the winding up of the affairs of the Zambia Wildlife Authority; establish the Department of National Parks and Wildlife in the Ministry responsible for tourism; provide for the appointment of a Director and other officers responsible for National Parks and Wildlife; provide for the transfer of the functions of the Authority to the Ministry responsible for tourism, Department of National Parks and Wildlife and Director of National Parks and Wildlife; establish the Wildlife Management Licencing Committee; provide for the establishment, control and management of National Parks.

Relevance: - *The site is within the development zone of the game management area. Lake Agro Industries shall therefore act in a manner consistent with defined protected area management plans and adhere to principles highlighted in this law during project implementation of the farm.*
***Compliance there of**: The project shall comply with the provisions of the Act by particular attention is paid to establish the presence of any significant wild fauna and flora within the project area that may require protection.*

The Fisheries Act No. 22 of 2011

The Act provides for the appointment of the Director of Fisheries and fisheries officers and provides for their powers and functions. It promotes sustainable development of fisheries and a precautionary approach in fisheries management, conservation, utilization and development. It establishes fisheries management areas and fisheries management committees and provides for the regulation of commercial fishing and aquaculture. It establishes the Fisheries and Aquaculture Development Fund. It has replaced the Fisheries Act of 1974. The implementing institution for this Act is the Ministry of Fisheries and Livestock. The Act regulates all fishing activities in Zambia undertaken in any kind of aquatic ecosystem. This includes lakes, rivers and streams. It also regulates activities that may interfere with fisheries.

***Relevance:** The project area has the Luwombwa River which form boundaries to the project site. Operations near the water body if not properly managed may affect the aquatic ecosystem (fish and other species) that may be found within the water body.*
***Compliance thereof:** LAIL will follow the guidelines in this Act to avoid the contamination of the stream which may result in adverse impacts on aquatic species.*

The Noxious Weeds Act, Cap 231

The Noxious Weeds act gives provisions for the regulation of weeds declared noxious in an area or agricultural lands. The relevance of this act is that LAIL will not import, distribute, convey and or sale any noxious weed or any part thereof or of any seed with which the seed of any particular noxious weeds has become mixed with as provided in the act.

***Relevance:** The Act is relevant to avoid the introduction of noxious weeds in the agriculture area although the farm will not be involved in cropping activities whose core operation will involve the application of pesticides and fertilizers.*

Compliance thereof: *LAIL will remove any noxious weeds as identified and instructed by an authorizing officer acting legally and in accordance with this act.*

The Plant, Pests and Diseases Act

The plant, pests and diseases Act cap 233 has provisions for eradication and prevention of spread of pests, control of importation of growing media, injurious organisms, invertebrates and plants, cured tobacco and miscellaneous.

Relevance: *In the cropping operations at the farm, pest infestation may occur and LAIL will take all necessary measures within the provisions of this act to eradicate and prevent the spread of pests within and outside the proposed project site.*
Compliance thereof: *Importation of any growing media, injurious organisms, invertebrates and plants will be controlled in accordance with the provisions of this act.*

Plant Variety and Seeds Act (Amended by Act No. 21 of 1995)

The plant, pests and diseases act gives provisions on administration, registration of seed importation and cleaning, seed certification, inspection of seeds, prescribed seeds, import and export of seed, offences related to seeds and miscellaneous issues regarding seeds.

Relevance: *In the farming process, pests and diseases may affect the crops to be planted at the farm. The possibility of disease outbreak may be there within the farm.*
Compliance there of: *LAIL will take all necessary measures within the provisions of this act to eradicate and prevent the spread of pests and disease within and immediate surrounding of the proposed project site. Importation of any growing media, injurious organisms, invertebrates and plants will be controlled in accordance with the provisions of this act.*

Agriculture (Fertilizers & Feed) Act No. 13 of 1994

The act provides for the regulation and control of the manufacture, processing, importation and sale of agricultural fertilisers and farm feed. It also provides for minimum standards of effectiveness and purity of such fertilisers and feed.

Relevance: *This act is relevant in that the cropping operations at the farm will involve application of fertilizers on the fields that will be irrigated and this may have been carried with water run-off into the stream affecting downstream users and leading to eutrophication.*
Compliance thereof: *LAIL will strictly follow the requirements and provisions in this act and prevent contamination of the stream bed.*

Biosafety Act

An Act to regulate the research, development, application, import, export, transit, contained use, release or placing on the market of any genetically modified organism whether intended for use as a pharmaceutical, food, feed or processing, or a product of a genetically modified organism; ensure that any activity involving

the use of any genetically modified organism or a product of a genetically modified organism prevents any socio-economic impact or harm to human and animal health, or any damage to the environment, and provide for matters connected with or incidental to the foregoing.

Relevance: *It is relevant because the project will produce crops of which globally there are GMO varieties available. It is relevant because the project will require stiff measures on bio-safety to control diseases on the farm.*
Compliance there of: *Compliance with the provisions of the Act with regards to operating according to the requirements of the Bio-safety act.*

The Occupational Health and Safety Act No 36 Of 2010

The Occupational Health and Safety Act cover all types of industries in Zambia. It provides general guiding principles for occupational health and safety. For Example, Section 11 of the Act requires that all employers establish health and safety committees.

Relevance/ Compliance: - *It is a legal requirement for all industries to comply with these provisions hence the relevance to LAIL Limited.*

The Investment Act

Enacted in 1993, the Act provides for a legal framework for investment in Zambia. The Act relates to the environment indirectly by providing incentives for tree planting, soil and water conservation activities. The Act further recognises the role of other agencies including those responsible for environmental protection in authorities' specific projects. Thus, no investment project can be implemented without giving due consideration to environmental protection.

Relevance: *The project is an investment and therefore the Act is very applicable.*
Compliance there of: *Obtaining the relevant Investment incentives.*

International conventions

The Zambian Government is a party to a number of multilateral international environmental agreements. Being a signatory to such international devices imposes obligations on the host country to address the topics raised in those documents. Most of the Conventions have been customized through various statutory instruments and are already being enforced. Applicable Conventions are briefly described below.

Zambia is signatory to a number of international conventions and protocols aimed at addressing environmental concerns. Some of the conventions and protocols relevant to the project are:

The **Montreal Protocol** of 1987 for the control of ozone depleting substances; all refrigeration systems bought and installed at the farm will be CFCs free compliance.

The **Convention on International Trade in Endangered Species of Wild Flora and Fauna**; as a site within a pristine ecosystem care shall be taken to protect any endangered species of wild flora and fauna.
The **Convention on Biological Diversity**. The objective of the CBD is to foster international cooperation in the conservation of biological diversity and to promote sustainable use of natural resources worldwide. It also targets the sharing of the benefits arising from utilization of natural resources.
African Convention on the Conservation of Nature and Natural Resources (Algiers, 1968), (Maputo, 2003):-

The objective of the convention is to encourage individual and joint actions for the conservation, utilization and development of soil, water, flora and fauna for the present and future welfare of mankind. This must be done from an economic, nutritional, scientific, educational, cultural and aesthetic point of view.

Other International and Regional Conventions

- Convention on the Protection of World Cultural and Natural Heritage
- Convention on Migratory Species (CMS)
- The Ramsar Convention
- Convention on Wetlands of International Importance, e.g. Waterfowl Habitat,
- Convention on International Trade in Endangered Species of Wild Flora and Fauna
- United Nations Convention to Combat Desertification

The above environmental laws, policy and regulations, as well as conventions and protocols, together provide the environmental legal framework which the EIA Team shall study in order to advise Lake Agro Industries on compliance requirements during project implementation.

Associated Projects within the region

Farmers in the area rarely embraced large scale farming. The site is about 28 Km from Nansanga farming block.

PROJECT Description

Lake Agro Industries Limited (LAIL) intends to establish a commercial farming unit with associated infrastructure such as centre pivots, silos, workshop and offices. The proposed project will be fully integrated into a commercial irrigated agriculture scheme for food crops and its ancillary infrastructure. The project will include introduction of irrigated fields within the farm boundary (centre pivots). The operations will involve land clearing, tilling, levelling and construction of an irrigation system to provide the necessary water required for crop production. Exploiting this potential will enable Lake Agro Industries to contribute to increased overall national production levels of cash crops such as wheat, maize and soya beans which are far short of meeting demand at national and regional level. Lake Agro farms geographical location in the northern part of Serenje gives it a competitive edge given that this part of the country is near to the equatorial region and less vulnerable to rain variability compared to the southern part.

The other components will include construction of necessary infrastructure such as silos, installation of chemical storage sheds, workshops and accommodation units for workers. The main activities of the project will include:

- Land clearing for center pivots as well as rain fed farming;
- Sinking of boreholes of irrigation water;
- Water abstraction;
- Construction of farm buildings and field access tracks;
- Installation of the power and water reticulation system;
- Building of staff housing units, offices, workshops, petroleum storage tanks and storage barns;
- Establishing waste disposal site in close collaboration with Chitambo district Council
- Planting of crops

The operations at LAIL farm shall be supported by associated infrastructure such as boreholes for domestic water, road network and electricity supplied by ZESCO Limited (ZESCO), which is Zambia's power utility provider.

The area has three proposed electricity supply lines which are intended to service the Nansanga farm block. The construction works of 95 km, 33 kV overhead line from Serenje Central Business District to Kabeta 2.5 MVA, 33/11 kV substation via the Core venture was completed in March 2006. The overhead line runs from Serenje substation through Lumpapa School to Chimupati School on the Great North road, before branching northwards at Mulilima.

The proponent intends to apply to ZESCO for power extension.

Project Components

Land Preparation for Agricultural Fields

Land preparation will inevitably lead to clearing of flora and generation of biomass. The project site, as viewed during the visit to the area, is predominantly miombo woodland. This kind characterises thick and heavy trees which, for the planned scale of operation, require mechanical clearing. Vegetation will be cleared in a way to establish the required field radius for each crop field; several patches of undisturbed vegetation will be left between crop fields. Vegetation will also be cleared in the area designated for the pump houses and access roads and firebreaks. Vegetation clearing will also be necessitated to pave way for construction/establishing of farm tracks and to some extent electricity and water reticulation system.
The cleared biomass will be ferried to the outlying areas of the fields and the locals will be allowed to collect this for fire wood or construction materials. The leaves and grass debris will be left to decompose as organic materials. Care will be taken when clearing land, only flora in the radii of Centre pivots will be affected. The following areas will not be utilized for production:

Dambo, riverine and other areas prone to flooding;

Non-arable areas such as hills, steep slopes and rocky areas where natural vegetation is retained;
Conserved land where there is little or no impact;
Wooded areas between pivots which act as wind breaks and fauna habitat.

Site equipment and machinery will include bulldozers, crawler excavator, tractors, ploughs and other land tilling farm equipment, while raw materials will include cement, timber, iron sheets, steel bars, diesel fuel, seeds, and agriculture chemicals, among others.

Tillage

The process of cultivating crops begins with tillage of the soil. Although tillage can serve a number of functions within a crop production system, the most fundamental function is to create conditions that will ensure good contact between seed and soil at the time of seed planting and the ready availability of water to the seed during germination. LAIL will apply minimum tillage using a rotary disc mounted on a tractor. After primary tilling secondary operations will be carried out, before seed furrows are prepared. All stones will be removed from the field to prevent serious damage to implements.

Tillage is key because, apart from disease and the weed problem, poor tillage and consequent poor and uneven germination constitute one of the important limitations to good crop yields. Rushed and inadequate landscaping gives rise to problems that grower has to live with for full crop cycle. Good tillage ensures excellent yields and thereby improving the economics of cereal production. Tillage carries the following additional benefits:

Creation of a seedbed or root bed;
Control of weeds or the removal of unwanted crop plants;
Incorporation of plant residues into the soil profile;
Establishment of specific soil surface configurations for planting, irrigating, drainage, and/or harvesting operations.

Planting

After phased tillage, mechanical planting using planters toppled by tractors will follow. The basal dressing of synthetic fertilizer will also be applied at this stage. The optimum number of seeds planted will vary with soil type, hybrid, irrigation, fertility, and other management practices. Irrigated crops require higher plant population than non-irrigated crops to fully utilize the potential of irrigation. Seeding rates depend on the hybrid, yield expectations, and row width. The number of seeds to be planted for rain-fed crops will be in the range of 15,000 to 23,000 seeds /acre. Seeding rates for irrigated production will range from 24,000 to 32,000 plants / acre. Seed companies normally provide a recommended population for each hybrid. Generally, 24,000–30,000 plants/acre are recommended for most early and medium maturing hybrids with irrigation. Plant populations for the later maturing hybrids should be 22,000–26,000 plants/acre. Excessive populations may increase seed costs and may reduce yield because of inadequate watering or rainfall and lodging, however, 10–15% more seed/acre will be planted as it is necessary to produce the desired plant population in case of

die outs. It is expected that the seeds will germinate at the rate of about 95%, and another 5–10% may be lost to insects, disease, or other pests.

Increased yields shall be obtained with more narrow rows at high plant populations. This allows plants to exploit more moisture, nutrients, and light due to greater space between them. Basal fertilisers may be added according to soil type but there is a risk that this can also be washed away by rain or irrigation water to river bodies if the fields are flooded with water.

Irrigation - Centre Pivot

The project is designed to use the centre pivot irrigation system which will have over 35 circular fields across the project site with varying areas covering about 80 –100 ha The centre pivot system was chosen due to its high proficiency in conserving water than other systems and it allows a significant amount of vegetation between the pivots to be retained. The amount of water required for each crop cycle will be optimally utilized without unnecessary losses in irrigation lines. All scheduling of irrigation cycles will be done using scientifically proven methods. In-field gauging rainfall figures and evapotranspiration ratios pertaining to each individual crop will be recorded. This will prevent any water loss. Associated infrastructure such as pump stations and network of distribution of feeder pipelines will be constructed.

Water from the Luwombwa river will be transported via hydro lines to agricultural fields constructed with a network of distribution pipes. Water shall be pumped to the respective agricultural fields from pumping stations located at appropriate points. The estimated water requirements (which will be applied for and obtained through WARMA) is 25, 000m^3 per annum.

Centre pivot pump houses shall be constructed of a mono pitched roof corrugated iron sheets resting on timber members devoid of ceilings. Each agricultural field shall have a Centre pivot system that irrigates the crop at given times and duration according to farm irrigation schedule.
Irrigation, when combined with other good production practices result in good yields usually around 150 bushels per acre and greater, non-irrigated crop yields can range from 5% to 75% of irrigated corn.

Total water needs for cereal crops shall vary from 500-610 mm during a season, depending on weather, plant density, fertility, days to maturity, and soil type. With normal rainfall events, about 300 mm of irrigation is often needed. Ample moisture should be available in the root zone until physiological maturity is reached (maximum dry weight of grain), which is about 60 days after tassel emergence.

Coarse-textured soils will need to be irrigated more frequently than fine-textured soils. In general, fine-textured (clay and silt loam) soils have a lower infiltration rate than coarse-textured (sandy and sandy loam) soils. Dambo soils would hold from about 18 mm of water per foot to about 40 mm of water. The main principle underlying the project is to irrigate and avoid excessive runoff.

Agricultural Chemicals

Storage

The storage and handling of agricultural chemicals is one of the many activities that will be done during operational stage. However, if stored safely in a secure location, agricultural chemicals (pesticides and fertilizers) pose little danger to the environment. LAIL will use the Best Management Practices (BMPs) for handling and storage of all the agriculture chemicals on the farm. The following will be done for proper storage of agriculture chemicals:

Storage facilities will be built to keep pesticides and fertilizers secure and isolated from the surrounding environment. These storage facilities will be located down slope away from water bodies on the farm.
Herbicides, insecticides, fungicides and fertilizers will be segregated and their respective labels kept during storage to prevent cross-contamination and minimize the potential for misapplication.
All agriculture chemicals (pesticides and fertilizers) will be kept out of the way of activities that might rip open a bag or puncture a liquid storage container
All chemicals will be maintained in their original well labeled containers, securely closed and regular inspections will be carried out for splits, tears, breaks, or leaks.
Apart from handling chemicals, employees will also be trained on the BMPs of storing agriculture chemicals.

Fertilizers will be stored in a high head room steel framed structure. The shed will be constructed of a ridged roof of IT4 iron sheets resting on steel members with roof additionally supported on stanchion bolted on to concrete pad foundations.

Chemicals will be stored in a shed constructed of a mono pitched roof of corrugated iron sheets resting on timber members devoid of ceilings, concrete block infill walls plastered and painted internally and rendered externally and solid concrete floor finishes with cement and sand screed.

Handling

To ensure that there is minimal contamination of the environmental from handling of chemicals, the following will be done:

LAIL will provide protective attire for all employees working with agriculture chemicals. Employees will be trained in the BMPs of handling and storage of agriculture chemicals.

Extreme caution will be taken when handling concentrated chemicals as spills could result in expensive hazardous waste cleanups. The mixing and loading operations of pesticides will be located away from ground bodies and areas where runoff may carry spilled pesticides into surface water bodies. All mixing and loading areas will be placed close to storage facilities, to minimize the distance that chemicals are transported before filling the sprayers.

All application equipment will be properly calibrated and kept in good repair. All calibration will be done according to the measure of the amount of pesticides per hectare.
Chemical spills will be cleaned up immediately to avoid contamination of the water bodies.

Before disposal, containers and bags will be cleaned and dried respectively. Liquid containers will be pressure rinsed and punctured. The container and bags will then be stored temporarily before being transported to approve disposal sites.
LAIL will keep records of all chemicals used on the farm. These will include records of all chemicals available and those that have been used in the past, what they are going /were to be used for, where and how they will/were disposed off. Record keeping is intended to ensure that all chemicals used on the farm are accounted for as a measure towards BMPs of handling and storage of these chemicals.

Application

The application of all chemicals will be done using Boom Sprayers and Aerial Sprayers.

Herbicides: these will include pre emergence and post emergence herbicides. Pre emergence will be applied to the soil to prevent all weeds and any other undesirable vegetation such as grasses from germinating. Post emergence herbicides will be used to kill weeds after they germinate.
Insecticides: oil seed crops such as Soya bean and wheat are prone to attack from insects at almost any time of the season. To ensure that all crops are protected at all stages of their growth season, LAIL will procure only certified seed that will be purchased from accredited suppliers and all growing plants threatened by insects will also be sprayed.
F*ungicides***:** will be applied to kill or inhibit the growth of fungi that may cause damage to crops on the farm.
Fertilizers: these will include booster/ liquid fertilizers, organic fertilizers and inorganic fertilizers. All fertilizers will be applied to ensure that maximum yield is achieved.

Chemical Use

Fertilizers will be used to grow the crop followed by chemical weeding and control of pests. At final harvest, chemicals will still be used in or to add port-life to the produce and further protection from pests. In the silos, fumigation or drenching will be used according to the state of technology preferences.

Harvest Storage

LAIL will carry out harvesting on time at the recommended moisture content to avoid losses for all crops that will be grown on the project site. Soyabeans, for instance, will be harvested as soon as the crop is ready, at moisture content of 13% to 15% because harvesting losses increase rapidly as soya beans dry out. Harvesting will utilize a combination of manual harvesting and a combine harvester. The company will employ combine harvester to avoid losses. The local people employed in harvesting operations will also be trained in the best harvesting techniques of all crops. All the yields from crops will be stored in silos. The company will implement the most effective measures to maintain quality in storage by ensuring that the silos are well ventilated, clean and sanitized before and during storage.

Farm Infrastructure

Expected infrastructure will include housing, office buildings, workshops, storage silos, weighbridge and other support facilities for long term operational workers. Access roads to link the agriculture fields to other facilities on the farm and link the project area to the existing road infrastructure will also be constructed to establish an efficient network system. LAIL expects that some of the workers, especially the general workers from the local community, will be living in their own houses outside the project area.

Housing Area

It is anticipated that several housing units will be located in various areas of the farm block; houses. Housing areas will be located in the vicinity of the farm centers for which provision will be made for medium cost houses for management staff and low cost houses for skilled workers.

Fuel Storage Facility

Fuel storage (80m^3 diesel) will be provided at the farm center in accordance with Energy Regulation Board regulations and the standards set by The Zambian Bureau of Standards: ZS 392: Part 2.

EIA Scope of Work

The study will be conducted by different experts in the relevant areas. Since the project is already planned and designed, some secondary data is already available. Secondary data will be analyzed for adequacy and used in the EIS where necessary. Data collected over the period of time will be evaluated and analyzed before being put into the EIS.

The following tasks will be undertaken during the EIS study for the Project:-

Scoping of the proposed study area during site familiarization visits;
Public Consultation to develop the TORs;
Submission of the TORs to ZEMA and review for adequacy;
Literature review and analysis of secondary data;
Baseline Studies;
Compilation of draft EIS;
Review of draft EIS by ZEMA; and
Compilation ad submission of the final 12 EIS report copies to ZEMA.

EIA METHODOLOGY

The method adopted during the scoping process involved consultative meetings and discussions with relevant government institutions at national, provincial and district level, local communities, chiefs, headmen and community at large communities in Serenje. The process also included initial environmental survey of the project site.

Responses from the consultations and discussions provided the relevant background information and helped identify major environmental concerns of the communities in the project area for this report.

The ESIA study will focus on having an in depth understanding of how the project, its activities, processes and its management regime, the nature of the current status of the site and its surrounding environment and how the potential impacts of the project in its operational phase will be managed. The study will gather data on the different facets of the environment such as climatic conditions, geographical characteristics, biological characteristics, socio-economic characteristics and possible impacts such as the socio-economic environment, employment opportunities and effects on other land-uses that are important to the area's economy, etc. Emphasis shall be placed on impacts that will have been caused as a result of the operations of the project activities during all the three phases of project implementation.

The EIA shall involve:-

Desk study and review of the available background information about the project proponent, the project operation and its nature., the environmental and legislation information, literature review concerning the project site, collection of secondary data, analysis of survey plans, stakeholder meeting and interviews;
Collection of primary data and carrying out ground truthing on the information provided to the consultants and triangulation of important information during literature review in order to have an in-depth understanding of the current status of the project site and its surrounding environment;
Evaluating the objective of the project against the current environmental status and project conceptualization;
Identifying all potential social-economic, positive and negative impacts that may have arisen as a result of implementing the project and their impacts on the biophysical environment, their magnitude and significance;
Prescribing the mitigation measures to all the identified potential negative impacts;
Outlining a sustainable Environmental and Social Management Plan (ESMP) for the project.

Characterization of impact significance will be done considering the following factors:

Beneficial or detrimental (Positive, Negative),
Probability of impact occurrence (Unlikely, Possible, Probable, Certain),
Frequency of impact occurrence (Continuous, Frequent, Infrequent, Occasional),
Duration of the impact (Short-term, Medium-term, Long-term),
Timing of the impact (Preparation, Construction, Operation, Post Decommissioning/Closure),
Severity of the impact (Very High, High, Moderate, Low),
Spatial extent of the impact (Localized, Project Area, Limited, Widespread) and
Sensitivity of the element being impacted (High, Moderate, and Low).

Other considerations will include assessment of the value of the affected environmental component, risk posed by the impact to the human population and cumulative Effects. Impacts will also be characterized as direct or indirect in order to have a full appreciation of the impacts and facilitate effective management of the impacts.

The Environmental Management Plan (EMP) will seek to give a comprehensive plan on how proposed mitigation measures will be implemented during preparation, construction, operational and decommissioning phases of the project and as such will serve as a useful management tool to guide implementation of the proposed measures. The ESMP will comprise of an Impact Mitigation Plan, Impact Monitoring Plan and Emergency Response Plan.

The ESMP will outline the duties and responsibilities of the developer, contractor and other relevant parties with respect to environmental management to ensure successful implementation of these measures, monitoring and subsequent audits during all project phases.

EIA REPORTING AND OUTPUTS

Steps of the EIA Study Process

The study will be conducted by different experts in the relevant areas. Since the project is already planned and designed, some secondary data is already available. Secondary data will be analyzed for adequacy and used in the EIS where necessary. Data collected over the period of time will be evaluated and analyzed before being put into the EIS.

The following tasks will be undertaken during the EIS study for the Project:-

Scoping of the proposed study area during site familiarization visits;
Public Consultations;
Submission of the Scoping Report to ZEMA and review for adequacy;
Literature review and analysis of secondary data;
Baseline Studies;
Compilation of draft EIS;
Review of draft EIS by ZEMA; and
Compilation ad submission of the final 12 EIS report copies to ZEMA.

EIA Study Spatial Extent

The environmental and social impacts of the project are to be addressed to the degree necessary to enable all relevant decision makers and the general public to be adequately informed. The nature and level of investigations to be carried out during the EIA study will be relative to the likely extent and gravity of impacts.

These ToRs adhere to the requirements of the Environmental Impact Assessment (EIA) regulations of the Environmental Management Act (EMA) of 2011. The EIA regulations demand that socio-economic and environmental impacts consequential to the construction and operation of the project are assessed well in advance.
In particular, the preparation and submission of these draft ToRs fulfills the requirements of regulation 8 of Part II of the EIA regulations which states the following:

An environmental impact statement shall be prepared and paid for by the developer in accordance with terms of reference prepared by the developer in consultation with the Agency.

To ensure that public views are taken into account during the preparation of the terms of reference, the developer shall organize a public consultation process, involving Government agencies, local authorities, nongovernmental and community-based organizations and interested and affected parties, to help determine the scope of the work to be done in the conduct of the environmental impact assessment statement and in preparation of the environmental impact statement.
The developer shall prepare the Terms of Reference taking into account issues contained in the Third Schedule and the results of the consultations undertaken under sub-regulation (2) and submit these to the Agency for approval.

Proposed EIA Content

The EIS will contain a non-technical summary in a style of writing understandable for the majority of the general public. The format of the EIS will be in accordance with the following outline:

EXECUTIVE SUMMARY

The executive summary will briefly describe the proposed project, alternatives considered, baseline data, major impacts and environmental management commitments.

TABLE OF CONTENTS
Introduction

Background of the project.
Summary description of the project including project rationale.
Objectives of the project.
Brief description of the location.
Particulars of Shareholders/Directors.
Developers' physical address and contact person.
Track record/previous experience of enterprise elsewhere.
Total project cost/investment.
Proposed project implementation date.

Policy, legal and institutional framework

Legislative and institutional framework in Zambia.
Environmental Legislation in Zambia.
Requirements for EIA.
Institutional framework for environmental management.
Land tenure and land acquisition.

3.0 Description of the Proposed Project and Project Activities

Location
Project description
Main activities
Site preparation phase
Construction phase
Operation phase
Decommissioning and Closure phase

Project Alternatives

Location alternatives
Process and technology
Raw materials
By products
Justification for the selected option(s)

5.0 Baseline Study of the Project Site

Topography
Climate (*Rainfall, Temperature, Humidity, Sunshine*).
Air quality
Geology
Hydrology (*surface water quality*)
Hydrogeology (*ground water availability*)
Soils
Landuse
Built Environment
Land tenure
Noise and vibration
Fauna
Flora
Birds
Archaeological and cultural environment

5.1 Social-Cultural and economic set up

Population dynamics
Administration
Social services and amenities
Market availability on various commodities
Literacy levels, health and gender equity
Cultural and historic environment (e.g. sites of cultural interest, landscape)
Interested and affected Parties

Environmental Impacts of Proposed Activities

Biophysical environment

Positive – direct, indirect, short term, long term, reversible and irreversible
Negative - direct, indirect, short term, long term, reversible and irreversible

6.2 Socio- economic and cultural

Positive – direct, indirect, short term, long term, reversible and irreversible
Negative - direct, indirect, short term, long term, reversible and irreversible

Evaluation of impacts significance should combine:

The ***frequency*** of occurrence of the impact.
The ***duration*** of the impact.
The ***spatial extent*** of the impact.
The ***sensitivity*** of the element being impacted.

Environment and Social Management Plan

This will include Management commitments (**Mitigation Measures)** for mitigating negative Environmental Impacts identified and evaluated in section 6.0 and measures for enhancing positive impacts.

Environment and Social Monitoring Plan

This will include environmental management cost estimates, responsible personnel and the frequency of monitoring as reflected in the table below;

Aspect	Impact	Mitigation measure	Frequency of monitoring	Time frame	Performance indicator	Responsible person	Cost

DECOMMISSIONING AND CLOSURE PLAN
CONCLUSION
REFERENCES
APPENDICES

A copy of approved Terms of Reference
Maps and satellite images
Proof of public consultation (Minutes and comments from the public consultation and scoping)
Any other relevant supporting documents or information that cannot be presented in the report.

SPECIALIST STUDIES

As part of the EIS study, the following specialist studies would be undertaken among others :

Socio-economic and cultural Impact Assessment;
Air and Noise Pollution Impact Assessment;
Ecological Impact Assessment;
Hydrological (include the source of water and its effects)
Soil studies;
Flora and Fauna

SOME OF THE MAIN ISSUES TO BE CONSIDERED DURING THE EIA STUDY

Air Quality study

Thorough review of literature, collection and review of the local meteorological data around the project area;
State and analyze different sources of air quality;
Evaluate the existing air quality around the project area, which may be affected due to the development.

Noise

Determine the sources of noise in the project area and how the proposed constructions will affect the surrounding communities;
Evaluate the noise impacts due to the project development.

Waste

Establish the baseline situation with regards to categories of waste according to construction waste, domestic waste etc.;
Impacts of waste to the surrounding communities.

Land Use and Tenure

The consultant will examine the following:

Current zoning classification of the site;
Current use of the site and adjacent properties;
Existing structures on the site and if such structures will be demolished;
Existing wetlands and other protected areas (if any);
Existing hazardous waste sites;
Existing farmland, residential.

Flora

The consultant will examine the following:

Examine the Flora in the study area with rare, threatened, endemic and specially protected species;
Photos showing the characteristics of the vegetation type on site;
Photos showing

Fauna

The consultant will examine the following:

Fauna in the study area, threatened endemic and specifically protected species if any;
Photos showing the characteristics of more important species.

Socio-economic Environment

The consultant will examine the following:

Assessment of peoples livelihoods in the project area;
HIV/AIDS and other diseases and the projects likely to influence on the disease;
Customs ,value systems, social classes, hierarchical relationships and kinship structure;
Organization, leadership structure, and decision making system;
Social activities, community organizations and facilities, such as health, education and sources of energy.

Climate

Through review of literature, collect and analyze the local meteorological data around the project area.

Geology and Hydrogeology

The consultant will examine the following:

Review of literature, collect and analyze the local geological data of the project site;
Assessment of rock formation of the project area;
Assessment of hydrogeology of the project area.

Hydrology

Investigate the existing water quality of the area;

Water Quality-Surface and Ground water Quality.

Noise and Vibrations

The consultant will examine the following:

The sources of noise in the project area and how the proposed construction will affect the surrounding communities;
The effects on the surrounding communities;
Evaluate the noise impact due to the project development.

Potential Environmental Impacts

From the consultations and field survey of the proposed project, it is the opinion of the project proponent that the focal environmental issues when implementing the project are as follows:
Planning Phase
The Environmental issues likely to be of concern during the planning phase of the project include:

Project design,
Obtain development permits,
Obtaining Water rights
Initial consultative meetings,
Identifying environmental baseline data and its sources,
Draft plan for waste systems,
Construction Phase
Environmental issues likely to be of concern during the land clearing phase of the project include:

Site clearing,
Siting of construction works;
Construction of access routes,
Waste at construction;
Increased traffic;
Increased incidences of HIV/AIDS, other STIs and pregnancies;
Air pollution during delivery of materials to the project site;
Construction of buildings and infrastructure,
Construction of drainage and waste systems,
Waste management from construction works;
Employment for the local community.

Operational Phase
Environmental impacts over the operational life of the project could include:

Abstraction and use of water;
Generation of waste – solid, gaseous;
Employment of staff and training;
Consumption of energy for conditioning, heating, etc;
Maintenance of facilities and infrastructure;
Transport movements;

The concerns of the public and the key potential environmental impacts will all be carefully addressed in the detailed EIA study.

Analysis and Evaluation of Impacts

The objective of this section will be to predict and assess the likelihood of potential impacts that may rise from implementing the proposed Farm Project and recommend mitigating measures. A matrix will be prepared according to the criteria below:

Nature of Impact

This will be an appraisal of the type of effect the implementation of the project will have on the affected environmental component. Its description will include what will be affected and in what way.

Direct Impacts

These will be impacts that are most likely to appear immediately as a result of the activity of farm establishment project.

Indirect Impact

These will be impacts that will be related to the project but will arise from the activity of farm establishment project.

Spatial Extent

The physical and spatial size of the impact. This will be a description of whether the impact would occur on a scale described as follows:

The physical and spatial size of the impact. This will be a description of whether the impact would occur on a scale described as follows:

Site, the impact could affect the whole or measurable portion of the site. Whether it is limited to the immediate area the proposed project;

Local, the impact could affect the extended area adjacent to the site perhaps a neighbourhood or small town. Whether it would affect environs up to 15 Km outside the immediate environment;

Regional, that impact could affect the area including the outlying areas of the city, the transport routes and the adjoining towns.

National, the impact could be as far reaching international boundaries.

Duration

The lifetime of the impact; this will be measured in the context of the life-time of the proposed development as follows:

Short term, the impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase.

Medium term, the will last for the period of the construction phase, thereafter it will entirely negated.

Long term, the impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter.
Permanent, the only class of impact which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

Intensity

This will be a description of whether or not the intensity (magnitude) of the impact would be high, medium, low or negligible (no impact).

Low, where the impact will not have significant influence on the environment, and this will not be required to be significantly accommodated in the project design or implementation; the impact alters the affected environment in such a way that natural process of functions are not affected in any significant way.
Moderate, where it could have an adverse influence on the environment which would require modification of the project design or alternative implementation schedules; the affected environment is altered, however, function and process continue, albeit in a modified way.
High, where it could have significant influence on the environment but cannot be mitigated or be accommodated by the project environment by introducing alternative mitigation measures such as realignment of the farm boundaries at a particular stretch or adoption of different design measures. Function or process of the environment is disturbed to the extent where it temporarily or permanently.

Probability

This will describe the likelihood of impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity and not at any given time. The classes are rated as follows:

Unlikely, the probability of the impact occurring is very low, due to the circumstances, design or experience.
Possible, the impact could possibly happen, and mitigation planning should be undertaken.
Probable, it is most likely that the impact will occur at some or other stage of the development. Plans must be drawn up before the undertaking of the activity.
Definite, the impact will take place regardless of any prevention plans, and only mitigatory actions or contingency plans can be relied on to contain the effect.

Determination of Significance
The classes are rated as follows:

Negligible, the impact is not substantial and does not require any mitigatory action.
Low, the impact is of little importance, but may require limited mitigation.
Moderate, the impact is of importance and therefore considered to have mitigation. Mitigation is required to reduce the negative impacts to acceptable levels or positive impacts maximised.
High, the impact is great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential. Positive impacts should be enhanced as a priority.

Project Influence Areas with Direct Impact

Areas within the road reserve and falling within 30 metres width of the road.
Steep, mountainous and rugged topographic terrain areas.
At maize storage sites, access roads and boundaries.
Fields with or without crop located in the boundaries with Nswebe.
In forest areas, mountain sides and vegetation covers.
River and stream crossings and river banks within the proposed farm project area.

Project Influence Areas with Direct Impact

Adjacent areas beyond the 10 Kms width will be the areas that could indirectly benefit and or experience adverse impacts of the farm project.

The majority of the population in the area is already linked to agricultural inputs and markets from the existing LAIL operations and will benefit from the close proximity of this project to their farming areas.

Annex 12: APPROVED TORs

ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY

Head Office
Corner of Church & Suez Roads
P.O. Box 35131
Lusaka, Zambia
Tel: +260- 211-254130/254023/254059
Fax:+260-211-254164/256658

Northern Regional Office
Jacaranda Road
P.O. Box 71302
Ndola, Zambia
Tel: +260-212-621048/610407
Fax: +260-212-610246

Livingstone Office
Plot No. 555
Junction Obote / Neru Roads
P.O. Box 60195
Livingstone, Zambia
Tel / Fax:+260-213-321297

Chirundu Border Office
Lusaka Road
P.O. Box CRU31
Chirundu, Zambia
Tel/Fax: +260-211-515261

In reply please quote

ZEMA/FAC/101/12/5/L/12/3

September 26, 2019

The Director
Lake Agro Industries Limited
Farm No 39, Chichele
New Airport
NDOLA

Dear Sir,

RE: SECOND DRAFT TERMS OF REFERENCE AND SCOPING REPORTS FOR THE DRAFT TERMS OF REFERENCE AND SCOPING REPORTS FOR THE PROPOSED INTERGRATED FARMING PROJECT IN MAPEPALA/NABOWA AREA IN SERENJE DISTRICT

The Zambia Environmental Management Agency ("ZEMA") is in receipt of the draft Terms of Reference (ToRs) and Scoping Report for the above captioned project submitted for review. This is in accordance with the provisions of the Environmental Management Act No. 12 of 2011 as read together with the Environmental Impact Assessment Regulations, Statutory Instrument No. 28 of 1997.

ZEMA has reviewed the Terms of Reference and Scoping Report and would like to inform you that the general objectives are acceptable. The Agency therefore has **no objection** with you proceeding with the EIA study. However, ensure that the EIA document has a consent letter from the Chief on headed paper.

Find attached to this letter the list of issues that your EIA study should address.

Do not hesitate to contact the undersigned should there be any issue needing our attention.

Yours faithfully,

Christopher Kanema
Acting Manager Operations - South.
For/Director General
ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY

All correspondence to be addressed to the Director General - Head Office
Email: info@zema.org.zm, Website: www.zema.org.zm
Emergency Toll Free No. on Zamtel Lines: 953

Annex 13: CURRICULUM VITAE FOR PROPOSED PROFESSIONAL STAFF

Profession Position: Team Leader – EIA expert, Waste management/ Air pollution/ Noise Specialist

Name:	Gillan Simfukwe
Profession:	Environmental Management and Expert
Years of experience:	18 years
Nationality:	Zambian

Membership in Professional Societies:-

- Associate Member of Engineering Institute of Zambia [EIZ]
- Current Interim President of Impact Assessment Association of Zambia (IAAZ)
- Member of the University of Zambia Metallurgical Society.
- Former Board Member of Association International des Commercial (AIESEC).

KEY QUALIFICATIONS:

Mr. Gillan Simfukwe has over Eighteen years of professional working experience in Environmental management and sanitary analysis. His experience encompasses practical areas of environmental management at Amanita Premier oils where he served as Environmental manager and process superintendent for over six years; In impact assessments in various environmental undertakings covering Mining, Water management, road and bridge construction, plantation management, water and waste sewerage systems, aqua cultural environment, plastic industry and Oils. Further he has worked on aspects of industrial waste management in liaison with the Lusaka water and sewerage especially on effluent treatment and management in process industries. He has undertaken several research works in dust and noise related projects.

His experience emanates from portfolios he held from 1998. He was an understudy at ZCCM, Mufulira division, later joined Amanita Premier Oils where he worked as Process manager (superintendent) and later as Environmental manager where he formulated company environmental policies and co-odinated all Environmental Impact Assessments **(EIAs**). He assisted Amanita Premier Oils to develop Environmental Management and Monitoring Systems and was part of the team, which formulated the Safety Policy. He was also assigned to study the viability of Amanita (formerly Mansa) Batteries and assess Manganese presence in Northern Province. He coordinates Environmental requirements at Dolomite Aggregates, Kafue Textiles, Handyman's Paradise etc.

Gillan was the deputy team leader in the Environmental Impact Assessment conducted on behalf of **Zambia Sugar Plc** for the expansion project covering ten (10) thousand hectares in Mazabuka. He was the team leader for the EIAs conducted on behalf **of Greenbelt Fertilizers Limited, Weye Construction & Materials, China State Construction Engineering Corporation Limited**, **Zambeef**

Products Plc, **Handyman's Paradise**, **Atlantis Metals**, **AMATHEON Agri (Z) Limited**, **Amanita Group of Companies**, **KOBIL, ORYX, PEGASUS**, **Mukambi Safaris**, **Uniturtle Industries, AVIC INTL**, **Zambia Consolidated Copper Mines Investment Holdings Plc, ACACIA Park, East Park Mall**, **MRI Seeds, 20,000ha Muma plantation and ETC Bio-Diesel**. He formulated environmental management plans for **Dolomite Aggregates**, **Zamanita** Processing Plant under **Zambeef Plc'**, Fuel depot for **Kobil Limited** and **Alasia Building & Construction**. He was sub-contracted under Kaizen consulting international for the **Chiawa Bridge** Environmental Impact Assessment. He was part of the team that was contracted by CIET (Community, Information, Empowerment and Transparency) of Canada for a countrywide impact assessment on HIV and AIDS. This involved carrying out interviews with locals of Chiengi, Kaputa, Nchelenge, Mbala and several other districts in Eastern and Northern Provinces.

Has done **International Environmental Law under the United Nations Training (Geneva, Switzerland)** with a bias in Environmental Management and Law, Environmental Impact Assessments, Climate Change at regional and global levels. He is also in possession of Certificate in Business Management from Management College of Southern Africa and Bachelors' degree in Metallurgical Engineering from the University of Zambia. In addition he has attended relevant workshops and conferences in Environmental aspects.

In addition, he is hard-working, good-oriented, organized, and enjoys solving problems and likes to see results. Proven public relations skills and ability to meet deadlines and work productively. Adept at handling steadily, increasing levels of responsibility. Able to work independently but enjoys working as a team.

Education and Professional Qualifications

- Post graduate studies in International Environmental Law offered by United Nations Institute for Training and Research (UNITAR), Geneva, Switzerland. **2007**
- **B.Sc. Mining**, Metallurgical Engineering, University of Zambia, (1998). **2005**
- Obtained a degree, Bachelor of Mineral Science from University of Zambia. **1998**
- Obtained a Division one G.E.C '0' level School Certificate from Mufulira Technical High School. **1991**

Short Courses

- Certificate in Business Management from Management College of Southern Africa. **2005 – 2006**

Career / Employment Record:-

August, 2011

Contracted to prepare the Environmental Project Brief for quarry by Longgan Limited in Chief Mungule's area,

April , 2011

Contracted to prepare the the Environmental Project Brief study report for Chambishi Filling Station by Ngucha Energy Limited, Lusaka, Zambia.

November, 2010

Contracted to prepare the Environmental Project Brief report for construction of a modern shopping complex incorporating Kobil Filling Station at Former Dunlop in Ndola, Zambia by Ancona Properties.

August, 2010
Contracted to prepare the Environmental Impact Statement (EIS) Study Report by Handyman's Paradise, Ndola, Zambia

November, 2009
Contracted as Consultant to prepare the Environmental Project Brief study report for the renovations and refurbishment of Mfuwe Lodge and Bush Camps in South Luangwa National Park, Lusaka, Zambia.

October, 2009
Contracted as Consultant to prepare the Environmental Project Brief for construction of an Airstrip in Bangweulu Game Management (GMA), Lusaka, Zambia.

August, 2009
Contracted as Consultant by Zambeef Products Limited Plc Company through Global Environmanagement Consultancy Firm to prepare the Environmental Project Brief study report for Zambeef's Chiawa Farms in Chirundu by Zambeef Products PLC, Lusaka, Zambia.

August, 2009
Contracted as Consultant by Zambeef Products Limited Plc Company through Global Environmanagement Consultancy Firm to prepare the Environmental Project Brief study report for the installation of a 6 km water pipe line for Zambeef's Chiawa Farms in Chirundu by Zambeef Products PLC, Lusaka, Zambia.

August, 2009
Contracted as Consultant by Zambeef Products Limited Plc Company through Global Environmanagement Consultancy Firm to prepare the Environmental Project Brief study report for Zambeef's Chiawa Farms in Chirundu by Zambeef Products PLC, Lusaka, Zambia.

July, 2009
Contracted as Consultant by Zambeef Products Limited Plc Company through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief study report for the extension works of Mwambashi River Lodge in Lower Zambezi National Park, Lusaka, Zambia.

June, 2009
Contracted as Consultant by MTN Zambia Limited through Plessey Execution Zambia Limited and through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief study report for the proposed Installation of the MTN GSM Base Station in South Luangwa National Park, Lusaka, Zambia.

June, 2009
Contracted as Consultant by Adventure Purists Limited through Global Enviromanagement Consultancy Firm to prepare Environmental Project Brief study reports for the proposed Mobile Bush Camps in Kafue National Park, Lower Zambezi National Park and South Luangwa National Park, Lusaka, Zambia.

May, 2009
Contracted as Consultant by Zambeef Products Limited Plc Company through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief study report for the Installation of the Fuel Depot by ZamPalm a subsidiary of Zambeef Products Limited Plc in Mpika District Project, Lusaka, Zambia.

May, 2009
Contracted as Consultant by TATA Zambia Limited (TZL) a subsidiary of TATA Zambia under the TATA Group of Companies through Global Enviromanagement Consultancy Firm to prepared the Environmental Management Plan (EMP) report for the operational management of the TATA Tannery, Kabwe Project, Lusaka, Zambia.

May, 2009
Contracted as Consultant by Sable Quarry Limited through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief study report for the Proposed Quarry & Crushing Plant in the Munali Hills Areas of Mazabuka District – Southern Province by Sable Quarry Limited, Lusaka, Zambia.

May, 2009
Contracted as Consultant by Alasia Building & Construction Limited through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief for the proposed Quarry and Crushing Plant within the Shimabala Area of Kafue District by Alasia Building & Construction Limited, Lusaka, Zambia.

May, 2009
Contracted as Consultant by Mukambi Safari Lodge (MSL) through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief study report for the proposed extension works of Mukambi Safari Lodge project within Mumbwa Game Management Areas (MGMA), Lusaka, Zambia.

May, 2009
Contracted as Consultant by Zambeef Products Limited Plc Company through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief study report for the operations of the Ranching and Sugar Cane project at Nanga Farm in Mazabuka Project, Lusaka, Zambia.

March, 2009
Contracted as Consultant by Zambeef Products Limited Plc Company through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief study report for the operational dairy project at Kalundu Farm in Chisamba, Lusaka, Zambia.

March, 2009
Contracted as Consultant by Zambeef Products Limited Plc Company through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief study report for the proposed piggery for Masterpork a subsidiary of Zambeef Products Limited Plc managing the Kalundu Farm of the Chisamba Project Lusaka, Zambia.

February, 2009

Contracted as Consultant by Sable Quarry Limited through Global Enviromanagement Consultancy Firm to prepare an Emergency Preparedness Plan (EPP) report for the operational management of the Proposed Quarry & Crushing Plant within the Shantumbu – Chalala Area of Lusaka by Sable Quarry Limited, Lusaka, Zambia.

February, 2009

Contracted as Consultant by Hippo Lodge Zambia Limited through Global Enviromanagement Consultancy Firm to prepared an Emergency Preparedness Plan (EPP) report for the operational management of Hippo Bush Camp within the Kafue National Park North, Lusaka, Zambia.

January, 2009

Contracted as Consultant by Sable Quarry Limited through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief for the Proposed Quarry & Crushing Plant within the Shantumbu – Chalala Area of Lusaka by Sable Quarry Limited, Lusaka, Zambia.

December, 2008

Contracted as Consultant by Zambeef Products PLC through Global Enviromanagement Consultancy Firm to prepare the Environmental Management Plan for Zambeef's Chiawa Farms in Chirundu by Zambeef Products PLC, Lusaka, Zambia.

October, 2008

Contracted as Consultant by Hippo Lodge Limited through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief for the proposed Hippo Lodge Bush Camp within Kafue National Park North by Hippo Lodge Limited, Lusaka, Zambia.

March, 2008

Contracted as Consultant by Mr. Wina Wina through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief for the construction of a Safari Lodge adjacent to the Kafue National Park close to the Hook Bridge, Lusaka, Zambia.

February, 2008

Contracted as Consultant by Mkambi Safari Lodge through Global Enviromanagement Consulting Firm to prepare the Environmental Project Brief for the construction of Plains Bush Camp in the Busanga Plains of Kafue National Park, Lusaka, Zambia.

December, 2007

Contracted as Consultant by Export Trading Company Bio-Energy Limited (Zambia) (ETCBEL) through Global Enviromanagement Consultancy Firm to prepare the Environmental Impact Statement (EIS) Report, Lusaka, Zambia.

November, 2007

Contracted as Consultant by Seam Investment Limited through Global Enviromanagement Consultancy Firm to prepare the Environmental Project Brief for the Small Scale Mining in Lunga Luswishi Game Management Area (GMA), Lusaka, Zambia.

2003 – 2005 Amanita Premier Oils Principal Environmental Officer, Work done as Environmental Officer included among others:-

- Planning and managing all Environmental Project activities, co-ordination of departmental heads, guiding all employees on soap stock and general waste management.
- Preparing Environmental Impact Assessments, Environmental Project Briefs for the Company e.g.

Refurbishment of Margarine plant and Mansa Batteries; establishment of plastic plant etc.

- Prepared bi-annual reports on solid waste disposal in accordance with Environmental Council of Zambia requirements.
- Formulated a project proposal regarding effluent management (minimization of COD and BOD using flocculants)
- Responsible for planning and management of company Environmental, Health and Safety Policies.
- Preparing Cleaning Programmes for our general cleaning crew.
- Ensuring that all liquid effluent, air and solid waste parameters are within the requirements of the law.
- Advising management on pollution aspects.
- Planning on energy use for the plant.
- Liaison officer between company and other Environmental stakeholders such as Lusaka Water and Sewerage Company, Lusaka City Council and Environmental Council Of Zambia.
- Redesigned and simplified the method for Soap stock storage and subsequent disposal.
- Planned and implemented training and orienting programme for all staff in Environmental issues.

1998 - 2003 Process Manager (Process Superintendent) involving among others:-

- Involved with solvent extraction of crude oil from soya/sunflower seed; Palm oil refining; Cotton oil refining; filling room, crushing plant and boiler operations.
- Preparing technical reports to the Factory Manager.
- Ensuring all the oil process parameters are within speck.
- Analysing quality of end product.
- Preparing monthly production reports for management.
- Overseeing the entire plant on a given shift.
- Interpreting production costs to subordinates.
- Developed and implemented rigorous solution for solvent recovery.

Assignments with CIET International

Date: July 4 – 30 July, 2007
Location: Eastern, Luapula and Northern Provinces
Position: Consultant
Project: Conducting an Impact Assessment on the Knowledge of HIV & AIDS, health living and Kwatu (Soul City) Materials. A follow up on the Baseline Evaluation done in 2004.

Assignments with Kaizen Consulting International

Date: Dec 2006-Jan 2007
Location: Chirundu, Zambia
Position: Sub - Consultant
Client: Ministry of Works and Supply
Project: Environmental Impact Assessment of the Design and Construction **Chiawa Bridge** in Chirundu.
Assignment: Evaluating Impacts and their mitigation measures in line with waste management

Assignments with EnviroSolutions Consultants

Year: 2006
Position: Waste management expert/engineer
Project: Environmental Impact Assessment (EIA) for Zambezi Fish Farm in Siavonga.
Study: Establishing of commercial off shore fish cages around Banana Island, Lake Kariba.
Client: Zambezi Fish Farm Limited

Date: Sept –Nov 2006
Assignment: Preparation of Environmental Impact Assessment and development of an environmental Management and monitoring plan for the expansion project extending more than 10,000hactares of land in Mazabuka.
Project: Environmental Impact Assessment for expansion of the existing **Nakambala Sugar Estate**
Location: Mazabuka – Zambia
Position: Deputy Team leader /Environmental Waste Management co-consultant
Client : The study was undertaken for Zambia Sugar Plc-leading Sugar producer in Zambia.

Date: June –August 2006
Assignment: Preparation of Environmental Impact Assessment and development of an environmental Management and monitoring plan for the establishment of palm oil plantation.
Project: Environmental Impact Assessment for Oil Palm Plantation
Location: Luchembe and Kopa chiefdom – Mpika, Zambia
Position: Environmental Waste Management co-consultant
Client : The study was undertaken for Amanita Premier Oils-one of the leading oil companies in Zambia.

Year: 2005
Client: Saja Wood processing Industry
Project: Environmental Project Brief
Study: Carrying out a brief study on wood plantation and the eventual processing effects on the environment.
Position: Consultant

Year: 2004
Client: Greenbelt Fertilizers
Project: Environmental Project Brief
Assignment: Carrying out a study on the fertilizer mixing plant in Kabwe and later Mazabuka.
Position: Consultant

Date: 2006
Location: Lusaka, Zambia
Position: Consultant
Client: Darmesh Housing Complex

Project: Environmental Project Brief for Development of ten (10) housing units in 'New Kasama', Lusaka East

Assignment: To prepare an acceptable environmental assessment at and around the project site

Assignments with Germany Technical Co-operation- GTZ

Year: 1998

Position: Co-Research Assistant

Project: Copperbelt Air pollution management**.** Coordinated by **Professor Simukanga.** The study was under the support of the German Embassy.

Study: Involved analysis of gaseous emissions formed from combustion processes, Nitrogenous oxides etc. on the Copperbelt.

Year 2005

Project: Environmental Project Brief (EPB)

Study/Assignment: Establishment of Cooking Oil Factory in Lusaka's industrial area. Preparing an EPB describing environmental impacts likely to emanate from the industrial processes.

Client: Sun – Soft Trading Limited

Position: Consultant

Year: 2002

Project: Environmental Project Brief for Unified Chemicals of Zambia in Lusaka.

Assignment: Production of an EPB for Crude Oil Processing plant including advisory guidelines for the developments expected outputs.

Position: Consultant

Year: 1998

Position: Co-Research Assistant

Project: Copperbelt Air pollution management**.** Coordinated by **Professor Simukanga.** The study was under the support of the German Embassy.

Study: Involved analysis of Sulphur dioxide formed from combustion processes, Nitrogenous oxides etc.

Year: 2006

Position: Co-Environmental consultant

Project: Undertaking a study in Carbon dioxide manufacturing process for fizzy drinks.

Study: Environmental Project Brief considering gaseous, solid and liquid waste.

Client: Californian Beverages manufacturers of different blends of drinks

Year: 2003

Clients: Petauke and Willy's Breweries

Project: Combined Environmental Project Brief

Study: Brief evaluation of both positive and negative impacts of the two Breweries in Petauke.

Position: Consultant

Year: 2005

Client: Continental Ginneries Limited

Project: Environmental Project Brief conducted in Sinda, Eastern Province

Assignment: To review existing bio – physical environment and consider potential impacts of proposed project.

Position: Project Consultant

Year: 2004
Client: Goodman Crushers Limited, Lusaka
Project: Environmental Project Brief
Assignment: To assess viability (environmentally) of the project according to the Environmental Protection and Pollution Act No. 12 of 1990 cap 204.
Position: Project consultant

Year: 2004
Client: Supersteel Limited
Project: Environmental Project Brief
Assignment: To conduct an EPB on how hot works impact on the environment.
Position: Project consultant

Year: 2004
Project: Refurbishment of Margarine plant
Assignment: Brief Environmental Study on the rehabilitation of fats/margarine processing plant (formerly Premium oils fats plant).
Position: Environmental Officer

Year: 2004
Project: Restoration former Mansa Batteries
Study: Carrying out an Environmental Impact study of former Mansa Batteries. Providing advisory technical information on environment and project viability.
Position: Project Environmental coordinator.

Year: 2005
Project: Plastic making factory within Amanita Premier Oils
Study: To conduct an EPB for submission to ECZ and suggest environmental management plans.
Position: Environmental co-odinator

December 1998 Monitoring pyrometallurgical activities such as blending of concentrates, smelting, drying etc for Mopane – Mopani Mining. Analysing each process activity and how spillages could be avoided to enhance pollution control.

December 1995 – March 1996 with Mopani – Mopani Mining

- Monitoring of copper floatation cells.
- Preparing of daily production reports.
- Monitoring lime dosage and tailings disposal.

Professional Seminars and Workshops:-

June 1998 Presented a paper on causes of high copper losses to converter slags and how slags can safely (environmentally) discarded at an international Jubilee conference held at University of Zambia.

July 1997 University of Zambia; Wrote a paper on air as waste depository**.**

1997 Attended a symposium organized by AIESEC on capital markets development in Zambia and future prospects. Participated in AIESEC extension programs to tertially Institution of learning.

2002 Attended a workshop on 'Cleaner Production' in Lusaka

2003 Attended a workshop on discharge of effluent into sewer and aquatic environment organized by Environmental Council of Zambia in conjunction with Lusaka Water and Sewerage Company at Fairview Hotel.

2004 Attended a workshop on Invasive Alien species organized by Musekela Research and Forestry station in Chipata, Zambia.

Skills and Competencies:-

Possesses the following Skills and Competencies:- Advanced Computer skills, Public Relations skills, Data Collection and Analysis skills, Negotiation skills, Facilitation skills, Training and Capacity Building skills, Participatory Methodological skills, Resource Mobilization skills, Environmental Impact Assessment skills, Strategic Environmental Assessment Skills; Project Planning and Management skills, Logical Frame-work Approach skills, Project, Research and Consultancy Proposal Writing skills, Environmental and Natural Resources Management skills, Policy Formulation and Analysis skills, Net-Working and Coordination skills, Monitoring and Evaluation skills, Information Technology skills, Sensitization / Awareness Creation skills, Analytical skills, Statistical skills, SWOT Analysis skills, Needs Assessment skills, Feasibility Analysis skills, Organizational skills, Administrative and Management skills and Driving skills.

Languages:-

	Understanding	**Speaking**	**Reading**	**Writing**
English	Excellent	Excellent	Excellent	Excellent
Mambwe	Excellent	Excellent	Excellent	Excellent
Bemba	Excellent	Excellent	Excellent	Excellent
Nyanja	Excellent	Excellent	Excellent	Excellent

Certification:-

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe my qualifications, my experience, and me.

Date: August, 2019

[Signature of Consultant] *[Day/ Month/ Year]*

Full Name of Consultant: **Gillan Simfukwe**

Proposed Position: HYDROLOGY & HYDROGEOLOGY SPECIALIST

1. Date of Birth	30th June, 1973	**Nationality:** Zambian	**Marital Status:** Married
2. Contact Details		E-mail : siwalechisanga@gmail.com or siwalechisanga@yahoo.com Mobile Nos. : +2609774413, +260955275467 Home Address : Flat 1 B3, Former Zambia Airways Flats Avondale, Lusaka, Zambia	
3. Education		• • **BSc** (Natural Resources Management), University of Zambia ,1995-2002 • • **MSc** (Integrated Water Resources Management), University of Zimbabwe, 2007-2008	
4. Membership of Professional Institutions		• • Member of the Engineering Institution of Zambia (EIZ, REng) • • Member of Impact Assessment Association of Zambia (IAAZ) • • Member of International Association of Hydrological Sciences(IAHS)	
5. Short Term Training		• • Negotiation Skills in Transboundary Surface and Groundwater Management (WaterNet/SADC, Tanzania, 2017) • • International Water Law and Instruments (WaterNet, 2017, Botswana) • • Water Observation Information System (Tigernet, Italy) • • GIS and Surface Water Resources Modeling (DHI-South Africa, Zambia) • • Advanced Earth Observation for Water Management (Tigernet, Zambia) • • Contract Management (ACEZ/FIDIC, Zambia) • • Groundwater Modeling (JICA, Ethiopia)	

		• • Hydrogeological Mapping (SADC, South Africa) • • GIS and Remote Sensing (Peace Parks Foundation, South Africa) • • Geographic Data and its Applicability for Water Management (Ofek, Israel) • • Environmental Impact Assessment (COWI, Zambia)	
6. Work Experience and competency		Thirteen (13) years working experience in Hydrology and Water Resources Management. **Competencies** **- Water Resources Management and Planning** **-** Operational Hydrology (network planning and design, hydrographic survey, river gauging, bathymetry survey,hydrometric instrument installation and maintenance) - Hydrological data analysis - Applied Geographic Information System (GIS) and Remote Sensing in Water Resources Management - Proposal and Technical report writing	
7. Languages	***Speaking***	***Reading***	***Writing***
English	Good	Good	Good
Bemba	Good	Good	Good
Namwanga	Good	Good	Good
Employment Record			
January 2017 to date	Employer		**Department of Water Resources Development**
Position held		Principal Water Officer (International Waters)	
Responsibilities		Providing technical input in formulation of proposals for transboundary water projects, undertake research on management and development of transboundary waters, review of international water policies and agreements, monitoring and evaluation of transboundary water projects and preparation of technical reports	
December 2005 to 2016	Employer		**Department of Water Resources Development**

Position held		Acting Principal Hydrologist
Responsibilities		Carrying of research and assessment of surfacewater resources, planning for surface water resources management, monitoring and evaluation of water research projects and monitoring
2014 to 2015	Employer	**Department of Water Resources Development**
Position held		Senior Water Resources Engineer
Responsibilities		Developing procedures for assessment of water resources, prepare technical report for water resource demand assessment

2009-2014	Employer	**Department of Water Resources Development**
Position held		Senior Hydrologist
Responsibilities		Undertaking data compilation and analysis, surface water research, and monitoring of projects and programmes
2005-2009	Employer	**Department of Water Resources Development**
Position held		Hydrologist
Responsibilities		Undertaking data collection, analysis, technical reporting on status of surface in Lusaka Province

9 **Projects and Assignments undertaken in Water Resources Management/Hydrology and related work**
(i) **Name of assignment or project:** Assessment of Water Resources and Irrigation Potential at Druadan and Kindgom Fams, Mkushi District
Year: 2018
Location: Mkushi, Central Province, Zambia
Institution : Zenith Consulting Company Limited (Zambia)
Tasks Performed: (i) Field assessment and mapping of reservoirs (ii) Bathymetry surveys (iii) Catchment yield analysis (iv) Preparation of thematic maps and technical report (iv) Cropwater requirement analysis
Position held: Hydrologist/Water Resources Expert

ii) **Name of assignment or project:** Hydro-meteorological Network Optimisation for Zambia (Water Resources Management Component of the project funded by the World Bank)
Year: 2016-2018
Location/Sites: Zambia
Clients: Ministry of Water Development, Sanitation and Environmental Protection (Zambia)
Tasks Performed: (i) Preparation of terms of references (ii) Contract management and supervision (iii) Review of the technical reports on network optimisation (vi) Technical Report Writing
Position held: Task Leader – Water Resources Management

Name of assignment or project: Hydrological Analysis for Irrigation Projects under the Irrigation Development and Support Project (IDSP) – World Bank
Year: 2013
Location/Sites: Lusitu, (Southern Province), Musakashi (Copperbelt Province), Mwomboshi (Central Province)
Clients: Société Française de Réalisation, d'Études et de Conseil (SOFRECO)/IDSP Project
Tasks Performed: (i) Hydrological data analysis of water availability for irrigation purposes (ii) Catchment delineation and assessment (iii) Analysis of project impacts on water resources (vi) Technical Report Writing
Position held: Position: Hydrologist

Name of assignment or project: Gap Analysis Study for Peri Urban WASH Project in George and Chawama Compound
Year: 2014
Location/Sites: George and Chawama Peri Urban Areas, Lusaka
Clients: Village Water Zambia

Tasks Performed: (i) Design of data collection tools/methodology (ii) Data collection of water and sanitation facilities (iii) Production of thematic maps on water and sanitation facility distribution
Position held: Position: GIS Expert and Team Leader

Name of assignment or project: Setting up of a water resources monitoring system at community level for selected wards in Kazungula and Namwala Districts
Year: 2014

Location/Sites: Kazungula and Namwala Districts (Southern Province)
Clients: Zambia Community Based Natural Resources Management (CBNRM Forum/WWF)
Tasks Performed: (i) Development of a community water resources plan with a monitoring system (ii) Development of a training programme (iii)Undertake participatory training in community water resources planning and monitoring (iv) Production of area water resources/thematic maps (v) Installation of gauging equipment
Position held: Position: GIS Expert / Hydrologist

Name of assignment or project: Groundwater Resources Management for Lusaka (GReSP) supported by Federal Institute for Geosciences and Natural Resources (BGR)
Year: 2010-2012
Location: Lusaka City, Zambia
Institution : Ministry of Energy and Water Development/BGR
Main Project Features: Production of Hydrogeological and Vulnerability Maps for Lusaka and surrounding areas, catchment water balance studies for Chongwe and Chunga catchments, Technical report writing, Hydrological operations
Position held: Senior Hydrologist/GIS Expert

Name of assignment or project: Environmental Impact Assessment (New Chibuyu Township and Expansion of Muyotujana Cemetery)
Year: 2011
Location: Mazabuka, Southern Province
Clients : Mazabuka District Council
Tasks Performed: (i) Description of hydrogeology, hydrology, water quality of study area (ii) Desk analysis of water quality vulnerability of the development (iii) Digitizing and production of location maps (iv) Assessment of potential environmental impacts on water resources (vi) Compilation of environmental and mitigation plan
Position held: EIA team member (Hydrology and GIS)

(viii) **Name of assignment or project**: Mapping of Suitable Areas in Zambia for Manual Drilling
Year: 2010
Location: Zambia
Institutions : Department of Water Affairs /Ministry of Local Government and Housing/UNICEF
Tasks Performed: (i) Compilation and analysis of water point data using GIS

(ii) Contributed to report writing of the final report
Position held: GIS Expert/Hydrologist

(ix) **Name of assignment or project**: Mapping of Water Points in Cholera prone areas in Lusaka (Kanyama, Chipata, George and Misisi Compounds)
Year: 2009
Location: Lusaka
Institutions : Department of Water Affairs/University of Zambia/UNICEF

(x) **Name of assignment or project**: Environmental and Social Impact Impact Assessment (Northern Coffee Corporation Limited (NCCL)
Year: 2013
Location: Kasama, Mungwi, Mbala Districts, Northern Province
Clients : Zenith Consulting Company Limited
Tasks Performed: (i) Description of hydrogeology, hydrology and physiography of study area (ii) Analysis of surface water demand and for Lukulu, Isanya and Chamfubu Rivers on Kateshi, Isanya and Ngoli Estates respectively (iii) Digitizing and production of location maps (iv) Assessment of potential environmental impacts on water resources (vi) Compilation of environmental and mitigation plan
Position held: EIA team member (Hydrology and GIS)

(xi)	**Name of assignment or project:** SADC HYCOS Project (Phase II) Equipment Installation at Luangwa River Bridge Hydro Station (Luangwa River in Zambia)
Year: 2010	
Location: Luangwa District, Lusaka Province	
Clients: Department of Water Affairs	
Tasks Performed: (i) Gauge Plate Installation (ii) Calibration and installation of the HYCOS equipment (iii	

xii)	**Technical Papers/Reports**
1. Discharge measurements and Rating Curves of the Rivers Chalimbana, Chilongolo, Chongwe, Chunga, Kapwelyomba, Mwembeshi Ngwerere and Laughing Waters Spring, 2012, GRESP Project-Report No. 7 (Siwale C and Klekler T.)	
2. Water Balance Estimates for Sub-Catchments of the Chongwe and Mwembeshi Rivers of the Lusaka Region, 2012, Report No. 7 (Siwale C and Klekler T.)	
3. Upstream and Downstream Interactions in Chalimbana River Catchment, Zambia (MSc Dissertation, 2008, University of Zimbabwe (Siwale C)	

Referees	
i	**Name:** Mr. K. Nyundu
Title: Director, Department of Water Resources Development	
Phone: +260955780120 **Email:** : kenneth.nyundu@gmail.com	
ii	**Name:** Mr. E. Ngonomo
Title: Executive Director, Village Water Zambia	

Phone: +260978483873 **Email :** elisha@villagewater.org	
iii	**Name**: Dr. H. Makurira
Title: Lecturer, Faculty of Civil Engineering, University of Zimbabwe, Mount Pleasant, Harare	
Email : hmakurira@yahoo.com	

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe my qualifications, my experience, and me.

Year: 2019

[Signature of Authorised Signatory] *[Day/ Month/ Year]*

Full Name of Consultant: **Chisanga Siwale**

CURRICULUM VITAE FOR PROPOSED PROFESSIONAL STAFF

Proposed Position:	SOIL/BOTANY SPECIALIST

PERSONAL DETAILS

Name:	Phillip Chikasa
Date of birth:	15th July 1961
Place of birth:	Isoka
No. of children:	Three
Nationality:	Zambian
SADC driver's license No.:	130340/2/1, Code: C
Contact address:	C/o Mr. Zakayo Chikasa, Barfig Swimpool, P.O. Box 31155, Lusaka, Zambia.
Cell phone Nos.:	+260 966688414/+260 966616132/+260 966163805
E-mail:	pchikasa@gmail.com

ACADEMIC QUALIFICATIONS

Year	Qualification	Institution
1994 to 1995	MSc. Environmental (Natural Resources/Forestry)	University of Wales, Bangor, United Kingdom.
1987 to 1991	Bachelor of Agricultural Sciences	University of Zambia, Lusaka, Zambia.
1982 to 1985	Diploma in Agriculture	Natural Resources Development College, Lusaka, Zambia.
1977 to 1981	School Certificate	Mbala Secondary School, Mbala, Zambia.

EMPLOYMENT RECORD (SUMMARY)

From	To	Organisation/employer	Job titles
Oct. 2010	April 2011	Hodi	• Acting Director
Mar.	Oct.	Hodi	• Head of Programmes

2010	2010		• Country Coordinator - Stop AIDS Now Project
April 2009	Mar. 2010	NAMIM Agro and Environmental Management Consultant, Lusaka, Zambia	• Consultant
Aug. 2007	Nov. 2009	Natwange Multipurpose Cooperative Society Limited, Kalulushi, Zambia	• Cooperative Chairman
April 2005	March 2007	Copperbelt University (Zambia)	• Assistant Director/Lecturer, Centre for Lifelong Education
Dec. 2002	Dec. 2004	Namibia-Finland Forestry Programme (Namibia)	• Ecological Training Officer/Lecturer, Ogongo Agricultural College, Oshakati, Namibia • National Coordinator and Part-time Lecturer (Distance education), Biological and Agricultural field and laboratory practicals, Vista University, Pretoria, South Africa
Dec. 1997	Dec. 2002	Ministry of Agriculture, Water and Rural Development (Namibia)	• Natural Resources exprert/Lecturer, Ogongo Agricultural College, Oshakati, Namibia • National Coordinator and Part-time Lecturer (Distance education), Biological and Agricultural field and laboratory practicals, Vista University, Pretoria, South Africa
April 1992	Dec. 1997	Ministry of Agriculture and Cooperatives (Zambia)	• Research Officer/ National Scientist, SADC-ICRAF Agroforestry Research Project, Chalimbana, Lusaka, Zambia • Research Officer / National Scientist, SADC-ICRAF and Zambia/ICRAF Agroforestry Research Project, Chipata, Zambia
Oct. 1991	April 1992	Ministry of Agriculture and Cooperatives (Zambia)	• Assistant Provincial Crop Husbandry Officer, Luapula Province. • Agricultural Officer
Oct. 1985	Oct. 1991	Ministry of Agriculture and Cooperatives (Zambia)	• Supervisor/District Animal Husbandry Officer, Mwense District.

RESPONSIBILITIES

CONSULTANT; NAMIM NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT CONSULTANT, LUSAKA, ZAMBIA (April 2009 to March 2010)

- Conducting research (including data analysis and interpretation) on, Agriculture and Rural Development, Agro-eco-tourism, Agroforestry, Forestry
- Education and Training
- Natural Resource Management
- Environmental Impact Assessment

ACTING DIRECTOR; HODI, LUSAKA, ZAMBIA (October 2010 to April 2011)

- Led the organisation's programmes and operations in Zambia by providing overall leadership and direction of all programmes country-wide
- Leading, developing and management of long-range strategic plans in-line with the organisation's vision, mission and strategies
- Recruitment and direct supervision of senior management staff
- Ultimately responsible for all financial matters in the organisation
- Principal point of contact with the donors, government, media and other implementing partners

COUNTRY COORDINATOR – STOP AIDS NOW; Hodi, LUSAKA, ZAMBIA (March 2010 to October 2010)

- Coordination of a Global HIV and AIDS Project in Zambia aimed at increasing quality of existing life-skills programmes in Zambia.
- Coordination of eight (8) consutium partners on improving the scale and quality of Youth Life Skills and HIV&AIDS Work in Zambia
- Capacity Building Initiative on HIV Prevention & life skills

HEAD OF PROGRAMMES; HODI, LUSAKA, ZAMBIA (March 2010 to October 2010)

- Developing Hodi programmes (which included; Agriculture, Education, Water and Sanitation, HIV & AIDS and Gender based violence), planning and monitoring their implementation in conformity with the organisation's overall development vision and goals and ensuring that strategic alliances were maintained for effective contributions to the achievement of programmes' objectives.

CHAIRMAN; NATWANGE MULTIPURPOSE COOPERATIVE SOCIETY LIMITED, KALULUSHI, ZAMBIA (August 2007 to November 2009)

- Head of the Cooperative, technically and administratively

ASSISTANT DIRECTOR; COPPERBELT UNIVERSITY, CENTRE FOR LIFELONG EDUCATION, KITWE, ZAMBIA (April, 2005 to March, 2007)

- Coordinated the effective and efficient implementation of Copperbelt University policy on distance education
- Developed and provided support through the development and distribution of study materials
- Represented the Copperbelt University/Centre for Lifelong Education on Education Sector Advisory Group Reference meetings at the Ministry of Education Headquarters in Lusaka, Zambia
- Copperbelt University nominee to the National Adult Literacy Technical Committee – Ministry of Education
- Coordinated the Registration of students and maintenance of records
- Coordinated and administered examinations, assignments and processing of examination results
- Developed a computer programme for processing examination results
- Liaised with the Academic Office on issues related to student admissions and examinations
- Drafted and prepared Time tables

National Diploma in Forestry

- Mbongo, W. (2000). Approaches to fruit tree promotion in Northern Namibia. Department of Forestry, Ogongo Agricultural College, Oshakati, Namibia

SKILLS

- Computer literate. Able to competently use Microsoft Office (MS Word, MS Excel, MS PowerPoint), Data Chain, Genstat amd Mstat.
- Driving (SADC driver's license Code C)

EXTRA CURRICULA ACTIVITIES

- Travelling, swimming, playing table tennis.

PROFESSIONAL REFEREES

1. Ms Chileshe Chilangwa
   Deputy Chief of Party
   Zambia-Led Prevention initiative (ZPI)
   North Mead
   Lusaka
   ZAMBIA

   Cell: 260 97 777 3171

   E-mail: cchilangwa@aed.org
   chechwac@hotmail.co.uk

2. Mr.Julius Siwale
   Team Leader/Head – Wheat Research
   Zambia Agricultural Research Institute
   Mt. Makulu Central Research Station
   P/B 7
   Chilanga
   ZAMBIA

   Tel: +260 211-278380/278023/278130
   Cell: +260 977869005/0966363190
   E-mail: siwalejulius@gmail.com

3. Ms Albertina Ndeinoma
   Head of Forestry Programme
   University of Namibia
   Faculty of Agriculture and Natural Resources
   Department of Natural Resources and Conservation
   Ogongo Campus
   Private Bag 5520
   Oshakati
   NAMIBIA

   Tel: +264 (0)65 2235205 (w) +264 (0)65 257014 (h)
   Fax:+264 (0)65 2235294 (w)
   Mobile: +264 (0)812572292/0811497037

[Signature of Authorised Signatory]

Year: 2019

[Day/ Month/ Year]

Full Names of Consultant: Philip Chikasa

Proposed Position:	AIR/NOISE SPECIALIST

CURRICULUM VITAE-MUBANGA MWANSA

PERSONAL DETAILS

NAME	:	Eng. Mwansa Mubanga
SEX	:	Male
DATE OF BIRTH	:	16th July 1984
PLACE OF BIRTH	:	Mufulira
NATIONALITY	:	Zambian
NRC NUMBER	:	294596/66/1
MARITAL STATUS	:	Married
CONTACT NUMBER	:	+260-966-656697 or +260-977-656697
POSTAL ADDRESS	:	C/O Dickson Kabwe Zambia Environmental Management Agency P.O Box 35131, Lusaka.
EMAIL ADDRESS	:	mwansa.mubanga@yahoo.com

VISION

To develop and contribute to an insight that will help achieve sustainable development through production and to reduce pollution of the environment.

OBJECTIVES

- To contribute to sustainable economic development through efficient resource use and pollution prevention.

QUALIFICATIONS

1. Currently studying for Master of Science in Project Management at University of Lusaka.
2. **Bachelor of Engineering Degree in Environmental Engineering.**

Major: Cleaner Production and Environmental Management

CURRENT POSITION: Managing Partner **-:** GREENLINE ENVIRONMENTAL SOLUTIONS

EDUCATION

Year	Name Of Institution	Qualification
2012 Class	University of Lusaka	Studying Msc. Projects Management
2005-2009	Copperbelt University	Beng. Environmental Engineering
1999-2001	Butondo High School	Senior Secondary School Certificate
1997-1998	Chankwa Junior Secondary	Junior Secondary School Certificate
1990-1996	Mutamba Primary School	Primary school Certificate

RELEVANT WORK EXPERIENCE

1. Greenline Environmental Solutions Limited- Managing Partner

   Responsibilities:

- Conducting Environmental Impact Assessment for new projects as per EMA of 2011.
- Conducting site inspections for new projects and assessing likely environmental impacts.
- Air emission testing and reporting for boilers, incinerators and ambient environment.
- Environmental auditing and formulation of environmental management plans for existing facilities.
- Design and planning effluent management systems for farms, abattoirs and processing plants. Water quality testing and reporting.

2. Zambeef Products Plc as Area Manager- Safety, Health, Environment and Quality (SHEQ) from January 2010 to July 2014. Reporting to the Head of Environment and Technical Services. In charge of Zambeef group's manufacturing and processing plants.

   Responsibilities include:

- Implementation of Zambeef Products Plc's Policies, Procedures, and Systems to maintain and enhance Safety, Health, Environmental and Quality performance.
- Implementation of General and specific IFC guidelines on Environment, Health Sanitation, sustainable energy and product manufacturing.
- Prepare and submit required Environmental status and Food Safety reports. In house training in GMP, EMS and HACCP.
- Conduct plant and farm energy audits for the Zambeef group. Conduct Environmental and Social Impact assessment for new projects.

- Preparation and submission of Environmental Project Brief (EPB), Environmental Management Plans (EMP) and Environmental Impact Assessment (EIA) for submission to ZEMA prior to development. Monitoring of mitigation measures for project environmental impacts.

- Provide professional and technical support and expertise to all Zambeef subsidiaries, including review of capital projects for environmental impacts.

- Planning and implementation of Pest Control Programs for all operation centres.

- Designing and implementation of water quality systems, management of waste water through treatment and monitoring against effluent standards.

- Monitor Water, Food Quality and Safety in compliance with prevailing food Standards.

- Monitor the quality of soil, effluent, and air emissions in line with relevant regulations.

- Assist plant management in developing, implementing and maintaining Environmental compliance measures required under State and Local regulations.

- Assist management in interpreting and applying technical regulatory requirements on the production operation.

- Auditing the Environmental, Occupational Health & Safety compliance and Food Safety status of the entities as per supplied ISO 14001 EMS Self-Assessment Checklist and other relevant regulations and conventions.
- Planning, execution and monitoring of effluent treatment and drainage systems for Zambeef manufacturing plants.

- Social and community liaison and inclusion in Zambeef's operation areas throughout Zambia.

3. Zambia Environmental Management Agency (formerly Environmental Council of Zambia), Ndola as an intern from January, 2009 to April, 2009. Reporting to the Zone Manager.

Duties included:

- Inspections of industries for compliance prior to issuance of Environmental licences.

- Conducting licensing inspections for various facilities and industries. Site verification for intended proposed projects.

- Reviewing of Environmental management returns from industries to check for compliance. Comments on Environmental project briefs submitted to ECZ.

- Attending to environmental complaints from the public and hearings regarding

- Responding to emergencies and accidents leading to spills, pollution and contamination the environment.

4. White Cross Investments limited Kitwe, from May, 2009 to January 2010 as a part ti Assistant Environmental Officer. Reporting to the Senior Consultant.

Duties included:

- Conducting assessment and preparation of Environmental Project Brief (EP Environmental Impact Assessment (EIA) and Environmental Management Plans (EM for developmental project for submission to ZEMA.
- Site verification of Proposed projects before EPB submission to ZEMA.
- Environmental monitoring and compliance audits for clients.
- Advertising for Environmental Management Service providers through Print media.

COMPUTER PROFICIENCY

- MS excel MS power point, MS publisher, MS project and MS word.

TRAINING AND OTHER SKILLS

- Environmental Management and Occupational Health & fire rescue training.
- Good Manufacturing Practices (GMP) training.
- Driving (in possession of a valid Zambian driver's license).
- Occupational First –Aid and Emergency Rescue certified provider.

AFFILIATIONS

- Professional Engineer of the Engineering Institution of Zambia (EIZ). Certific **No.01261726223.**
- Registered Engineer of the Engineers Registration Board **No. 006261**
- Member of the Zambia Red Cross Society.

EIA & EPB ENVIRONMENTAL PROJECTS

- EIA for the proposed development of Kafubu farm in Ndola District-Agricultural Sector
- EIA for the proposed Development of an irrigation dam by Apollo Agricultural Holdin Chingola.
- EIA for the proposed development of integrated farming project in Mpongwe GoldenLay Agri Limited-Agricultural sector.
- EPB for the proposed operation of manganese mine in Milenge District.
- EPB for the proposed operation of a quarry and crusher plant by Avex Technical Ltc Chadiza District.
- EPB for the proposed development of incinerator by Cardinal Memorial Hospital
- EPB for the proposed development of an opaque beer plant by Midlands (PVT) Limited.
- EPB for the mineral prospecting & mining of Copper in Kafue National Park by Easifuel Limited.

REFEREES

Mr Cliff Ngwata (Principle Inspector) Zambia Environmental Management Agency P.O Box 71302, Ndola. Contact number: 0976 009 495 E-mail: cngwata@zema.org.zm	Mrs. Elizabeth Silwenga Human Resources Manager Zambeef Products Plc. Private bag 17, Woodlands. Lusaka. Contact number: 0977 999 040/0978 779 148 Email: esilwenga@zambeef.co.zm
Mr. Seveliano Phiri HOD/Senior Lecturer- Civil Engineering Copperbelt University P.O Box 21692 Kitwe. Contact number: 0976-340133/0699-660 600 Email: seveliano@yahoo.co.uk	Prof. Nkonde G.K. Senior Lecturer- Chemical Engineering Copperbelt University P.O Box 21692, Kitwe. Contact number: 0977 879 986 Email: nkondegk@yahoo.com

Certification:

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe my qualifications, my experience, and me.

Year: .2019

[Signature of Authorized Signatory] *[Day/ Month/ Year]*

Full Name of Consultant: **Mwansa Mubanga**

Proposed Position: SOCIO ECONOMIC SPECIALIST

PERSONAL DATA

First Name: Wisdom

Other Names: Chasaya

Marital Status: Single

Address: P.O Box 660200 Monze, Zambia

E-mail wisdomzm@yahoo.com

Telephone: (+260) 977- 509654

GOAL: To be part of Social and economically just, responsible and self-reliant generation, working toward a transparent, just and healthy society through objective research with an aim of achieving sustainable development through participatory inclusive methodologies.

PROFESSIONAL SUMMARY

Accomplished development practitioner with a proven ability to design, and implement projects and programmes through sustaining community participatory inclusive methods like Training for transformation, Social marketing with an aim of attaining integral human development.

Experienced and knowledgeable in social economic development work with strong social analytical skills rooted in both qualitative and quantitative research.

An outstanding institutional development specialist and once a supporting and accompanying officer for ten provincial offices for Caritas Zambia in institutional policies, structures and human resource strengthening. Strong manager with skills to build and maintain highly motivated focused management teams with common goal of achieving the intended objectives. Emotionally balanced and excellent leader with high level expertise in HIV and AIDS and Gender Mainstreaming skills.

Skilled in public Speaking being a member of Southern Africa Toastmasters Club, Pretoria, Republic of South Africa.

OTHER COMPETENCES INCLUDE:

- Excellent leadership, management and team working strategist for results
- Internal and External Project Social economic Impact assessment through both qualitative and quantitative research skills.
- Feasibility Studies for project appraisal, implementation, Monitoring and Evaluation

- Training for transformation programmes facilitation.(National Trainer)
- **Social, Economic and political Advocacy for Gender Justice programming.**
- Education for Life Behaviour change Programmes Administration & facilitation
- Excellent Communication, Negotiation and Public speaking skills with effective Team coordination.
- Strategic planning, proposal development and Report writing skills.
- HIV/AIDs Donor funded programmes Coordination and Management
- Community based project management, development and Coordination
- Human Rights Based Approach programming
- Computer skills, MS Word, Excel, Adope pagemaker, publisher, Power point, Internet Explorer and SPSS.

EDUCATION BACKGROUND

I hold a Bachelors of Arts in Religious Studies, Diploma in Social work and communication for development, diploma in Theology and diploma in philosophy.

Other academic credential include, certificate in Education for Life Behaviour Change Programme, Project planning, monitoring and evaluation, Certificate in Finance for non Financial Managers, Certificate in EU Development Aid and Proposal writing skills, Certificate in Research Methods and Design, Certificate in AWISA Beyond the Balance Sheet, Certificate in HIV mainstreaming, Certificate in Peer Education and certificate in proposal writing.

EXPERIENCE (within the following countries: Zambia, Botswana, South Africa & Kenya)

CONSULTANCY EXPERIENCE

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2009- 2011: Caritas Zambia employee.

Position: Disaster Management for Emergence Response.

Duties include: identifying and responding to possible Human disasters, development needs, designing and preparing mode of response and planning. Carrying out impact assessment on disaster areas in Zambia.

The programme deals with Disaster management, Impact assessment, research coordination and analysis, publishing and resource center management etc.

Beside engagements into Caritas Zambia emergence response programmes was involved in the 2011 Tripartite elections as Rapid Response Project commonly known as PVT as a Provincial Coordinator- Eastern Province under National Democratic Institute (NDI). Duties included: elections advocacy programme design, Training of Monitors, coordination and Results tabulations and analysis.

2012: **Global Earth Consultants**;

Position: Research Coordinator

Head of Research: duties included:

Managing research projects and data collection, analysis and reporting. Among other duties include, Proposal writing and review, carrying out feasibility studies, social cost benefit analysis, Project Appraisal, planning, monitoring and evaluation.

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Global Earth Consultant Sanitation project Evaluation/ Review: ADB Zambia.(2012)

The main consultant on the African Development Bank water and sanitation project review and evaluation for Central Province.

Prepared the evaluation plan, evaluation tools and conducted the interviews, FGD and physical observation and cost benefit analysis of the whole project. An Evaluation report with recommendations was submitted to ADB Zambia and its Partners

2012:

CRS Zambia: Team leader for end line survey of phasing out of SUCCESS project in Copperbelt, Central, Eastern and Southern Provinces. The nature of the work was to visit all project centers in these provinces, carry out interviews and make reports for management. I also did the Cost based funding evaluation for AIDS RELIEF PROGRAMME at CRS. This involved visiting hospitals in Eastern, Southern, Lusaka and Copperbelt provinces to collect data project results based on the relief funding given to them.

July 4- 30th 2011 **Field Coordinator**: Part of the team contracted by National Aids Council (NAC)& Community Information, Empowerment & Transparency (CIET) Africa, for a country wide impact assessment on **HIV/AIDS Media Prgrammes e.g. Kwatu (Soul City), Trendsetters and Your Health Matters**

2012:

Global Enviromanagement Consulting: Team leader for socio component of phasing the BOLOGNA EIA Project, KOBIL EPB project in Lusaka and Eastern Provinces.

INTERNSHIPS (MAY TO AUGUST EACH YEAR)

2004: **Administrator/ Projects Officer:** (ACHAP) BONASO-World Bank funded programmes, Gaborone, Botswana

2003: **Administrator:** Botswana Network of Aids Service Organization (BONASO), Gaborone, Botswana.

DUTIES/RESPONSIBILITIES-BONASO (2002 – 2004)

Project management, Participated in conferences and meetings among stakeholders such as NGO'S, CBO's and Government Agencies in project designing, Appraisal, implementation, monitoring and evaluation and Project Funding especially for HIV/Aids projects both urban and rural areas. Others included, community mobilization, dissemination of HIV information on prevention and positive living.

2001 :(Jan to July) **Youth Animator and Counselor: Coping Center for People living with HIV/AIDS (COCEPWA), Gaborone, Botswana**

2000: **Orphans Sponsorship Coordinator**: St Bernadette Catholic primary school, Lobatse, Botswana.

Terisanyo- Diocese of Gaborone: Counselor & Administrator- Pastoral Attachment

Sanitation Marketing and Hygiene Promotion Strategy development for Lusaka Peri urban area (WSP-World Bank- 2008)

Worked with Lusaka water and Sewerage Company peri Urban team, International sanitation specialist consultant as the Main local principal investigator for the 26 peri urban areas in Lusaka. Developed and supervised the following:

- research tools design
- Training data collectors
- Data collection supervision and quality control
- Data entry, analysis and report writing under World Bank principles and guidelines.
- Sanitation social marketing strategy development
- Sanitation and hygiene sensitization programmes for behaviour change.
- Create market for sanitation and hygiene products/facilities e.g. Toilets, soup, disinfectants, hand washing plastic products.
- Develop Sanitation and Hygiene promotion Marketing Strategy tools.
- Develop strategy impact and process Monitoring & Evaluation Framework

Eight Centers Water Supply and Sanitation Project; Public Health & HIV/AIDs Education Campaign project in peri urban areas central province of Zambia (African Development Bank).

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Facilitated the following programmes:

- Health Care, Public Health and hygiene promotion/ sensitization
- Mobilization of sanitation facilities e.g. VIP-latrines
- Safe and clean water: keeping and treatment e.g. chlorine use
- HIV/AIDS awareness Education campaigns and VCT services
- Malaria control and safe use of treated mosquito nets

EXTRA-CULICULAR ACTIVITIES:

2003 – 2004 **Editor in Chief:Tangaza Vision Magazine,** Tangaza College

Catholic University of Eastern Africa, Nairobi, Kenya.

2003 – 2004 **Chairperson:** Justice and Peace Commission, Tangaza College, Catholic

University of Eastern Africa, Nairobi Kenya.

2003- 2004 College **football captain: Tangaza College**

College magazine Editor: Tangaza College

LANGUAGE SKILLS

	Reading	Writing	Speaking
English	Excellent	Excellent	Excellent
Bemba	Excellent	Excellent	Excellent
Tumbuka	Excellent	Excellent	Excellent
Chewa	Excellent	Excellent	Excellent
Tonga	Fair	Fair	Good
Tswana	Fair	Fair	Good
Lozi	Fair	Fair	Fair
Swahili	Good	Good	Good
Nyanja	Excellent	Excellent	Excellent

REFERENCE:

Kenneth Nyundu

Lusaka Province Dep. of Water Affairs

Water Engineering Section

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Lusaka.

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Cell: +260 977712051

Mr Emmanuel Ngulube

Oxfam Zambia

Lusaka

Cell: +260 - 977509654

egngulube@zec.org.zm

Year: 2019

[Signature of Authorised Signatory]

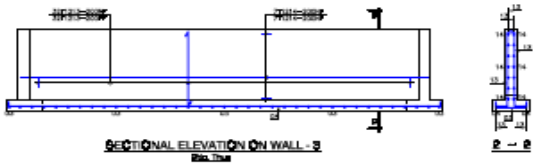
Full Name of Consultant: **Wisdom** **Chasaya**

LOCATION	MARK	DIA.	LENGTH	No. EACH	TOTAL No.	BAR CODE	A	B	C	D	E/R	SHAPE
FOUNDATION WALL 1	01	T12	875	30	100	38	100	520	(100)			
	02	T12	10200	4	8	38	100	(10060)	(100)			
FOUNDATION WALL 2	03	T12	875	37	74	38	100	520	(100)			
	04	T12	7325	4	8	38	100	7180	(100)			
FOUNDATION WALL 3	05	T12	875	11	22	38	100	520	(100)			
	06	T12	2175	4	8	38	100	2035	(100)			
FOUNDATION WALL 4	07	T12	875	31	62	38	100	520	(100)			
	08	T12	6350	4	8	38	100	6210	(100)			
WALL 1	09	T12	1625	105	210	54	100	1385	(190)			
	10	T12	10750	14	28	20	STRAIGHT					
WALL 2	11	T12	1125	20	40	54	100	885	(190)			
	12	T12	2370	10	20	20	STRAIGHT					
WALL 3	13	T12	1625	64	128	54	100	1385	(190)			
	14	T12	8780	14	28	20	STRAIGHT					
WALL 4	15	T12	1125	64	128	54	100	885	(190)			
	16	T12	8780	14	28	20	STRAIGHT					

REINFORCEMENT SUMMARY

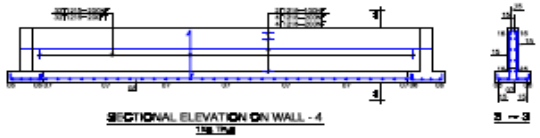
BAR DIA. mm	6	8	10	12	16	20	25	32	40	HIGH YIELD REINFORCEMENT
'A' TOTAL LENGTH (m)										AREA = —
'A' TOTAL WEIGHT (kg)										
'T' TOTAL LENGTH (m)				3556.52						MESH WT. =
'T' TOTAL WEIGHT (kg)				3556.5						REINFT WT. = 1850.0kg
TOTAL WEIGHT (kg/m)										1850.0kg

THE BENDING DIMENSIONS GIVEN IN THIS SCHEDULE ARE MEASURED IN ACCORDANCE WITH BS 4466 UNLESS OTHERWISE STATED



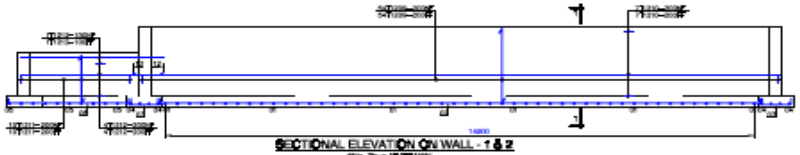
SECTIONAL ELEVATION ON WALL - 3

2 — 2



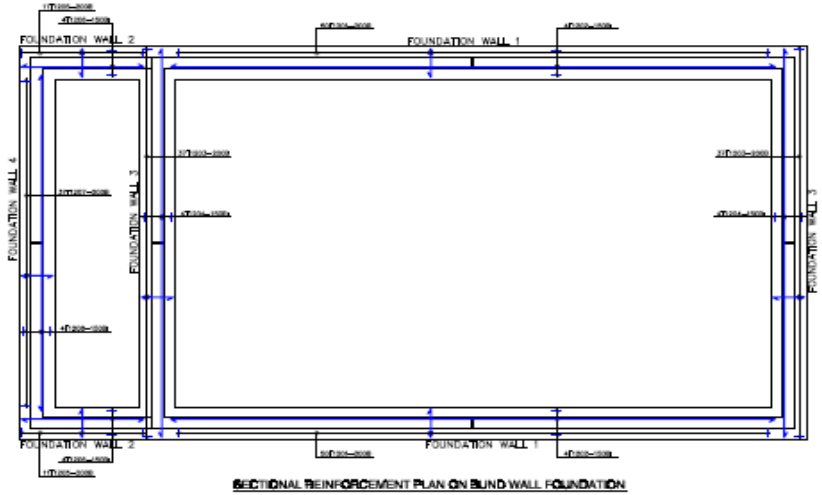
SECTIONAL ELEVATION ON WALL - 4

3 — 3

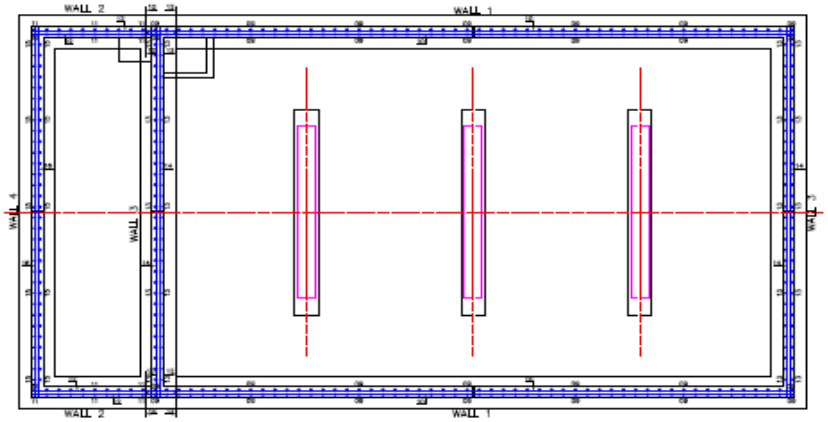


SECTIONAL ELEVATION ON WALL - 1 & 2

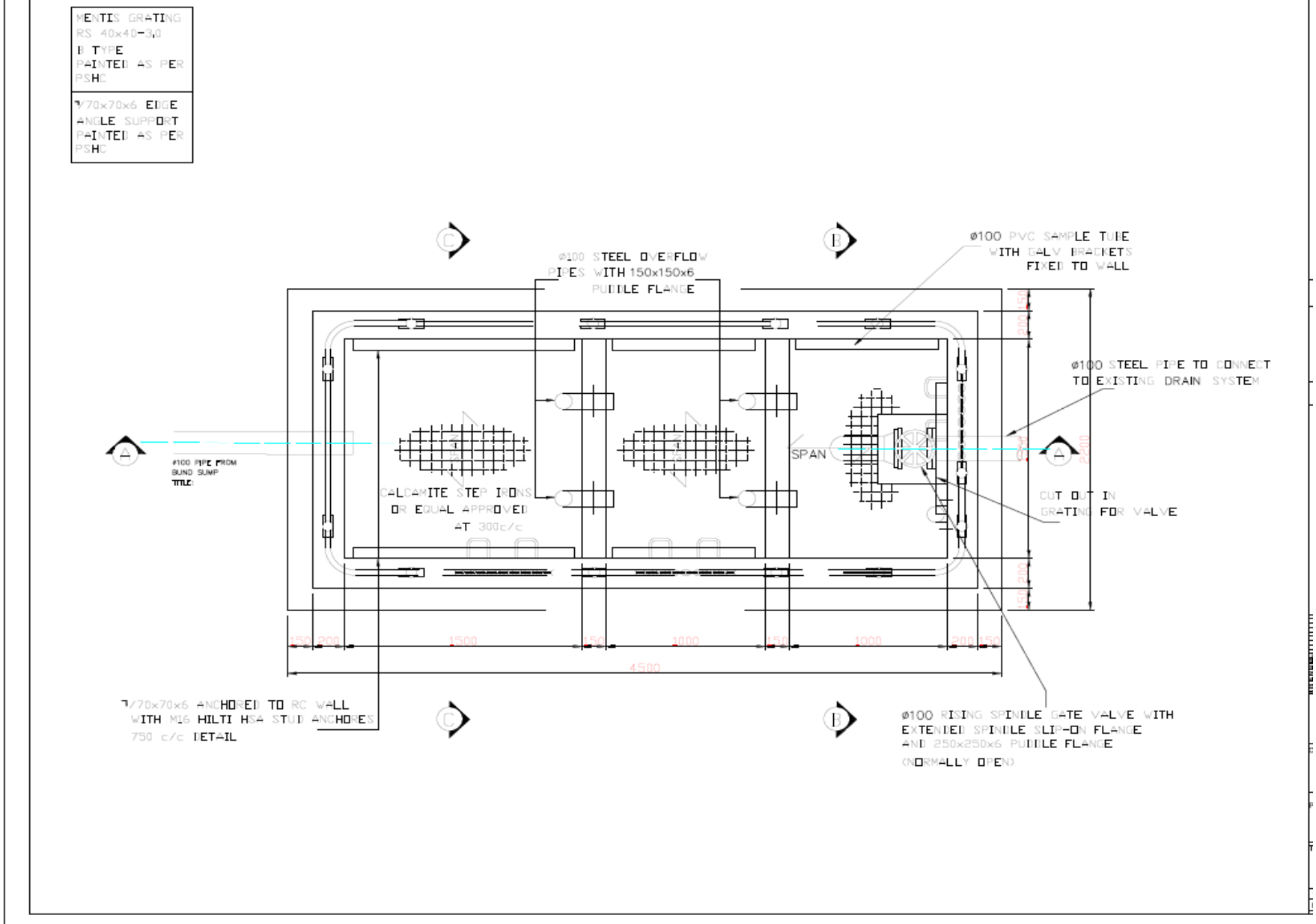
1 — 1



SECTIONAL REINFORCEMENT PLAN ON BLIND WALL FOUNDATION



SECTIONAL REINFORCEMENT PLAN ON BLIND WALLS


MENTIS GRATING
RS 40x40-3/0
B TYPE
PAINTED AS PER
PSHC
70x70x6 EDGE
ANGLE SUPPORT
PAINTED AS PER
PSHC
ø100 STEEL OVERFLOW
PIPES WITH 150x150x6
PUDDLE FLANGE
ø100 PVC SAMPLE TUBE
WITH GALV BRACKETS
FIXED TO WALL
ø100 STEEL PIPE TO CONNECT
TO EXISTING DRAIN SYSTEM
SPAN
CALCAMITE STEP IRONS
OR EQUAL APPROVED
AT 300c/c
CUT OUT IN
GRATING FOR VALVE
ø100 PIPE FROM
BUND SUMP
TITLE:
70x70x6 ANCHORED TO RC WALL
WITH M16 HILTI HSA STUD ANCHORES
750 c/c DETAIL
ø100 RISING SPINDLE GATE VALVE WITH
EXTENDED SPINDLE SLIP-ON FLANGE
AND 250x250x6 PUDDLE FLANGE
(NORMALLY OPEN)
4500