

FINAL COPY

SILVERLANDS RANCHING LIMITED
ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT FOR THE PROPOSED DAM
CONSTRUCTION PROJECT ON LUEZI RIVER

ZIMBA DISTRICT, SOUTHERN PROVINCE, ZAMBIA



**SILVERLANDS RANCHING
LIMITED**



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ENVIRONMENTAL IMPACT STATEMENT

July 2013

EXECUTIVE SUMMARY

The Environmental and Social Impact Assessment findings presented in this report provide a critical examination of issues considered important in fulfilling the requirements of a clean, sustainable and healthy environment. This report is primarily aimed at establishing the environmental and social impacts of the proposed Luezi Dam construction project. During the study, the ESIA team made wide consultations, interviews and field visits to the project area and offices of relevant stakeholders. The views and concerns of all relevant stakeholders were noted and considered when writing this study report.

The Proposed project

The proposed dam is an embankment dam with crest height of 23m above river bed and throwback of 4100m. The dam wall length will be 1045m. The catchment area is 127km² with an average capacity of 14000000 m³ at Full Supply Level (FSL). The embankment for the proposed earth dam will be located on farm 1206 belonging to Silverlands Ranching Limited in Zimba district, 7 km upstream from the Kalomo-Luezi River junction. The site for the proposed dam is about 15 km off the Great North Road and in total 18 km from Zimba Town. The dam construction is expected to commence on receipt of EIA approval and be completed before April 2014 when the first crops will be in the winter (i.e. April planting) of 2014. The total cost of the project is 4.8 million United States Dollars.

Project Justification and objective of the project

The main enterprise on this farm is intended to be cattle ranching and intensive cattle production using irrigated pastures - as well as engaging in intensive crop production by the use of irrigation. The natural rainfall precipitation in Southern Province is adequate in total precipitation, but lacking in distribution over the growing season. This factor makes Zimba an unreliable farming area, but with the facility of being able to harvest the rain and store it in a dam then farming enterprises can be maximized with obvious benefit to employment as well as food and foreign exchange earnings for Zambia as a nation.

Legal Framework

Laws and regulations pertinent to the various aspects and activities of the proposed project were reviewed and considered. The various national and international pieces of legislations and international environmental conventions relevant to the proposed dam project have been listed in Chapter two of this report.

Land Ownership

The land where the proposed dam project will be constructed belongs to Silverlands Ranching Limited (SRL) on a 99 year lease. The inundation area will fall within the SRL farm except small parts (about 1.5 ha) that will affect farm 2815 belonging to Gerjon Investments Limited. The owners of the affected farms have been consulted and are in agreement to the implementation of the project.

Project Need and Alternatives

A number of project alternatives were considered. Due consideration was given to topographical characteristics - narrowest section of the valley is preferred, Catchment area of the dam - the wider the Catchment area of the dam the higher discharge available, Distance to beneficiary areas - the shorter the conveyance the more economical, and Accessibility of the site - the easy accessibility of the site the cheaper it is to construct. In addition, the geology and soil type are the other critical factors that were taken into account. Given the development objectives of the Luezi dam project, three options were available and considered:

Do nothing option

Avoid construction of the earth dam at the farm and continue to depend on rains with the view of increasing agricultural productivity without irrigation. This option was not chosen given the irregularity in the rainfall patterns in the area and the semi-aridness of the region. The option would not have been commensurate to the scale of investment being proposed in the area of creating modern commercial farming for social economic development.

Construct one large dam on the Luezi

The second option available was to construct one big dam on the Luezi that will cater for all the proposed activities on the farm. This option was found to be attractive as one big dam will be easy to manage and water storage capacity will be high to meet the proposed investment. One large dam will be easy to manage and does not cause ecosystem fragmentation as compared to a number of small dams dotted all over the facility. This is better for the environment as most rivers in the area will remain continuous rather than being disrupted by a number of small dams placed throughout the Ranch. With the scale of investment proposed, it would require a number of small dams that may complicate management and safety of the humans and animals.

Dam Design Alternatives

The primary purpose of a dam may be defined as to provide for the safe retention and storage of water. As a corollary to this every dam must represent a design solution specific to the site circumstances. The design therefore represents an optimum balance of local technical and economic consideration at the time of construction. Embankment dam type was selected to be the appropriate design for the Luezi dam for technical and economic reasons. They are and simpler in structural concept than the early masonry dam, the embankment dams utilise locally available and untreated materials. They are adaptable to a wide range of site environments. In contrast, concrete dams and their many predecessors are more demanding in relation to foundation conditions. Additionally they have also proved to be dependent upon relatively advanced and expensive construction skills and plant.

Approach and Methodology

The study assessed and quantified the potential impacts, both positive and negative of the proposed dam project. The baseline information collected was used to analyze the potential impacts of the proposed project. The ESIA study team used various methodologies such as field visits, literature review, consultations with the affected public and stakeholders, among others. In order to generate

adequate baseline information this served as a benchmark for analysing potential impacts and generating an Environmental and Social Management Plan (ESMP).

The fieldwork was extensive and included several activities: A reconnaissance visit was made to the project area by the ESIA team which helped the team to set out key areas of observation during the study. This was then followed by field visits to the project area and the neighbourhood, taking records of observations as well as interviewing community members.

Reports and reference materials on physical and biological data on the study area were also studied including literature on dams and their impacts. Questionnaires were administered to the community members in an attempt to get detailed individual views about the proposed project and data on the socio- economic landscape of the study area.

Public Consultation

Public participation was mainly achieved through direct interviews, observations, questionnaire administration, holding stakeholder and public meetings. Those consulted included Government departments, NGOs, Civic leaders, Traditional leaders, opinion leaders within the community; local politicians, Religious organisations, Water utilities and ZEMA. The EIA consulting Team ensured that vulnerable groups such as youths, women and physically challenged were consulted.

Conclusion

According to the results of the public consultations and baseline studies conducted, it is evident that construction of the proposed dam will result in overall economic growth and development as a result of improvement in the availability of water for irrigation. 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, the neighbouring community and air quality. There will be no relocation of households or economic displacement as the project will only affect the area within Silverlands Ranching area.

Recommendations

Minimal vegetation destruction

Ensure minimum destruction of vegetation. If possible, all project –related activities should be done within the designated project alignment areas.

Rehabilitation of quarries and borrow pits

Rehabilitate quarries, borrow and gravel pits to avoid potential health hazards.

Occupational safety and Health

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.

Environmental audits and monitoring

Annual environmental audits should be carried out on the dam in order to ensure compliance of the project with the mitigation measures outlined in the Environmental and Social Management Plan (ESMP).

Record keeping

Dam maintenance records should be retained in a computer database to enable engineers to monitor the maintenance activities and costs.

Good housekeeping

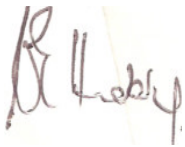
All activities concerning dam construction and maintenance such as, work execution, site inspection, and material testing, should be strictly monitored by an engineer or a designated official.

Community participation

There is need for strengthening and promoting the role of community groups, women and youth to fully participate in health, sanitation, water resources and environmental management and conservation.

Water quality tests

There is need to strengthen the various water testing laboratories within the project area through the provision of adequately trained personnel and necessary laboratory equipment to be able to accurately determine the quality of water when necessary. Silverlands will have to monitor water quality from some selected points within the farm area.



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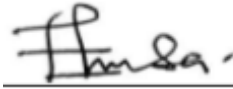
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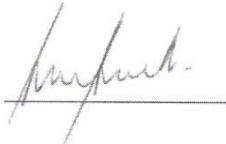
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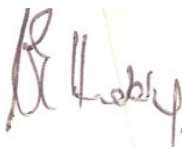
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ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
BID	Background Information Document
CITES	Convention on International Trade in Endangered Species
CRR	Comment Response Report
dB	Decibel
DBH	Diameter at Breast Height
EIA	Environmental Impact Assessment
EHS	Environment Health and Safety
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
ESMP	Environmental and Social Management Plan
EPPCA	Environmental Protection and Pollution Control Act
FAO	Food and Agriculture Organization
FRA	Food Reserve Agency
FSL	Full Supply Level
GDP	Gross Domestic Product
GHGs	Green House Gases
GPS	Global Positioning System
HIV	Human Immunodeficiency Virus
ILO	International Labour Organization
IMF	International Monetary Fund
ITCZ	Inter-Tropical Convergence Zone
KEGS	Kasumwa Enviroconsult & General Supplies Limited
MAL	Ministry of Agriculture and Livestock
MAR	Mean Annual Runoff
NAPSA	National Pension Scheme Authority
NHCC	National Heritage Conservation Commission
NGOs	Non-Governmental Organizations
NP	National Parks
PAYE	Pay As You Earn
RBA	Relative Basal Area
RHCs	Rural Health Centers
SIs	Statutory Instruments
SRL	Silverlands Ranching Limited
STIs	Sexual Transmitted Infections
SWSC	Southern Water and Sewerage Company
ToRs	Terms of Reference
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
VCT	Voluntary Counseling and Testing
WMM	World Medical Mission
ZAWA	Zambia Wildlife Authority
ZAMSEED	Zambia Seed Company

ZEMA	Zambia Environmental Management Agency
ZMH	Zimba Mission Hospital
ZRA	Zambia Revenue Authority

1. INTRODUCTION

1.1 Background of the Project

Agriculture is one of the main sectors of the Zambian economy that can drive social economic development. Agriculture like tourism and mining is expected to be the engine of growth over the next decades. It is recorded that agriculture has consistently generated between 18-20% of Zambia's Gross Domestic Product (GDP) since the early 2000's, serving as a source of livelihood for more than 50% of the population (IMF, 2012). The sector accounts for 67% of the labour force and remains the main source of income and employment for rural women who constitute 65% of the total rural population. Zambia's GDP composition by sector was; agriculture: 21.5%, industry: 35.2% and services: 43.4% whereas as from the total 5.57 million people labour force, the sector employed 85% with the remainder being shared among industry (6%) and services (9%). The Government of the Republic of Zambia strongly supports agriculture as it is one of the means to diversify the economy.

Silverlands Ranching Limited would like to be part of the efforts being made by the government and other private players to increase the national water storage capacity through the construction of dams. Silverlands Ranching Limited recognises the important role the private sector can play in increasing irrigated land in Zambia and supports the government's stance of encouraging private sector participation. Taking advantage of this enabling environment, Silverlands Ranching Limited intends to construct a dam of capacity 14000000m³ at FSL for irrigation from the Luezi River, a tributary of the Kalomo River. The objective of the dam project is to mitigate effects of perpetual droughts and recurrent scanty and poorly distributed rainfall during the four months of the rain season in the area.

1.2 Summary Description of the Project

The Luezi Dam Project involves the construction of a dam and associated infrastructure on the Luezi River, a tributary of the Kalomo River in Zimba district of Southern province of Zambia, to provide water for irrigation of pasture and crops within the Silverlands Ranching farm area. The dam will be situated on Silverlands Ranching's farm in Zimba District, 7 km upstream from the Kalomo-Luezi River junction. The project site is 15 km off the Great North Road and 18 km from Zimba Town. The Luezi is a right bank tributary of the Kalomo River. The embankment for the proposed earth dam will be located on farm 1206 belonging to Silverlands Ranching Limited. The earth dam will have a catchment area of 127 Km² with an average capacity of 14 000 000 m³ at Full Supply Level (FSL). The height of crest above river bed will be 23m and a throwback of 4100m is expected with a surface area of 410 ha. The dam wall length will be 1045m.

Zimba has been gazetted by the government as one of the new districts in Southern province. As a new district, Zimba will need investment that will promote the development of the local economy and infrastructure. The Government of Zambia has been encouraging irrigation farming due to the irregularities in rainfall patterns that have been experienced in recent years. The construction of dams is promoted by the government as this will increase the national water storage capacity. This is more critical in areas that are prone to droughts. Southern province is one of the areas in the country that has experienced droughts and therefore construction of a dam

in the area will boost agriculture development and contribute to the social economic development of the area. The proposed Silverlands Ranching dam project is in line with government commitment to develop the economies of the newly established districts in Zambia. The dam project will be developed on an already existing property formerly known as Foresythe Estate. The project will also boost the economic activities in the newly established district. This project will be one of the major investments in the area. With the construction of the dam on Luezi River, Silverlands Ranching Limited envisages a reliable water supply through stored water throughout the year leading to increased agricultural production in terms of cattle and crops thus contributing to social and economic development. There are several small dams in the area, however, their capacities are too low to support the scale of investment being proposed in the area. Some of these dams dry up in the dry season.

1.3 Objectives of the Project

The main objective of constructing the dam is to establish a cropping division to enable the intensification of the cattle program on Foresythe in two ways;

1. To provide water for a cropping program of 1000ha
2. To enable a programme for fattening cattle sourced from third parties in a feedlot.
3. To increase the farm's capacity to hold more cattle and therefore allow for an increase in the size of the breeding herd

1.4 Company's Track Record

SRL is the proponent of the project and was registered on 6th November 2012 (appendix 1). It is part of SilverStreet Private Equities Strategies SICAR sub-fund Silverlands (the "Fund"). The Fund is focussed on investing in agriculture and agricultural businesses in sub-Saharan Africa and has total committed capital of US\$214 million plus US\$106 million in debt finance from the Overseas Private Investment Corporation of the United States. To date approximately 25% committed capital has been deployed.

Cattle ranching is a key component of the fund's "protein strategy". By comparison to some other countries in the region, the consumption of beef per capita is relatively low in Zambia. With growing prosperity however, the demand for beef is growing fast and Silverlands Ranching believes that there is an opportunity to benefit from this growth which cannot be met by current domestic supplies. The fund's commercial farming crop focus in Zambia will be on the major food crops such as, wheat and soya beans. Commercial farming will represent the core of the portfolio. There will also be a focus on increasing small-scale agricultural output through the implementation of out-growers schemes and sourcing much of the required raw materials, in particular maize for feed mills from small scale farmers.

SRL is committed to effective environmental management and has employed a senior and middle management team with a wealth of experience in delivering large scale agricultural projects, supported by a team of specialised consultants with expertise in delivering sound environmental and technical advice for the project. SRL is committed to ensuring the development and implementation of an appropriate Environmental and Social Management Plan (ESMP) in accordance with its environmental policy and commitments made in the EIS. SRL is also committed to national and international environmental and social requirements as it implements the dam project.

1.5 Particulars of Shareholders

The shareholders of Silverlands Ranching Limited are as indicated below:

Shareholder	Percentage Shares	Address
Silverlands Ireland Holdings (Z2) Limited	99.9%	12 Merrion Square, Dublin 2, Republic of Ireland
SilverStreet Private Strategies Soparfi. SARL	0.1%	6, Rue Gabriel' Lippmam, E Building Parc d'Activitie Sgndall L-5365 Munsbach, Grand Duchy of Luxemburg

1.6 Project and Summary Contact Details

<i>Company Proponent</i>	Silverlands Ranching Limited (Subsidiary of Silverlands Ireland Holdings (zz) Limited)
<i>Name of Facility</i>	Foresythe Estate
<i>Theme/Type of Facility</i>	Agriculture
<i>Location</i>	Zimba District
<i>Province</i>	Southern Province
<i>Reviewed Document</i>	Environment & Social Impact Assessment (ESIA)
<i>Address</i>	P.O Box 610003, Zimba
<i>Contact Person</i>	Colin Huddy (Mr.)
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<i>Physical Address</i>	Plot B, Mukwa Drive, Eureka Park, Lusaka

1.7 Total Project Cost/Investment

The total cost of the project is 4.8 million United States dollars.

1.8 Proposed Project Implementation date

The dam construction is expected to commence on receipt of EIA approval and be completed before April 2014 and the first crops will be harvested in the winter (i.e. April planting) of 2014.

1.9 EIA Process

The Environmental Impact Statement (EIS) has been prepared to inform the Proponent, decision-makers and stakeholders, including government agencies, NGOs, and others whose interests may be affected by the Project, community groups and the public about the need for the Project, potential environmental, social and economic issues relating to the construction and operation of the Project, and how these issues could be managed.

This EIS has therefore been prepared in compliance with Zambian legislation elaborated by the Environmental Management Act (EMA) of 2011 and several international environmental conventions and principles. The EIS contains the most significant information to help decision-makers when considering approvals for the Project.

1.9.1 Objectives of the EIS

The EIS serves to evaluate the findings of the baseline studies undertaken as part of the EIS process and to provide a summary of the findings of these reports, including an analysis of environmental impacts and a description of the major recommendations and management measures. A number of key issues associated with the project are described, and recommendations on how to manage and mitigate these are made, generally by reference to the ESMP. The key objectives of the EIS are to:

- Document the environmental, social and health baseline conditions of the study area and the affected communities;
- Inform and obtain input from stakeholders, (e.g. governmental authorities, the public, and local communities) and capture their relevant issues and concerns;
- Describe the outcomes of consultation with stakeholders about the project
- Assess in detail the environmental, social, and health impacts that would result from the Project;
- Assess the significance of potential environmental, social and economic impacts and propose acceptable standards and levels of impact
- Identify environmental and social mitigation measures to address the impacts identified;
- Meet the requirements or recommendations of the applicable national and international regulations and standards;
- Be guided by the policies, guidelines, and procedures of the relevant international treaties and agreements.

1.9.2 Scope of the EIA Study

The EIA study has been carried out following the guidelines and requirements of both the Zambia Environmental Management Agency (ZEMA) and International Finance Corporation (IFC). The Terms of Reference were reviewed by ZEMA and approved on June 18th 2013(Appendix 2). The approved Terms of Reference have guided the Environmental and Social Impact Assessment of the proposed project culminating in the preparation of this study report.

The final document of the EIA study comprises an EIS and an ESMP. The ESMP outlines duties and responsibilities of the developer, contractor(s) and other relevant parties to serve as a management tool in the successful implementation of recommended mitigation measures and subsequent monitoring thereof during all project phases.

1.10 Approach and Methodology

A systematic approach was employed to investigate and examine different aspects of the project in relation to the environment. Collection of secondary data was done by reviewing literature while collection of primary data through field surveys, consultative meetings for consideration of opinions and concerns of affected and interested parties formed an important element of the process. Specifically, the EIA multi-disciplinary team studied the project site and its condition, assessing the need for design adjustments taking into account existing infrastructure. The survey indicated that the Luezi stream is not a perennial stream and falls within the Foresythe Estate belonging to Silverlands Ranching. The Luezi is a tributary of the Kalomo River. The nearest communities are settled along the Kalomo River not the Luezi River. The project does not have communities directly affected by the project downstream. Since the Luezi drains into the Kalomo River, communities using the Kalomo may be affected to a lesser extent.

The EIA study team embarked on various methodologies such as field visits, literature review, consultations with the affected public and stakeholders, among others. In order to generate adequate baseline information which served as a benchmark for analysing potential impacts and generating an ESMP, the fieldwork was extensive and included several activities: A reconnaissance visit was made to the project area by the EIA team which helped the team to set out key areas of observation during the study. This was then followed by field visits to the project area and the neighbourhood, taking records of observations as well as interviewing community members.

The approach to the EIA consisted of four main stages: Scoping, Stakeholder consultation, Specialist studies and Impact Assessment/Management plans (Figure 1). Stakeholder consultation was conducted throughout the whole EIA process and will continue through Implementation.



Figure 1: EIA Process/Stages

1.10.1 Scoping Phase

Scoping was the first phase and provided for the identification of issues that were to be investigated and addressed during the subsequent phases. 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 ToRs, and to exclude issues unlikely to be of any significance. The primary stakeholders were also identified during the scoping phase. The scoping phase was initiated in February 2013 and continued throughout the entire EIA process. The objectives of this phase were to:

- Identify stakeholders and inform them of the Project and the EIA process;
- Provide stakeholders with the opportunity to identify any issues and concerns associated with the Project;
- Identify areas of likely impact and environmental issues that may require further investigation in an EIA; and
- Determine the need for specialist baseline and impact assessment studies in response to initial stakeholder input.

Kasumwa EnviroConsult & General Supplies Limited (KEGSL) a registered environmental consultancy firm of Zambia was contracted by SRL to prepare the EIA for the proposed Luezi dam project.

1.10.2 Consultation Process

An extensive consultation program has been undertaken for the period January 2013 to May 2013. A variety of communication activities and tools were used to seek broad community input, and the issues and opportunities identified through stakeholder engagement informed the EIS technical studies. The objectives of the community consultation program were to:

- Add value to the study's decision-making process

- Inform stakeholders about the study objectives, drivers, processes and consultation opportunities
- Provide easy and accessible ways for stakeholders to participate in the consultation process
- Inform the EIS Project Team

1.10.2.1 Project Announcement

The project was announced about seven weeks before the commencement of EIA scoping by means of a Background Information Document (BID) and posters which contained some key information about the proposed project. In this document stakeholders were informed how they could take part in the EIA process and provide valuable inputs. The list of stakeholders to whom the BID was distributed is shown in Table 2. Posters announcing the proposed project were also put in strategic public areas such as Municipal Council Libraries, shopping centres, schools, clinics, markets. During the scoping stage, local communities and stakeholders were given the opportunity to comment and raise concerns, which were captured in a Comment and Response Report (CRR) (Appendix 3). The list of stakeholders consulted is shown in appendix 4.

Table 1: List of some stakeholders

	Organisation	Category	Location
1	Zimba District Council	Local Government	Zimba
2	Southern Water and Sewerage Company (SWSC)	Private company	Zimba
3	Department of Community Development	Government	Zimba
4	Zambia Electricity Supply Cooperation (ZESCO)	Parastatal	Zimba
5	Zimba Mission Hospital	Private - Health	Zimba
6	Ministry of Agriculture and Livestock (MAL)	Government	Zimba
7	World Vision	NGO	Zimba
8	Department of Fisheries	Government	Kalomo
9	Ministry of Lands	Government	Kalomo
10	National Heritage and Conservation Commission (NHCC)	Government	Kalomo
11	Zambia Wildlife Authority (ZAWA)	Semi-Government	Kalomo
12	Forestry Department	Government	Kalomo
13	Department of Water Affairs	Government	Kalomo
14	Lion's Den Farm	Private (Farm adjacent to SRL – affected by flow back)	Zimba
15	Gerjon Investment Limited	Private (Farm adjacent to SRL)	Zimba
16	Chiinda Machiswe Farm	Private (Farm adjacent to SRL)	Zimba

Table 2: List of Headmen of Villages consulted in the project area

	Headman	Village	Contact	Location
1.	Bernard Lukumbe	Siakaloba	0978796870	Zimba
2.	Cornard Siatindi	Simbai		Zimba
3.	Phenias Sibuchi	Siamazila		Zimba
4.	Bernard Kantini	Chingobe	0979979565	Zimba
5.	Killion Lukumba	Wasilela		Zimba

1.10.2.2 Scope of Community Consultation

The consultation has included communities located downstream and around the Project area, civic leaders, local government representatives and government officers, industry sectors, NGOs, traditional owners, special interest groups and organisations in close proximity to the Project area, road users, public utilities and media. Stakeholders were encouraged to make comment via written submissions or via the Project email address, fax and mailing address at any time.

The Community and Stakeholder Engagement Plan utilised a range of engagement techniques for the different stakeholder groups, including:

- Departmental presentations and forums
- Key stakeholder focus groups
- Information day and information day report
- Display/s
- Corporate presentations to community organisations
- Dissemination of community feedback and comments to the EIS Project team

1.10.2.3 Consultation Results to Date

During the period when the EIS was being prepared, a number of feedback forms/letters (appendix5) were received by KEGS during the consultation process. The outcomes of the engagement process also included identification of the issues raised. Issues raised were considered in this EIS.

1.10.2.4 Scoping Meetings

Public and focus group meetings were held with key stakeholders in the area. Individual stakeholders were informed two weeks in advance of the date on which the meetings were to be held. The schedule for all the meetings held with stakeholders is shown in Table 4. The agenda of these meeting included a presentation of the proposed project and findings of the socio-baseline survey by the Developer with questions and answers followed by an outline by the Environmental Consultants of anticipated impacts and proposed mitigation measures with an open floor discussion. A sample attendance list and minutes of all the meetings conducted are shown in appendix6.

Table 3: Schedule of scoping meetings held in the area

Interested & Affected Parties	Category of interested & Affected Parties	Purpose of Meeting	Venue	Date
Ministry of Agriculture and Livestock – District Offices	Government	Introduction, explanation of need to perform baseline studies and EIA. Distribution of	District offices Zimba	Wednesday 20 March, 2013 at 09:00hrs (am)
Zimba District Council	Local Government	Background information document	Council Chambers Zimba	Wednesday 20 March, 2013 at 10:00hrs (am)
Community Development	Government		District offices Zimba	Wednesday 20 March, 2013 at 11:00hrs (am)
World Vision	Non-Governmental Organisation		Introduction, explanation of need to perform baseline studies and EIA. Distribution of Background information document	World Vision offices Zimba
Zimba Mission Hospital	Private	Zimba District Hospital offices Zimba		Wednesday 20 March, 2013 at 11:00hrs (am)
ZESCO	Parastatal	ZESCO Offices		Wednesday 20 March, 2013 at 11:30hrs (am)
Forestry Department	Government	District Offices Kalomo		Thursday 21 March, 2013, 09:00hrs (am)
Department of Fisheries	Government	District offices Kalomo		Thursday 21 March, 2013, 09:30hrs (am)
ZAWA	Semi-Government	ZAWA offices Kalomo		Thursday 21 March, 2013, 10:30hrs (am)
Ministry of Lands	Government	Lands offices Kalomo		Thursday 21 March, 2013, 11:30hrs (am)
NHCC	Government	NHCC offices		Thursday 21 March, 2013, 14:00hrs (pm)
Lion's Den Farm – Owner Mr. J.K Sopa	Private Farm - affected by flow back	Introduction, explanation of need to perform baseline studies and EIA. Distribution of Background information document and seeking consent.	At the Farm Zimba	Friday 22 March, 2013, 09:00hrs (am)
Gerjon Investment Limited – Mr. J. Imbwae	Private Farm - affected by flow back		At the Farm Zimba – affected by flow back	Friday 22 March, 2013, 09:30hrs (am)
Chiinda Machiswe Farm – Mr D. Hamanyanga	Private Farm		At the Farm	Friday 22 March, 2013, 10:30hrs (am)
Government, NGOs and	Government, NGOs and	Introduction, explanation of need to perform	Council Chambers	Wednesday 3 April, 2013, 10:00hrs (am)

Community Representatives	Community Representatives	baseline studies and EIA. Collection of concerns to be included in the EIA	Zimba	
Community Members	Community Members downstream	Introduction, explanation of need to perform baseline studies and EIA. Collection of concerns to be included in the EIA	Community Centre	Wednesday 3 April, 2013, 14:00hrs (pm)
Headmen	Traditional Authority	Collection of concerns to be included in the EIA	Community centre	Wednesday 3 April, 2013, 16:30hrs (pm)
Water Affairs	Government	Introduction, explanation of need to perform baseline studies and EIA. Distribution of Background information document	Through email – feedback was received	April 22, 2013

1.10.2.5 Specialist Studies

From the scoping consultation meetings that were conducted, the need to undertake five specialist studies (baseline data) was identified. These studies are soil survey and land use planning, flora and fauna, ground and surface water quality, air quality and noise studies and socio-economic studies. The major issues to be covered in the specialist studies are presented in Table 4. The studies were conducted by different specialists (see appendix 7: curriculum vitae for specialist involved).

Table 4: Specialist studies covered in the EIA

NO.	Specialist Studies	Scope of study
1	Soil survey and land use planning	<ol style="list-style-type: none"> 1. Physical characteristics. 2. Chemical characteristics. 3. Topography. 4. Soil classification. 5. Crop production potential per type of soil. 6. Preparation of a soil map. 7. Land use planning.
2	Flora and fauna study	<ol style="list-style-type: none"> 1. Animal population and distribution. 2. Habitat description. 3. Tree species diversity and distribution. 4. Tree volume, diameter and height distribution. 5. Classification of vegetation types
3	Air Quality and Noise Studies	<ol style="list-style-type: none"> 1. Levels of fumes and emissions 2. Noise levels
4	Ground and surface water quality	<ol style="list-style-type: none"> 1. Surface water quality and availability. 2. Ground water quality and availability
5	Socio-economic study	<ol style="list-style-type: none"> 1. Population and distribution. 2. Existing social facilities and services. 3. Social amenities

		4. Housing and farming inventory and mapping 5. HIV/AIDS i.e. prevalence in the area
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1.10.2.6 Summary of issues raised during the public consultation

As mentioned earlier, a CRR trail can be found in Appendix3 of this report; however, Table 6 below is a summary of the major issues which were discussed throughout the public consultation activities associated with this project.

Table 5: Summary of issues raised during the scoping stage

Issue	Sub Issue	Comment
Employment	Recruitment procedure for the proposed Luezi dam and the Silverlands Ranching Limited Estate	Concern that local population and contractors are given preference in employment and concern for how local people will be identified in employment recruitment process
		Concern of lack of education and skills among the local communities and implications for employability
		Concern regarding provision of on-job training for unskilled, skills transfer to locals
		Impact of employment policy on influx of people into the area and ability to control influx through employment policy
	Corruption in the recruitment process	Concern of gender equality in recruitment and employment of vulnerable persons (elderly, disabled and widowers)
Stakeholder Engagement Issues	Need to be continuously updated on future exploration and mining activities	Concern on the availability of all documents concerning the project including EIA final report
	Need to be updated on community development projects by the developer;	Concern on how the company will work with stakeholders especially community members
Health and Safety Issues	Threat to human health and safety	Health concern from communities and their livestock in case of dam failure Increase in the population of crocodiles in the Luezi River
	Safety of the bridge	Concern on whether Luezi bridge will be redesigned as current state cannot contain the pressure of water in an event of dam failure
Local development issues	Construction, Upgrade and Maintenance of Existing Public Infrastructure and Services	Community school
		Rural health Centre
		Public roads
	Corporate Social Responsibility Initiatives	Concern of type and scale of community development projects by developer during construction and operation
Water rights		
Loss of Biodiversity	Natural habitats and flora and fauna due to vegetation clearance	Concerned with the population of fish in the river
	Ecosystem fragmentation	Concerned with disturbance of the ecosystem
Accessibility and use of the dam by local community	Fishing activities on the dam by local communities	Concern on whether local communities will be allowed to use the dam for fishing
	Limited Mobility of Community Members	Will the community have access to the water especially during dry season

2. REGULATORY FRAMEWORK

A number of local and international Acts and Regulations related to environmental management and protection relevant to the implementation of this proposed dam project were reviewed. The review done so far indicates that the following pieces of legislation are relevant to the dam project:

2.1 The Environmental Management Act (EMA) No. 12 of 2011

The EMA is currently the Principal Act on environmental governance and regulation in Zambia that was passed in April 2011 to replace and repeal the Environmental Protection and Pollution Control Act (EPPCA) of 1990. Section 29 of this Act provides that a developer shall not implement a project for which an EIA is required. The following Statutory Instruments (SIs) of the EMA that are relevant to the project are listed in Table 9:

Table 6: Statutory Instruments under EMA relevant to the project

Statutory Instrument	No.	Description	Relevance to Project
Waste Management (Licensing of Transporters of Wastes and Waste Disposal Sites) Regulations	71 of 1993	Provides for licensing of solid non-hazardous waste transportation and operating/owning of a non-hazardous waste disposal site.	The proposed project has the potential to generate solid waste whose transportation and disposal may require licensing. Managing of all solid waste will therefore be done in accordance with the requirement of these Regulations. The dam project will not generate hazardous waste.
Water Pollution Control (Effluent and Wastewater) Regulations	72 of 1993	Provides for licensing of liquid waste discharge to the environment and also provides for statutory discharge limits for respective parameters.	The activities involved throughout the dam project, especially during the construction phase, have the potential to cause pollution of the aquatic environment. SRL will therefore take cognizance of the need to prevent pollution of the aquatic environment.
Air Pollution Control (Licensing and Emission Standards) Regulations	141 of 1996	Provides for licensing of gaseous waste emission to the environment and also provides for statutory discharge limits for respective parameters	There is high potential that the proposed Luezi Dam project will discharge particles and dust that have potential to pollute ambient air, especially during preparation and construction activities. SRL will therefore take mitigation measures to prevent air pollution in accordance with this instrument
The Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations	28 of 1997	Provides the framework for conducting and reviewing environmental impact assessments for any project and regulations for auditing project implementation;	The proposed project requires an EIA in accordance with the requirements of these regulations as indicated in the Second Schedule (regulation 7 (2)) under the heading "Projects which require Environmental Impact Assessment" and

			specifically under the sub heading “Dams, Rivers and Water Resources”
Hazardous Waste Management Regulations	125 of 2001	Provides for licensing of solid hazardous waste transportation and operating/owning of a hazardous waste disposal site.	The proposed project has minimal potential to generate hazardous waste especially but if any is generated especially during the construction phase, generation, collection, storage, transportation, pre-treatment and disposal of such waste may require to be licensed under this regulation. SRL will take measures to adhere to the provisions of this regulation.

2.2 Other Acts reviewed

Other acts that are closely related to environmental management and relevant to the proposed dam project are shown in Table 10.

Table 7: Other Acts relevant to the proposed dam project

ACT/Statutory Instrument	No.	Description	Relevance to Project
The Water Resources Management Act	21 of 2011	Provides for the main functions and powers of managing and protecting water resources in line with environmental sustainability.	A dam project predominantly deals with the water resources in a proposed project area. The proposed Luezi dam project will be developed on the Luezi river and contaminated effluents from the project activities have the potential to pollute this river and the Kalomo River which the Luezi joins downstream. The pollution of public water (surrounding rivers, streams and underground sources) is established as an offence under this Act and proposed project will be carried out in accordance with this Act to avoid pollution of water resources in the area.
The Zambia Wildlife Act	12 of 1998	Provides for the establishment, control and management of National Parks (NP) and for the conservation and enhancement of wildlife ecosystems.	The Preliminary assessment on the proposed project area indicate the presence of wildlife resources such as baboons, monkeys, rabbits, snakes, birds, lizards to mention but a few. The proposed project will follow the requirements of this act to ensure that the wildlife habitats are conserved and ensure that there is minimal disturbance in the project area.
The Forest Act	39 of 1974	Provides for the establishment and management of National and Local forests, conservation and protection of forests and trees, and licensing and sale of forest products.	The proposed project area is characterized both primary and secondary miombo that will have to be cleared in preparation of the construction activities for the proposed project.
		The Land Act guarantees peoples' right	The proposed project area falls understate

The land Act	1995	to land while enhancing development. It recognizes two categories of land: State land (private land, protected land or land under the control of any Government institution or department) and Customary Land (held through customary tenure under different chiefdoms). However, Section 3 of the Act vests all land in Zambia in the President and is held by him in perpetuity for and on behalf of the people of Zambia.	land on a 99 year lease. The developer recognizes the importance of closely working with the chief and the local communities, Area Councillors and local authorities during the EIA process and will continue to do so during the implementation and operational phase of the proposed project.
The Lands Acquisition Act	2 of 1970	The Act sets out regulations for compulsory acquisition of land and property and compensation for such acquisition. The president (as the designated and authorized person) may acquire any property in the interest of the Republic.	In the case that the president acquires the land on which the proposed Luezi Dam project will be based, SRL will act in accordance with the provision of these regulations.
National Heritage and Conservation Commission Act	1989	The act is responsible for the conservation of ancient, cultural and natural heritage, relics and objects of aesthetic, historical, prehistoric, archaeological or scientific interest by preservation, restoration, rehabilitation, reconstruction, adaptive use and good management. The Commission also provides regulations for archaeological excavation and export of relics	The reconnaissance survey indicates that the site does not accommodate any features which have been confirmed to have cultural or heritage value; however, during site clearing and land preparation, any discoveries of possible ancient cultural, historical and natural heritage features will be reported to the National Heritage Society as per provisions of this Act.
Roads and Traffic Control Act	11 of 2002	The Act established the Road Transport and Safety Agency mandated to provide for a system of roads safety and traffic management.	SRL will use different vehicles on the road during site preparation, construction, operation and demolition. Thus, the company will ensure the use of the road in accordance with these regulations.
The Local Government Act	1991	The Local Government Act allows for the Council to implement environmental protection and natural resources management functions, including prevention of pollution of water supplies.	The proposed project will be located in Zimba District. As SRL will be implementing this project, it will abide by the Laws and requirements established by the Zimba District Council.
Energy Regulation Act	1995	The Act allows for the establishment of procedures for the transportation, handling and storage of fuels to minimize negative environmental impacts.	During project implementation, fuels such as petrol and diesel will be used. SRL will ensure that such fuels are stored and used in accordance with the provisions of these regulations so as to protect human health and the environment.

The Public Health Act	1930	The Council, under the Public Health Act, is empowered to prevent diseases and pollution dangerous to human health and to any water supply for domestic use.	The premises and surrounding environment of the proposed development shall be managed in accordance with this Act so as to safeguard human life. The project shall also ensure that measures to prevent diseases and pollution dangerous to human health and to any water supply are taken into account throughout the construction and operations of the dam.
The Employment	Cap 268	Provides for the employment of persons on contracts of service and for the form of and enforcement of contracts of service, appointment of officers of the Labour Department and for the conferring of powers on such officers and upon medical officers and protection of wages of employees as well as control of employment agencies.	SRL will employ people to work on this project who might be either permanent employees or on contract. The company will therefore ensure that recruitment procedures and treatment of workers in this project will be in accordance with these regulations.
Compensation Act	10 of 1999	The Act provides for the establishment and administration of a Fund for the compensation of Workers disabled by accidents to, or diseases contracted by, such workers in the course of their employment, and for the payment of compensation to dependants of Workers who die as a result of such accidents or diseases.	There is a possibility that some workers employed on this project, might be involved in accidents. In case of any accidents occurring to any worker, the SRL will treat such employees in accordance with these regulations
Town and Country Planning (Amendment) Act	1997	The Act Provides for the appointment of planning authorities for the following prepare, approve and revoke development plans Control of development and subdivision of land.	The Proposed project is a developmental project. Therefore, SRL in consultations with Zimba District Council will act in accordance with the provisions of this Act.
Zambia Development Agency Act	2006	The Act controls all investments in Zambia and recognizes the role of sectoral agencies including those responsible for environmental protection in authorizing specific projects .	The proposed project involves large investment in the agriculture sector. The developer will therefore work closely with ZDA and other sectoral agencies responsible for protecting the environment to ensure that the requirements of this Act are adhered to.
The Fisheries Act	No. 22 of 2011	To provide for regulation of commercial fishing and aquaculture and; for sustainable approaches to the development of fisheries, fisheries management, conservation and utilization.	The proposed dam project is likely to increase the fish stock on the Luezi River as the river is reported to dry up in the dry season. SRL will act in accordance with the provisions of this act for any fishing activities on the dam.

Explosives Act	Cap 115	This Act aims to regulate control over the manufacture, use, possession, storage, importation, exportation, transportation and the destruction of explosives.	In case the use of explosives arises during construction, the provisions of the Act will be adhered to closely. Section 13 obliges any person, having in his possession or under his control any explosive, to take all precautions to ensure that the explosive is not lost or stolen or is not at any time available to any person not lawfully entitled to possess or use that explosive.
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2.3 International Environmental Conventions to which Zambia is a Signatory

Zambia is a signatory to a number of international environmental conventions which are applicable to this project. Some of these conventions and protocols relevant to the proposed Luezi project were reviewed and are listed in Table 11. A protocol of signature is an instrument subsidiary to a treaty, and is built up by the same parties. Such a Protocol deals with ancillary matters such as the interpretation of particular clauses of the treaty, those formal clauses not inserted in the treaty, or the regulation of technical matters. Ratification of the treaty will normally involve ratification of such a Protocol. When Countries become signatory to Conventions, Protocols, Treaties and Agreements; they accede to incorporate the conventions principles and standards into their legislation (Coastal & Environmental Services, 2011). Though most of these agreements are non-committal, they are vital in ensuring that individual countries operate while conscious of the local but think globally. The agreements are meant to encourage countries to operate on agreed principles to enhance environmental, social and economic development.

Zambia is not alone in the world and hence has the responsibility to ensure that all activities being implemented within the country do not only comply with the local legislation but also conform to international requirements. In most cases when a country signs these agreements, new laws are developed that are usually oriented towards international mandates and provisions.

Table 8: International Environmental Conventions to which Zambia is Signatory

Convention	Description	Relevance to the Luezi Dam Project
<p>UNFCCC United Nations Framework Convention on Climate Change Ratified 1997</p>	<p>This aims at stabilizing greenhouse gas (GHGs) concentration in the atmosphere at the level that would prevent ‘dangerous interference with climate’. It urges countries to take steps in reducing the GHGs.</p>	<p>There will be not much emission of GHGs from this project except CO₂ from fossil fuel consumption. Silverlands Ranching Limited will endeavour to use best technology and practices to reduce emissions of GHGs.</p>
<p>UN Convention on Biological Diversity(1992)</p>	<p>This convention promotes conservation of biological diversity and sustainable use of its components.</p>	<p>The proposed project area is not very rich in biodiversity as it has been cultivated several times; however, there is the presence of biodiversity especially aquatic and some flora. SRL Limited will ensure measures are put in place to ensure conservation of any remaining biodiversity in the area in line with the requirements of this convention. This will involve supporting initiatives meant to conserve biodiversity for example, tree planting, wildlife conservation awareness programmes to mention but a few.</p>
<p>Convention on Control of Trans boundary Movements of Hazardous Wastes and their Disposal (1992).</p>	<p>The convention aims at controlling and reducing transboundary movements of hazardous wastes and assist developing countries in environmentally sound management of the hazardous and other wastes they generate.</p>	<p>Since SRL will be involved in the export and import of several products, the company will ensure that there is no transboundary movement of hazardous waste and if any management of such waste will be done in accordance with the outcome of this convention.</p>
<p>CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora Ratified : 1975</p>	<p>The convention aims at the protecting endangered species prominent in international trade through appropriate trade control measures and monitoring the status of such species</p>	<p>No direct impact on the Luezi dam Project. In case of the presence of any endangered species, correct measures will be implemented.</p>
<p>Basel Convention Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Ratified : 1994</p>	<p>Aims at the reduction of the production of hazardous waste and the restriction of transboundary movement and disposal of such waste. It also looks at any transboundary movement and disposal of hazardous waste.</p>	<p>No direct impact on SRL dam project as the company will not be transporting any of its waste across any international boundaries.</p>
<p>Nations Framework Convention on Climate Change Signatory: 2005</p>	<p>Related to the UNFCCC and aims at further reducing greenhouse gas emissions by encouraging developed implement programs that contribute to GHGs reduction.</p>	<p>As in described for UNFCCC</p>

<p>UNCCD Convention on Desertification</p> <p>Ratified : 1997</p>	<p>Convention established to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa</p>	<p>This Convention has no bearing on Silverlands Zambia Limited as the project site is not prone to serious drought/desertification. Although the area falls within a low rainfall area, it is however, not prone to serious droughts like in most arid regions of Africa.</p>
<p>Ramsar Convention</p> <p>Convention on Wetlands of International Importance especially as Waterfowl Habitat.</p> <p>Ratified : 1975</p>	<p>The convention aims at protecting wetlands through sustainable utilisation of them. It addresses one of the most important issues in Southern Africa, namely the conservation of the countries water supplies, for both the use of the natural resources.</p>	<p>The project will have impacts on Wetlands which provide a range of services, functions, and products that have direct social, economic and cultural value and are integral to the survival and well-being of communities. These systems have indispensable ecological value, being repositories of biodiversity and providing essential life support for a range of plant and animal species. The conservation and wise use of all wetlands is therefore in the national interest. This convention has little to do with SRL dam project as there are no wetlands within the project site.</p>
<p>Montreal Protocol Protocol for the Protection of the Ozone Layer</p> <p>Ratified : 1990</p>	<p>The protocol is aimed at ensuring measures to protect the ozone layer</p>	<p>SRL needs to ensure its compliance by excluding all products and equipment making use of CFCs</p>
<p>African Convention on the Conservation of Nature and Natural Resources (Algiers, 1968), (Maputo, 2003)</p>	<p>To encourage individual and joint action for the conservation, utilization and development of soil, water, flora and fauna for the present and future welfare of mankind, from an economic, nutritional, scientific, educational, cultural and aesthetic point of view.</p>	<p>Silverlands Ranching Limited will ensure the conservation of important habitats as well as habitat corridors to promote biological diversity. The EMP deals with these aspects of ensuring habitat diversity and sustainable utilisation of natural resources.</p>
<p>Convention concerning the Protection of the World Cultural and Natural Heritage</p> <p>Ratified : 1972</p>	<p>The Convention deals with the protection and continuity of cultural and natural heritage. Natural heritage are constantly under threat from not only traditional causes of decay but also from anthropogenic activities.</p>	<p>The convention has direct relevance to the Luezi dam project, and aspect contained in the convention is dealt with in the EMP.</p>

2.4 IFC Performance Standards Relevant to the Project

IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced.

The EIA process also reviewed the Equator Principles (EPs) and IFC guidelines to ensure that the implementation of the proposed Luezi dam project is in compliance with international principles and guidelines. The EPs represent a voluntary set of nine principles based on World Bank and International Finance Corporation (IFC) standards, for assessing environmental and social impacts of projects in project financing. Based upon the EIA assessment, the following IFC Guidelines and Performance Standards (PSs) were determined to be relevant and were reviewed:

Table 9: IFC Performance Standards Relevant to the project

IFC Performance Standard	Description	Relevance to the Luezi Dam Project
<p>Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts</p>	<p>Underscores the importance of managing environmental and social performance throughout the life of project</p>	<p>SRL dam project will have environmental and/or social risks and/or impacts. SRL will establish and maintain a process for identifying the environmental and social risks and impacts of the dam project as outlined in paragraph 18 for competence requirements.</p>
<p>Performance Standard 2: Labor and Working Conditions</p>	<p>Recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. The requirements in this has also being guided by those provided for by other requirements such as that of the International Labor Organisation (ILO)</p> <ul style="list-style-type: none"> • ILO Convention 87 on Freedom of Association and Protection of the Right to Organize • ILO Convention 98 on the Right to Organize and Collective Bargaining • ILO Convention 138 on Minimum Age (of Employment) • ILO Convention 111 on Discrimination (Employment and Occupation) 	<p>SRL will employ a number of people to work on the Ranch. These workers will either be direct, contracted or supply chain workers. SRL will ensure that what is provided for in this performance standard is adhered to. In Zambia, the law recognizes workers ‘rights to form and to join workers’ organizations of their choice. SRL will not interfere with this right of workers in line with this PS2.</p>
<p>Performance Standard 3: Resource Efficiency and Pollution Prevention</p>	<p>recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels</p>	<p>This performance standard applies as SRL will use water resources for irrigation. There will also be sanitary water from residential areas though the volumes are negligible. Soil quality may be affected during the construction of the dam though pollution will be negligible</p>

<p>Performance Standard 4: Community Health, Safety, and Security</p>	<p>Recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to project activities</p>	<p>SRL will ensure that the dam and other infrastructure element on the ranch are designed, constructed, operated, and decommissioned in accordance with good international industry practice (GIIP), taking into consideration safety risks to third parties or Affected communities. The dam project will be located within SRL property.</p>
<p>Performance Standard 5: Land Acquisition and Involuntary Resettlement</p>	<p>Recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood¹) as a result of project-related land acquisition² and/or restrictions on land use.</p>	<p>Land was bought from a private owner and there are no people settled within the impact radius of the project. This performance standard does not apply</p>
<p>Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources</p>	<p>Recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.</p>	<p>Approximately 410 hectares be affected. Part of the area will be cleared and the remaining will be flooded leading to the loss of flora and termite mounds, or 'termitaria'. The clearance will be confined to the areas that will be used for the dam and those that will be used for the growing of crops. The flooding and clearing of vegetation will lead to loss of biodiversity especially fauna diversity</p>
<p>Performance Standard 7: Indigenous Peoples</p>	<p>recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population.</p>	<p>No indigenous people as defined by IFC PS7 are affected by the dam project</p>
<p>Performance Standard 8: Cultural Heritage</p>	<p>Recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities.</p>	<p>No cultural heritage will be affected by the proposed dam project. The dam catchment area falls within the Ranch Land. This performance standard does not apply.</p>

3. PROJECT DESCRIPTION

3.1 Location

The proposed dam site will cross the Luezi River at grid ML 292844, on map sheet Luezi Ranch 1726A4, of the 1: 50000 series. The dam will be situated on Silverlands Ranching Estate in Zimba District of Southern Province. The dam site is 15 km off the Great North Road and 18 km from Zimba Town. It will be located 7 km upstream from the Kalomo-Luezi Rivers junction. Luezi is a right bank tributary of the Kalomo River (Figures 2 and 3 and 4). The geographical coordinates (UTM) for the dam site are between 425000E, 430000E and 8085000S, 8082500S. The dam wall will be between 428500E, 430000E and 8083500S, 8084000S. The location of the dam site, dam wall and the pivots is shown in Figure 3.

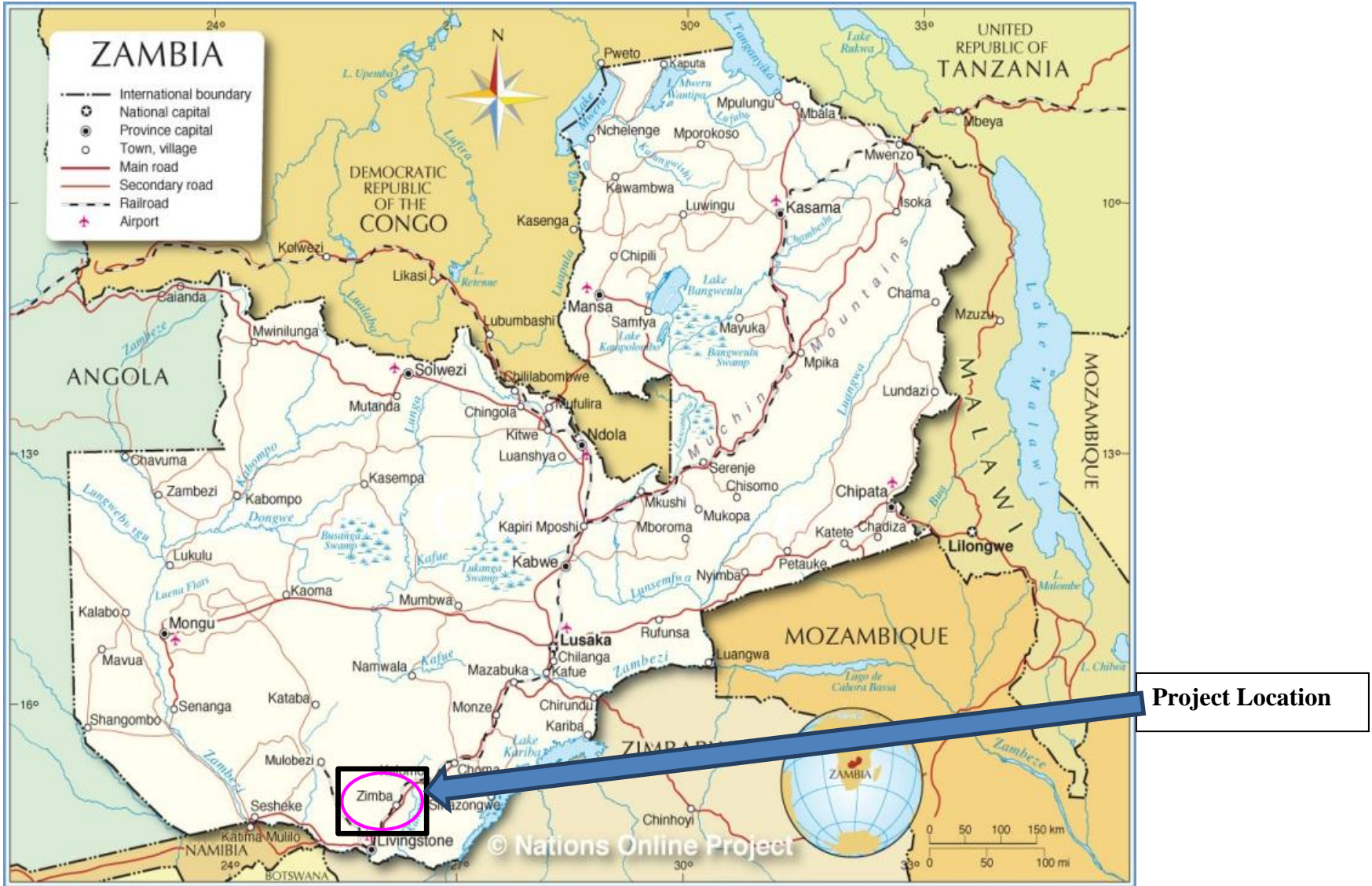


Figure 2: Location of the Dam project

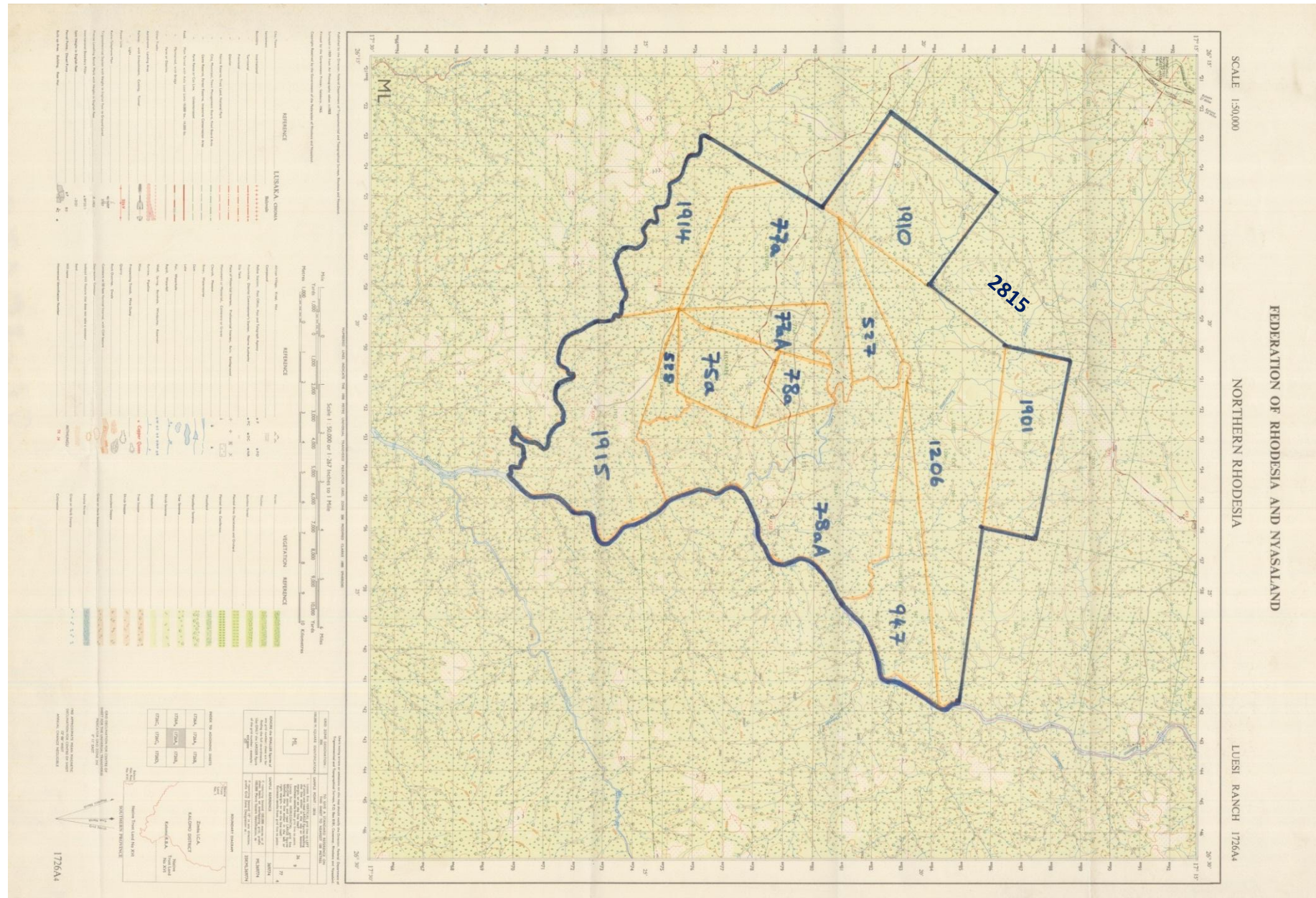


Figure 3: Siverlands Ranching - Entire Farm Boundary

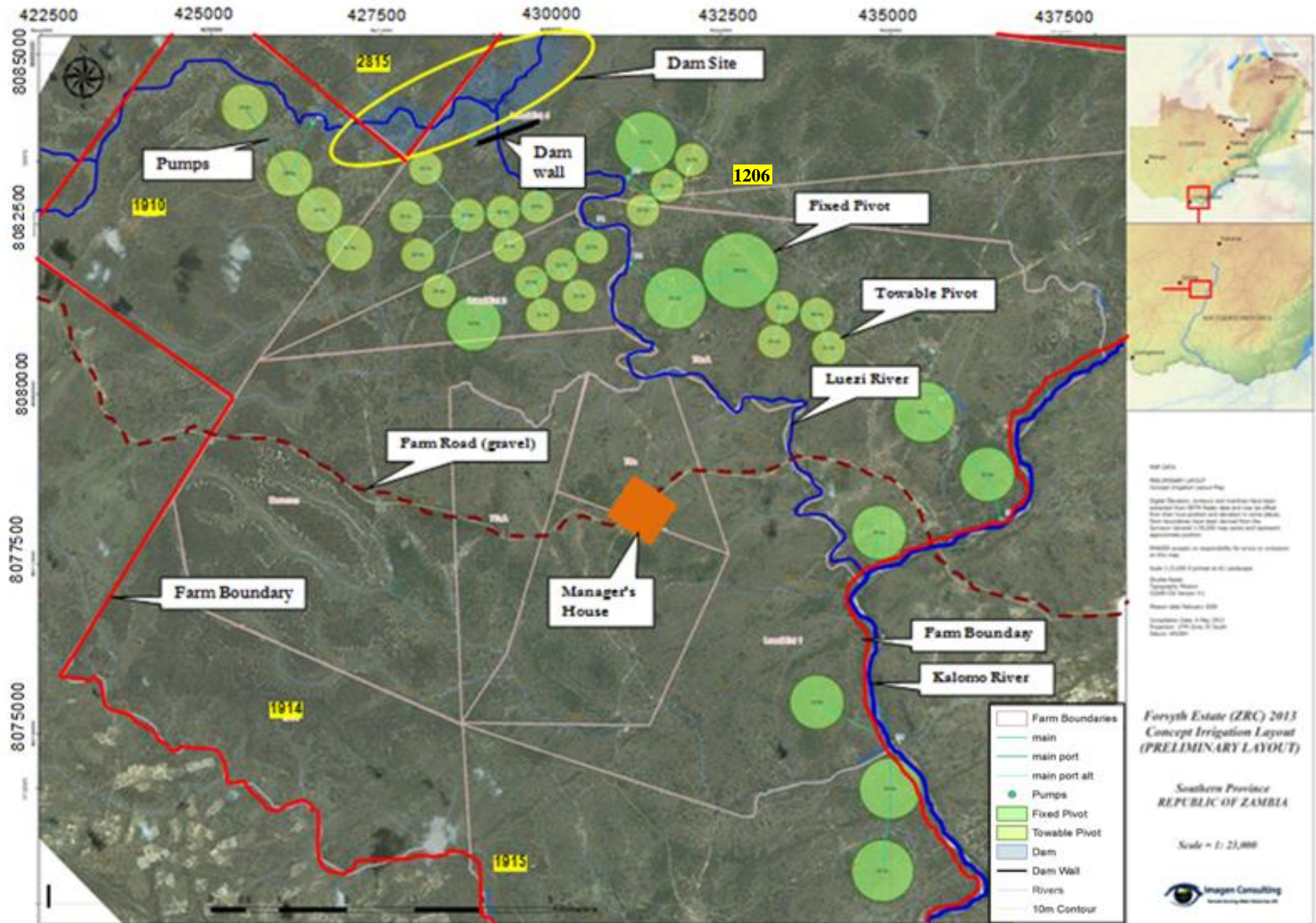


Figure 4: Location and Layout of various facilities on the farm including the proposed dam site

3.2 Project Details

SRL intends to construct an earth dam on Luezi River a tributary of Kalomo in Zimba district. The stored water in the earth dam amounting to 14,000, 000 million cubic meters at full capacity will be used mainly for irrigation of 1000 hectares under crops (figure 5 for layout of the fields) and to a lesser extent irrigation of pasture and animal watering.

The Catchment area of the proposed dam will be around 126km² (figure 5). The length of the catchment is 16km. The average yield of this earth dam once constructed is expected to be 14,000, 000 million cubic meters at Full Supply Level (FSL) while the height of crest above river bed will be 23m. A throw back of about 4.1Km is expected and mainly arable land belonging to Silverlands Ranching Limited will be submerged. However, part of the land that is expected to be inundated belongs to Gerjon Investment Limited (See appendix 6). The dam wall length will be 1045m. No households (HHs) are expected to be relocated as the dam will mainly affect the area of the developer. The whole property is surrounded by commercial farmers and the only farm that will be affected is that of Gerjon Investment LTD (see appendix 8 letter of no objection).The nearest settlements for local people are about 10 km away and all of them are on the other side of the Kalomo River. No households are located along the Luezi River as all the part of the Luezi River downstream is within Silverlands Ranching property. The dam rock consists of granite, granite gneiss and sandstone. The summary of the project details is shown in Table 10.

Table 10: Summary of Dam Details

Description	Extent
Catchment area	127 Km ²
Catchment Length	16 Km
River Bed Level	1146.00 m
Design Crest Level	1169.00 m
Crest Height Above River Bed	23 m
Settlement Allowance	5%
Dam Wall Length	1045 m
Dam Crest Width	4. 0 m
Upstream Slope	3 : 1
Downstream Slope	2 : 1
Cut Spillway Width	80 m
Total Freeboard	3.0 m
Dam Capacity At FSL	14 000 000 m ³
Throwback	4100 m
Surface Area @ FSL	410 Ha
Outlet Pipe Inlet Level	1149 m

3.3 Nature of Project

The nature of the project will in the course of development involve three stages namely Site Preparation, Construction and Operation Phases. The project is expected to begin in 2013; however, actual commencement date of the project will depend on when the approvals from ZEMA, Water Board and other relevant authorities will be obtained. During Site Preparation phase the project area was investigated for dam construction suitability through a number of tests. The concept was to determine the nature of the soil and geology critical in dam construction. In addition, hydrological investigations were conducted using both primary and secondary data.

During the preparation phase, a number of alternative sites were also investigated. However, all the sites except for the site (stated dam 5) where the earth dam is proposed to be located were found to be lacking in one way or another. Reasons for not choosing the other sites included unsuitable topography, soils and underlying geology for constructing the earth dam wall, spillway and foundation. The construction phase will mainly involve excavations, earth movements and development of embankment. The Operation phase will involve filling the dam and abstraction of water for irrigation.

3.4 Input Raw Materials

In order to implement the proposed dam project, it will require different types of raw materials as inputs. For outlet works, rubber lined pipes and fittings of various diameters will be used. The embankment and spillway will be cleared of vegetation and top soil. The core will be excavated to bedrock and spread and compacted with suitable impervious material. The rest of the embankment will be constructed using suitably conditioned material. The material to be used for the embankment will mainly be excavated from the spillway area, outlet works and designated borrow areas if need be. Bull dozers and other related equipment will be used. The borrow area will be in close proximity to the main embankment thereby reducing hauling distances. In addition, removing of the soil from the outflow area down to rock will limit siltation for the downstream portion of the stream. All foreign materials will be removed except vegetation before flooding the area. Vegetation left will enhance fish breeding as it rots and this will encourage legal fishing.

3.5 Products, by-products and wastes

There will be liquid, solid and gaseous wastes from the project site. These will be from project activities during construction, operation and possibly decommissioning phases. There shall be effluents from civil works, workers and the storm water. It is envisaged that at the construction stage, wastewater that shall be discharged will also be sprinkled on routes and working areas to reduce dust generation by construction machinery. Other wastes from construction site will be mainly material residues of the construction materials. These include pieces of concrete, heaps of sand and aggregates, bits and pieces of various pipe types, cans of paint, polythene sheets, paper packaging materials, pieces of timber, pieces of iron (metals) among others scattered within the project site. Wastes during operation will include packaging wastes from the various packaging materials used in cargo handling. Solid waste shall be managed in strict recognition of the existing legal framework. Relative air emission is expected during construction when dust from

traffic, construction activities and construction machinery will be emitted. It is recommended that watering be enforced to keep dust at minimal levels. The employees at the site shall also be provided with dust masks to protect them from dust emissions.

3.6 Embankment

This will be a zoned structure having a 4.0 m wide crest and built up to a settled crest level of 1169.0 m, and will have a height above the river bed of 23.0 m (Figure 8). Embankment slopes are expected to be: - 3: 1 for the upstream and 2: 1 for the downstream. The hearting will be constructed using Sandy Clay and Silty Clay, while the upstream portion will be constructed using Sandy Loam. On the upstream wetted face, as much as possible, Gravelly Sandy Clay will be used. The downstream zone will be constructed using Gravel, Gravelly Sand and Sand. River sand on site will be used to construct a sand blanket and sand chimney drain in the downstream zone. These materials will ensure that the phreatic line will deflect down sharply to intersect with the ground level well before the downstream toe. The most stable porous material will be selected first to be used at the bottom of the embankment and continue for as high as possible in order to improve drainage in the downstream zone. The materials that will be used to construct the embankment will mainly be excavated from the spillway area and outlet works.

The crest will be sloped 1: 20 to the upstream so that rain water will drain to the shorter return side. The soils that will be employed in the construction of the embankment will be placed in thin layers, at the correct moisture content - and compacted, layer by layer to 95% L.C.E. using appropriate heavy compaction machinery. The thickness of layers and the required moisture content will be determined on site, according to each borrow area and according to the findings of the soil analysis. There will be uniform compaction throughout the structure of the dam. The crest length will be 1045m and the total embankment volume will be 340 000m³ of compacted.

Construction Material	<ul style="list-style-type: none"> • Core/hearting: Gravelly Sandy Clay, Sandy Clay. • Semi Pervious upstream: Sandy Loam and Gravelly Sand. • Porous downstream: Gravel, Gravelly Sand and Sand.
Core Trench	<ul style="list-style-type: none"> • Minimum bottom width: 3.0 m • Depth: dug to impervious zone. • Core fill material placed in thin layers and compacted at optimum moisture to 98% LCE. • Side walls trimmed to 1:1 slope. • Total volume of core trench excavations 25 200 m³
Embankment	<ul style="list-style-type: none"> • Dam settlement allowance of 5% added on construction to design level. • Embankment material to be placed in thin layers at optimum moisture and compacted to 95% LCE. • Upstream slopes to be constructed to 3:1. • Downstream slopes to be constructed to 2:1. • Embankment compacted volume 340 000 m³
Drainage	<ul style="list-style-type: none"> • Surface rain water to drain off to the upstream at a slope of 1:20. • Foundation drains to be placed in the downstream at 8.0 m C-C. • Foundation drain dimensions to be 0.6 m x 0.6m.

	<ul style="list-style-type: none"> • Drains to enter embankment up to the toe of the hearding. • Drains to extend from the river to contour 1162 on both abutments. • Foundation drains to drain into open drains which will train the water back to the river and be 0.6m x 0.6m in dimension. • Drains filled with river sand and have a rock filter at the exit. • Volume of river sand for drains 550 m³.
Outlet Works	<ul style="list-style-type: none"> • 2 x 400 mm Class 16 PVC piping, 6 m lengths, flanged and bolted with high tensile bolts. • Both pipes encased in one concrete casing. Pipes separated by 250 mm. • Encasing thickness to be 300 mm. • 400 mm butterfly valve and 400 mm gate valve on each pipe outlet. • Pipes set at level 1149 m.
Spillway	<ul style="list-style-type: none"> • Right bank side overflow cut spillway. • Spillway channel width of 80 m. • Channel cut to rock at level 1166.0 m. • Concrete used to adjust spillway channel base to correct level and gradient. • Total freeboard of 3.0 m. • Spillway channel to discharge into right bank dambo. • Spillway excavations of 64 000 m³. • Training bank volume 800 m³
Slope protection	<ul style="list-style-type: none"> • The upstream wetted face to be planted to ‘Tanner Grass’. • The balance of the structure to be planted to a good stoloniferous grass.

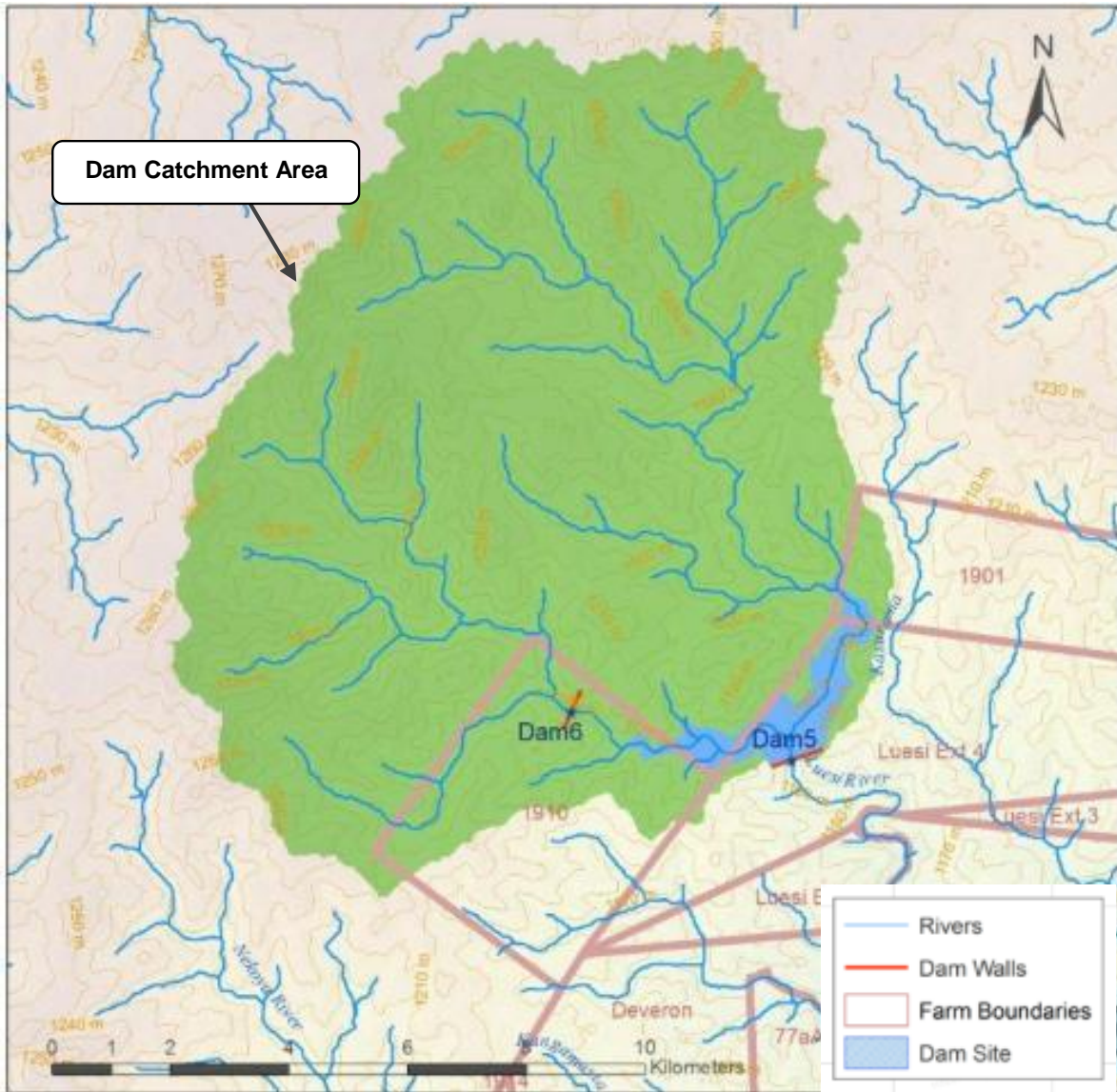


Figure 5: Dam Catchment Area

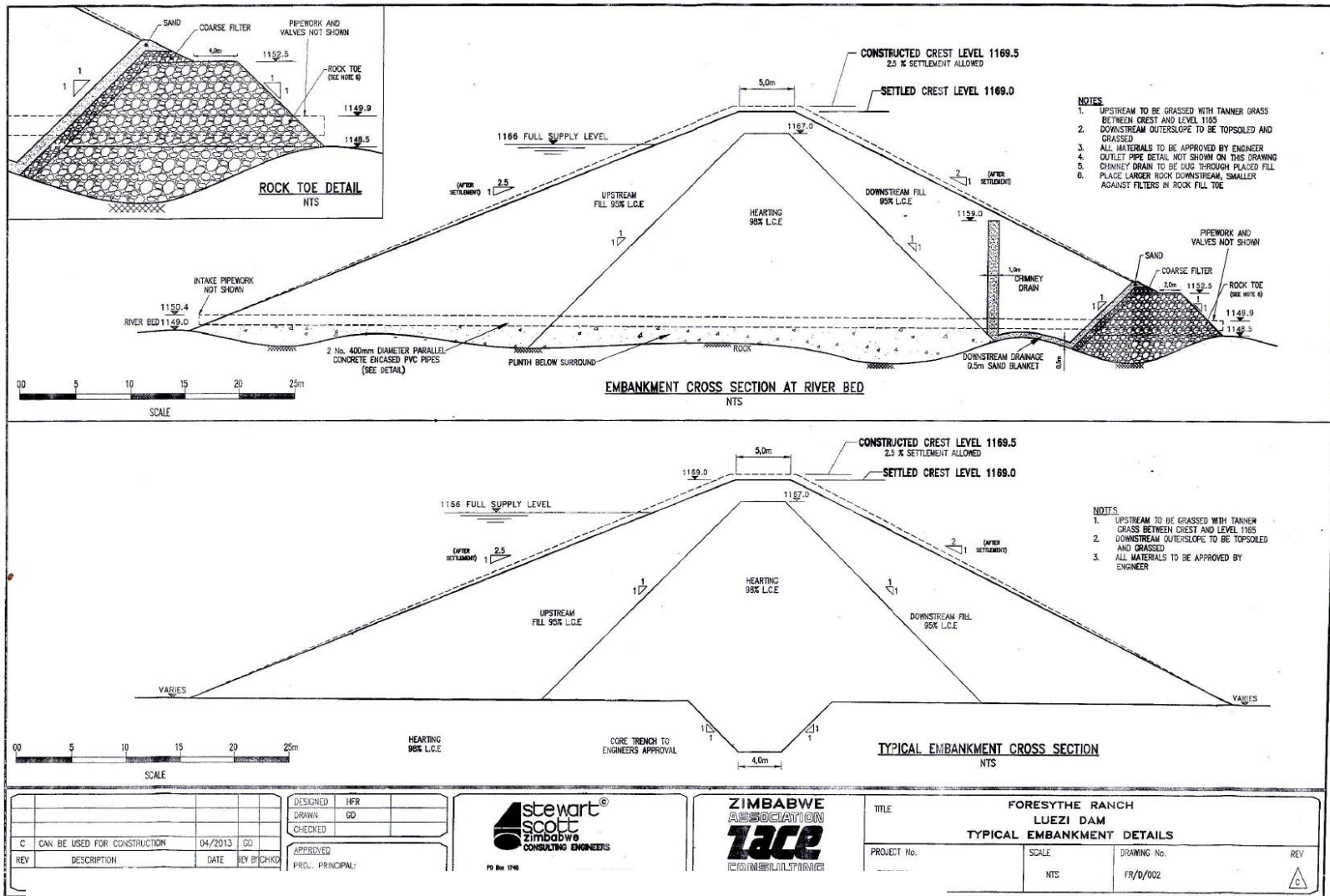


Figure 6: Dam Embankment Plan

3.7 Project Activities

The project will in the course of development involve three main stages namely Site Preparation, Construction and Operation Phases. The project is expected to begin in October 2013; however, actual commencement date of the project will depend on when the approvals from ZEMA, Water Board and other relevant authorities will be obtained.

The construction phase will mainly involve excavations, earth movements and development of embankment. The Operation phase will involve filling the dam and abstraction of water for irrigation. Summary of the project phases are shown in Table 14.

Table 11: Summary of project phases and associated activities

No.	Project Phase	Project Activities
1.	Site Investigations	<ul style="list-style-type: none"> • Land Surveying • Soil and Geotechnical Surveys • Detailed engineering design of dam
2.	Site Preparations/Pre Construction Phase	<ul style="list-style-type: none"> • Construction of temporary project site offices and worker camps • Transport to and establish on site all Construction plant and equipment • Land Clearing • Construction of new access roads and improvement of existing roads
3.	Construction Phase	<ul style="list-style-type: none"> • The construction of a cofferdam to regulate flows during building • Construction of dam – Excavations, Dam embankment and cut-off, drilling and grouting, Spillway and Outlet Pipes • Clean up operations and demobilisation
4.	Operation of the Dam and Maintenance Phase	<ul style="list-style-type: none"> • Operation of the dam – regulation of river flows, Flood control, Irrigation • Maintenance of the dam periodically - inspection, preventive maintenance / general maintenance and repair.

4. PROJECT ALTERNATIVES

Project alternatives may comprise alternative sites, alternative processes or alternative implementation schedules. The EIA process contributes to generation of a number of project alternatives. Seeking project alternatives for Luezi dam Project focused on investigating a number of sites along the Luezi and Nekoya tributaries of the Kalomo River.

A number of project alternatives were from the design and management of dam project. Due consideration was given to topographical characteristics - narrowest section of the valley is preferred, Catchment area of the dam - the wider the Catchment area of the dam the higher discharge available, Distance to beneficiary areas - the shorter the conveyance the more economical, and Accessibility of the site - the easy accessibility of the site the cheaper it is to construct. In addition, the geology and soil type are the other critical factors that were taken into account. Given the development objectives of the Luezi dam project, three options were available and considered:

4.1.1 Do nothing option

Avoid construction of the earth dam at the farm and continue to depend on rains with the view of increasing agricultural productivity without irrigation.

This option was not chosen given the irregularity in the rainfall patterns in the area and the semi-aridness of the region. The option would not have being commensurate to the scale of investment being proposed in the area of creating modern commercial farming for social economic development. The proposed investment requires constant and sustainable water supply to cater for the agricultural program proposed for the area.

4.1.2 Construct one large dam on the Luezi

The second option available is to construct one big dam on the Luezi that will cater for all the proposed activities on the farm. This option was found to be attractive as one big dam will be easy to manage and water storage capacity will be high to meet the proposed investment. One large dam will be easy to manage and does not cause ecosystem fragmentation as compared to a number of small dams dotted all over the facility. This is better for the environment as most rivers in the area will remain continuous rather being disrupted by a number of small dams placed throughout the Ranch.. With the scale of investment proposed, it would require a number of small dams that may complicate management and safety of the humans and animals.

Silverlands Ranching Limited is committed to the protection of the environment and the safety of people and humans and as such this option was selected to be suitable for the current site and the scale of investment being proposed. One big dam will not only provide enough water for irrigation but will also promote the increase in fish population which would supplement the employees' diet.

4.1.3 Construct a number of small dams at number of sites on the Luezi

Choosing this option will entail substantial difficulties in the management of various sites. In order to provide the quantity of water required, it will mean constructing a number of small dams and this may present a challenge to the environment. Though small, having a number of small dams on the river will affect the integrity of such a system and may affect biodiversity in the long run. The system will be fragmented. This may impact negatively on biodiversity. Though impacts will be localised, cumulative impacts resulting from the small dams may affect a wider area.

4.1.4 Dam Design Alternatives

The primary purpose of a dam may be defined as to provide for the safe retention and storage of water. As a corollary to this every dam must represent a design solution specific

to the site circumstances. The design therefore represents an optimum balance of local technical and economic consideration at the time of construction. Two design alternatives were considered. These included the embankment and the concrete dams. Embankment dams are constructed of earthfill and/or rockfill. Upstream and downstream face shapes are similar and of moderate angle, giving a wide section and a high construction volume relative to height. Concrete dams are constructed of mass concrete. Face slopes are dissimilar, generally steep downstream and near vertical upstream, and dams have relatively slender profiles dependent upon the type.

Embankment dam type was selected to be the appropriate design for the Luezi dam for technical and economic reasons. They are and simpler in structural concept than the early masonry dam, the embankment dams utilise locally available and untreated materials. They are adaptable to a wide range of site environments. In contrast, concrete dams and their many predecessors are more demanding in relation to foundation conditions. Additionally they have also proved to be dependent upon relatively advanced and expensive construction skills and plant.

4.1.5 Location Alternatives

Six potential locations (figure 7) of the dam were considered. The six potential sites were selected on the suitability for the storage of water, using the following key criteria:

- A narrowing of the river valley, to ensure the shortest possible length of dam wall. This is a key consideration for the cost of construction.
- Storage capacity assessed as a factor of the dam surface area.
- Catchment area sufficient to supply the planned storage.

Site 5, at a depth of 16 metres was selected to be the best site for the location of the dam, with a volume to MAR ratio of 1.8, and yielding two times the annual irrigation demand. It has a large catchment area of 127 square km. Note that this site has a potential depth of 16 metres, which yields over three times the annual irrigation demand. Furthermore, this dam site is ideally located in the northern part of Foresythe Ranch, which is one of the highest parts of the ranch, which would allow for cost effective pumping for irrigation.

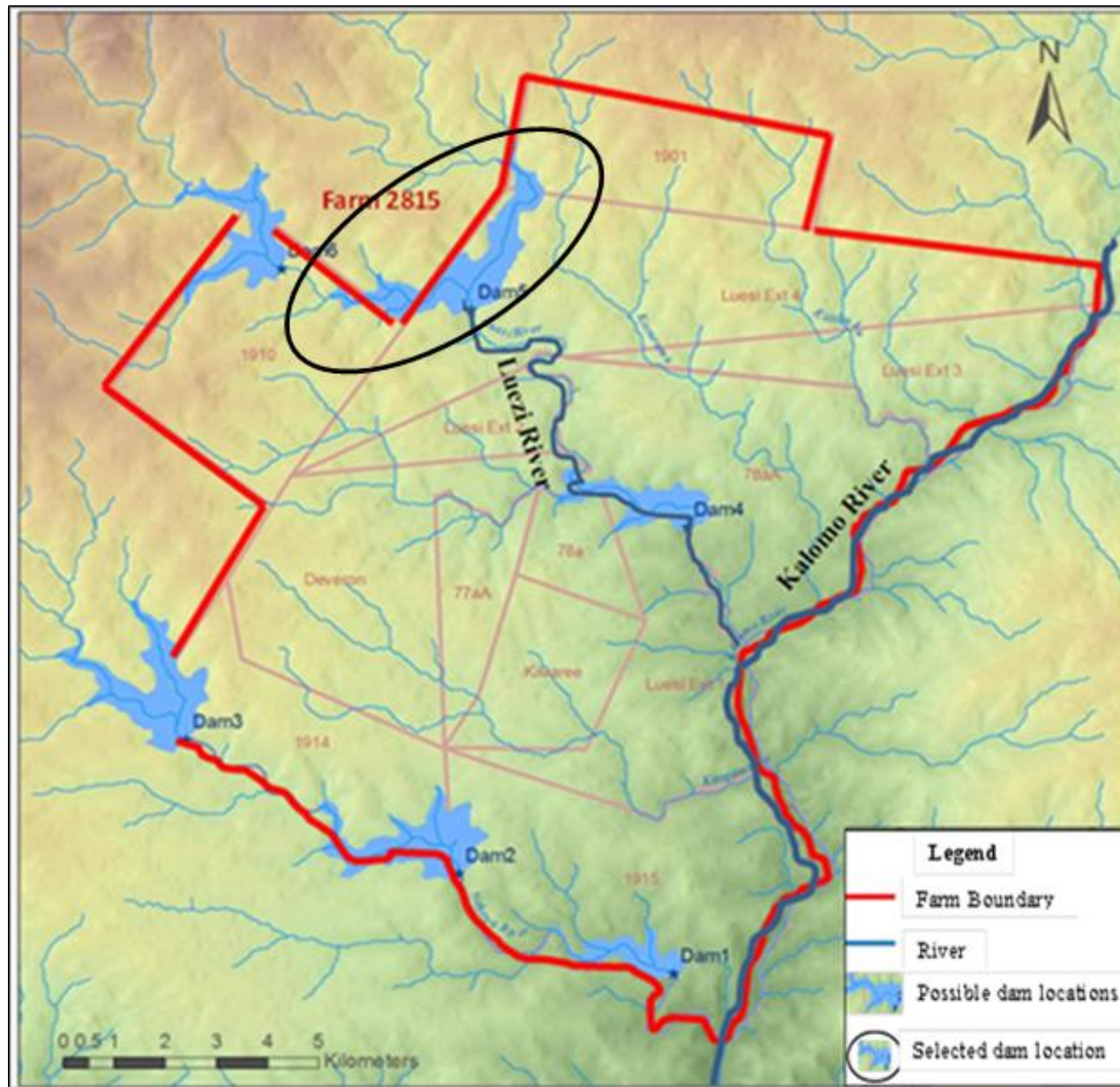


Figure 7: Possible dam locations considered

4.1.6 Water Right

Information obtained from the Water Affairs and Water Board indicated that there are not many existing water right holders upstream of the proposed dam site on the Luezi River. Downstream, of the dam site on the Luezi River, there are no existing holders of water rights. The river is not gauged and reliable consistent hydrological data is unavailable. The river is not perennial as it dries up during the dry season. SRL takes full recognition of existing water rights and is convinced that priority of use will be applied in granting the water right to ensure water availability to downstream users as prescribed in the Water Act. In this regard, the developer has made a preliminary application for a Water Right permit subject to the EIA report for the proposed dam being approved by ZEMA. At the time of reporting an application to store 14 000 000 m³ of water had been lodged and is awaiting the approval of the EIS by ZEMA. Application number WARMA/10094 dated 14/5/2013

5. ENVIRONMENTAL BASELINE STUDY

5.1 Description of the physical environment

5.1.1 Climate

Zimba District is located in the Southern Province of Zambia and the proposed project site has the climatic conditions that are prevalent in this province. Like most of Zambia, the Southern Province has three (3) distinct seasons:

- Rainy season – a warm wet season from November to April
- Cold season – a mild to cool, dry season from April to August
- Hot season – a hot and dry season from September to November.

The rains in Southern Province like the rest of the country are brought by the International Convergence Zone (ITCZ). Southern province generally receives low rainfall with a mean annual rainfall of 700–800 mm in normal seasons. Drought periods are also common as a result of the erratic and poorly distributed rainfall. Past rainfall records show that some places in the south western parts of the province have received rainfall below 650 mm in some years. The project site is located in the south western part of the province and a 7 year analysis of average monthly rainfall for the Silverlands ranch farm shows that the area has an average annual rainfall below 500mm (Figure 8). The average relative humidity in the project site is also noticeably lower compared to the whole of Zambia as a direct consequence of lesser rainfall.

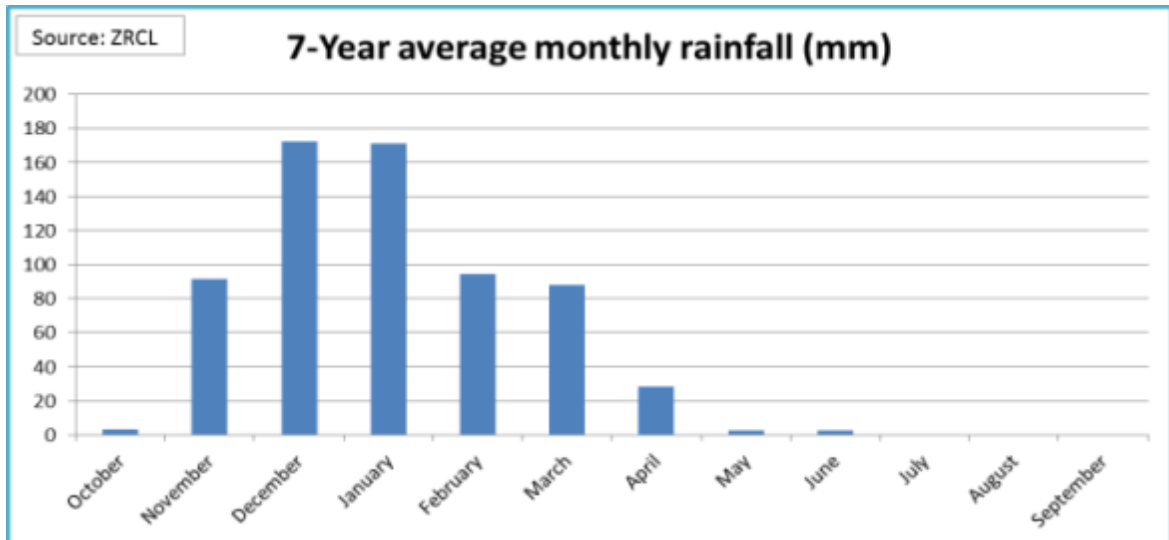


Figure 8: Seven Year average monthly rainfall at Silverlands Ranch

According to data from the four metrological stations in Southern Province as researched by Bäumle *et al* (2007) the mean annual temperatures in the province are subtropical with values ranging from 19.3 to 22.1°C. An analysis of the annual high/low temperatures for Zimba District shows that average minimum temperatures range from as low as 5°C in July and to about 16°C from December to March and the average maximum temperatures range from as high as 21°C in July and to about 28 °C in the months September and October (Figure 9). The Province receives above-average sunshine compared to the national average. Bäumle *et al* (2007) indicates that sunshine duration measured at stations in the Province and countrywide average at 8.4 and 7.8 hours per day, respectively.

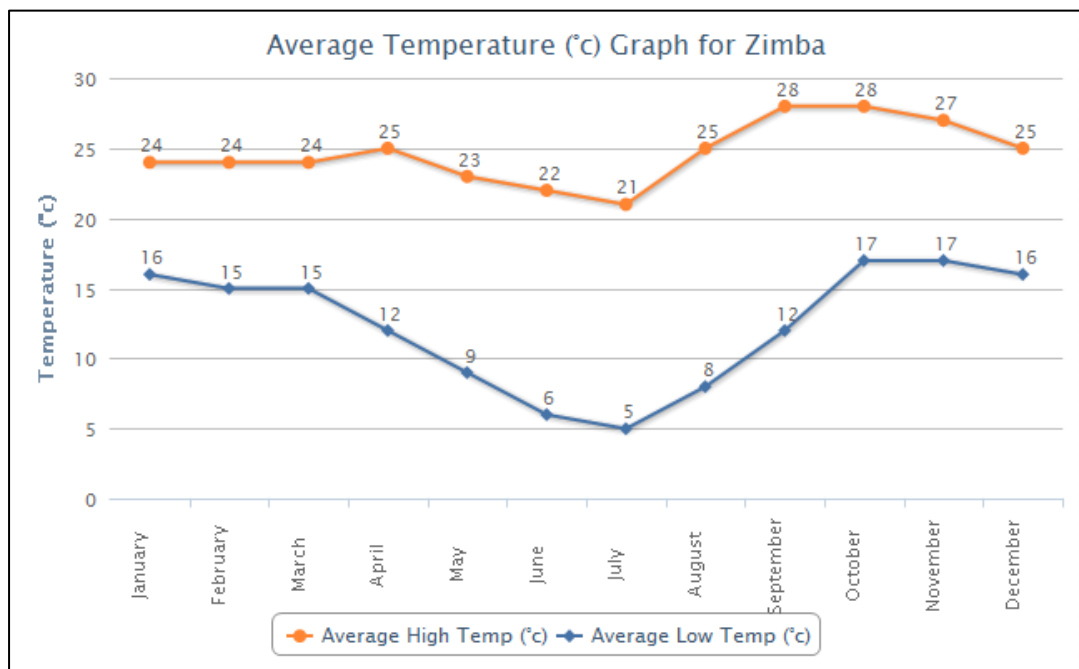


Figure 9: Average maximum and minimum temperatures for Zimba District

5.1.2 Geology

The geology of the Southern Province is very complex. It encompasses a large variety of rocks that were formed over thousands of years in the past. The oldest rocks of the Southern Province are exposed within the Basement Complex and the overlying Muva Super group as well as the associated Choma-Kalomo Batholith which together form the Choma-Kalomo-Geology Block (Bäumle *et al.* 2007).

The geological map of the Southern Province places Zimba District and the project area within the Choma-Kalomo-Block at the boundary of the Basement Complex and the Muva Supergroup. The Basement complex comprises metamorphic rocks like Schist, Gneisses, Granite-gneiss, Granites, amphibolites, Quartzites Marbles and calc-silicate rocks. The Muva Supergroup is mainly a metasedimentary succession (also known as “Upper Basement”) which predominantly consists of schist, Quartzites, gneisses, amphibolites and marble (Porada & Berhorst 2000, Bäumle *et al.* 2007b).

5.1.3 Topography

According to Bäumle *et al.* (2007a), the Southern Province is dominated by three topographic features: the Choma-Kalomo Block in the centre of the Province; the escarpment and the Zambezi valley (“graben”) in the east and the Kafue Flats in the north. The altitude within the Province rises from approximately 400 m in the Zambezi valley to almost 1,400 m on the central plateau. The Choma-Kalomo Block within which the project site is located is part of the central plateau.

The topography of the project site is generally high on the sides and slopes down towards the Luezi River in the middle. Specifically the altitude at the Silverlands Ranch ranges from 1,190 metres at the headquarters down to 1,100 metres at the lowest point.

5.1.4 Soils

The Soil Map for Southern province modified after the Zambia Soil Map (NCSR, 1986), shows that Zimba district and the project area fall under a Soils Unit characterized by Acrisols and Luvisols. This Soil Unit has moderately leached reddish to brownish clayey to loamy soils, derived from acid rocks and is usually associated with magmatic and metamorphic rocks of the Hook Igneous and Basement Complex.

Site investigations carried out show that the project site is dominated by Acrisols. The World Reference Base for Soil Resources, (FAO 2006), defines Acrisols as soils that have a higher clay content in the subsoil than in the topsoil as a result of pedogenetic processes (especially clay migration) leading to an argic subsoil horizon. Generally most clay soils are suitable for dam construction.

In terms of agriculture use, generally top yields for conventional crops (maize, wheat and soya) should not be expected from these soils. Whilst the soils may not produce the top yields for conventional growth the climate, coupled with these soils may provide excellent yields on certain crops such as sorghum and seed maize. Additionally, with a properly managed liming and fertilization system, Acrisols become suitable for production of rain-fed and irrigated crops.

The grading analysis for soil was done. The grading coefficients, Uniformity Coefficient C_u [D_{60}/D_{10}] and Coefficient of Curvature, C_c [$(D_{30})^2/(D_{60}.D_{10})$] could not be determined from sieve analysis by itself, except for one sample. The results are summarized in Figures 10 and 11 and Tables 12 and 13, for L Band RB series, respectively. The physical and chemical properties of the soil are shown in Tables 14 and 15.

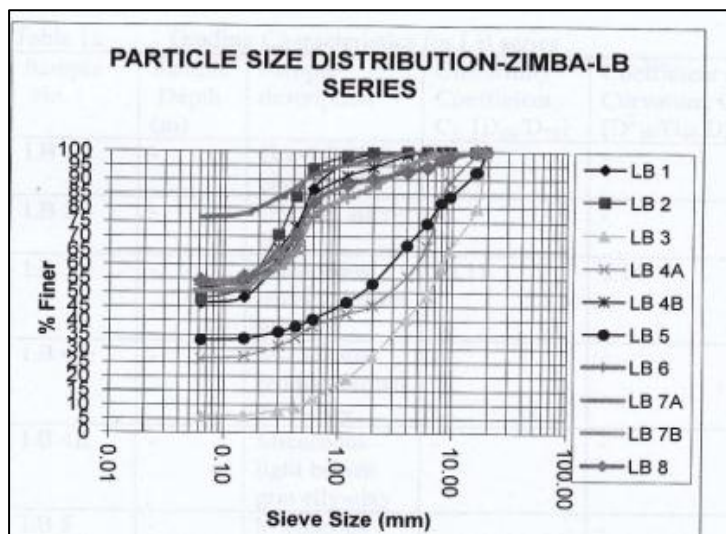


Figure 10: Grading Characteristics for LB series

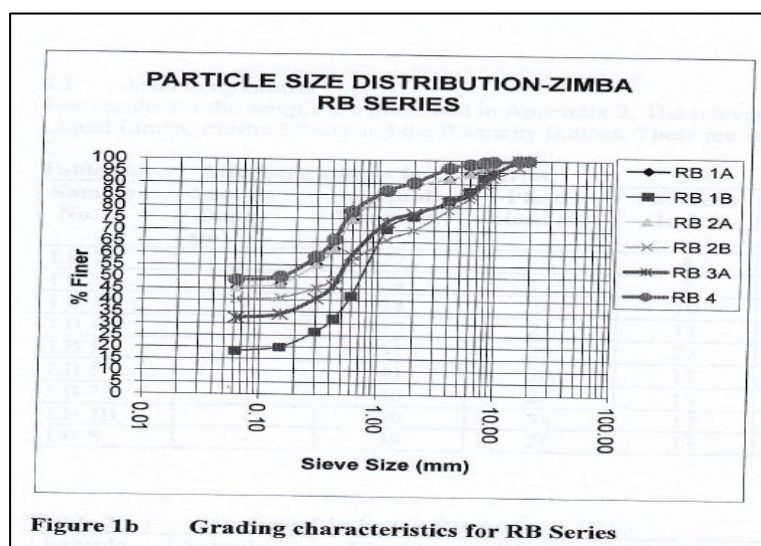


Figure 11b Grading characteristics for RB Series

Figure 11: Grading characteristics for RB series

Table 12: Grading Characteristic for LB Series

Sample No.	Sample Depth (m)	Sample description	Uniformity Coefficient, C_u [D_{60}/D_{10}]	Coefficient of Curvature, C_c [$D_{30}^2/D_{60} \cdot D_{10}$]	% passing the 200 Sieve	Comments
LB 1	-	Grayish silty-clay	-	-	Less than 50%	Coarse grained
LB 2	-	Grayish silty-clay	-	-	Less than 50%	Coarse grained
LB 3	-	Micaceous lateritic gravel mixture	18.18	1.14	Less than 50%	Coarse grained but well graded
LB 4A	-	Micaceous reddish brown silty-clay	-	-	Less than 50%	Coarse grained
LB 4B	-	Micaceous light brown gravelly-clay	-	-	More than 50%	Fine grained
LB 5	-	Micaceous light brown gravelly-clay	-	-	Less than 50%	Coarse grained
LB 6	-	Micaceous reddish brown gravelly-clay	-	-	More than 50%	Fine grained
LB 7A	-	Reddish brown sandy-clay mixture	-	-	More than 50%	Fine grained
LB 7B	-	Light brown silty-clay	-	-	More than 50%	Fine grained
LB 8	-	Light brown sandy-clay mixture	-	-	More than 50%	Fine grained

Table 13: Grading Characteristics for RB series

Table 1b Grading Characteristics for RB series						
Sample No.	Sample Depth (m)	Sample description	Uniformity Coefficient, C_u	Coefficient of Curvature, C_c	% passing the 200 Sieve	Comments
RB 1A	-	Light brown schist	-	-	Less than 50%	Coarse grained
RB 1B	-	Grayish brown schist	-	-	Less than 50%	Coarse grained
RB 2A	-	Light brown schist	-	-	Less than 50%	Coarse grained
RB 2B	-	Grayish brown schist	-	-	Less than 50%	Coarse grained
RB 3A	-	Micaceous silty-clay	-	-	Less than 50%	Coarse grained
RB 4	-	Micaceous light brown silty-clay	-	-	Less than 50%	Coarse grained

Table 14: Soil Physical Characteristics

Your Ref	Depth cm	Clay %	Silt%	Coarse sand%	Fine sand%	Total sand %	Colour (munsell)	Soil colour	Texture (USDA)
Unit 1	0-20	1.3	7.63	49.56	41.51	91.07			Sand
	20-40	0.23	11.67	50.00	38.1	88.1			Sand
	40-60	0.24	10.75	44.70	44.31	89.01	5YR6/2	Pinkish grey	Loamy sand
Unit 2	0-20	0.15	15.72	32.89	51.15	84.13			Loamy sand
	20-40	1.18	19.72	37.88	41.22	79.1			Loamy sand
	40-60	5.0	22.9	24.08	50.02	72.1	10YR4/6	red	Sandy loam
Unit 3	0-20	1.21	11.75	45.70	41.34	87.04			Loamy sand
	20-40	3	15.87	42.90	39.17	81.87			Loamy sand
	40-60	3.21	13.69	23.35	51.66	83.01	5YR6/1	Reddish grey	Loamy sand
Unit 4	0-20	1.14	12.21	33.80	52.85	86.65			Loamy sand
	20-40	1.2	15.24	54.13	29.43	83.56			Loamy sand
	40-60	5.17	24.24	3.64	69.95	70.51	10YR4/3	Weak red	Sandy loam
Unit 5	0-20	1.11	16.27	43.97	38.65	82.62			Loamy sand
	20-40	2.11	11.30	34.15	52.44	86.59			Loamy sand
	40-60	5.11	24.36	41.55	29.98	70.53	10YR5/4	Weak red	Sandy loam
Unit 6	0-20	2.11	10.36	34.12	53.41	87.53			Loamy sand
	20-40	3.05	19.27	11.35	64.33	77.68			Loamy sand
	40-60	5.11	19.18	40.95	34.76	75.71	5YR5/2	Reddish grey	Loamy sand

Table 15: Soil Chemical Characteristics

Your Ref	Depth cm	pH CaCl ₂	Total N%	P ppm	K ppm	Ca meq/100g	Mg meq/100g
Unit 1	0-20	5.7	0.139	10	530	1.50	2.0
	20-40	6.0	0.141	8	365	0.75	2.0
	40-60	4.7	0.108	6	339	0.70	2.0
Unit 2	0-20	4.8	0.191	12	463	1.10	2.25
	20-40	5.6	0.242	11	290	0.55	1.65
	40-60	4.7	0.191	7	420	1.10	2.95
Unit 3	0-20	4.9	0.180	10.0	438	1.00	2.05
	20-40	4.6	0.222	12.0	330	0.85	1.40
	40-60	4.7	0.143	9.0	401	0.90	1.85
Unit 4	0-20	4.8	0.166	12	417	1.00	1.95
	20-40	4.7	0.222	10	370	0.85	1.80
	40-60	4.6	0.169	10	306	0.70	1.40
Unit 5	0-20	5.0	0.134	14.0	475	1.20	1.85
	20-40	6.4	0.230	13	488	1.25	2.75
	40-60	4.8	0.170	13	503	2.00	2.25
Unit 6	0-20	4.6	0.198	12	510	1.25	4.45
	20-40	4.7	0.198	9	320	0.75	3.10
	40-60	4.6	0.168	8	398	0.90	3.70

5.1.5 Air Quality and Noise

The air within the vicinity of the proposed Luezi dam is clean. The presence of agriculture as the main economic activity and absence of any polluting industrial activities (factories, power plants or any other emission producing activities) in Zimba District renders 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 from exhaust fumes from vehicles along the Lusaka-Livingstone Road. Considering that the proposed dam site is in a rural area, air pollution can be caused by fumes from bush/forest fires and firewood; and dusty roads in general.

The air quality assessment conducted by the EIA study team 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/km² over 30 days. The results of the dust fall results for the site where the proposed dam will be situated are shown in Table 16.

Table 16: Dust fall results for the proposed dam site

Location	Days	Dust (g)	Tonnes/km ² /30days
Housing area	26	0.0265	0.16
Dam wall area	16	0.0380	0.37
Kataba (community area)	21	0.0484	0.36

All the three sites where air quality assessment was monitored were below the limit (mean = 0.2967tonnes/km²/30days). Air quality in the project area is quite good though the introduction of the proposed dam project will impact on this aspect and may alter the current status. The impact will be low and mainly during construction phase.

Noise levels in the area are very low. The only potential sources of noise in the immediate vicinity of the site are human activities and some traffic along the dirt roads leading to the site. Another source of noise is the traffic along the Lusaka-Livingstone. The source of noise or air emissions is mainly from the above factors and the impact is insignificant. Therefore, the general air and noise quality for this part of the district is much better than the urbanized areas of the province.

Assessment carried out in the project area using Sound Level Meter showed that the noise levels from three different sites within the project area site are low. The sound meter was calibrated before each measurement with an internal calibration and three records were taken per reading. Over a one week period, readings were taken at three different localities. The results are shown in Table 17.

Table 17: Summary of the noise data for the Luezi dam project area

Location	Mean dB	Min (dB)	Max (dB)
Housing area	31.8	30.4	35.5
Dam wall area	39.4	27.3	30.9
Kataba (community area)	31.6	28.1	39.6

The study shows that noise is generally low in the area due to the lack of any industrial activities. The absolute baseline is the natural and rural residual situation on which the project is based. All readings fell within risk category D(noise <85 dB), which requires no actions to be taken (see Table 17).

5.1.6 Hydrology and Water Resources

The main rivers within and near the project area are the Luezi, Nekoya and Kalomo Rivers. Water samples were collected from different points of the Luezi River. The main water body to be affected by the construction of the proposed dam is the Luezi River. The Luezi River is not a perennial river as it usually dries up during the dry season. In the Kalomo area, data on MAR from a catchment is sparse but from the Zambia National Water Resources Master Plan it was estimated that it could be as low as 70mm per annum (worst case scenario).

The water was analysed at the Environmental Engineering Laboratory at the Copperbelt University. For ground water, data was collected from different boreholes in the project area. The results of the water analysis data from both the Luezi River and selected boreholes are shown in Tables 18 and 19 respectively.

Table 18: Water results for the Luezi River

Parameter	Unit	Upstream	Midstream	Down Stream
pH		7.16	7.04	7.20
Turbidity	NTU	102	34	24
Conductivity	μS/cm	480	171.43	265.714
TSS	ppm	70	35	13
TDS	ppm	336	120	186
SO4	ppm	17	14	7
Cl	ppm	33	39	38
NO2	ppm	0.013	0.021	0.07
PO4	ppm	Nil	0.23	0.51
Ca-Hardness	ppm	6	28	26
Total Hardness	ppm	70	64	100
Ca	ppm	2.405	17.54	10.421
Mg	ppm	15.552	8.452	17.982
Cu	ppm	<0.01	0.03	0.01
Fe	ppm	<0.01	4.071	2.060
Pb	ppm	<0.01	<0.01	<0.01
Mn	ppm	0.003	<0.01	<0.01
Co	ppm	<0.01	<0.01	<0.01
Cd	ppm	<0.01	<0.01	<0.01
Feecal Coliform	#/100	79	0	123
Total Coliform	#/100	150	237	331

Table 19: Ground water results from different boreholes within the project area

Parameter	Unit	H/Land	Kataba	Kalundu	Kobotu	Section 17	Luezi
pH		7.24	6.84	7.08	7.01	6.41	7.10
Turbidity	NTU	0	0	2	39	22	0
Conductivity	µS/cm	202.86	1094.3	792.86	1404.285	832.86	932.86
TSS	ppm	0	0	9	29	3	8
TDS	ppm	142	766	555	983	583	653
SO4	ppm	3	15	54	92	5	20
Cl	ppm	35	126	60	365	137	135
NO2	ppm	<0.001	0.001	0.003	0.006	0.01	0.001
PO4	ppm	<0.01	0.02	0.004	0.34	0.023	0.12
Ca-Hardness	ppm	56	148	60	10	160	52
Total Hardness	ppm	186	610	426	520	410	490
Ca	ppm	22.44	59.314	24.048	4.008	64.128	20.84
Mg	ppm	31.57	112.266	88.938	123.93	60.75	106.434
Cu	ppm	0.01	0.02	<0.01	<0.01	0.02	0.06
Fe	ppm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pb	ppm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mn	ppm	<0.01	0.02	0.516	0.290	0.037	<0.01
Co	ppm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	ppm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Feecal Coliform	#/100	Nil	0	0	0	0	0
Total Coliform	#/100	381	0	0	0	0	0

5.2 Description of the Biological Environment

In order to describe the biological environment, the EIA team carried out a detailed assessment of the flora and fauna in and around the proposed project area. The main objective of the flora and fauna assessment was to quantify and document the ecological status of the area. The results of the assessment were to assist in identification and analysis of impacts of the proposed Luezi dam on the environment both in the short and long terms. The specific objectives of the assessment included:

- Collect data on flora and fauna composition within the proposed Dam area.
- Measure a number of plots in representative areas of the forests that may be used to adequately describe the forests
- Characterize the forest ecosystems based on flora and fauna populations
- Provide indicators that will be used to monitor the impacts of the various activities of the proposed plan on biodiversity within and around the farming block area

- Come up with flora and biodiversity indices that can be used for monitoring the impacts of the various projects on flora and biodiversity

5.2.1 Flora Assessments

5.2.1.1 Reconnaissance Survey and Actual Assessments

Prior to conducting the assessments, the team visited the proposed site and consulted all the available maps of the proposed site and the Silverlands ranch. These enabled the team to adequately plan and make an effective sampling design for collection of representative data. The first step of fieldwork was the cutting of transects into the forest prior to the demarcation of a baseline and reading of GPS. Transects varied in length depending on their position across the area. Transects were laid in such a way that the variations in terms of vegetation structure that was noticed could be covered. Within the main plot (20m x 20m), two to three 3m x 3m plots were established to collect data on regeneration.

Main Plots and Regeneration Plots

Main Plots of 20m x 20m were established at every 500m along transects. During the data collection in the field, however, the square plots were converted to circular plots. This is because the 14 to 20 m radius has been reported to capture adequate data (e.g. Zimba, 1991; Geldenhuys, 2004) in the inventory of the Zambezi phytoregion. In total 23 circular sample plots (900m² each) were made throughout the area. All the tree species in the main plot were identified and recorded. Table 20 shows the parameters that were taken from the main plots (radius = 16.9m radius). Diameter was taken at breast height on all the trees with DBH greater than 5cm and more than 50cm height. All the measurements taken on the parameters from the main plot were recorded on the main plot data collection form.

Table 20: Parameters measured from the main plot

Parameter	Comment
Diameter at Breast Height (DBH)	Taken on each tree in cm
Bole height	Taken in m
Total Height	Measured in m
Tree condition	Crooked, moribund, etc
Tree species	Identified by use of check lists and KYT
Crown size	In m
Evidence of fire	
Health of canopy	In %
Vegetation type	Mopane, Parinari forest etc

In each main plot 2-3 (3mx3m) sub-plots (also referred to as regeneration plots) were established. On these plots, all seedlings below 50cm of height were noted and recorded.

5.2.2 Fauna Assessments

The number of fauna survey sites closely reflected the number of vegetation communities present within the study area. Location of fauna survey sites was determined from vegetation community maps prior to the commencement of detailed surveys. Sampling transects and point stations were used to collect data on fauna in the proposed Luezi dam project area. The boundaries of each vegetation community and the location survey sites were determined from the map of the study area.

Fauna data was mainly collected through the following methods:

Interviews: Community members were interviewed for the purpose of collecting data on the type of animals; location, distribution and frequency of occurrence in the project area.

Checklists of Questions: The following key questions were used to collect data on wildlife resources in the area:

- What types of animals (mammals, birds, reptiles, amphibians and insects) were once present in the area?
- What animals are found in the area today? and
- What has caused the changes in animal population structures?

For bird species, the questions included:

- What type of migratory birds you usually see in the area?
- Do you notice any strange or extraordinary birds during certain seasons?
- Do you know their names?
- When do they appear and leave each season?

For insects or other invertebrates, establish circular plots on the transect lines at predetermined interval and then identify and record all the biological organisms present. Other data collection methods involved searching and direct observation. All the data collected was recorded on the fauna assessment form.

The assessment of fauna and flora was conducted in one season as there were no seasonal variations expected. Previous studies and the extensive consultation conducted with community members in the area guided this approach.

5.2.3 Flora Data Analysis

5.2.3.1 RF, Relative Density (RD), Relative Basal Area (RBA) and IV

Excel was used to analyze the data on flora. The species data was used to determine species importance values (IV) and species richness. Importance values were calculated as adopted from DWAF (2005). Species important values are very important in determining the dominance of the species in a given area.

For plants with $dbh \geq 5$ cm

$$IV = \frac{[\text{Relative Frequency (RF)} + \text{Relative Density (RD)} + \text{Relative Basal Area (RBA)}]}{3}$$

$$RF = \frac{\text{Number of plots in which species is present}}{\text{Total Number of plots recorded}} \times 100$$

$$RD = \frac{\text{Number of stems recorded for species}}{\text{Number of stems recorded for all species}} \times 100$$

$$\text{Abundance} = \frac{\text{Total number of stems recorded for species}}{\text{Total number of quadrants in which the species occurred}}$$

$$RBA = \frac{\text{Basal area of a species in a community}}{\text{Total basal area of all species in the community}} \times 100$$

5.2.3.2 Calculation of dominance Indices

Dominance indices are weighted towards the abundance of the commonest species. Dominance indices were calculated for the commonest species. The Shannon index was used to come up with dominant species.

a. Shannon Index (H_s)

$$H_s = -\sum p_i \ln p_i$$

Where: P_i = Proportion of individuals found in the i th species

5.2.4 Flora and Fauna Assessment Results

5.2.4.1 Flora Assessment Results

Table 21: RF, RD, RBA and IV

SPECIES	RF (%)	RD (%)	RBA (%)	IV (%)
<i>Accacia spp.</i>	10	2.7	2.7	5.1
<i>Albezia spp.</i>	20	4.1	4.6	9.6
<i>Brachystergia specifformis</i>	90	78.1	81.3	83.1
<i>Combretum spp.</i>	10	5.5	2.7	6.1
<i>Diplorhinchus condilocarpon</i>	10	2.7	3.3	5.3
<i>Erithrophleum africanus</i>	10	1.4	1.3	4.2
<i>Isoberlinia angolensis</i>	10	1.4	1.2	4.2
<i>Jacaranda mimosifolia</i>	10	1.4	1.4	4.3
<i>Monotes africanus</i>	20	2.7	1.6	8.1

Important values (IV) measure the relative dominance of species in a forest community (Curtis, 1959). IV rank species within a site based upon three criteria:

- a) How commonly a species occurs across the entire forest area,
- b) The total number of individuals of the species and
- c) The total amount of forest occupied by the species

From Table 15 above, *Brachystegia spiciformis* had the highest IV (81.3%) indicating that it is the most dominant species within the proposed mine area.

Abundance

Abundance is the study of the number of individuals of different species in the community per unit area. By quadrats method, samplings were made at random at several places and the number of individuals of each species was summed up for all the quadrats divided by the total number of quadrats in which the species occurred. For the proposed Luezi dam area, the results are shown in Table 22.

Table 22: Species abundance within the proposed dam area

Species	Stems	Plots	Abundance
<i>Accacia spp.</i>	2	1	2
<i>Albezia spp.</i>	3	2	1.5
<i>Brachystegia spiciformis</i>	57	9	6.3
<i>Combretum spp.</i>	4	1	4
<i>Diplorhinchus condilocarpon</i>	2	1	2
<i>Isoberlinia angolensis</i>	1	1	1
<i>Jacaranda mimosifolia</i>	1	1	1
<i>Monotes africanus</i>	2	2	1

Species Diversity

The Shannon index was used to calculate the current status of species diversity within the proposed dam area. The overall index is shown in Table 23.

Table 23: Shannon Index for the species observed within project site

Species	pi	lnPi	PilnPi
<i>Accacia spp.</i>	0.027397	-3.59731	-0.09856
<i>Albezia spp.</i>	0.041096	-3.19185	-0.13117
<i>Brachystergia speciformis</i>	0.780822	-0.24741	-0.19318
<i>Combretum spp.</i>	0.054795	-2.90417	-0.15913
<i>Diplorhinchus condilocarpon</i>	0.027397	-3.59731	-0.09856
<i>Erithrophleum africanun</i>	0.013699	-4.29046	-0.05877
<i>Isoberlinia angolensis</i>	0.013699	-4.29046	-0.05877
<i>Jacaranda mimosifolia</i>	0.013699	-4.29046	-0.05877
<i>Monotes africanus</i>	0.027397	-3.59731	-0.09856
	1	-30.0067	-0.95548

5.2.4.2 General Vegetation Description

The general vegetation of the proposed dam construction area is typically a *Miombo* woodland type, which has been degenerated over time due to the prevailing land use system at the farm. Foresythe Farming Estate, as it was formally known, is a rangeland with a carrying capacity of about 4,500 herds of cattle. As such, the land has been managed as a cattle ranch with most of the primary vegetation cover removed to promote fodder growth for the grazing animals, generally resulting into a very open regenerating miombo woodland forest.

The entire area is influenced by the Luezi River catchment with its characteristic dambo and wet lands. The majority of the trees have dried up due to low parent rock arrangement with persistant short water logging during the rains and very long dry periods. As such, the vegetation occurs mostly in more or less dying groups. Few tree species such as *syzygium* species survive on the wetlands. On the higher lands however, *Brachystergia spiciformis* dominates the woodland followed by *Combretum species* which graduate form open grasslands to open *miombo*. Thickets of a closed regenerating hilly *miombo* type of vegetation are not a common site around the farm area. The stand density in the dam construction area was found to be 180 stems/hectare being dominated by the same *Brachystegia spiciformis* at 145 stem/ha. Three vegetation type was identified in the project area and these included:

Riparian Forest: Along the Luezi River, the riparian vegetation was significantly modified and degraded to an open and broken *Munga* type of vegetation. This is a riverine type of vegetation and occurs along the rivers or stream-bank dominated by tree species such as *Syzygium guineense*, *Diospyros mespiliformis* and *Homalium abdessammadii*. Other characteristic trees species and shrubs include *Garcinialivingstonei*, *Crotonmegalobotrys*,

Antidesmavenosum, *Kraussia floribunda*, *Rhus longipes*, and *Warneckea sansibaricum* to mention a few (Figure 12).



Figure 12: Riparian vegetation along Luezi River

Open Grassland/Dambo cover: Immediately off the riverbanks, the vegetation is an open dambo land with grass and anthills closing into a young regenerating miombo woodlands with scattered tree further on the higher land.

Open Miombo woodland: The woodland was dominated by *Brachystegia spiciformis* with significant *Combretum* plant species. The vegetation of the area has been significantly modified and degraded by both controlled and late burning of the rangelands (Figures 13, 14 and 15).



Figure 13: Part of the upland regenerating miombo within the area that will be submerged



Figure 14: Regenerating miombo woodland within the inundation area



Figure 15: Effect of fire on termitaria vegetation within the project area

5.2.4.3 Miombo Regeneration

Extensive study reports of the Miombo ecology prove that natural regeneration of this vegetation type is through seed, stumps (coppices) and roots (Chidumayo (1997)). Principally, five factors affect natural regeneration and these are:

- a) Canopy shading in selective felling systems.
- b) Inter-shoot competition-whereby only the dominant shoots contribute to the next generation.
- c) Capacity to regenerate (coppice) decreases with age and stem size.

- d) Late forest fires which kill seedlings and coppices.
- e) Cutting of seed plants for woodfuel, sawing timber and agricultural land.

Most seed bearing trees have economically large diameter stems, which are preferably cut down for timber, which has drastically impacted on the potential of natural forest regeneration since the process has been confined to seed regeneration resulting into poor growth and yields.

At the proposed dam construction area, there was little potential of the forest or the riparian vegetation to regenerate due to the agricultural activities taking place. The openness of the adjacent forest coupled with grassland/dambo has made it difficult for the forest to regenerate. At the margins of the dambo area, even the rich anthill vegetation has diminished greatly. Bordering these areas, only acacia seemed to have been resistant to browsing but, seasonal and rangeland management fires have greatly degenerated the species resulting in an area of scattered semi-dry thorny patches across the land.

However, the regeneration potential of the upland miombo woodland had the potential to produce a closed forest subject to range management and future farm expansion. In the upland area, 3 tree species were observed to be regenerating despite the prevailing land use around the proposed dam area. The general species regeneration status is shown in Table 24.

Table 24: Tree species regeneration status

	SPECIES	COUNT	STEMS/HA
3	<i>Albezia anthunesiana</i>	3	8
4	<i>Brachystergia specifformis</i>	183	458
5	<i>Combretum sp.</i>	63	158
7	<i>Diospyros batocana</i>	2	5
8	<i>Diprolinthus condilocarpon</i>	28	70
9	<i>Erithrophleum africanus</i>	1	3
10	<i>Harunguana madagascariensis</i>	6	15
13	<i>Isoberlinia angolensis</i>	7	18
14	<i>Julbernardia paniculata</i>	1	3
17	<i>Magnistipula butayeyi</i>	22	55
18	<i>Monotes africanus</i>	40	100
19	<i>Philiostigma thonningi</i>	1	3
22	<i>Pseudollachnostylis maprouneifolia</i>	14	35
24	<i>Rhus longipese</i>	4	10
25	<i>Rothmania anglerana</i>	1	3
27	<i>Swatzia madagascariensis</i>	2	5
28	<i>Uaccapa kirkiana</i>	2	5

There are no rare species or important species

5.2.4.4 Fauna Assessment Results

The relativity in abundance of both the regional and endemic species cannot be confirmed especially in the insect category. The EIA study team did however manage to identify most of the faunal species encountered in the proposed project area during the survey and there were variations in species composition and type following site variations. The determinant factors

among others; were topography, land use and the anthropogenic factors which have been playing on the land.

Though the study team did not encounter any big animals during the survey, there was overwhelming evidence of the likelihood of big animals such lions, elephants and buffaloes, roaming in the area as the project site are close to the Kafue National Park. Small animal species such as reptiles, birds, insects and fish were abundant. Foot-marks and droppings of bush pigs, carcasses (Figure 16), common duiker and spring hare were recorded. The study team also run into a wood fox, monkeys and some snakes. There was also evidence of the presence of the Ant-Lion, which could be identified by evident characteristics of damaging anthills during its hunt.

The following birds were spotted on site during the survey and included; *Kaupifalcoono grammicus*, *Streptopelia semitorquata*, *Pycnonotus barbatus*, *Batismolitor*, *Parusgriseiventris*, *Orioluslarvatus*, *Tchagrasenegala*, *Dicrurusadsimilis*, *Emberizaflaviventris*, *Anhinga rufa*, *Milvusmigrans*, *Gallinulachloropus*, and *Uraeginthus angolensis*.



Figure 16: Dead Wood Fox spotted in the area

FISHERIES: When collecting data on fish and aquatic species the team focused on critical variables which included among others; fish species, stream conditions and fishing activities in the area. The methodology used included Interviews with local inhabitants and Fish trapping using fishing baskets. The rapid assessment of Aquatic biota for small streams was also applied.

Fish species from Luezi and Kalomo Rivers included *Tilapia rendallii*, *Clariasngamensis*, *Luciolates stappersii* and *Ctenopoma multispinis*. Crabs and earthworms were are presentation of the lower invertebrates while spiders and other arachnids were present..

Insects: The Zambian entomology is one area which has not been explored in great detail as most research has focussed on large mammals and very few on insects.. However, a number of insects were observed in the area some of which are of value to the locals who frequent the area to collect them. Some of the insects are beneficial while others may be harmful to human. The useful ones include the honey bees (*Apis mellifera*), termites (*Microtermes goliath*) and various species of grass hoppers. Table 25 and Figure 17 show insect species observed in the area.

Generally, insects of the following broad categories; grasshoppers, bugs, beetles, dragon flies, wasps, bees, butterflies, moths and ants were represented. However, the faunal and fish numbers and diversity were low.

Table25: Insect species observed in the area

No	Scientific name	Order/Family	Common name
1	<i>Apis mellifera</i>	<i>Hymenoptera</i>	Honey bee
2	<i>Microtermes goliath</i>	<i>Isoptera</i>	Termite
3	<i>Dorylshelveolus</i>	<i>Formicidae</i>	Ants
4	<i>Solenopsis spp.</i>	<i>Formicidae</i>	Red ants
5	<i>Belonogastarjunceus</i>	<i>Vespidae</i>	Wasp
6		<i>Coleoptera</i>	Beetle
7	<i>Helicoprisspp</i>	<i>Scarabaeidea</i>	Dung beetle
8	<i>Anopheles spp.</i>	<i>Culicidae</i>	Mosquito
9	<i>Muscadomestica</i>	<i>Diptera</i>	House fly
10		<i>Orthoptera</i>	Grass hoppers
11		<i>Odonata</i>	Dragonfly and Damselflies
12	<i>Brachytrypasmembraneus</i>	<i>Orthoptera</i>	Giant cricket
13	<i>Cicadetta spp.</i>	<i>Cicadidea</i>	Cicada



Figure 17: A red ant (left) and Grasshopper (right) found in the project area

Faunal Habitats: Although most of the area in the proposed project site has been degraded due to anthropogenic factors, a number of possible habitats were identified for avifauna and terrestrial life. There a number of thickets on anthills and along some river valleys that could accommodate a variety of wildlife. Most anthills had holes which were being used as fox-dens and the vegetation was sufficient to support nesting birds and other land animals. These were some of the habitats being utilized by the surviving fauna.

Table 26: Faunal habitats identified within the project area

	Habitat	Description
1	Miombo Woodland	The habitat included predominately <i>Brachystergia specifformis</i> tree species with an open canopy to support both shade and light-tolerant species. Bare earth, leaf litter and decaying wood material from the dead trees all provided a habitat for reptiles such as snakes and mammals like foxes and squirrels. This habitat supports most small mammals present within the area.
2	Riparian forest	The habitats are along the banks of the Luezi and Kalomo Rivers. This habitat type supports birds and many other animals associated with riparian forests. This type of habitat is classified as sensitive as they protect the river itself.
3	Termitaria	The termite mounds within the project area mostly support termite ants, rodents, hares and some snakes colonise such habitats.
4	Streams	These habitats support a number of aquatic lives such as fishes and other organisms.
5	Open dambo and grassland	This supported most of the insects, birds, duikers and other small mammals.

5.3 Description of the Social Economic Environment

5.3.1 Land Tenure

The land tenure system in Zambia consists of two systems: Customary tenure applying to Customary Land and the Leasehold tenure applying to State Land. Customary Land is held under the traditional leadership (Chief) as regulator of the acquisition and use of the land. The traditional leadership is however, required to act with the consent of the people. The land under leasehold tenure is under the control of the republican president and can only be acquired by a direct grant from him through the commissioner of lands. State Land is generally leased for a 14 year or a 99 year renewable period.

Commercial farms in Zambia are mainly located on State Land. The entire 19, 632 hectares of the Silverlands Estates (formerly Foresythe Estates) and the proposed Luezi Dam site is on State land. The land belongs to Silverlands Ranching Limited and is held under a 99 year lease (Appendix 7).

5.3.2 Land Use

The Silverlands ranch and the proposed dam site are situated in the commercial farming heartland of the Southern Province of Zambia. This area has traditionally been considered the top ranching area in Zambia because of the high quality grazing available. The current primary land use under Silverlands Ranch is cattle ranching (Figure18). The farm currently holds about 4,419 heads of cattle. After the construction of the Dam, Silverlands Ranching Limited plans to develop up to 1000 Ha of irrigation on their ranch and grow other high cash crops such as wheat and soya beans.



Figure 18: Herd of Cattle at the Farm

The farm is also surrounded by three other established commercial ranching and cropping farms. Apart from cattle ranching, the farms also keep other animals such as goats, pigs, sheep and chicken. The crops grown by these surrounding farms include maize, sunflower, wheat and soya beans.

The project affected communities downstream are also predominantly semi- commercial small scale cattle farmers. Other animals kept by the local communities include goats, pigs, ducks, chicken and turkeys to a smaller scale. The most common grown crops among the communities are maize, sunflower and groundnuts. The crops are grown for both subsistence and commercial purposes. Maize and sunflower are reported to be grown on a larger scale than other crops for income generation. Maize is mainly sold to the government Food Reserve Agency (FRA) while sun flower is to small businesses in Zimba and those from Kalomo.

5.3.3 Population Pattern

Zimba District was part of Kalomo District before it was recently declared a district by the Republican President in 2012. According to the 2010 census of population and housing

report, Zimba District is one of the districts in Southern Province that has been growing at a very fast rate. The report indicate that the number of households in Zimba increased from 403 households in 2000 to 2,531 households in 2010 while the total population increased from 2,614 in 2000 to 12,669 in 2010 translating into a population growth rate of 38.5 % (compared to 2.8% national average).

The rapid population growth in the district has increased the demand for social economic development. Developments such as the Luezi Dam project present more opportunities for the local people. Although the population has increased tremendously, the reports show that there has not been much change in the population distribution of males and females. The population estimates indicate that males and females both constitute about 50% each of the total population.

5.3.4 Human Settlements

There are no settlements on the proposed Luezi Dam project site. However, the farm currently employs 88 people and there are permanent houses on the ranch that have been built for the employees. SRL has two (2) managers' houses, two (2) houses for their assistants and sixty (60) other permanent houses for other farm workers. The houses are made of standard concrete blocks with roofing sheets. Some houses for farm workers have thatched roofs (Figure19).



Figure 19: Some houses at the farm

The nearest community to the project area is located downstream from the dam site, about 10 km from the site and beyond the Kalomo River which marks the boundary between the local villages and the Commercial farms in Zimba. A total of 5 villages with 226 households and an estimated population of 930 people use the Kalomo River (Table 27). The construction of

the dam will have a positive effect as the Luezi River might stop drying up during the year (September to November) as it has always done in the past.

Table 27: List of Villages along the Kalomo River downstream of the dam site

No.	Village	No. of Households
1.	Siakaloba	15
2.	Simbai	26
3.	Siamazila	76
4.	Chingobe	40
5.	Wasilela	69
Total		226

5.3.5 Education

There are six basic schools offering education from grade one to grade nine. The six basic schools include: Zimba Basic School, Nakowa Basic School, Chundwe Basic School, Mayoba Basic School, Muziya Basic School and Sipatunyana Basic School. The district also has two secondary schools (Zimba and Kabanga) offering education from grade ten to grade twelve. All the Schools are located within a radius ranging from 10km to 50 km from the project area. For tertiary education, parents are forced to send their children to institutions outside the district. The majority of the population around the project area generally has access to basic education.

5.3.6 Religion

A survey of the religious practices and beliefs around the project area indicate that the predominant religion is Christianity. Some of the Christian denominations around the project area include: Jehovah's Witnesses, Truevine Church, Future Hope Church, Pilgrim Wesleyan Church of Zambia, Church of Christ, New Apostolic Church, Brethren in Christ (BIC) and Seventh-day Adventist (SDA) (Figure 20). Most of the farm workers and the people from the villages near the farm are Christians.



Figure 20: One of the Church building near the project area

5.3.7 Health

There are four health facilities in Zimba District. These include: Zimba Mission Hospital (ZMH) and three Rural Health Centres (RHCs) - Nakowa clinic, Muziya clinic and Sipatunyana clinic. The RHCs are reported to provide ineffective health care services due to several challenges - poor infrastructure, poor staffing levels, low supplies of drugs, inadequate medical equipment and poor funding from the government. Serious cases from the RHCs are referred to ZMH.

ZMH is the main health facility in the district (Figure 21). It is situated along the main road from Livingstone to Lusaka about 15 km from the project area and 22km from the nearest project affected village. The people around the project area that access health care services from the mission hospital consider the services as effective. ZMH is adequately stocked with necessary drugs and medical equipment, and the infrastructure is in good condition. This has been attributed to the fact that the mission hospital receives a lot of support through partnerships and associations with a number of different organizations in both Zambia and the United States. The partnerships and associations offering support to ZMH include: Global Partners, Churches Health Association of Zambia (CHAZ), Pilgrim Wesleyan Church of Zambia (PWCZ), World Medical Mission (WMM), World Wide Lab Improvement (WWL), International Technical Electric and Construction (I-TEC), International Pathology Services (IPS), CURE International, Mercy Flyers, International Vision Volunteers (IVV), Flying Mission Zambia, Resurge International and Personal Energy Transportation (PET) Project International. However, ZMH still faces difficulties in the provision of health care services due to poor staffing levels.



Figure 21: Part of Zimba Mission Hospital

5.3.7.1 HIV/AIDS

The most prevalent diseases in the district are diarrhoea related diseases, malaria, tuberculosis, and HIV/AIDS related diseases. Sensitisation programs aimed at preventing the spread of diseases are available in the district through the active NGOs and Church bodies in the area. An extensive HIV/AIDS study on the status of the disease was conducted. This involved literature review and interviews with health staff at ZMH Hospital and community HIV/AIDS volunteer worker. No data was available at the time of the assessment on the prevalence of the disease in the district. However, from the interviews conducted, HIV/AIDS infections were high among married couples and the most affected were men. The common methods of transmission of the disease in the district were through sexual intercourse.

5.3.8 Water and Sanitation

All domestic water used at the Silverlands Ranch Estates is ground water through boreholes. The Silverlands Ranch Estates has seven boreholes in total, with 4 yielding in excess of 1 litre/sec and the rest yielding about 0.5 litre/sec. The water from the boreholes is treated and stored in reserve tanks before distribution to the farm workers. The farm has water collection points where the farm workers and other local people collect water for their domestic needs (Figure 22)



Figure 22: Borehole Water Reserve Tanks and Water collection points at the Farm

The majority of the people in the villages downstream collect their domestic/drinking water from a number of hand pumps that were installed by World Vision and Care International, active NGOs in the area. At the time of the survey, it was reported that a considerable population still use water from the Kalomo River for their domestic purposes.

5.3.9 Energy Services

The farm is not connected to the main grid but the nearest access point is 4.9km from the farm. The ranch currently uses diesel generators (Figure 23) for energy needs at the two managers' houses. However, other farm workers use charcoal and firewood, paraffin lamps and battery operated torches for heating and lighting purposes respectively. Solar panels have also been installed at some farm worker houses. The panels are mainly used for lighting, radios and charging mobile phones.



Figure 23: Diesel Generator at the Ranch

5.3.10 Transport and Communication

The ranch is well serviced by a government maintained gravel road that turns off from the Lusaka – Livingstone road and travels through the ranch. The road is in a relatively good condition and can be used throughout the year. All the mobile service providers (Airtel, MTN and ZAMTEL) are present in Zimba District although the quality of mobile phone reception signals varies within the district. There is also a post office situated at the central business area of the district along the Lusaka – Livingstone road.

5.3.11 Economic Activities

Generally, economic activities in Zimba District can be categorized as mainly commerce and agriculture. The commercial sector is characterised by activities such as retailing of merchandise in shops and through open markets, livestock marketing, abattoirs, local butcheries, restaurants, bars and guest houses. The retail shops, bars, restaurants, butcheries, milk centres (dairies) and guest houses are mainly located at the central business area of the district along the Lusaka – Livingstone road.

As indicated earlier the other commercial farms adjacent to the project area and the project affected communities are predominantly cattle farmers although they also keep other animals such as pigs, goats, chickens and ducks. They also grow crops such as maize, sunflower and groundnuts. Selling of agricultural produce (livestock and crops) is reported to be the main income generating activity in the district. There are no other major industries in the district apart from agriculture.

5.3.12 Cultural, Historical and Archaeological Sites

The proposed Luezi dam site does not have any features which have been confirmed to have cultural or heritage value. However, during site clearing and land preparation, any discoveries of possible ancient cultural, historical and natural heritage features will be reported to the NHCC for appropriate action to be taken aimed at preserving such sites.

5.3.13 Conflict resolution mechanism

A conflict resolution mechanism will be set up during the project implementation. The conflict resolution mechanism will enable affected parties to lodge complaints and/or concerns regarding the project, without cost, and with the assurance of a timely and satisfactory resolution of the issue or complaint. The Grievance Procedure will not replace existing legal processes. Based on consensus, the procedures will seek to resolve issues promptly, without resorting to expensive and time-consuming legal actions. If the grievance system fails to provide a satisfactory result, complainants can still seek legal redress. The grievance system will be accessible to all affected parties.

The conflict resolution mechanism will be advertised and announced to affected parties so that they are aware of the process, know they have the right to submit a grievance, and understand how the mechanism will work and how their grievance will be addressed.

In most cases, a grievance or complaint will be declared by a stakeholder or community member phoning, writing to or speaking with the Community Relations Manager. Grievances should be logged on the form presented in appendix 10.

6. ASSESSMENT OF ENVIRONMENTAL IMPACTS

6.1 Environmental Overview

The objective of assessing environmental impacts of any undertaking is to ascertain the potential impacts and prescribe a way of mitigating them at the initial stages of project development. This helps to identify and put in place sustainable measures of environmental and social planning to maximize the project benefits and avoid adverse impacts during project implementation, operation and final closure.

The Luezi dam Project will cause various social, economic and environmental impacts. The majority of the direct negative impacts of the Project will be felt in the local area, while the majority of the positive impacts (relating to water for irrigation and flow-on economic benefits) will be felt at local and regional levels, largely outside the area of negative impact. While the cumulative impacts of the Project suggest that these impacts will be both negative and positive, the issues highlighted as being most significant are those which are positive – associated with socio economic conditions, and those which are negative - associated with flora and fauna, and landholders. All other negative impacts can successfully be mitigated through appropriate design and management.

The flora and fauna impacts associated with the habitat loss and fragmentation are the most relevant. These are impacts that cannot be totally directly mitigated and will result in some habitat loss and fragmentation. Proposed mitigation strategies for these impacts include restricting clearing of vegetation to actual dam site, protection of riparian zones upstream and downstream of the dam to mention but a few. The following broad division into impact zones was made;

- Areas influenced by hydrological changes in the river system: Reservoir area where the reservoirs will be created following the closure of the dam and area immediately below the dam
- Areas influenced by activities associated with dam construction: Dam construction impact zone, Access roads and local communities within radius of 5km

6.2 Methodology

The impact assessment process has utilized a significant number of existing studies and research, field studies, published and unpublished information, professional and expert input and review, community and agency consultation and government and consultant professional input. References and material sourced have been referenced in the EIS. The level of confidence in the predictions of impact and the likely success of mitigation strategies is high but varies between disciplines.

6.3 Typical Environmental Considerations for Dam Construction

Dam construction significantly alters and affects upstream hydrological regimes and the local ground water reservoirs with resultant obstruction of downstream flow if not properly planned and managed, which can have far reaching consequences ranging from regional environmental disturbance to social and human-animal conflicts in areas near national parks and game management areas. All the above are considered in this particular project.

The dam construction and management plans should therefore contain mitigation measures for all the anticipated environmental impacts to address issues such as dam extent (Upper

limit – downstream catchment reservoir), watershed and downstream river valley. The direct environmental impacts associated with dam construction include dust, erosion, borrow and disposal problems and downstream water impoundment will impact directly on soil, vegetation, wildlife and wild habitat, fisheries and the human settlements.

The indirect effects of the proposed dam construction project anticipated are construction of dam facilities, maintenance and functioning of access roads, irrigation facilities etc. The benefits which the dam project will bring are immense and include flood control, continuous and abundant supply of fresh water for irrigation and domestic/industrial use and proliferation of aquatic life, riparian vegetation, wildlife and scenic beauty.

6.4 Impact Identification

The ESIA has predicted and evaluated anticipated impacts using acceptable standard methods of impact prediction and evaluation. Constant reference to a checklist of project activities was made. The study team used several approaches such as brainstorming and use of checklists and matrices to identify the main sources and establish the potential impacts from the proposed main project activities. Public participation and consultation with a wide sector of the community and stakeholders were conducted to reduce uncertainty.

6.4.1 Impact Criteria

The positive and adverse project impacts assessment was based on the following impact criteria during pre-construction, construction, operation phases and decommissioning phase as follows:

1. **Scale:** Physical scale / area over which the impact will be felt: Local, Regional, National or International
2. **Duration:** The length of time the impact is likely to occur: Short, Medium or Long Term
3. **Severity:** The intensity of the impact: Low, Medium or High
4. **Certainty:** The probability of the impact occurring: Possible, Likely, Highly Likely or Definite
5. **Direction:** Whether the impact is Positive (beneficial) or Negative (adverse)

6.4.2 Impact Assessment Scoring

Evaluation of identified impacts was guided by careful assessment and judgment of the anticipated consequences with regard to set standards or the pre-development environmental situation of the site. The assessment and assignment of values to each identified impact was based on the values developed in the table below which is adapted from international good practices. Positive impacts are evaluated by assigning positive scores while the adverse impacts are evaluated by assigning negative scores (Table 28).

Table 28: Scale for evaluation of project impacts

Score	-1 (+1)	-2 (+2)	-3 (+3)	-4 (+4)	-5 (+5)
Magnitude or extent	Impact will occur only on site	In between	Impacts will occur within a 3-5km radius of site	In between	Impacts will occur regionally
Significance	Low. Small changes which are hardly detectable	Moderate. Impact measurable but does not alter processes	High. Many people, animals, plants affected. Major disruption of ecosystem processes.	Very High. Loss of people, Biodiversity, property loss of local livelihood systems.	Unknown. Insufficient information available. Apply precautionary principle.
Probability of Occurrence	Possible. Impact can occur but controllable.	In between	Probable. The impact is likely to occur but can be controlled by effective measures.	In between	Definitely to occur.
Duration of Occurrence.	Short term. During construction phase only.	Medium term. During early operations.	In between	Long term. For the entire operational phase.	Very long term. For the entire operational phase and after closure.

6.4.3 Potential Positive Impacts Associated with the Proposed Luezi dam Project

There are a number of positive impacts which will benefit the local community and the nation in general. The benefits of the project in the proposed area are both social and economic and are outlined below.

1. The dam will be used effectively to regulate the Luezi River levels and flooding downstream of the dam by temporarily storing the flood volume and releasing it later ensuring a sustainable flow of water in the river for various users. The Luezi normally dries during the dry season but with the construction of the dam, it will have water throughout the year.
2. *Increased value of land in the project area.* The project will attract more investment to the region hence leading to accelerated business growth and leading to the development of the new established district of Zimba.
3. The project will ease the current water storage problem in the area and this will promote irrigation leading to increased agricultural production.
4. *Creation of market for goods and services.* This will be significant especially during construction period. The goods will be sourced from local suppliers thus creating a ready market leading to general economic growth.
5. Provision of employment opportunities during both construction and operation phases of the project.
6. *Increased local trade and economic activities.* Mobilization of equipment and labour to the proposed project site will lead to increase small-scale trade and businesses among the local community population. Local households and people will trade their traditional and homemade foods, goods and services to site workers and this will promote trade and increase currency circulation in the area

7. *Increased public revenues.* Revenue going to the national treasury (local and central treasury vaults) will increase during the operational phase of the project; annual land rates payable to Zimba District Council and public tax regimes. The increase in employment levels and trade activities in the district will directly boost revenue collection by ZRA through VAT and sale tax through purchase of farming inputs. Corporate income taxes paid by SLR, including PAYE, NAPSA, personal levy paid by employees will further boost national coffers. The increase in the employed population will increase demand for more service from ZESCO and water utility companies, which will further increase the public revenue collected by the state.
8. *Multiplier effects.* The increase of socio-economic activities in the area will lead to several more economic multiplier effects such as numerous indirect jobs being created through support services such as transportation, water production and engineering companies; motivating agricultural equipment/input supplying firms, which may include turnery, glue production, abattoirs, ZAMSEED, SEEDCO and other financial lending institutions etc., to enter the district to provide their services to the community.

Table 29: Impact scoring for positive impacts

Impact	Aspect			
	Magnitude or Extent	Significance	Probability of occurrence	Duration of occurrence
Flood control and water storage	4	4	5	4
Increased value of land in the project area	2	2	3	4
Attracting more investment to the Zimba district	4	5	5	4
Easing the current water storage for irrigation in the area	5	5	5	5
Market for goods and services	5	5	5	1
Employment opportunities	4	4	5	4
Improved infrastructural services	5	5	5	5
Increased Local Trade and Economic Activities	4	4	5	5

6.4.4 Environmental Impacts of Site Clearing/Construction Phase

6.4.4.1 Displacement of people

The number of people actually living in the Catchment area of the proposed reservoir was derived from census data and field surveys. It was established during field surveys that the project area particularly impoundment areas are part of commercial fields meant for

agricultural activities. As such there are no households living on the area that will be affected by the dam project. Therefore no people are expected to be relocated due to inundation.

6.4.4.2 Loss of vegetation

There will be a significant vegetation loss both during the construction of the access road and the dam itself. The vegetation will be cleared so that the area where the construction work is to take place is clear for the construction work to be performed.

6.4.4.3 Loss of wildlife habitat

Vegetation removal will result in the habitat of certain animals being damaged. Though there are not many big animals within the project location, the small number there are will have to migrate elsewhere since their habitat will be lost or degraded.

6.4.4.4 Soil erosion

Soil erosion will result due to the intensive activities that will be going on in the construction area. The heavy equipment and machines that will be used in the construction process will interfere with the soil structure making it loose hence liable to erosion.

6.4.4.5 Dust effects

There will be a lot of dust from the construction activities. The excavation of the reservoir area and mining of the soil to be used in the construction of the embankment will both result in pollution from dust particles. The movement of heavy earth moving machinery and equipment on the gravel and site roads is likely to generate a lot of dust in the area. This will not only be a nuisance to the physical environment but a health hazard to people, especially the workmen if appropriate protective clothing such as respirators or dust caps are not provided

6.4.4.6 Impacts on Air Quality

- *Dust Emission*

Dust emissions are characteristic of site clearing operations for land preparation emission. Such operations also involves trenching, excavations, movement of vehicles and cut and fill activities, which all lead to nuisance dust emissions with the potential to disturb the local air quality. During site clearing and land preparation activities, dust can be a nuisance to the health of site workers posing a danger of dust lung diseases. With increased wind velocities in dry season however, dust can move considerable distances to an extent of even disturbing other surrounding human settlements. Of particular note is the nuisance of dust during the offloading of the building and construction materials such as sand, cement, aggregate stones and other related construction items.

- *Exhaust Gases and Emissions*

Gaseous exhaust emissions are likely from the heavy flow of traffic and operation of machinery on site and will therefore result in increased levels of air pollution. The impact will however be localized and moderate.

6.4.4.7 Sanitary and health problems from construction camps

There is a likelihood that a construction camp to accommodate construction workers will be built. Disposal of wastes within the construction camp must be given careful consideration and procedures put in place. Unhygienic disposal may lead to the spread of diseases.

6.4.4.8 Changes in downstream morphology of the riverbed and banks

The impact of the proposed dam on downstream habitats will be through changes in the sediments load of the River. All rivers carry some sediment as they erode their watershed. When the river is held behind a dam in the reservoir for a period of time, most of the sediment is trapped in the reservoir and settles to the bottom. Clear water below the dam will recapture its sediments load by eroding the downstream bed and banks. Eventually all the erodible material on the riverbed below the dam will be eroded away, leaving a rocky streambed, and a poorer habitat for aquatic fauna.

6.4.4.9 Changes in the downstream water quality

This will manifest itself in change in river temperature, nutrient load, and turbidity; dissolved gases, concentration of heavy metals and minerals. When river water is held in a reservoir for a period of time, the quality of the water is affected. When a reservoir is first filled, submerged vegetation and soil decomposes. As it does so it will deplete oxygen in the reservoir water. Deoxygenated water can be lethal to both plant and animal lives. Another water quality problem is mercury contamination. While mercury is often present in a harmless inorganic form in soil, once the soil is flooded bacteria may transform this inorganic mercury into methyl-mercury, which is toxic and can be absorbed, concentrated and passed up the food chain.

6.4.4.10 Reduction of biodiversity due to blocking of movement of organisms

Dams generally tend to fragment river ecosystems, isolating species population living up and downstream of the dam and cutting off migrations and other movement. The peak flows that carry suspended sediments to the shore will be reduced by the presence of this dam. This dam will block the upstream and downstream passage of migrating aquatic animals. This will isolate them from vital spawning and feeding areas. Many fish and invertebrates inhabit the gravely river bottom, but these habitats will decline due to depletion of riverbed gravels.

6.4.4.11 Spread of waterborne diseases from stagnation of the watercourse

This may be quite common in irrigation systems. Changes in the ecosystem will be responsible for the increase in diseases.

6.4.4.12 Exclusion of future land uses

Once the reservoir is in place, other land uses shall be excluded automatically and the benefits associated with them foregone.

6.4.4.13 Turbidity and siltation during filling

This will mainly occur during the construction of the dam and the filling of the main dam which will take 1.21 years. This period was arrived at using the following data: Total Volume = 10.72m^3 , MAR (Mean Annual Runoff) = 8.84m^3 . Therefore the ratio will be 1.21 which means that under normal rainfall, the dam will fill in 1.21 years.

The figure was calculated from the Suspended particles including soil from the neighbouring catchment area will contribute to this. The Luezi River will not be completely impounded but will allow environmental flows for both the ecosystem and any other activity that may be undertaken downstream at any given time. Measures will include;

- Ensure that excess flow during summer season is harnessed
- Ensure that optimal flow are allowed continuously
- Observe Water Right regulatory requirements

The people downstream will not be significantly affected as all the communities are living on the side of the Kalomo River. The whole downstream part of the Luezi River is within the farm area.

6.4.4.14 Wildlife and wildlife habitat loss

The removal of parts of the natural vegetation or habitats resulting from the land clearing and preparation activities will lead to a significantly disturbed environment or, some of the important ecosystems, which certain animal species may depend upon for survival may be lost. This may lead to species migration or complete loss if no other habitats can support them. However, during the specialized studies, no such endangered or threatened animal species were identified and contingent measures have been provided for in the site management plans to mitigate any such eventuality during site preparations.

6.4.4.15 Pollution of the aquatic environment

Disturbance to geophysical configuration of the land during land clearing with loss of vegetation cover will have a number adverse impact on the aquatic environment. Disturbed or loosened soil materials will be eroded with the run-off by storm water into the aquatic environment to cause pollution. Any oil leakages from the heavy equipment and other earth moving machinery is likely to impact on the soil and finally enter the aquatic environment through erosion if sound mitigations measures are not put in place.

6.4.4.16 Increased Spread of HIV/AIDS/STI/TB

The influx of people in the area usually leads to various kinds of social interactions and entertainment such as social drinking and association. This usually leads to casual friendships and relationships among people of the opposite sex and it may lead to cohabitation and illicit sexual conduct leading to the rise in HIV/Aids, TB, STIs infections in the area. New diseases may be brought in the area, and the visitors may also introduce some of these infections back to their homes and communities

6.4.4.17 Increased possibility of people drowning either intentionally or accidentally

Because of the large body of water that will be created as a result of construction of the proposed dam, there is a potential for accidental drowning or suicides in the dam, as has been the case with other dams. Cases of people being killed elsewhere and dumped in the dam may also arise.

6.4.4.18 Increased Traffic Volumes

Traffic volumes will increase during dam construction. A number of trucks will be required to transport material to the construction site. The environmental impacts likely to be caused by materials and equipment haulage into this Project (such as noise, vibration, air quality and amenity) are considered to be short term and relatively minor.

Operators will live in the local area, and long term operations will result in limited traffic. From time to time traffic volumes will increase slightly when heavy equipment and associated materials required for dam and access road maintenance are required to travel to the site.

6.4.5 Environmental Impacts of Operation Phase

6.4.5.1 Skills transfer to locals

The presence of the dam will promote skills transfer not only during the construction phase but also during the operation phase of the project.

6.4.5.2 Increase in local population

The dam project will lead to an increase in the local population in the area as some people come to work or seek employment. The increase in local population will increase the market for local products.

6.4.5.3 Increase in local economic activities

The presence of the dam and its associated activities will increase local economic activities. The proposed dam project will be one of the biggest investments in the area. Therefore, once implemented will boost the local economic activities of the area.

6.4.5.4 Increased danger of people drowning either intentionally or accidentally

Because of the massive water body that will be created as a result of construction of the proposed dam, there is a likelihood of people on suicide missions drowning in the dam, as has been the case with other dams. Cases of people being killed elsewhere and dumped in the dam may also arise.

6.4.5.5 Change in landscape character and visual amenity

Generally, the Project will have a low visual impact on the landscape, as visibility of the dam wall will be relatively limited, with few nearby viewpoints. The most significant change to scenic quality will be the new water body (lake) in place of grazing paddocks and bushland. As a compatible and familiar feature of many rural landscapes, the water body will not appear out of place in the context of the existing landscape and the final form of the wall will have a natural configuration due to the relatively narrow and elongated topography. The new water body is considered a beneficial landscape outcome.

6.4.5.6 Downstream flooding

There is a possibility of downstream flooding especially in the event of dam failure. However, the likelihood of this is very insignificant as the dam will be constructed according to sound engineering standards. It is also important to note that flooding occurs currently due to changes in the rain patterns in the area.

6.4.5.7 Fire and explosion

There is the possibility of fire and explosions during operation. Measures will be put in place to ensure that fire occurrence and explosions are prevented and all workers will be made aware of what to do in case such an event happens.

6.4.5.8 Pollution due to increased usage of pesticides and fertilizers

Pollution of the environment may arise due to the use of pesticides and fertilizers. These may affect the water, soil and biodiversity in the area. Measures will be put in place to ensure that pollution will fall within acceptable limits.

6.4.5.9 Change in water flow downstream of the Luezi River

The dam will be effectively used to regulate the Luezi River levels and flooding downstream of the dam by temporarily storing the flood volume and releasing it later ensuring a sustainable flow of water in the river for various users. The Luezi normally dries during the dry season but with the construction of the dam, it will have water throughout the year.

Table 30: Impact scoring for negative impacts

Impact	Aspect			
	Magnitude or Extent	Significance	Probability of occurrence	Duration of occurrence
Resettlement impacts and associated social problems	N/A	N/A	N/A	N/A
Clearing of vegetation and loss of habitat	-1	-3	-5	-1
Surface and ground water pollution	-2	-2	-3	-1
Erosion from earthworks and escape of hazardous materials	-1	-5	-3	-2
Dust and Air Pollution	-2	-3	-3	-1
Noise and Vibrations	-1	-2	-5	-1
Quarrying and blasting hazards	-2	-2	-1	-1
Pressure on social services and facilities	-3	-2	-1	-3
Increases in the incidence of diseases such as HIV and STIs	-2	-2	-2	-4
Clashes between the workforce and local communities	-3	-2	-1	-2
Disturbances to the social practices and fabric of local communities	-2	-2	-3	-3
Human and petroleum waste disposal	-1	-2	-2	-1
Some terrestrial animals will be drowned or their habitat destroyed	-1	-3	-5	-4
Loss of connectivity preventing up and downstream migration of fish	-1	-3	-5	-4
Danger of drowning	-1	-4	-1	-4
Changes to the surrounding micro-climate	-4	-5	-5	-5
Change in daily flows	-5	-3	-5	-5

Table 31: Summary of Environmental Impacts

	ENVIRONMENTAL COMPONENTS	Climate	Geology	Soils	Water Resources	Topography & Geomorphology	Flora	Fauna	Air Quality	Noise & Vibration	Local Communities	Rural Livelihoods	Land use	Local Economy	Health & Safety	Aesthetic & Amenity values
	PROJECT ACTIVITY															
A	Construction Phase															
1	Relocation and Resettlement															
2	Construction of Water Barrier			●				●							●	
3	Diversion Works							●							●	
4	Draw off Works/ Tunnelling							●							●	
5	Foundation Grouting		●	●		●		●	●						●	
6	Cut-off		●	●				●							●	
7	Filters				●											
8	Construction of Embankment		●					●	●						●	●
9	Spillway				●			●							●	
10	Construction of Auxiliary Facilities		●					●		●	●	●	●	●	●	●
11	Storage	●	●	●	●		●	●		●	●	●	●	●	●	●
B	Operation Phase															
1	Offices				●											●
2	Residential				●											●
C	Decommissioning															
1	Demolition of Facilities		●						●	●		●	●	●	●	●
2	Restoration Efforts					●		●							●	●

7. MITIGATION AND MANAGEMENT MEASURES

7.1 During Construction Phase

7.1.1 Occupational Safety and Health issues

During construction phase, the following mitigation and management measures will be put in place:

- Dust control through regular watering of access roads
- Use of respiratory protective equipment by workers closely involved in excavation, blasting and crushing activities
- Capacity building and training of personnel with respect to environment, health and safety shall be observed.
- Personnel protective equipment as per health and safety regulations will be provided and medical check-up of workers as is required by national and international regulations shall be observed.
- Observing effective emergency response plans to reduce health and safety risks.
- Waste, including excavated soil and debris shall be properly disposed of by backfilling and landscaping. The contractor shall provide acceptable and standard sanitary facilities for the workers.
- Implementation of a preferential employment strategy.
- In consultation with local authorities and community representatives, construction camps will be located and designed to maximise local service provision and minimize informal settlement development.
- Ensure that acceptable facilities are provided at construction camps (e.g. health services, water and sanitation facilities and, recreational facilities)
- Ensure that health programmes and measures are provided for the construction workforce (e.g. Programmes on STDs and occupational health).
- Ensure in cooperation with other government agencies, that health programmes are made available to communities affected by construction activities (e.g. campaigns on STDs and general health improvement measures).
- Road signs will be put in place and the speed of vehicles controlled. Heavy traffic shall be restricted to the day period for reasons of security and the restful sleep of the inhabitants.

7.1.2 Health and safety issues

- Limiting the extent of site clearance as far as possible.
- Keeping stockpiled materials moist.
- Rehabilitating disturbed areas as soon as possible.
- Keeping earth and gravel roads damp.
- Fitting silencers to ventilation fans.
- Maintaining vehicles in good order.

7.1.3 Mitigation measures for Security /Safety risks

Management of security risks, including flooding and a dam-break flood wave entail:

- Regular liaison with local authorities and community representatives to discuss security and safety risks and management plans;
- Fencing of high risk construction sites to prevent accidents;
- An emergency preparedness plan for flooding and a dam-break event.

7.1.4 Mitigation against HIV/AIDs and STIs

Mitigation against HIV/AIDs and STIs will involve the following:

- Implementing an extensive HIV/AIDs and STI education campaign among the local population, targeting not only youth but adults as well. Such a campaign shall be initiated immediately as soon as construction starts.
- Implementing a comprehensive and on-going HIV/AIDS and STI education campaign targeting all workers hired for the project, both local and international.
- Implementing a well thought and effective HIV/AIDS and STI education campaign among sex workers. Such a campaign shall be initiated immediately and pursued throughout the construction phase of the project as a constant flux of individuals involved in this activity is expected. This will of course be done in conjunction with the Ministry of Health.
- Establishing a strong, well-publicized, effectively applied and closely monitored zero tolerance policy in accordance with which workers and service providers seeking sexual favours in exchange for project related benefits will be banned for the remaining duration of the construction phase.

7.2 Mitigation and Management Measures during Operation Phase

- To cater for surface drainage, well-designed concrete drain channels will be proposed to harmonize management of the resulting storm water within the site.
- A water flow monitoring programme is proposed.

7.2.1 Mitigation on downstream flooding

- Preparing an emergency plan.
- Incorporate flood management into operating rules for dam releases.
- Observe standard dam operation rules
- Ensure optimal flows downstream at all times
- Ensure that the dam is regularly checked and maintained

7.2.2 Mitigation on fire and explosion

- Installation of fire control devices in chemical storage areas, preparation of emergency plan, containment and collection measures.

7.2.3 Mitigation and Management Measures on Pollution

Mitigation on combustion gases will include:

- Reduction of use of fossil fuels, limitation of exposure time, use of antipollution systems,

- Improved combustion performance of machinery and vehicles.

Mitigation on non-biological waste will include:

- Recovery of waste materials and restoration of site.

7.2.4 Mitigation on hygiene and biological waste will include:

- Providing sufficient toilets for both men and women with complete sanitary fixtures;
- Providing safe and clean potable water for drinking and hand washing, including sanitary detergents;
- Providing an adequate amount of water for washing facilities and sanitation;

Table 32: Potential Environmental Impacts and Mitigation/Enhancement Measures

Activity	Phase	Potential Environmental Effects/Impact	Mitigation Measures	Enhancement Measures
Dam wall and spillway construction	Construction	Displacement of people	No households are expected to be relocated due to inundation resulting from dam and spillway construction. Therefore no mitigation is required	
		Loss of productive land, historical and cultural sites	No mitigation is required for loss of historical and cultural sites since none are present within the impoundment area. However, loss of agricultural land is expected. This impact is moderate considering that only a small area of land compared to the total area of the farm will be inundated. Nevertheless, the developer will take the following measures; Take a precautionary measure i.e. should any effect of historical nature be discovered during construction, relevant authorities will be notified immediately.	
		Skills Transfer to Local People		This impact is high and of great importance and therefore it will be enhanced by; i) ensuring there is a skill transfer programme ii) Categorise staff and each group to be supervised by a dedicated skilled personnel to ensure on job training iii) Encourage job on training through observation and trial under supervision
		Erosion of the top soil and reservoir sedimentation	Disturbed top soil in the area due to use of heavy machinery may lead soil erosion consequently silting the stream and if not checked can be the impact can be significant. To minimise soil erosion the following measures will be undertaken. Reforestation elsewhere. Carryout reforestation of the disturbed area after construction activities	

Activity	Phase	Potential Environmental Effects/Impact	Mitigation Measures	Enhancement Measures
Dam wall and spillway construction	Operation	Pollution due to increased usage of pesticides and fertilisers	<p>The presence of a dam wall will entail increased storage of water and therefore increased agriculture usage throughout the year. Consequently more agro chemicals are likely to be used posing a risk of pollution. This impact will be low. To minimise this impact the following measures will be put in place;</p> <ul style="list-style-type: none"> • stick to recommended dosage and frequency of application of agro chemicals • ensure recommended types of agro chemicals are used • Conduct awareness campaign among communities on dangers of agro chemicals. 	
		Deterioration in Water quality	<p>This impact is expected to be moderate and measures to minimise deterioration in water quality will include;</p> <p>i) Stick to good practices of dam operation rules of ensuring minimum flows in times of low flow</p> <p>ii) Ensure removal of foreign particles (e.g. metals) but leave vegetation to allow fish breeding to provide for legal fishing</p>	
		Change in Water flow in downstream	<ul style="list-style-type: none"> • Ensure that the design has adequate design provisions to allow flow downstream even in times of dry months. • Apply standard dam operational rules • Observe water right permit regulations and requirements for the sake of downstream water right holders 	
		Encroachment of aquatic weeds	<p>Weeds may increase due to increased nutrient load. Impact will be low, nevertheless Silverlands Ranching will ensure:</p> <ul style="list-style-type: none"> • a buffer zone between the waterfront and settlement area is created • avoid discharge of any waste effluent into the dam • conduct awareness on invasive aliens aquatic weeds 	
		Deterioration of Public health	<p>Spread of mosquitoes and vectors of malaria are prone to reservoirs and immediate environs. This may threaten public health if no special attention and mitigation measures are put in place.</p> <p>i) Employ disease vectors disruption techniques such as regulated reservoir operation to curb vectors for malaria and water borne diseases.</p> <p>ii) Encourage natural aquatic life that takes care of mosquito larva as part of the food chain</p>	

Activity	Phase	Potential Environmental Effects/Impact	Mitigation Measures	Enhancement Measures
Dam wall and spillway construction	Operation	Dust Pollution	Dam construction normally takes place in the dry season which is well known for dust circulation thus posing a danger to human health. Proposed mitigation measure will include i) Undertake watering of the area and surroundings regularly during construction stage	
		Danger to Human Safety	Increase in population of crocodiles in the dam may be a possibility and may pose a low impact on human safety. To minimise this developer proposes to; i) Conduct awareness campaigns among the community ii) ensure that safe recreation activities and sustainable fishing methods are used	
Equipment mobilisation and operation	Construction	Loss of wildlife habitat, indigenous flora and fauna	There is not much wildlife habitat or indigenous fauna and flora left in the area. Instead, impoundment of the reservoir is expected to promote aquatic life as well as other small animals. The developer proposes to i) encourage natural restocking of the area by educating the locals on the benefits of conserving nature ii) Discourage cutting of trees and unnecessary clearing of vegetation within the area.	
		Erosion of the top soil	This impact is high. The following measures are proposed i) limit use of heavy machinery to designated areas ii) avoid unnecessary clearing of the vegetation iii) rehabilitate heavily disturbed areas	
	Operation	Reservoir sedimentation	Soil erosion mainly of top soil may lead to sedimentation of reservoir if not checked. To avoid this developer proposes to; i) Ensure a buffer zone is created between the water front and occupied areas of human settlement and agricultural activities. ii) avoid unnecessary clearing of the vegetation	
		To Soil and Water Pollution due to oil spills	Not well maintained or serviced machinery usage may lead to leakages thus polluting soils and consequently water resources. To minimise this; i) ensure all machinery and equipment is regularly maintained ii) limit servicing and repair of machinery and equipment to designated areas iii) dispose any used oil at a designated place in accordance with the law	

Activity	Phase	Potential Environmental Effects/Impact	Mitigation Measures	Enhancement Measures
Dam wall and spillway construction	Operation	Skills Transfer to Locals		Employing as many local people as possible will enhance skill transfer thus building human capacity in the area. This impact will be high and to enhance it the following measures will be taken i) adopt a deliberate policy of giving employment priority to locals ii) design on job training programmes iii)ensure skilled manpower is employed
		Dust Pollution	Dust pollution is expected since the project implementation will take place during the dry season, well known for dust circulation. Measures to minimise this impact will include; the project site will regularly be watered using an interval of two to three hours interval depending on intensity of sunshine	
Borrow pit operation, materials handling and rehabilitation	Construction	loss of productive land, historical and cultural sites	No historical or cultural sites are expected to be lost. However, agricultural land will be affected though relatively of low significance. Mitigation Measures will include; rehabilitation of affected areas through reforestation	
		Loss of wildlife habitat, indigenous flora and fauna	No direct interference with any existing wildlife reserves or national parks is expected. However, limited loss of wildlife habitat and flora is expected. Undertake reforestation of affected areas by planting plant species carefully selected to avoid introducing invasive alien species. Both exotic and indigenous plants will be considered for planting in consultation with experts from the Forestry Department	
		Loss of Cultural Sites	No cultural site is reported at the proposed site and as such none is likely to be affected. Should any site be discovered during operation the matter will be brought to the attention of the relevant authorities	
	Operation	Erosion of the top soil and reservoir sedimentation	Use of heavy machinery may cause soil erosion causing siltation and sedimentation of rivers/ reservoirs in the Catchment if not controlled. The following measures are proposed; I) Restrict movement of vehicles and equipment to designated areas II) Restrict clearance of vegetation to critical areas	

Activity	Phase	Potential Environmental Effects/Impact	Mitigation Measures	Enhancement Measures
Inundation of productive land	Construction	loss of productive land, historical and cultural sites	No historical and cultural sites were reported to be located within the project area. However, loss of agricultural land belonging to the project proponent though relatively small is expected.	
	Operation	Loss of wildlife habitat, indigenous flora and fauna	Years of human activity in the area has depleted wildlife habitat, flora and fauna. Nonetheless, the developer will i) restrict unnecessary cutting of trees and clearing of vegetation to areas ii) conduct awareness campaigns on the benefit of conserving nature. Employ retired ZAWA officers to help with conservation of wildlife	
		Increased Fish Production		Though fish mortality may be high initially, fish production is expected to increase significantly with time in the reservoirs. To enhance this developer will; i) encourage natural fish restocking of the reservoir and stream ii) Promote use of sustainable methods of fishing
		To Danger to Human Safety	The dam may result in an increase in population of crocodiles in the dam posing adanger to the local people. To minimise this, the developer will i) conduct awareness campaigns on the dangers of human animal conflict ii) promote safe recreational activities and fishing methods	
Change in stream flow regime and water quality	Operation	Deterioration in Water quality in downstream reaches of the stream	Impoundment may increase or decrease (dilution) the pollutant load of receiving waters while withdraws may indirectly lead to an increase of the pollutant loads affecting water quality. Measures will include; i) Observe standard dam operation rules ii) Ensure minimum flows downstream at all times	
		Change in Water flow downstream reaches of the stream	Luezi River will not be completely impounded but will allow environmental flows for both the ecosystem and any other activity that may be undertaken downstream at any given time. Measures will include; i) Ensure that excess flow during summer season is harnessed; ii) Observe Water Right regulatory requirements	

Activity	Phase	Potential Environmental Effects/Impact	Mitigation Measures	Enhancement Measures
Change in stream flow regime and water quality	Operation	Encroachment of aquatic weeds and water quality of the reservoirs	The aquatic ecosystem in newly constructed reservoirs is very unstable and water is often eutrophic as a result of the inundation of fertile land. To minimise this, the developer will; i) conduct awareness campaigns among the staff and community on the dangers of invasive aquatic weeds ii) Promote sustainable fishing methods iii) Minimise nutrient loading through effective usage of agro chemicals	
Change in groundwater level and quality	Operation	Increase in Groundwater Level	Generally, the project area has poor groundwater yield. The developer will enhance increase in groundwater level by i) Impound Luezi River to promoting percolation of water to deeper levels. ii) Ensure that the dam is constructed to standard design ensuring that there is no dam wall seepage thus minimizing losses while increasing retention time for percolation Generally, the project area has poor groundwater yield	
		Deterioration in Groundwater Quality	Decay of organic matter mainly from vegetation can impact on the water quality in the reservoir and in turn lead to contamination of groundwater. The developer will ensure that i) remove foreign matter (e.g. matters, solid waste) and leave vegetation ii) regulate use of agro chemicals to maintain water quality in the reservoir	
Waste management	Construction	Pollution due to solid waste	Solid waste in form of rubble and litter is expected during construction. The developer will ensure that i) waste is collected at selected points for proper disposal at a designated area ii) Some of the rubble will be used for compaction in the construction of the dam wall	
		Deterioration in Water quality due to liquid waste	Water quality can be affected by receiving untreated human waste. The developer will i) provide portable sanitation facilities for construction workers	
		Threat to Human Health	Water pollution due to indiscriminate disposal of waste may lead to water borne diseases. To minimise this i) encourage the community to have their own household pit latrines ii) Conduct awareness campaigns among the staff and the community.	

Activity	Phase	Potential Environmental Effects/Impact	Mitigation Measures	Enhancement Measures
Socio-economic and cultural	Construction	Displacement of people	No mitigation measure is required since no single household is expected to be affected due to inundation resulting from dam and spillway construction	
		loss of productive land, historical and cultural sites	No mitigation is required for loss of historical and cultural sites since none are located within the impoundment area. However, loss of agricultural land belongings the project proponent is expected. Nonetheless the developer will take the following measures; i) Take a precautionary measure i.e. should any effect of historical nature be discovered during construction, relevant authorities will be notified immediately	
		Loss of wildlife habitat, flora and fauna	The project area has been subjected to years of human activities such as agriculture and charcoal burning and as such not much wildlife habitat, flora and fauna is left. Therefore this impact will be low. However, the following mitigation measures are proposed i) Limit clearance of vegetation only to critical areas ii) Conduct awareness campaigns among staff and community on the need to conserve nature iii) Adopt strict good practices in conservation	
		Employment Opportunities		Construction of a dam creates opportunities for jobs mainly for the local communities. It is expected that the project will employ 160 men and 60 women and .Local people will be given priority for employment as a deliberate company policy
		Increase in Local Population	During the construction, skilled personnel will add on to the population of the local community. There is also a possibility that the community will receive an influx of labourers looking for employment which will further add on to the local population. Measures will include) Adopt selective employment opportunities targeting locals, ii) Ensure adequate facilities are provided for staff such as sanitation facilities;	
		Increase in Local Economic Activities		It is also expected that the presence of a dam will result in more fish production and other trading activities in the area. To enhance this developer will ensue that the irrigation scheme is operated in a professional manner.

Activity	Phase	Potential Environmental Effects/Impact	Mitigation Measures	Enhancement Measures
Socio-economic and cultural	Construction	Loss of Social & Cultural Infrastructure	No social or cultural infrastructure will be inundated and therefore no mitigation is required	
		Employment Opportunities		Construction of a dam creates opportunities for jobs mainly for the local communities (160 men and 60 women will be employed). To enhance this, the developer will ensure that the irrigation scheme is operated in professional manner. Promote formation of small holder schemes to be run by small scale farmers within the community
		Increased Fish Production		Though fish mortality may be high initially, fish production is expected to increase significantly with time in the reservoirs. To enhance this, the developer will; i) ensure only sustainable methods of fishing are used ii) sensitise the community on the dangers of using unconventional methods of fishing
		Economic Growth		Reliable water supply throughout the year will effectively enable farmers to increase their production levels to satisfy local demand while at the same time contribute generally to economic growth. To enhance this, the developer will ensure effective management of the irrigation scheme

Activity	Phase	Potential Environmental Effects/Impact	Mitigation Measures	Enhancement Measures
Socio-economic and cultural	Operation	Increase in Local Population	During the construction, skilled personnel will add on to the population of the local community. There may also be an influx of labourers looking for employment. Measures will include; give priority for employment to local people	
		Increase in Local Economic Activities		Dam construction will provide temporary employment to the local people as well as fishing and other trading activities. To enhance this, the developer proposes that the irrigation scheme is operated in a professional manner.
		Skills Transfer to Locals		Skills transfer through employment of local people will enhance human capacity building in the area. To enhance this, the developer will develop a programme for on job training
		Threat to Human Health		Dam construction will also expose the community to the non-local people which may lead to the spread of HIV/AIDS and other STIs. Measures to minimise this will include; i) sensitise staff and community on the dangers of HIV/AIDs and STIs ii) support local programmes by Ministry of Health regarding HIV/AIDs
		Danger to Human Safety	Crocodile population may increase in the stream and reservoir and may expose the community to crocodile attacks. To minimise this, the developer will conduct awareness campaigns among the public.	
		Limited Mobility of Community Members	The dam is likely to isolate some area of the catchment due to inundation. This may impact on mobility of people and animals. The developer will ensure that mobility of the people is guaranteed by building bridges if necessary at appropriate selected points where the local people often cross the river.	

Activity	Phase	Potential Type of Impact	Mitigation Measures	Enhancement Measure
<i>Physical and Chemical Impacts</i>	Operation	<ul style="list-style-type: none"> Changes to downstream hydrologic regime Changes in groundwater recharge 	Regular monitoring of the changes in the riverine hydrology during the decommissioning period	
		<ul style="list-style-type: none"> Changes to stream channel hydrogeometry Changes to stream slope Changes to retention time of water and sediment Streambed degradation upstream of impoundment Change in channel type upstream of impoundment Re-exposure of natural physical characteristics (e.g., ledge, boulders) Exposure of manmade physical characteristics (e.g., pipeline) Transport and deposition of woody debris 	Regular monitoring of the changes in the riverine hydrology during the decommissioning period	
		<ul style="list-style-type: none"> Change in flood elevations upstream of dam Change in flood elevations downstream of dam 	Maintain public awareness and provision of flood early warning system in case of any eventualities.	
		<ul style="list-style-type: none"> Rate of stream bank sloughing/bank failure Amount of stream bank sloughing/bank failure Location of stream bank sloughing/bank failure 	Ensure vegetation is maintained along the banks and reinforce this with replanting of vegetation along streams	
		<ul style="list-style-type: none"> Change in wetland extent Change in wetland community(ies) Change in wetland function(s) 	Ensure protection of the resultant wetlands	
		<ul style="list-style-type: none"> Change in retention time for carbon and nutrients Change in rates of biogeochemical reactions (e.g., plant uptake, nitrification, denitrification, anaerobic/aerobic sediment/water interface) 	Initiate water quality monitoring on the basic ambient water quality parameters in the reservoir to meet the applicable parameters of water quality standards.	
<i>Ecological Impacts</i>		<ul style="list-style-type: none"> Altered hydrology may affect aquatic habitats and organisms Altered morphology may affect aquatic habitats and organisms Altered water quality may affect aquatic habitats and organisms 	Observe standard dam operation rules	

		<ul style="list-style-type: none"> • Altered sediment transport and deposition may affect aquatic habitats and organism • Diurnal and seasonal affects due to altered physical and chemical conditions of aquatic habitat. • Reconnection of stream segments may affect fish movement and fecundity (for both migratory and resident species) • Alterations may affect various life stages of aquatic organisms 		
		<ul style="list-style-type: none"> • Change in areal extent of aquatic and terrestrial vegetative communities upstream of dam • Change in type of aquatic and terrestrial vegetative communities upstream of dam • Change in type of aquatic and terrestrial vegetative communities downstream of dam • Succession of vegetative communities due to hydrologic changes • Alterations in the location of erosion and deposition of sediment may affect vegetative communities • Change in viability of non-native and/or invasive species • Change in the fish population 	<p>Minimise plants (trees and shrubs) to be removed and provide compensation plantation when necessary.</p> <p>Establish a controlled vegetated buffer zone upon completion of the dam</p>	

8. Environmental and Social Management Plan (ESMP)

ESMP involves the protection, conservation and sustainable use of the various elements or components of the environment. The ESMP for the propose Luezi dam project provides all the details of project activities, impacts, mitigation measures, time schedules, costs, responsibilities and commitments proposed to minimize environmental impacts of activities, including, monitoring and evaluation and environmental audits during implementation and decommissioning phases of the project.

The ESMP is a very important output of an ESIA since it provides a framework or checklist for project monitoring and evaluation/audit. Mitigation measures provided in this chapter are aimed at making changes in any of the following ways: project materials, raw materials, project sites to mention but a few.

8.1 Objectives

The objectives of the ESMP include the following:

1. To bring the project into compliance with applicable national/international, social and legal requirements, social policies and procedures.
2. To outline mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts, or enhance the project beneficial impacts.

8.2 Responsibilities

In order to ensure accountability and protect the environment from unnecessary degradation, specific people must be accorded responsibilities to ensure that all activities are carried out within the set out limits and that environmental standards are maintained. The Water Board has the responsibility of ensuring the successful construction and maintenance of the proposed project infrastructure. This can be achieved by making sure that the contractors have the necessary competence to carry out this work. The supervising engineer must ensure that contractors perform their duties up to the specified standards and that they adhere to the mitigation measures stated in the EMP and Environmental Health and Safety (EHS) provisions. The following entities will be involved in the implementation of this ESMP.

- Environmental consultants.
- Water Board
- Zambia Environment Management Agency (ZEMA)

8.3 Environmental monitoring, audits and training

Environmental monitoring and audits are essential in a project's life span as they are conducted to establish if project implementation has complied with set environmental management standards for Zambia as spelt out in EMA 2011 and the Environmental Assessment regulations. In this Project, environmental monitoring and audit will be conducted to ensure that identified potential negative impacts are mitigated during the project's implementation, operation and decommissioning periods. Environmental concerns, that will be monitored and audited during the project's construction and maintenance period include:

- Water quality
- Air Pollution,
- Occupational health and safety (including worker accidents and hazards),
- Soil erosion,
- Socio-cultural changes;
- Dust and gaseous emissions;
- Populations of disease vectors and
- Socio-economic benefits.

8.4 Monitoring Data

Regular sampling for observation and monitoring should be undertaken in the dam points and compared against water quality standards.

8.5 Health and Safety Plan

Silverlands Zambia will adopt internationally accepted occupational health and safety standards and procedures in close association with national occupational health and compensation regulations to safeguard its workforce and the public in general. This will help to provide an accident free environment, which will benefit employees and Management. The most fundamental OHS measures to be implemented are outlined in the following sections.

Occupational health and safety is a cross-disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment. The goal of all occupational health and safety programs is to foster a safe work environment. As a secondary effect, it may also protect co-workers, suppliers, nearby communities, and other members of the public who are impacted by the workplace environment. It should be site specific to fully cater for the issues that might pose a risk to the workers on the site and the nearby communities.

Apart from observing the requirements of the law on health and safety it is paramount to establish safe working practices and policies. It is also important to establish effective health and safety procedures for all the activities planned to be undertaken. All actors involved should be aware of and identify potential hazards. However everyone involved is held responsible to use a common sense safety approach in the work environment and report to the relevant authority any hazard that has been created but not addressed.

Table 33: Health and Safety Plan

Anticipated Impacts	Mitigation Measures	Location	Responsibility	Time Frame /Frequency
Accidents	<ul style="list-style-type: none"> • Ensure good housekeeping by the contractor • Establish the appropriate safety measures for the construction phase, • Ensure a perimeter fence is constructed on most risk areas (pump house, dam area) of the dam to avoid drowning • Safety signs should be put up • Isolate the construction sites from the general public, • Ensure safety of the construction workers by putting first aid area and injury reporting mechanism • Fire fighting equipment should be easily accessible and in good condition. • Public education and awareness for local communities and workers regarding personal safety measures. • Restrict settlement in flood plains • Proper understanding of geotechnical survey reports before commencement of construction, blasting or excavation activities • Ensure proper handling of hazardous substances to avoid spillage 	Access roads and dam area	SRL and Contractor	During construction, Implementation and decommissioning
	<ul style="list-style-type: none"> • Establish the appropriate safety measures in the O & M manual for the operation phases. • Ensure safety of residents by providing safety signs at strategic places around the dam access roads. • Ensure compliance to Occupational Safety and Health standards 	Dam area	Contractor	During construction
Noise and Vibration	<ul style="list-style-type: none"> • Notification of the residents on unusual noise and vibration levels during construction, • Construction need to be limited during the daytime only, • Maintain vehicles and equipment well to avoid unnecessary noise and vibration. • Construction of perimeter wall around dam construction and excavation site to reduce noise emitted. • Workers to be provided with safety clothing capable of absorbing noise and excessive vibrations • Use of improved equipment that emits less noise and vibration • Compliance with occupational Safety and Health 	Dam area	Site manager/Contractor	During construction and decommissioning

Anticipated Impacts	Mitigation Measures	Location	Responsibility	Time Frame /Frequency
Sexually Transmitted diseases	<ul style="list-style-type: none"> • Ensure sexually transmitted diseases public awareness and education to both workers and local communities. • Enhance accessibility to health services • Encourage local workforce and provide for leave to workers working away from their families for longer periods. 	Dam area	Contractor and SRL	During construction
Air Pollution	<ul style="list-style-type: none"> • Construction need to be limited during the daytime only • Ensure dump conditions as much as possible during excavations and earth moving, • Construction machinery be maintained in good working conditions, • Construction materials be maintained covered whenever possible, • Local communities shall be informed on anticipated emissions for preparedness. • Planting of vegetation around the dam to reduce CO² produce from decomposition of organic matter in the dam, • The workers shall be provided with protective clothing like masks and goggles. 	Dam area	SRL, Site manager/contactor	During construction, Implementation and decommissioning
Water Pollution	<ul style="list-style-type: none"> • Ensure appropriate waste water discharge from construction site and worker's camps. • Remove foreign matter and leave vegetation before operation. • The hygiene and sanitation standards within the construction site shall be improved and maintained • Public awareness and capacity building among workers and local community in regard to personal hygiene practice. • Planting of vegetation around the dam and increased soil conservation • Initiate water flow monitoring programme. 	Dam area	SRL and contactor	During construction, Implementation and decommissioning

8.6 Environmental Management Plan

8.6.1 Management Plan Principles

This proposed Luezi dam project is geared towards meeting the water demand for irrigation of pasture and crops within Silverlands Ranching Farm. The project will observe environmental conservation requirements in accordance with the established laws and regulations. To realize this goal, an Environmental Management Plan (EMP) has been prepared. Major factors that were considered in this EMP include;

- Enhancing integration of environmental, social and economic functions in the project implementation.
- Compensation or appropriate acquisition process of any land and/or property affected by the project in accordance with the laid down guidelines.
- Ensuring water resources conservation throughout the project area and downstream.
- Ensuring soil erosion control and prevention of siltation into the water sources.
- Ensuring prevention of pollutants discharge into the water sources, and
- The contractors and other players in the project activities will be required to implement the EMP through a sustained supervision and continuous consultations.

8.6.2 Environmental and Social Management Plan

The matrices below outlines the action plans and responsibilities on negative impacts anticipated from the project activities. The matrices are clustered into construction and operation of the project.

Table 34: EMP on Social Aspects

Environmental Issue	Action Required	Responsible Party	Time Frame	Estimated Cost (ZMW)
Involuntary Resettlement	N/A	N/A	N/A	N/A
Local Economy such as Employment & Livelihood	<ul style="list-style-type: none"> Impress upon the contractor(s) to utilize local labour Wherever possible construction materials will need to be sourced from the locality 	SRL and Contractor	Throughout construction and operation phases	60, 000
Land Use & Utilization of Local Resources	<ul style="list-style-type: none"> Rehabilitate the vegetation around the dam as much as possible. Involve the landowners in the neighbourhood on wise land use practices that will also contribute to the protection of the dam from siltation 	SRL and Contractor	Once during construction Throughout operation phase	200, 000
Water Usage or Water Rights& Rights of Common	<ul style="list-style-type: none"> Adopting the established water resources management rules, Institute a liaison committee to provide an accessible communication channel between the community and SRL/Government 	SRL	Throughout operation phase	40,000
Sanitation	<ul style="list-style-type: none"> Appropriate waste water and waste management shall be implemented for the construction site and worker's camps 	Contractor	Throughout the construction phase	20, 000

Environmental Issue	Action Required	Responsible Party	Time Frame	Estimated Cost (ZMW)
Hazards, Risks & Infectious Diseases such as HIV/AIDS	<ul style="list-style-type: none"> • Ensure compliance with regulations occupational health and safety regulations during construction • Provide safety gear to the construction workers and ensure application at all times, • Isolate safety risk areas and work camps from the public, • Collaborate with other players in community training and sensitization on disease control during construction 	Contractor	Throughout the construction phase	50,000
	<ul style="list-style-type: none"> • Provide necessary awareness and information to the communities on dam safety aspects, 	SRL	Throughout the operation phase	40,000
Total				310,000

Table 35: EMP on Physical Environment

Environmental Issue	Action Required	Responsible Party	Time Frame	Estimated Cost (ZMW)
Landscape	<ul style="list-style-type: none"> During construction, provide temporary walls and landscaping for the dam site if necessary, Ensure the contractor to use approved material/disposal sites and rehabilitate the sites appropriately. 	Contractor	Throughout the construction phase	70, 000
Fauna, Flora and Biodiversity	<ul style="list-style-type: none"> Minimise plants (trees and shrubs) to be removed and provide compensation plantation when necessary, Establish a controlled vegetated buffer zone upon completion of the dam 	Contractor	Throughout the construction phase	80, 000
Soil Erosion	<ul style="list-style-type: none"> Buffers would be developed and terracing will be implored were appropriate Apply restoration, vegetation and reforestation to exposed areas 	Contractor	During construction and operation stage	50, 000
	<ul style="list-style-type: none"> Encourage vegetation along the main stream to intercept additional silt (if any) during construction and operation, Encourage vegetation around the dam buffer zone to control soil loss, 	SRL and other conservation organisations	Throughout construction/ operation phase	15, 000
Groundwater	<ul style="list-style-type: none"> Observe the groundwater change by regular site visits/ communications through local governmental officers/leaders as an overall project monitoring. 	SRL	Throughout the operation phase	20, 000
Hydrological Situation	<ul style="list-style-type: none"> Monitor the flow trends of Luezi and Kalomo Rivers over time. 	SRL in cooperation with Water Affairs department and Water Board	Monthly during the operation phase	18, 000
	<ul style="list-style-type: none"> Ensure that minimum flows Luezi River are maintained at all times in accordance with Water Resources Management Rules. 	SRL	Throughout the operation phase	No direct cost estimated
Proliferation of aquatic weeds in reservoir and downstream Impairing dam discharge, Irrigation Systems, fisheries and Increasing water loss through transpiration	<ul style="list-style-type: none"> Remove foreign matter from the area and leave vegetation within the inundation zone prior to flooding Regulation of water discharge and manipulation of water levels. 	SRL	During operation phase	60, 000

Environmental Issue	Action Required	Responsible Party	Time Frame	Estimated Cost (ZMW)
Formation of sediment deposits at reservoir entrance creating backwaters effects, flooding and water logging upstream	<ul style="list-style-type: none"> Sediment flushing and sluicing 	SRL – Farm Manager	On-going during operation phase of project	60, 000
Loss of vegetation due to road Construction and Borrow Pits	<ul style="list-style-type: none"> Minimum access roads and borrow pits will be constructed. Many roads will be confined to existing cattle and farm paths 	Contractor/Site Manager	During dam construction	30, 000
Loss of wildlife and wildlife habitat	<ul style="list-style-type: none"> Undertake to revegetate disturbed areas 	Contractor/Site Manager	Upon commencement of dam filling	20, 000
Conflicting demand for water use, distortion of flow patterns and sediment loads of river	<ul style="list-style-type: none"> use of recommended devices to be taken care of during design of dam Planning and management of dams will be in context of existing laws and regulations 	Water Board (Permits from Water Board)	After completion and approval of ESIA by ZEMA	No cost estimated
Deterioration of Water Quality in Reservoir	<ul style="list-style-type: none"> Remove foreign matter and leave only vegetation from inundation zone prior to flooding Control of land uses, wastewater discharges though very limited or none at all Controlled and effective agricultural chemical use in watershed 	Contractor	Prior to filling of the dam	20, 000
Poor land use practices in Catchment areas above reservoir resulting in increased siltation and changes in water quality.	<ul style="list-style-type: none"> Buffer zone created to limit the distance of fields. Adhering to the Agricultural Act of last 50m away from the water body. 	Contractor and SRL	Before dam construction and after	40, 000
Total				583, 000

Table 36: EMP on Environmental Pollution

	Mitigation	Target Area	Responsibility	Frequency	Cost (ZMW)
Air Pollution	<ul style="list-style-type: none"> • Construction need to be limited during the daytime only • Ensure dump conditions as much as possible during excavations and earth moving, • Construction machinery be maintained in good working conditions, • Construction materials be maintained covered whenever possible, 	Dam area	Contractor	Throughout the construction phase	20, 000
Water Pollution	<ul style="list-style-type: none"> • Ensure appropriate waste water discharge from construction site and worker’s camps. • Remove foreign matter from the area and leave vegetation within the inundation zone prior to flooding. 	Dam area and including the tunnels	Contractor	Throughout the construction phase	12, 000
	<ul style="list-style-type: none"> • Initiate water quality monitoring on the basic ambient water quality parameters in the reservoir to meet the applicable parameters of water quality standards (for domestic water/irrigation water) of ZEMA. 	Dam area	SRL (examination of some parameters)	Twice a year at minimum, rain and dry seasons	20, 000
	<ul style="list-style-type: none"> • Enhance guided application of agrochemicals such as Integrated Pest Management (IPM) in the neighbouring farms by providing training and seminars for farmers 	Area around the Dam	SRL	Once a year at minimum	30, 000
Waste	<ul style="list-style-type: none"> • Contractor will be required to provide an adequate waste management mechanism to construction sites and worker’s camps, • Categorize wastes into inert materials and others for safe disposal. Inert materials (concrete residuals& earth) may be used on local access roads, • Other waste materials to be disposed off into the approved disposal site. 	Entire dam area and including the tunnels	Contractor	Throughout the construction phase	50, 000

	Mitigation	Target Area	Responsibility	Frequency	Cost (ZMW)
Noise and Vibration	<ul style="list-style-type: none"> • Construction need to be limited during the daytime only, • Notification of the residents on unusual noise and vibration levels during construction, • Maintain vehicles and equipment well to avoid unnecessary noise and vibration. 	Entire dam area	Contractor	Throughout the construction phase	20, 000
	<ul style="list-style-type: none"> • Compliance to the Environmental Management Act (EMA), Occupational Safety and Health standards. • Ensure the contractor will comply with all legislation (such as ZEMA and international standards) for the noise and vibration emitted from construction works. 	Entire dam area	Contractor/SRL	Monthly during construction	No estimate of cost
Accidents	<ul style="list-style-type: none"> • Establish the appropriate safety measures for the construction phase, • Isolate the construction sites from the general public, • Ensure safety of the construction workers • Establish the appropriate safety measures for the construction phase, • Isolate the construction sites from the general public, • Ensure safety of the construction workers 	Entire dam area and along the tunnels	Contractor	Throughout the construction phase	15, 000
	<ul style="list-style-type: none"> • Ensure safety of residents by providing safety signs at strategic places around the dam and canals. 	Entire dam area and	SRL	Throughout the operation phase	12, 000
Total					219, 000

9. ENVIRONMENT HEALTH AND SAFETY (EHS)

The EHS is a broader and holistic aspect of protecting the worker, the workplace, the tools / equipment and the biotic environment. It is an essential tool in determining the ESIA study. The objective of the EHS on the proposed project is to develop rules that will regulate environmentally instigated diseases and occupational safety measures during construction and operation phases of the proposed project by:

- Avoidance of injuries
- Provision of safe and healthy working environment for workers comfort so as to enhance maximum output.
- Control of losses and damages to plant, machines, equipment and other products.
- Enhance environmental sustainability through developing sound conservation measures.

9.1 Policy, Administrative and Legislative Framework

It is the primary responsibility of the contractor to promote a safe and healthy environment at the workplace and within the neighbourhood in which the proposed project will be constructed by implementing effective systems to prevent occupational diseases and ill-health, and to prevent damage to property. The contractor will prepare an EHS management plan. The EHS Management Plan when completed will be used as a tool and a checklist by the Ministries of Health and Sanitation, Water and Irrigation, Labour and the contracted engineers in planning and modification of the construction of the proposed project infrastructure where possible.

9.2 Organization and implementation of the EHS Management Plan

The contractor shall use the EHS plan at the proposed project site both during construction phase and SRL will be responsible during operation phase of the project. The Guiding Principles to be adopted by the contractor

The company will be guided by the following principles: -

- It will be a conscious organization committed to the promotion and maintenance of high standards of health and safety for its employees, the neighbouring population and the public at large.
- Ensuring that EHS activities are implemented to protect the environment and prevent pollution.
- Management shall demonstrate commitment and exercise constant vigilance in order to provide employees, neighbours of the project and the environment, with the greatest safeguards relating to EHS.
- Employees will be expected to take personal responsibility for their safety, safety of colleagues and of the general public as it relates to the EHS management plan.

Contractors

The EHS management plan code of practice shall be applicable to the contractors working in the premises, and shall be read and signed. It shall be incorporated into the contract to perform work. This should also remind the contractor of his/her;

- Legal requirements
- Statutory obligations
- Obligation to lay-down a system for reporting accidents
- Responsibility to ensure that his employees are supplied with personal protective equipment and where applicable as per the EHS management plan for the whole project.
- Responsibilities as it relates to contracting an EHS consultant in liaison with the proponent
- Obligation to ensure that he obtains detail of jobs and necessary work permits be obtained.

9.3 Safety requirement at the project site during construction and operation Period

The contractor

The contractor will ensure that:

- Safe means of entry and exit exist at the proposed project site.
- Ensure adequate briefing of job at hand on the safe system of work before commencement of work
- The EHS coordinator must be in attendance at all times throughout the duration of the project.
- Constant assessment of the risk involved as the work progresses must be maintained by the EHS consultant
- A safety harness must be worn before entry into all confined spaces

The Traffic / Drivers

Within the construction premises, the following traffic rules will be observed: -

- Observe speed limits and all other signs and obey traffic rules.
- Use the vehicle for the purpose to which it is intended only.
- Maximum speed limit within the project site will be 10km/hr for both operation and personal vehicles.

9.4 Emergency procedure during construction and operation

An emergency situation means:

- Unforeseen occurrences resulting in serious or fatal injury to employed persons or the neighbouring communities
- Fire or explosion.
- Collapse of dam walls or major work.
- Natural catastrophe.

In the event of such an emergency during construction, the workers shall:

- Alert other persons exposed to danger.
- Inform the EHS co-coordinator.

- Do a quick assessment on the nature of emergency.
- Call for ambulance.

When emergency is over the EHS coordinator shall notify the workers by putting a message: “ALL CLEAR”

In the event of such an emergency during operation the workers shall:-

- Alert other persons exposed to danger.
- Ring the nearest police station
- Call for an emergency response team.

9.5 Ambient Factors in the Workplace

The contractor and SRL shall ensure that the recommended levels for noise limits, vibration, hazardous materials sanitation levels and measures to eliminate/control hazards are adhered to in line with the provision of the national and international legislations.

9.6 Training and Documentation

The project beneficiaries shall ensure that workers, prior to commencement of new assignments have received adequate training and information enabling them to understand the hazards of work and to protect their health from hazardous ambient factors that may be present. The training must cover the following area:

- Knowledge of materials, equipment and tools
- Known hazards in the operations and how they are controlled
- Potential risks to health
- Precautions to prevent exposure
- Hygiene requirements
- Wearing and use of protective equipment and clothing
- Appropriate response to operation extremes, incidents and accidents

Table 37: Prevention and Management of Foreseeable Accidents

Anticipated Impacts	Mitigation Measures	Location	Responsibility	Time Frame /Frequency
Flooding	<ul style="list-style-type: none"> • Maintain public awareness and provision of flood early warning system in case of any eventualities. • Ensure routine inspection and regular maintenance of the dam embankment. 	Dam area	SRL and contractor	During Construction, implementation and decommissioning
Vehicular Traffic Accidents	<ul style="list-style-type: none"> • Ensure safety of residents by providing safety signs at strategic places around the dam access roads and barricading of the working area. • Provision of safety driving training to all project drivers • Imposing and controlling speed limits for all construction vehicles. • Public awareness and education on personal safety 	Dam area	contractor	During construction
Spillage of hazardous substances	<ul style="list-style-type: none"> • Proper management and handling of gasoline products used by machines at the site • Ensure appropriate maintenance of machines to avoid spillage 	Dam area	Contractor	
Injuries related to construction work or falling materials and debris	<ul style="list-style-type: none"> • Daily and weekly safety briefing including inspection of jobsites and correcting of noted deficiencies • Hand and power tools and similar equipment shall be maintained in safe condition and inspected prior to use. • The contractor shall ensure that a fall protection work plan has been developed and implemented during dam embankment construction • Appropriate personal protective equipment shall be identified, provided, and used for the safe operation of hand/power tools where need be. • The contractor shall ensure that workers working in excavations are protected from cave-ins by an adequate protective system • Daily clean-up of the working area shall be ensured to reduce injuries from overcrowded floors; this shall apply also to storage of materials and equipment in stores. 	Dam area	Contractor	During construction and decommissioning
Drowning	<ul style="list-style-type: none"> • Ensure safety of workers through awareness, safety training and safety clothing. • Public awareness and education to local communities and training of volunteer community rescuer/ first aider. 	Dam area	Contractor and SRL	During construction and Operation

Anticipated Impacts	Mitigation Measures	Location	Responsibility	Time Frame /Frequency
Fire/ Explosions	<ul style="list-style-type: none"> • All flammable liquid containers shall be adequately labelled with appropriate signs and kept safely away from direct heat or fire. • Fire fighting equipment shall be put in easily accessible areas known to every worker. • Fire assembly area shall be established with appropriate signs. • All workers and the general public shall be educated and trained on how to respond in the event of a fire incidence. • The contractor shall ensure that first aid volunteers are trained and availability of first aid kit that is easily accessible at the site. 	Dam area	Contractor	During construction and decommissioning

10. DECOMMISSIONING

This phase takes place during the final phase of a project life-cycle, but a degree of environmental planning is necessary before any decommissioning activities should be allowed to commence. The reason for this is that a project earmarked for decommissioning has in all likelihood been operational for some time, and as such, the environment within which it lies has stabilised in response to the presence of the associated infrastructure, activities and facilities. The decommissioning of one or all components of such a project would therefore have an effect on the environmental status quo, either in a positive or in a negative way (TCE, 2012).

10.1 Purpose and objectives of decommissioning

The generally accepted purpose of decommissioning is the release of valuable assets such as machinery and sites for alternative use, recycling and reuse of materials and the restoration of environmental amenity. In all cases, the basic objective is to achieve an end-point that is sensible in technical, social and financial terms, that properly protects workers, the public and the environment and, in summary, complies with the basic principles of sustainable development. Stringent regulatory controls protect the public, the environment and workers from the hazards associated with decommissioning activities.

During the past decade, dam removal has emerged as a major environmental management issue. Removal of unneeded dams is often promoted under the assumption that dam removal will be inherently beneficial because the dam presence is detrimental to aquatic ecosystems. While dam removal can benefit many components of local ecosystems, removing a dam may also result in detrimental impacts.

It is easier to decommission small dams (of height 6m) (AASHTO, 2005). The time and cost to remove a large dam (like Luezi dam) are substantial (Wik, 1995), and removal may cause unanticipated environmental damage with uncertain long-term benefits. Removal of dams has different impacts, beneficial and adverse, including physical and chemical, ecological, social, and economic. Removing dams can have distinct economic benefits, such as cost savings over repairing and maintaining the dam, potential for community riverfront revitalization, increased income to local fishing and boating industries, and decreased costs related to water quality improvements and fisheries management. However, these dam removal benefits may also come at a price, due to the loss of economic benefits from the dam. To determine the economic consequences of a dam removal, one has to consider different costs and benefits including those to the dam owner, society, recreation, and the environment.

The three most common reasons for dam removals are, in order of frequency, ecology, economics, and safety. In case the decommissioning issues arise for the Luezi dam, the following decommissioning plan (Table 38) will be observed. However, under this particular project as sited above, removal of the dam is very unlikely. The best option therefore, will be to ensure that the dam is made as stable as possible during the rehabilitation and closure plans. The sole purpose will be to render the dam stable and safe even after dam closure to avoid collapse. In this regard, the dam will be managed in such a way that it will be handed back to government if no alternative investor is found to buy the farm and run it profitably.

11. CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusion

Based on the various consultations, studies and findings, it is evident that the proposed Luezi dam project will be one of the biggest investments in the newly established Zimba district in Southern province. The project will result in overall economic growth and development as a result of the improvement in the availability of water storage for use especially for irrigation to boost the agriculture potential in the area.

The Project will have minimal negative impacts and most of these will occur within the project area (localized). However, the positive impacts will be many and they will be felt within the project area and beyond.

The flora and fauna impacts are associated with the habitat loss and fragmentation. Once appropriate mitigation measures and management plans are implemented, the scale and duration of the construction and operational phase impacts of the Project on terrestrial ecosystems are predicted to be minor and short-term.

In relation to areas and species of conservation significance, impacts to aquatic macrophyte, freshwater fish and aquatic fauna species of conservation significance are highly unlikely to occur as a result of the Project and no detectable or measurable impacts to the aquatic ecology of Ramsar listed wetlands are expected to occur since no Ramsar listed wetlands exist within the project area of negative impacts.

11.2 Recommendations

The following should be observed:

Minimal vegetation destruction

Ensure minimum destruction of vegetation. If possible, all project –related activities should be done within the designated project alignment areas.

Rehabilitation of quarries and borrow pits

Rehabilitate quarries, borrow and gravel pits to avoid potential health hazards.

Afforestation within dam area

Replant bare areas within the vicinity of the dam with vegetation cover to prevent soil erosion. This will help in ensuring that the dam depth is not interfered with because of siltation, grass should be planted along the edge of the dam so as to help in controlling soil erosion and siltation.

Occupational safety and Health (OSH)

Ensure that worker's occupational health and safety standards are maintained through capacity building, proper training, providing protective clothing and managing their residential camps up to the required health standards. The proponent and the contractor

therefore need to ensure all the workers wear safety devices like gas masks while in dusty working areas. Use of earmuffs must also be ensured by the contractor especially for the people working in areas where the noise level is high.

Environmental audits and monitoring

Annual environmental audits should be carried out on the dam in order to ensure compliance of the project with the mitigation measures outlined in the Environmental Management Plan (ESMP). To ensure that the impact on the environment can be completely minimized, a monitoring and training activity should be carried out as outlined in the report.

Record keeping

Dam maintenance records should be retained in a computer database to enable engineers to monitor the maintenance activities and costs.

Community participation

There is need for strengthening and promotion of the role of community groups, women and youth to fully participate in health, sanitation, water resources and environmental management and conservation.

12. DECLARATION

I do hereby attest that the information presented herein regarding the EIA for the proposed dam construction in Zimba District, Southern Province, Zambia by Silverlands Ranching Limited is correct and complete to the best of my knowledge.

I disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.



Robby Kasubika
Lead Consultant

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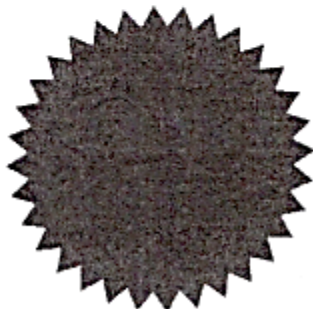
Republic of Zambia

**CERTIFICATE OF INCORPORATION
OF A PRIVATE COMPANY LIMITED BY SHARES**

(Section 10)

This is to certify that **SILVERLANDS RANCHING LIMITED** is on
and from the 6th day of November, 2012 incorporated as a private company limited by
shares.

Given under my hand and seal at Lusaka, Zambia, this 6th day of November, 2012.



L. S. Thole

Assistant Registrar of Companies

(Note that this certificate is not valid unless the official seal of the Registrar of Companies has been affixed)

0051209

Appendix 2: Approved ToRs and Letter of no objection



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In reply please quote

¹⁰⁰
ZEMA/INS/101/04/1

June 17, 2013

The Director
Silverlands Ranching limited
6 Kenilworth Road
Harare
ZIMBABWE

Dear Sir,

RE: TERMS OF REFERENCE AND SCOPING REPORT FOR THE PROPOSED CONSTRUCTION OF A DAM ON LUEZI RIVER IN ZIMBA DISTRICT.

Reference is made to the Terms of Reference (ToRs) for the proposed Construction of a Dam on Luezi River in Zimba District that you submitted to Zambia Environmental Management Agency (ZEMA) on May 13, 2013 for review in accordance with the provisions of the Environmental Impact Assessment Regulations of 1997.

Kindly be advised that the review of the ToRs indicates that the general objectives are acceptable and ZEMA therefore has **no objection** in you proceeding with the study.

Find herewith attached the **Approved ToRs**.

Please do not hesitate to contact the undersigned should there be any issue needing our attention.

Yours faithfully,

Joseph Sakala
Acting Director
ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY

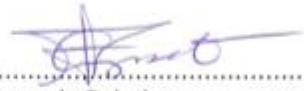
Approved Terms of Reference

The Terms of reference will include the following specialized studies with respect to their scope of works

1. Soil survey and land use planning
 - i. Physical characteristics.
 - ii. Chemical characteristics.
 - iii. Topography.
 - iv. Soil classification.
 - v. Crop production potential per type of soil.
 - vi. Preparation of a soil map.
 - vii. Land use planning.
 2. Flora and fauna study
 - i. Animal population and distribution.
 - ii. Habitat description.
 - iii. Tree species diversity and distribution.
 - iv. Tree volume, diameter and height distribution.
 - v. Classification of vegetation types
 3. Air Quality and Noise Studies
 - i. Levels of fumes and emissions
 - ii. Noise levels
 4. Ground and surface water quality
 - i. Surface water quality and availability.
 - ii. Ground water quality and availability
 5. Socio-economic study
 - i. Population and distribution.
 - ii. Existing social facilities and services.
 - iii. Social amenities
 - iv. Housing and farming inventory and mapping
-

6. HIV/AIDS. A study to determine the risk behavior in the project that may cause the spread of HIV/AIDS.

06/06/2013
Date


Joseph Sakala
Acting Director General
Zambia Environmental Management Agency



Appendix 3: Comment Response Report Form

<p style="text-align: center;">ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED LUEZI DAM PROJECT IN ZIMBA DISTRICT, SOUTHERN PROVINCE, ZAMBIA</p> <p style="text-align: center;">COMMENT SHEET</p> <p style="text-align: center;">Accompanying the Background Information Document March 2013</p>	<p style="text-align: center;">Robby Kasubika Kasumwa Enviroconsult 27 Zambezi Way, Riverside, Kitwe Tel: (+260) 979 319871 E-mail: Kasumwa@gmail.com</p>
--	--

Please complete and return to the EIA Public Consultation Office (as above) either by post or email by no later than Friday, 15 March 2013

Name:	
Position:	
Organisation:	
Postal Address:	
Telephone:	
Email:	

COMMENTS (please use separate sheets if you wish)

I suggest that the following issues of concern be investigated in the EIA:

.....

.....

.....

.....

.....

I suggest the following for the public consultation process:

.....

.....

.....

Any other comments:

.....

.....

.....

Please register the following people as I&Aps for this EIA:

.....

.....

.....

SIGNATURE:..... **DATE:**.....

THANK YOU FOR YOUR CONTRIBUTION

Appendix 4: List of Stakeholders consulted

Organization	Location
1. Zimba District Municipal Council	Zimba
2. Southern Water and Sewerage Company (SWSC)	Zimba
3. Department of Community Development	Zimba
4. Zambia Electricity Supply Cooperation (ZESCO)	Zimba
5. Zimba Mission Hospital (Ministry of Health)	Zimba
6. Ministry of Agriculture And Livestock (MAL)	Zimba
7. World Vision Zambia	Zimba
8. Department of Fisheries	Kalomo
9. Ministry of Lands	Kalomo
10. National Heritage and Conservation Commission (NHCC)	Kalomo
11. Zambia Wildlife Authority (ZAWA)	Kalomo
12. Department of Water Affairs	Kalomo
13. Forestry Department (FD)	Kalomo
Adjacent Farms to Silverlands Ranching	
14. Lion's Den Farm – Owner: Mr. J.K. Sopa	Zimba
15. Gerjon Investment Limited – Owner: Mr. J Imbwa	Zimba
16. Chiinda Machiswe Farm – Owner: Mr. D Hamanyanga –	Zimba

17. Local Community members

18. Headmen

**SILVERLANDS RANCHING LIMITED
P. O. BOX 610003
ZIMBA DISTRICT, SOUTHERN PROVINCE**

21st March, 2013

TO: _____

Dear Sir/Madam

**RE: INVITATION TO A SCOPING MEETING FOR THE PROPOSED DAM
PROJECT BY SILVERLANDS RANCHING LIMITED**

Silverlands Ranching, a Zambian registered company which is part of SilverStreet Capital, an international Group, is planning to construct a dam on the Luezi River on their ranch (formerly known as Foresyth Ranch) in Zimba District.

According to the Zambia Environmental Management Act of 2011, Silverlands Ranching is required to undertake an Environmental Impact Assessment (EIA) for the proposed Luezi Dam project. Kasumwa EnviroConsult & General Supplies an environmental consulting company has been engaged to conduct the EIA. Consultations with key stakeholders are an important part of the EIA process and are a necessary step to obtain the views of all Interested and Affected Parties (I&APs).

This letter serves to invite you to a scoping meeting for Key Stakeholders. The purpose of the meeting is to provide an opportunity for Key Stakeholders to familiarize themselves with the proposed Luezi Dam project and to meet the EIA team and Silverlands Ranching representatives. This meeting will further provide an opportunity for Key Stakeholders to raise any issues or concerns that need to be taken into account during the EIA process. The details of the meeting are as follows:

Venue: _____

Date: _____

Time: _____

We thank you in advance for your cooperation and look forward to your active participation. If you have any questions, please do not hesitate to contact the EIA team on the mobile number or email address indicated below.

**Matamyo Simwanda –EIA Consultant
On Behalf of Silverlands Ranching - Zambia**



**Kasumwa EnviroConsult & General
Promoting Environmental Sustainability**

**Phone: 0979319871/0964224637
Email: robbykasubiko@gmail.com**

Appendix 5: Sample of feedback letter

All Correspondence should be addressed to
The District Water Officer
Not to individual officers



In reply quote:

KWA/102/2/22

REPUBLIC OF ZAMBIA DEPARTMENT OF WATER AFFAIRS

OFFICE OF THE DISTRICT WATER OFFICER
P.O. BOX 620361
KALOMO

22nd April 2013

SILVERLANDS RANCHING LIMITED
P.O. BOX 610003
ZIMBA DISTRICT

Att: Robby Kasubika
Consultant for Silverlands Ranching Limited

Re: REVIEW OF SCOPING STUDY DOCUMENT FOR THE PROPOSED DAM PROJECT BY SILVERLANDS RANCHING LIMITED

As per our earlier discussions, asking the Department of Water Affairs to comment on the preparation of document for an environmental impact assessment for the construction of the dam on Luezi River by Silverlands Ranching Limited. We are happy to say that the document covers almost all areas of standard scoping studies of this nature. However, we have a few concerns or additions for the EIA study to be undertaken as listed below:

1. Extent of downstream area to be flooded in case of dam failure and immediate households to be affected.
2. Will affected households be relocated or compensated.
3. Expected life span of the dam.
4. Incorporate bridge along Luezi River which is along Zimba-Chuundwe Road to be redesigned in line with the spill way's carrying capacity in case of flooding.
5. Should involve Technical Officers from our Department, MACO, Health and community development during community meetings as local community may be limited in scope on how this project will affect them.

We look forward to a positive working relationship with you during this whole process.

Yours faithfully

A handwritten signature in black ink, appearing to read 'Chanda Dau', written over a grey rectangular background.

Chanda Dau

Appendix 6: Minutes and sample attendance list

**MINUTES OF THE SCOPING MEETING FOR THE ENVIRONMENTAL IMPACT
ASSESSMENT (EIA) OF THE PROPOSED DAM ON LUEZI RIVER IN ZIMBA
DISTRICT**

Held at Zimba Civic Centre in the Council Chambers, Zimba, Southern Province

April 3rd, 2013-10:00hours

ATTENDANCE

EIA Consultants

1. Mr. Robby Kasubika
2. Mr. Emmanuel Banda
3. Miss Mwansa Chisanga
4. Miss Janet Chikololo

Developer Representative

1. Mr. Jack Siyunda

Members from Government and Non- government organisations

No.	Name	Organization	Email address	Phone No.
1.	Mr. Perry Lilanda	SWASCO	-	0977270035
2.	Ms. Clara Bwalya	Ministry of Health	clara.nyirenda@yahoo.com	0977437575
3.	Mr. Kaunda Banda	ZAWA		0977303460
4.	Mr. MaingaKatala	Forest Department	maingakatala@live.com	0976594218
5.	Mr. John Imbwae	GrejornInvestment Ltd	john.imbwae@yahoo.com	0977777732
6.	Mr. Evaristo. C. Ndalama	Ministry of Community Development	evaristo.chanda@gmail.com	0977233542
7.	Mr. ChanizgaPhiri	Zimba District Council	-	0976785598
8.	Mr. Christopher Lukwesa	Zimba District Council	clukwesa@yahoo.co.uk/zimdico@z amnet.zm	0965250182/ 260-213-344

AGENDA

1. Introductory Remarks
2. Presentations from the Developer's representative and the EIA Consultants
3. Discussion - Collection of views and concerns regarding the Luezi Dam Project
4. Concluding Remarks

1. Introductory Remarks

The meeting was called to order at 10:05hrs, by the Mr. Robby Kasubika. He thanked the people present for attending meeting and introduced the EIA consulting team. Mr. Kasubika 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.

2. Presentations from the Developer's representative and the EIA Consultants

The first presentation was done by the Mr. Siyunda, the developer's representative. The purpose of this presentation was to introduce Silverlands Ranching Limited and the proposed dam construction on the Luezi River. He also briefly explained the area it was going to cover and purpose of the dam construction and possible benefits.

A follow up presentation was done by Mr. Kasubika explaining the importance of conducting an EIA process. The last presentation was undertaken by Mr. Banda who gave a detailed account of the EIA processes and the impacts the proposed dam construction will have on the environment. He stated the importance of conducting EIAs for all stakeholders involved especially local communities as they are the most affected.

3. Discussion - Collection of views and concerns regarding the Luezi Dam Project

The concerns, demands and suggestions from the Government and Non-Government Officials and some of the responses from the developer and the EIA Consultants are shown in the table below.

Name	Organization	Comments/concerns	Response by consultant or developer
Mr. C. Lukwesa	Zimba District Council	<ul style="list-style-type: none"> • Complained of lack of EIA copies at the council • Observed the lack of a commission and maintenance plan in the presentation 	<ul style="list-style-type: none"> • EIA consultant- Copies are supposed to be delivered in person, if not they can be downloaded on ZEMA website • EIA consultant- The developers have not yet come up with any of these plans but it will be taken into consideration.
Mr. C.	World Vision	<ul style="list-style-type: none"> • Asked how far the nearest village was from the construction 	<ul style="list-style-type: none"> • Developer- Between 10-15km apart

Miyoba		<p>of the dam</p> <ul style="list-style-type: none"> • Also asked measures that are going to be put in place to protect unnecessary loss of lives especially children or prevent illegal activities like fishing 	<ul style="list-style-type: none"> • Developer-By educating and forming committees within the community to continuously educate the community the consequences/dangers of carrying out illegal activities. Presence of security personnel and light fence to demarcate property. • EIA Consultant-It's private property, therefore, accessibility is limited and safety mechanisms will be put in place by investors.
Mr. P. Lilanda	Southern Water and Sewerage Company	<ul style="list-style-type: none"> • Wanted to know the what benefits are for the communities from the construction of the dam • Complained that the water affairs personnel were absent. 	<ul style="list-style-type: none"> • Developer- The project will create employment opportunities for the locals • The flooding of the dam will ensure sustainable supply of water for cattle unlike the current seasonal rivers that dry in the hot season • EIA consultant- Will visit the water affairs personnel and other key stakeholders absent
Mr. M. Katala	Forest Department	<ul style="list-style-type: none"> • Asked why another was been constructed while there are a number of them in the same area and wanted to the exact location of the dam to be constructed 	<ul style="list-style-type: none"> • EIA consultant- The dams are private and each of them have a specific purpose • Developer- The existing dams are small stock for sustaining cattle and dry up in the hot season therefore the dam will be constructed so as to forfeit the small ones • Developer- The dam will be located across Luezi river along chundu road
Mr. K. Banda	ZAWA	<ul style="list-style-type: none"> • Wanted to find out whether ZAWA and the developers will work together to reduce human-animal conflicts 	<ul style="list-style-type: none"> • Developer- ZAWA will have access to the property • EIA consultant- Sustainable water supply will mean water for wildlife all year round as well as fresh pasture hence ZAWA should patrol the area regularly and the relationship between ZAWA and the investors should be continuous
Mr. J. Imbwae	Gerjon Limited	<ul style="list-style-type: none"> • Concerned about low turnout of invited key stakeholders who in future claim not to have been informed hence making investors look bad 	<ul style="list-style-type: none"> • EIA consultant- Thanked him for coming and for making a valid point

Ms. C. Bwalya	Ministry of Health	<ul style="list-style-type: none"> • Inquired on the strategic plan that are going to be put in place to ensure safety and health of workers 	<ul style="list-style-type: none"> • Developer- Safety of workers is number one priority so as to also avoid losses
Mr. E. Chanda	Ministry of Community Development	<ul style="list-style-type: none"> • Concerned that absentees in the meeting usually criticize the project without any understanding • Emphasized the importance of agreement on key issues from the on-set of the project • Urged investors to continuously sensitize communities on the importance of on-going processes 	<ul style="list-style-type: none"> • EIA consultant- Concurred with stakeholder stating that participation is the key principle in sustainable development

4. Closing remarks

At 11:40 hours Mr. Kasubika gave the closing remarks and urged the stakeholders that attended to keep the spirit as this was not the last meeting to be held. He strongly emphasized of participation of all stakeholders as the decisions made at these ensure the security of future generations. The meeting was concluded on that note.

Chairman: Robby Kasubika

Sign:



Sample of Attendance List from the Scoping Meeting

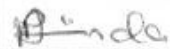




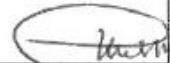
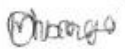

SCOPING MEETING FOR THE PROPOSED ESTABLISHMENT OF A DAM ACROSS THE LUEZI RIVER BY SILVERLANDS RANCHING

PLACE: ZIMBA DISTRICT COUNCIL CHAMBERS

DATE: 03/04/2013

TIME: 09:30HRS

ATTENDANCE LIST

No.	Name	Organization	Position	Phone	E-mail	Sign
1	LILANDA PERRY	SWOSC	MANAGER	0977270035	-	
2	CLARA BWALWA	HEALTH	EHT INFORMATION-OFF.	0977437575	Clara.Nyirenda@yahoo.com	
3	KAMUNDA BANDA	ZAWA	OFFICER IN CHARGE	0977303460	-	
4	MAINGA KATALA	FORESTRY	OFFICER IN CHARGE	0976594218	Maingakatala@lwe.com	
5	John Imbwae	Gegeya Investments Ltd	Director	0977777732	John.Imbwae@yahoo.com	
6	Zimba District Council	ZDC	Local Authority	260-213344027	zimdico@zamnet.zm	
7	Robby Kasubika	KEGS	Consultant	0979319871	robbykasubika@gmail.com	
8	MWANSI CHISANGA	KEGS	Consultant	0978544848	chisanga_mwansi@yahoo.com	
9	EMMANUEL BANDA	KEGS	CONSULTANT	0977880070	elf.emmanuel@yahoo.com	

Some photos from the Scoping Meeting



Mr. Jack Siyunda (developer's Representative) during introductory remarks



Member listening to the deliberations of the scoping Meeting

Minutes of the Community Meeting held at the community centre

**MINUTES OF THE COMMUNITY MEETING FOR THE ENVIRONMENTAL
IMPACT ASSESMENT (EIA) OF THE PROPOSED DAM ON LUEZI RIVER IN
ZIMBA DISTRICT**

Held at Community Centre in Zimba District, southern Province

April 3rd, 2013 – 14:35 hours

ATTENDANCE

EIA Consultants

1. Mr. Robby Kasubika
2. Mr. Emmanuel Banda
3. Miss Mwansa Chisanga
4. Miss Janet Chikololo
5. Mr. Jack. Siyunda- SRL Manager and Developer' representative

Community Members (see list at the end)

AGENDA

- Introduction of the EIA consultants and purpose of the meeting
- Presentation on the Project and EIA process
- Discussion - Collection of views and concerns regarding the Luezi Dam Project
- Concluding Remarks

1. Introduction of EIA consultants and purpose of the meeting

The meeting started at about 14:35 hours with Mr. Jack Siyunda introducing the EIA team and stating the purpose of the visit. He briefly explained the origin of Silverlands and some of the work they were currently undertaking in different parts of the country. He stated that apart from constructing the dam the company would also grow fodder and seeds which would be processed within the same premises into finished goods.

Presentation on the project and EIA process

The presentation was done by Mr. Kasubika who started by introducing himself and the team once more. He explained to the people that the purpose of the EIA process is to make sure that the well-being of the local communities is secured as required by the law. He emphasized that government was interested in knowing impacts the construction of the dam would have on the community before the project commences. He also stated the EIA process was undertaken in order to establish which natural resources are valuable to the people in terms of medicinal and traditional values as well as those endemic to the region so that these are protected during the implementation of the project. The meeting was informed that the government would then decide whether or not to allow the

construction of the dam. He strongly stated that not all questions or concerns would be attended to there and then but all would be documented for the consideration as this was not the last meeting that was going to take place.

2. Discussions

The concerns, demands and suggestions from community members and some of the responses from the developer and the EIA Consultants are shown in the table below.

Name	Village	Comment/Concern	Response By Consultant/ Developer
Mr. Thomas. N.M. Sipatunyana	Siamazila	<ul style="list-style-type: none"> • Thankful for being consulted but afraid the flooding of the dam might wash away the Luezi Bridge that connects them to Zimba where the nearest hospital and schools are. • Wanted assurance from the company as they may not compensate those affected • Asked if the investors would allow gardening near their pipes • Cautioned the consultants that next time the meeting should be held in the morning. 	We have taken your concerns. No relocation will occur as the dam will only flood SRL property. No communities will be relocated
Mr. Timothy Singoma	Siamazila	<ul style="list-style-type: none"> • Concerned that most of the headmen have not met with the investors 	The meeting can be arranged
Mr. Conard Siedindi	Simbai	<ul style="list-style-type: none"> • Asked how the community was going to benefit from the construction of the dam and if the investors are going to be selling seeds to the locals and other farming inputs 	Some members of the communities will be employed during the construction and operation phases
Mrs. Magdalena Mwaami	Chingobe	<ul style="list-style-type: none"> • Asked for help from the investor to set up a nearby health facility to assist pregnant women and infants and provision of an ambulance 	The investor can help of course in collaboration with government
Twaambo Hamanzi		<ul style="list-style-type: none"> • Concerned that if the dam was to burst open accidentally people, livestock and their property might be destroyed 	The facility will be made according to standards and the chances of bursting is almost

			impossible
Phinias Sibuchi	Siamazila	<ul style="list-style-type: none"> • Asked investors to employ the local youths that had turned to criminal activities to survive 	The developer is committed to sourcing labour from the local community especially for those skills that can be found within the community
Dickson Lukweemba		<ul style="list-style-type: none"> • Wanted to know whether access through the dam area would be allowed in case the Luezi bridge is washed off 	It may require that the bridge be redesigned
Cleopas Lakembe		<ul style="list-style-type: none"> • Wanted to find out whether the developers are going to replant the trees that are going to be cleared for the construction • Asked investors to create employment for the youths 	SRL is committed to environmental protection and management
Lazarus Muchenga	Siamazila	<ul style="list-style-type: none"> • Wanted to know if the area MP and the chief were aware of the project and if the investors are going to allocate land to the local people 	The MP and the Chief are aware of the project. The dam project falls within private land
Tobias Moono	Siamazila	<ul style="list-style-type: none"> • Asked if the investors are going to build schools and clinics. 	<ul style="list-style-type: none"> • The investors may help with the improvement of the infrastructure within the area.
Brian Siboli	Siakaloba	<ul style="list-style-type: none"> • Wanted to thank the developers and consultants for taking the time to seek their advice 	You are welcome
Justin Kabayame	Siamazila	<ul style="list-style-type: none"> • Cautioned the investor about displacing people in future after agreeing to the construction and no new issues should rise apart from those discussed at the meeting 	We have taken note of your comment
John Siachoongwe	Chingobe	<ul style="list-style-type: none"> • Thanked the consultants for consulting the communities as no one has ever done 	We will continue to consult the

		that and asked for help to improve their livelihood	communities as this is very important for the success of the project.
Amos Siamayobela	Chingobe	<ul style="list-style-type: none"> • Communities are neighbors with private farms, some livestock cross over to their land and the people call the owners, they would like the developer to do the same 	SRL will cooperate when such happens

3. Concluding remarks

At the end of the discussion, Mr. Banda reminded the community that the investor had limitations and so their demands should be realistic. He strongly urged the community to use their talents to empower themselves and not wait for handouts from the investor. Lastly, he thanked all had attended told them that it was not the end but the beginning of the discussions.

Chairman: Robby Kasubika

Sign:

Community Members Attendance List

No.	NAME	VILLAGE/ ORGANISATION	POSTION	PHONE NUMBER
1	Benjamin Mtembe	Silverlands Ranching	Section	0977661607
2	Victor Chilundika	Zambezi R. A	Gauge reader	0976258927
3	Bernard Lukumba	Siakaloba	Farmer	0978796870
4	BeniseniKapiliili	Siakaloba	Farmer	-
5	Emmanuel Kaate	Siakaloba	Farmer	0971567040
6	GoodwellMbundauma	Siakaloba	Farmer	0978933218
7	Joana Jamu	Siakaloba	Farmer	-
8	Abraham Siamiti	Simbai	Farmer	0971768627
9	AggreySiabona	Simbai	Farmer	0978124376
10	Gilbert Lukumba	Siakaloba	Farmer	0974828770
11	ConardSiedindi	Simbai	Headman	-
12	Phinias Sibuchi	Siamazila	Headman	-
13	JatoMasonkosi	Siamazila	Cattle herder	-
14	John Siachoongwe	Health	SMAG(Saving	0975024520
15	Rillion Lukumba	Siamazila	Farmer	0979310418
16	J. Kukumba	Siamazila	Farmer	
17	Joseph Halubinda	Siamazila	Farmer	
18	Fred Mate	Siamazila	Farmer	

19	Vein Mukenyami	Siamazila	Farmer	0971081970
20	Terry Lukumba	Simbai	Farmer	0973343889
21	PheniusKabuyame	Simbai	Farmer	0978489207
22	Gilbert Moono	Simbai	Farmer	
23	Stephen Siamulena	Siamazila	Farmer	
24	Andrew Siamalumba	Siamazila	Farmer	0975730655
25	Willie B. Sejani	Siamazila	Farmer	0978062144
26	Godfrey Choongwe	Siamazila	Businessman/far	0965152392
27	Bishop Kapundi	Siamazila	Farmer	0972557258
28	Kennedy Siamulonti	Siamazila	Farmer	09773725556
29	BestiniSimungoma	Simbai	Farmer	
30	Joseph Kabayabi	Simbai	Farmer	
31	Amos Siamayobela	Siakaloba	Farmer	09974800972
32	Webby Kabayame	Siakaloba	Farmer	09757206637
33	Justine Kabayame	Siakaloba	Farmer	0973848736
34	Edward Chikubwagi	Siakaloba	Farmer	-
35	Michael S. Kameli	Siakaloba	Farmer	0976845454
36	Patrick Selemani	Siakaloba	Farmer	0974919423
37	TwainingChinkusu	Siakaloba	Farmer	0978728703
38	Charles Muluka	Siakaloba	Farmer	-
39	Bernard Kantini	Siakaloba	Farmer	0979979565
40	PhanuelSiamayobela	Siakaloba	Farmer	-
41	Vendah Lukumba	Siakaloba	Farmer	0973968538
42	Innocent Siamayobela	Siamazila	Farmer	-
43	FinessMuzwamasimu	Siamazila	Farmer	-
44	Gift Mulungwa	Siamazila	Farmer	0976075672
45	Collins Chikunsu	Health	C. H. W	0976258903
46	James Kabayame	Siamazila	Farmer	0976900309
47	Sebastian Siabona	Siamazila	Farmer	0976053007
48	BannetSiabona	Siamazila	Farmer	0974361468
49	Evans Bbandama	Simbai	Farmer	0979971638
50	WinfordSiamulena	Simbai	Farmer	-
51	Brian Siboli	Siakaloba/Health	C. H. W	-
52	AustineChikobela	Health	C. H. W	0977577187
53	WestoneSiamauuka	Simbai	Farmer	0979919691
54	Thomas M. M.	Simbai	Farmer	-
55	Moses Siaindi	Simbai	Farmer	
56	Adrian M. Maleck	Simbai	Secretary	0973271951
57	Timothy Simungoma	Siamazila	Farmer	
58	LazarousMuchengu	Siamazila	Farmer	
59	Jonah Bweendo	Siamazila	Farmer	0978507622
60	Peter S. Muleya	Simbai	Farmer	
61	Isaac Bbumelo	Simbai	Farmer	0966821389
62	MandalenaMwaami	Chingobe/Luezi	Traditional Birth	0972926457
63	Rose Sibaziya	Chingobe	Farmer	
64	Florence Sibaziya	Chingobe	Farmer	
65	Judith Sibaziya	Chingobe	Farmer	
66	Donnah Lukumba	Siakaloba	Farmer	

67	ModySiamuyoba	Siakaloba	Farmer	
68	Elector Lifasi	Siakaloba	Farmer	
69	Conference Lifasi	Siakaloba	Farmer	
70	Grace Monde	Siamazila/World	Hygiene	0977372556
71	Marina Siacheenda	Siakaloba/Health	Trained	0979827659
72	AgenceSiedindi	Siakaloba	Farmer	
73	EsnalaChitambiandula	Siakaloba	Farmer	
74	JelinaSamboko	Siakaloba	Farmer	
75	Saliamumbe	Siamazila	Farmer	
76	EnelessMukalubono	Siamazila	Farmer	
77	Ruth Sibuchi	Siamazila	Farmer	
78	PriscaMunkombwe	Chingobe	Farmer	

Sample Attendance List from Community meeting

SCOPING MEETING FOR THE PROPOSED ESTABLISHMENT OF A DAM ^{ACROSS} ~~ACROSS~~ THE LUEZI RIVER BY SILVERLANDS RANCHING

PLACE: ZIMBA DISTRICT COUNCIL CHAMBERS

DATE: 03/04/2013

TIME: 09:30HRS

ATTENDACE LIST

No.	Name	Organization	Position	Phone	E-mail	Sign
	BENJAMIN NIEMBO	SILVERLANDS	SECTION MGR	0977661007	benjaminniembo@yahoo.com	
	VICTOR CHIKUNDIKA	ZIMBEZI-R.A	GADGET READER	0976258927	-	
	Bonwad Lukumba	TRADITIONAL FARMER	FARMER	0978796870	-	
	BEDISONI KAPILILI	SIKALOKA FARM	FARMER	-	-	
	Emmanuel Keate	farmer	FARMER	0971567040	-	
	Goodwell Mbandamwe	FARM	FARMER	0978933218	-	
	Joana Samu	FARM	FARMER	-	-	
	ABRAHAM SIMUTI	FARM	FARMER	0971768627	-	
	JAGREI SIABONA	FARM	FARMER	0978124376	-	

Some photos from the community meeting



Community member giving concerns/views during the meeting



Community members listening to the deliberations of the meeting



EIA consultants assisting community members to fill in their name on the attendance register

Appendix 7: Curriculum Vitae of Key personnel

Robby Kasubika

CURRICULUM VITAE

School of Natural Resources,
Copperbelt University, P.O Box 21692, Jambo Drive, Kitwe,
Cell +260 979319871,
Email: robbykasubika@gmail.com
robby.kasubika@cbu.ac.zm

Specialized in Environmental impact assessment, flora and fauna assessments, Biodiversity/Landuse modelling, Ecological assessments, Environmental Sustainability, applied participatory forest inventory, management, and technical training.

1. Professional experience since 1995:

- *Environmental impact assessment preparation, environmental auditing and Ecological Assessments*
- *Biodiversity modelling and analysis*
- *Landuse change modelling*
- *Climate Change*
- *Preparation of environmental assessment and forest training manuals for mining companies, government departments and Non-governmental organizations*
- *Natural resources management plan writing and mapping support*
- *Timber and non-timber forest product inventory training, data collection, and analysis*
- *Community-based resource management plans, posters, and brochures*

2. Degrees/Diplomas:

Master of Science in Environmental Sustainability - 2005 (University of Edinburgh), Scotland, UK
Bachelor of Science in Forestry – 2001 (Copperbelt University), Kitwe, Zambia
Diploma in Forestry – 1995 (Zambia Forestry College), Kitwe, Zambia
Certificate in Meteorology – December 1996 (Zambia Air Services Training Institute – ZASTI), Lusaka, Zambia

3. Other Professional Training

- Certificate in Journal Publications – May 2011 (University of Montana and Copperbelt University), Kitwe, Zambia
- Certificate in National Biodiversity and Landuse change Modelling and analysis – June 2007 (ITC), Enschede, Netherlands
- Certificate in Regional and national biodiversity Modelling and analysis – November 2006 (ITC), Enschede, Netherlands
- Certificate in Leadership Development: Building an Effective Team – June 2009 (Copperbelt University), Kitwe
- Certificate in Advanced Wildland Fire Management – June 2004 (United Nations University), Nelspruit, South Africa

4. Professional Experience

2006 TO DATE Lecturer – Copperbelt University, Zambia

- Lecturing *Environmental Management* which involves environmental impact assessment, social impact assessment, water quality assessment, environmental auditing, soil analysis, ecological processes, pollution and waste management
- Lecturing *Forest Resource Assessment* which deals with measuring the forest crop, vegetation and social surveys, forest inventories, forest sampling and site quality
- Lecturing *Research Methods*
- Lecturing on *Wildlife Management* including wildlife ecology, community wildlife management, wildlife population dynamics, wildlife vegetation interactions and ecotourism
- Conducting *Research and consultancy* on climate change, environment and development
- Supervision of final year undergraduate thesis projects

2001-2004 Extension Officer – Ministry of Tourism, Environment and Natural Resources (MTENR), Zambia

- Designing Forest management plans for various forest reserves in Lusaka province
- Carrying out forest awareness campaigns to promote sustainable management of forests
- Collection and analysis of forest and social data for the production of the state of environment report for Lusaka province
- Participating in various planning committees in the province
- Monitoring and evaluation of forest community based projects implemented by the various district forest offices in the province

1997-2000 Agrometeorologist – Meteorological Department HQs - Ministry of Transport and Communications, Zambia

- Production crop-weather bulletins every after ten days for farmers
- Participation in the vulnerability assessments and surveys that were conducted every year by the department in collaboration with World Food Programme (WFP) and Disaster Management Unit
- Weather and Climate analysis and dissemination of daily weather forecasts

5. Research Areas

- Landuse and Biodiversity Modelling and Analysis
- Community-Based Natural Management
- Participatory Forest Resource Assessment
- Ecosystem Services and Management
- Environmental Sustainability

6. Selected Seminar and Paper Presentation

2011: Application of geographical Information Systems in Zambia,

Paper presented at the GIS training workshop, Joensuu, Finland

2010: Modelling Landuse change as a consequence of biodiversity loss

Paper presented at the Environmental Education Association of Southern Africa (EEASA) Conference, Kitwe, Zambia

2007: The status of biodiversity in Zambia

Paper presented at the Biodiversity modeling and analysis workshop, Enschede, The Netherlands

2004: The Status of Forest Fires in Zambia

Paper presented at the Wildfire management workshop, Nelspruit, South Africa

2006: The impact of climate change and variability on biodiversity and livelihood

Paper presented at the AIACC workshop, Lusaka, Zambia

Documents and Publications:

- 2011: Kasubika, R and Chibesa, M. Strategic Environmental Assessment for the proposed Luswishi Farm Block in Lufwanyama District in Zambia
- 2011: Flora and Fauna Assessment Report for the proposed Luswishi farm Block in Lufwanyama District
- 2010: Flora and Fauna Training Guide for strategic environmental assessment
- 2005: Kasubika, R and Allen S. Forest Sustainability and the Privatization of the Copper Mines in Zambia, MSc Thesis, University of Edinburgh, Scotland, UK
- 2001: Kasubika, R and Chisanga, E. The Potential of Satellite Remote Sensing in Forest Resources Management, Undergraduate thesis, Copperbelt University, Kitwe, Zambia

Manuals

2010: Environmental Assessment Training Manual for Lumwana Mining Company

2008: Participatory Forest Resources Assessment Guide

2007: Best Forest Management Guide for Small scale Farmers

2007: Community Forest Facilitation Manual for Small Scale Farmers

2007: Timber Production Guide for Small Scale Farmers

7. Environmental Impact Assessment, Ecological Assessment, Environmental Training, Forest Inventory and EIA Experience:

*Sep 2012: **Consultant:** Environmental and Social Impact Assessment for the proposed Sterling Sugar Cane Project in Solwezi*

*Aug 2012: **Ecologist:** Fauna and Flora assessment for the Environmental Impact Assessment for the proposed dam project by Cropit in Mkushi*

*Jul 2012: **Lead Consultant:** Environmental Impact Assessment for the Proposed Kalumbila Commercial Farm in Solwezi*

*Apr 2012: **Ecologist:** Flora and Fauna assessment for the SOMAWHE Farm Development in Mpongwe*

*Feb 2012: **Ecologist:** Ecological Survey for the COPA Investment LTD Environmental Impact Assessment, Chingola*

*Jan 2012: **Consultant:** Preparation of strategic environmental assessment for the proposed Luswishi farm block.*

*Dec 2010: **Consultant:** Preparation Forest Plantation Management Plan (2011-2015) for Zambia Forest and Forestry Industry Corporation (ZAFFICO) - Ndola*

*Nov 2010: **Consultant:** Technocrats Scoping meeting for the preparation of the Strategic Environmental Assessment for Proposed Luswishi Farming Block – Lufwanyama (*Facilitated the stakeholder identification and analysis*).*

*Sep 2010: **Facilitator:** Training of Small scale mining companies staff in environmental impact assessment (Zambia, Copperbelt Province) (*resource person for Zambia Environmental Management Agency training workshop for small scale mining companies*). Presented a paper on the general overview of EIAs in Zambia*

*Oct 2010: **Lead consultant:** Fauna and Flora assessment for the proposed Luswishi Farming Block in Lufwanyama – Ministry of Agriculture and Cooperatives (MACO)*

*Mar 2010: **Lead Facilitator:** Training of Lumwana Mining Company staff in environmental assessment*

*Jan 2009: **Lead Researcher:** modeling Landuse change at two spatial scales in Zambia *The research is on-going and will end in 2013.**

*Sep 2008: **Facilitator:** Training of communities from Malawi and Tanzania in participatory forest resource assessment for WWF Songwe River Transboundary Catchment Management Project – Chitipa, Malawi*

*Aug 2008: **Ecologist:** Preparation of the Environmental Impact Assessment for proposed game reserve for Royal Luanzhila LTD, Solwezi*

*May 2008: **Lead Consultant:** Preparation of Environmental Project Brief for Copper Exploration Project in Ndola West Area by Consolite (Z) Ltd, Ndola*

*Mar 2008: **Consultant:Preparation** of the Environmental impact assessment of the proposed Siansowa Township in Sinazongwe District – Southern Province*

*Feb 2008: **Lead Consultant:** Preparation Environmental Project Brief for Mini Copper Smelter Project in Chingola by Liang Yun Company Ltd, Kitwe.*

*Jan 2008: **Consultant:** Updating of the Environmental Management Plan for Grizzly Mining Company*

*Jan 2008: **Ecologist:** Environmental and social surveys of the Mwekera and Luano National Forests for WWF – Miombo Ecoregion Copperbelt Programme. Responsible for the forest management component, WWF, Lusaka*

Dec 2007: Consultant: Production of Land use plans for Mwekera and Luano National Forests for WWF-Miombo Ecoregion Copperbelt Programme. The project involved production of landuse maps for both forest reserves and then identify conservation areas and suggest management objectives for each land use type. WWF, Lusaka.

Jun 2007: Consultant: Preparation Forest Plantation Management Plan (2008-2012) for Zambia Forest and Forestry Industry Corporation (ZAFFICO) - Ndola

Apr 2007: Consultant: Production of forest training manuals for small scale farmers for Kasisi Agriculture Institute

2006 to Date: Coordinator: Modelling Biodiversity and Landuse Change in Zambia project (Project carried by the Copperbelt University in collaboration with the Netherlands environmental assessment – MNP)

8. Languages:

English (official language)
Bemba, Lala, Tonga and Nyanja (Good) both written and spoken
Lozi and Kaonde (Limited)

9. Computer literacy:

Excel, Word, Power Point, Photo Editor, MinTab, Publisher, ArcGIS and SPSS

10. Biodata:

- Nationality: Zambian
- Marital Status: Married (with two children)
- Date of Birth: October 16, 1973

11. Membership

Wildlife and Environmental Society of Zambia
Environmental Education Association of Southern Africa
Southern Africa Fire Network

12. Referees

Furnished upon request

CURRICULUM VITAE _____ **Matamyo Simwanda**

**The Copperbelt University
School of Natural Resources
P.O. Box 21692**

Kitwe, Zambia

Date of Birth: 22nd June 1982

Email: matamyo@gmail.com
matamyo.simwanda@cbu.ac.zm

Mobile: (+260) 964 - 224637

Professional Experience

- GIS And Spatial Analysis
- Environmental Impact Assessments
- Flora Assessment and Forest Engineering
- Global Positioning Systems (GPS)

Degrees

- Master of Science in Forest Engineering/Geographic Information Science, Oregon State University, USA - 2010
- Bachelor of Science in Forestry, Copperbelt University, Kitwe, Zambia - 2004

Other professional training

- Certificate in Remote Sensing Applications for Agriculture Service Development – March 2012 – Pretoria South Africa
- Certificate in Journal Publications – May 2011 (University of Montana and Copperbelt University), Kitwe, Zambia

PROFESSIONAL EXPERIENCE

DATE	POSITION	ORGANISATION
April 2013 to Date	Deputy Dean	School of Natural Resources Copperbelt University, Zambia

- Co-ordinate, with the Heads of Department, and the academic office, in preparing the lecturing and tests time-tables and, in conjunction with the Registrar's office, the allocation of class-rooms and laboratories;
- Take care of the administrative side of tests and examinations in liaison with the Dean and the Registrar;
- Responsible for ensuring that up-to-date lists of students enrolled in the school and their file record (study-units registered for grades and credits obtained, etc) records for all examinations held at the school and school-based statistics and data are kept;
- Assist the Dean and the School board on implementation of course and university regulations;

- Prepare statements of results of students' academic record;
- Work with Heads of department to co-ordinate Industrial attachment placements as well as liaising with Human Resource Managers in relevant Industries to seek placement places for students in the school; and
- Perform other duties which may be assigned by the Dean of the school, the Registrar or the Vice Chancellor from time to time.

NOV 2007 TO DATE- LECTURER Copperbelt University, Zambia

- Lecturing **Forest Engineering** which is designed to provide students with the principles and practices of timber harvesting (logging), work studies, forest road planning and raw material transportation and the environmental effects of timber harvesting.
- Lecturing **Operations Research** which is designed to introduce students to mathematical model building and use of these in solving production and planning management problems and their applications to resources management and industries. The course also trains students in project management techniques to enable them to plan, execute and control projects so that they are completed on time within budget.
- Lecturing **Engineering Mechanics** which is designed to equip students with basic principles of engineering mechanics and their applications in forest management and wood technology.
- Supervision of final year undergraduate **thesis projects**
- Conducting **Research and consultancy**

Consultancies – Mainly carrying out Environmental Impact Assessments /environmental Project Briefs for Different Investment projects in the country.

**FEB 2007-Oct 2007 :Quality Control And Assurance Officer - PG Bisonite Zambia Plc
(Particle Board Manufacturers and Saw millers)**

- Responsible for the full day to day quality control and assurance of all production departments and ensuring the quality of the product achieved is as targeted and raw material is of standard quality.
- Setting up and implementing quality control standards in relation to the Zambia bureau of Standards and the environmental policy of the company.
- Laboratory testing of all chemicals to be used in production to determine their suitability for production and the environment.
- Taking part in response to emergencies, such as chemical spills and accidents
- Ensuring timely raising of red flags to management and production departments of any traces of variances /abnormalities in the materials or the process.
- Submitting to management, daily, weekly and monthly reports form informed decision making.

**MAY 2005-JAN 2007 - Production Superintendent - Wood Processing Industries
Zambia Limited** (Particle Board and Value added wood based products Manufacturers and Saw millers)

- Assessing material availability in the plantations and manufacturing plant in relation to sales department orders
- Planning daily, weekly and monthly production.
- Reporting to the Director of Operations on the progress of all projects and customer orders.
- Analysing the differences in actual production with normal production schedules and find out reasons for discrepancies to find solutions.
- Managing/supervising manpower of the plant during production
- Preparing and submitting daily, weekly and monthly production reports.

RESEARCH INTERESTS

- Environmental effects of Forest Land Use Changes
- Climate change
- GIS and Spatial analysis
- Forest Engineering

RECENT WORKSHOPS/SEMINARS

African Monitoring of the Environment for Sustainable Development AMESD – SADC – THEMA- 2nd National Workshop. Workshop held at Cosmic Lodge on 11th to 15th June 2012 Lusaka, Zambia.

African Monitoring of the Environment for a Sustainable Development - AMESD SADC-THEMA Regional Training and Workshop. Workshop held at the South African Weather Service (SAWS) in Pretoria South Africa from 20 February 2012 to 2 March 2012.

African Monitoring of the Environment for Sustainable Development AMESD – SADC – THEMA- 1st National Workshop. . Workshop held at Chrismar Hotel on 11th to 14th July 2011 Lusaka, Zambia.

Building a Faculty Publication Record. A Faculty publication Short course presented by Prof. Steve McCool from the University of Montana in cooperation with the Copperbelt University. Held at Edinburg Hotel 24th to 26th May 2011

Consultation workshop for the National Climate Change Response Strategy (NCCRS) for the Government of the Republic Of Zambia. Held in February 2010, Kabwe, Zambia

DOCUMENTS AND PUBLICATIONS:

PAPERS PUBLISHED

Simwanda M, M.G. Wing, J. Sessions (2011). Evaluating Global Positioning System Accuracy for Forest Biomass Transportation Tracking within varying Forest Canopy. West. J. APPL. FOR. 11(1) 2011.

PAPERS UNDER REVIEW/ IN PROGRESS

Simwanda M, M.G. Wing, J. Sessions and K. Boston (2011). Modeling Biomass Transport on Single Lane Forest Roads using GPS Technology. Under review by my MSc. Supervisors. Submitted to the Western Journal of Applied Forestry.

UNPUBLISHED PAPERS

Simwanda M. and D. Mbewe (2011). Evaluating Climate Change using Temporal Analysis of Climate Variability Data on the Copperbelt Province of Zambia (2011).

Simwanda M. and W. Nyimbwa (2011). Assessing the Effectiveness of the Government's Response to Climate Change Impacts in Zambia.

□ Simwanda M. and S. Mwaba (2010). Factors affecting the Productivity of small Scale Logging Operations in Zambia

Simwanda M and S. Zimba (2004). 'Joint Forest Management as way of enhancing sustainability of forest resources' (Case Study of Chief Nyamphande's Natural resources Management Area, in Petauke, Eastern province of Zambia. Undergraduate thesis for my BSc in Forestry, Copperbelt University, Kitwe, Zambia

Simwanda M (2003). Soil Nutrient Availability' - a case of Plantation (Exotic) Forests and Miombo (Natural) forests from Mwekera national forest in Kitwe, Copperbelt province of Zambia. Report was presented to the Copperbelt University students and lecturers.

RECENT CONSULTANCY AND OTHER WORKS

FEB 2013: CONSULTANT - Environmental Impact Assessment for the Proposed Dam Project in Zimba, Southern Province, by Silverlands Zambia Limited. (*In progress*)

DEC 2012: CONSULTANT - Environmental Project Briefs for the proposed ruralelectrification Projects in Southern, Northern Western, Muchinga and Luapula Provinces.

SEP 2012: LEAD CONSULTANT- Environmental and Social Impact Assessment for the proposed Sterling Sugar Cane Project in Solwezi (*in progress*)

JULY 2012: CONSULTANT: Environmental Impact Assessment for the Proposed Kalumbila Commercial Farm in Solwezi

JUNE 2012- NATIONAL FOCAL POINT FOR AGRICULTURE SERVICE – Training Government Officers in Remote Sensing Applications to improve Agriculture Service Delivery -

African Monitoring of the Environment for Sustainable Development AMESD – SADC – THEMA- 2nd National Workshop: 11th to 15th June 2012,Lusaka, Zambia

OCT 2011: CONSULTANT-Preparation of the Forest Plantation Management Plan (2012-2016) for Zambia Forest and Forestry Industry Corporation (ZAFFICO) – Ndola. Was responsible for Forest Survey, Designing Sampling Methodologies and Data collection Supervision.

SEPT 2011: CONSULTANT - Environmental Project Brief (EPB) for Southern African Ferro Alloys for a Proposed Manganese Processing Plant at Kanona, in Serenje District, Zambia

AUG 2011: CONSULTANT - Environmental Project Brief (EPB) for the setting up of the mobile sawmill for the Copperbelt University in Chati, Kalulushi, Zambia.

EDUCATION AND QUALIFICATIONS

SEP 2008 – June 2010 Master of Science in Forest Engineering/Geographic Information Science, Oregon State University, USA

Key Courses

Map and Image Interpretation, Cartography, Geographic Information Systems and Science, Advanced GIS Applications in Geosciences, Remote Sensing, Spatial Analysis of Forest Landscapes, Spatio-temporal Variation in Ecology and Earth Science, Methods of Data Analysis (Simple Linear statistics), Methods of Data Analysis (Multiple Linear Statistics), Combinatorial Optimization, Economics of the Forest Resource, Production Planning, Forest Transportation Systems, Biomass Assessment, Harvesting and Transportation, Forest Route surveying and Strategic & tactical planning techniques

2001-2004 Bachelor of Science in Forestry, Copperbelt University, Kitwe, Zambia

Key Courses

Forest Management, Forest Survey, Forest Resource Assessment, Forest Economics, Forest Ecology and Environmental Studies, Biometry, Operations Research, Research Methods, Forest for Rural Development, Soil Survey, Classification and Land Evaluation and Silviculture.

1995-1999 O-Level (Grade 12) School Certificate, Arakan High School, Lusaka, Zambia

PROFESSIONAL MEMBERSHIPS

- African Monitoring of the Environment for Sustainable Development (AMESD) project - Nation Focal Person for Zambia for the Agriculture Service. - AMESD is a program designed to empower African countries in the use of earth observation remotely sensed data for sustainable environmental development
- Copperbelt University Natural Resources and Environmental Society (CUNARES).
- Zambia Forestry Association
- Member of the Copperbelt University Board of Studies
- Member of the Copperbelt University Board of Examiners

SKILLS:

Computer Literacy

- Applications: Microsoft Office Suite(Excel, Word, Power Point, Photo editor, Publisher)

- Other Applications: Internet explorer, and e-mail packages.
- Programming Languages: Visual Basic
- Operating Systems: Windows 7 and Windows XP

Other Skills

- Knowledge of Research Methodologies
- Statistical software: S-PLUS, SPSS, R
- GIS/Remote Sensing Software: ArcGIS, QGIS, GRASS, ILWIS, ENVI(limited)
- Data and information collection
- Writing and presenting reports

LANGUAGES:

English: Official Language (Fluent)

Bemba, and Nyanja: (Fluent)

Written and Verbal

BIODATA:

- **Nationality:** Zambian
 - **Marital Status:** Married
-

The Copperbelt University,
School of Natural Resources
P.O Box 21692
Kitwe
Zambia.
Tell: +260-2-230923
E-mail: moses.chibesa@gmail.com
Or: moses.chibesa@cbu.ac.zm
Cell: +260976470204

Moses Chibesa

Personal Information

- Civil status: Married
- Nationality: Zambian
- Date of Birth: 27th July 1979
- Religion: Christian

Objective To continuously enrich and develop inter personal skills and academic profile so as to contribute more efficiently and effectively to the development of Zambia in particular and the world at large.

Language spoken English, Bemba and Nyanja

Education **2007-2008: University of Reading**
MSc Wildlife Management and Conservation (Merit)
2001-2004: The Copperbelt University, Kitwe
Bachelor of Science Degree in Forestry (merit)
1995-1997: Mufulira Secondary School, Mufulira
GCE O' Level Certificate

Patents and Publications

- *Carabid beetles in their environment: a study on diversity, abundance and the effect of pitfall trap spacing on the catches.*

A dissertation submitted in partial fulfillment of the requirements for the award of the Master of Science Degree in Wildlife Management and Conservation

- *Status of wood and wood based building materials in Zambia, a case of the Copperbelt Province*

A dissertation submitted in partial fulfillment of the requirements for the award of the Bachelor of Science Degree in Forestry

- *Assessing the quality of drinking water from the Kafue River.*

A scientific paper presented in September 2003 to C.B.U students and lectures
Management plan of Mwekera National Forest # 6 for the period January 2005-December 2009

Work experience

Date: June 2006 – To-date

Institution: The Copperbelt University

Position: Lecturer

Responsibilities:

- Lecturing ecology of terrestrial and aquatic ecosystems.
- Lecturing biometry
- Lecturing wildlife ecology and biodiversity management
- Lecturing wildlife resource assessment
- Research and development work.
- Preparation of tests and sessional examination papers
- Invigilation of sessional exams
- Marking of test and examination papers
- Counseling of students
- Participate actively in the professional, cultural, political, social and economic life of the community.

Date: February 2005- June 2006

Institution: Chaminuka Nature Reserve

Position: Tour guide

Responsibilities:

- Sustainable management of wildlife resources
- Educating tourists on the issues of wildlife management and conservation
- Educating the surrounding community on community based natural resource management in relation to wildlife
- Conducting annual census of wildlife species found at Chaminuka
- Guiding tourists in wildlife identification (mammals, birds, reptiles etc) during field tours

Date: January-March 2003

Institution: Eagle High School

Position: Teacher

Responsibilities:

- Teaching mathematics and chemistry
- Teaching Environmental Science

Research interests

- Wildlife Management
- Wildlife Diseases
- Human-wildlife conflicts
- Behavioural ecology and soci-biology of animals
- Climate Change

- Quantitative ecology
- Wildlife Taxonomy

**Consultancies/
Other Works**

In February 2007, I was part of the consultancy team that did the flora and fauna assessment for Luanshya Copper Mines and produced a physiognostic survey report. The work we did led to the development of Mulyashi open pit project.

In August 2010, I was part of the consultancy team that did the flora and fauna assessment for Rabya Machines, Tools and Hardware Limited Company and produced an Environment Project Brief (EPB) for the proposed Silica Mining at Luansobe in Mufulira. The EPB was approved and the project has started.

In March 2011, I was part of the team of lecturers of the School of Natural Resources of the Copperbelt University that did the flora and fauna assessment and produced an Environmental Project Brief (EPB) for the setting up of the mobile sawmill for the Copperbelt University in Chati. The EPB was approved and the project has started.

In 2011, I was part of the consultancy team from the School of Natural Resources of the Copperbelt University that did the flora and fauna assessment for the Ministry of Agriculture and produced the Strategic Environment Assessment (SEA) report. The work will lead to the development of Luswishi farm block in Lufwanyama District.

Awards	Best graduating student in forest protection. Given the award by The Zambia Forest and Forestry Industry Co-operation (ZAFFICO)
Membership	Member of the African Forest Forum (AFF) and Conservation International (CI)
Extra-curricular	2004: Active member- Copperbelt University Natural Resource and Environmental Society (CUNARES)
Activities	<p>Participated in tree planting activities in the surrounding communities to promote the activities of the Copperbelt University Natural Resources and Environmental Society</p> <p>Cleaned the Copperbelt University Stream that flows through the University workers residence to help reduce the breeding of mosquitoes and subsequently reduce the increase of malaria cases.</p> <p>2003: Participated in the commemoration of world environmental day on 5th June 2003</p> <p>1997: Vice Chairman of the mathematics club at Mufulira Secondary School</p>

PAUL HABASIMBI

Date of Birth: 6th June, 1980
Nationality: Zambian

Education:

Copperbelt University: Bachelor of Science in Civil Engineering, 2006
Stellenbosch University: Certificate in Flexible Pavement Design, 2008
National Council of Construction: Certificate in Construction Management, 2012

Membership in Professional Societies

Professional Member, Engineering Institute of Zambia (PrMEIZ)
Registered Member, Engineers' Registration Board (R.Eng)

Employment Record:

June 2011 to Date: UWP Consulting Zambia

Resident Engineer Output and Performance Based Road Contract **OPRCs** for Package 1: Choma District in Southern Province Funded by the World Bank. As Resident Engineer, he is responsible for the overall supervision of the project, preparation of monthly progress reports, monitoring and evaluating the contractor's compliance service levels, verifying and approving monthly interim payment certificates and undertaking all services needed for proper supervision of the project.

Client's Name: RDA/World Bank

Dec 2005 to June 2011: BCHOD Consulting Engineers

Engineer Habasimbi has experience performing a variety of roles in the design and implementation of engineering projects. He has also worked on engineering documentation, billing and contract administration.

May 2011 to August 2011 **Pavement Engineer** The Design, Supervision and Construction/Upgrading of 292.2 Km of Urban Roads in 11 Districts Based on Integrated Construction Unit Method of Works, Lot 7; Rehabilitate/Upgrade 33.45 km in Lusaka's UNZA, Chelston Areas. As a Pavement Engineer, he was responsible for the overall design and construction supervision of all the project roads under Lot 7 of the contract including the improvement of selected Intersections along Thabo Mbeki and Lumumba roads.

Client's Name: RDA

Sept 2010 to June 2011: **Field Team Leader/ROMDAS Operator** Consultancy Services for Data Collection for the Classified Road Network of the Republic of Mozambique – **Administracao Nacional de Estradas (ANE)**. Responsible for collecting the inventory and condition data for the entire road network of Mozambique using ROMDAS software. This

involves driving through on the entire road network of Mozambique collecting the road defects such as rut depth using a Transverse Profile logger (TPL Equipment) and roughness using a Laser Profilometer System. The project also involves processing of the data in the format prescribed by the Client and presenting it for approval. As a Field Team Leader, his other responsibilities were to efficiently coordinate the surveys and mentor two junior engineers on site. Additionally, Engineer Habasimbi successfully conducted trainings for the Clients Regional Engineers (Delegados) and Technologists for the entire 10 provinces of Mozambique as this was a requirement of the project.

Client's Name: ANE/European Union

Jan 2010 to Sept 2010

Project Engineer on the Construction of the Main Entrance for Trucks into Chilanga II Plant in Zambia. Responsible for the overall design and supervision of the 200m section of the rigid pavement, car park and construction of the guard house. The works includes design and supervision of the main entrance for trucks into Chilanga II entrance. Preparation of contract documents and selection of the contractor. Indicating to the contractor all critical design areas and approving and certifying work done.

Nov2009 to Dec 2009:

Site Engineer on Levy Business Park. Responsible for the supervision of works for the construction of the Hotel and Office Block at the Business Park. This includes inspection of excavations for foundations and deciding on the appropriate founding method in consultation with the Structural Design Engineer. Supervision and quality assurance of reinforced concrete works, guiding and instructing the contractor to ascertain compliance to the design specifications. Approving and calculating concrete volumes for the various works on site.

Client's Name: NAPSA

Oct to Nov 2009

GIS Engineer on Road Network Reclassification Study

Responsible for:

- Preparation of maps, reports and data validation using ArcGIS and MapInfo softwares.
- Data analysis
- Providing technical assistance to other GIS and/or non-GIS staff.
- Analysing GIS problems and recommend improvements and/or modifications
- Executing geoprocessing tools and models, integrating AutoCAD data into the GIS and creating maps with advanced labelling techniques.
- Performing Overlays of maps and edits using MapInfo and ArcGIS softwares.

April to July 2009

Road Condition Surveys Team Leader for the Visual surveys of about 5500km of urban roads and 15000 km of primary feeder roads and mapping. The Project was funded by the European Union. Planning of Surveys: - This includes using all available sources of

information, maps and lists of required road from various district councils, as well as Google Satellite Image printouts to ensure all roads taken into account. This also includes planning of the surveys such that they are conducted effectively and efficiently. Coordination of Surveys: ensuring that all roads are taken into account and surveyed.

Execution and Validation of Surveys: This entails ensuring that all roads to be surveyed are travelled on and surveyed correctly and that the information acquired meets the standards of information acquired by the Road Measurement and Data Acquisition System (ROMDAS) software.

Client's Name: RDA/World Bank

Nov 2007 to Dec2008

Materials Engineer/Assistant Resident Engineer on the Periodic Maintenance Works of Road T005 from Solwezi via Mutanda to Mwinilunga road project in North-Western province (**Contract sum 47 Billion ZMK**)

Responsible for:

- Supervision and monitoring of the project. Verification and proofing of materials on site.
- Monitoring the contractor's quality control (CQC) activities and taking appropriate action with the contractor to assure compliance with the quality control clauses of the contract.
- Inspecting works daily
- Preparation of detailed progress reports
- Supervision of all concrete works
- Rehearsing with the contractor on material schedule and location of all borrow pits.
- Ensure all testing procedures are as per requirement and specifications are followed.
- Ensure standard procedures/information is posted on the laboratory walls for reference.
- Training of all laboratory personnel including technicians.
- All testing results approvals and records keeping.
- Give instructions for field quality control testing\research discuss with Resident Engineer on how to improve quality based on research results.
- Overall management of laboratory equipment, results and person.**Client's Name: GRZ/RDA**

August 2006 - May 2007:

Assistant Resident Engineer on the Supervision of the DANIDA funded Rehabilitation of the Core District Feeder Roads in Mumbwa- Chisaka-Nangoma Road: Lot 1 and Lot 2 by Labour Based Methods. (**Contract sum 1Billion ZMK total for both Lots**)

Responsible for the supervision and monitoring. Measurement and verification of quantities on site and Preparation of contractor's Interim Payment Certificates (IPC's).Also responsible for preparing detailed monthly progress reports for both Lot 1 and 2.**Client's Name: DANNIDA**

- May 2006-Aug 2006:** **Assistant Resident Engineer** The Core District Feeder Roads in Mumbwa- Kaporoso-Mwango Road DANIDA funded Contract sum (2 Billion ZMK). Responsible for the supervision and monitoring of the project. Measurement and Preparation of contractors' Interim Payment Certificates (IPC's).
- April 2006- May 2006:** **Assistant Resident Engineer** Rehabilitation of eleven Forestry Roads in Luapula and North Western Provinces funded by IFAD. Responsible for preparation of Tender Documents and
- Assisting the Project Manager in compiling detailed Bid Evaluation Reports.
 - Analysing and examining bids for their eligibility, securities, verifications, completeness and substantial responsiveness.
 - Checking for any arithmetic errors in the bids submitted and making the necessary amendments.
 - Overall checking of submitted bids if they meet the Terms of References in terms of minimum turnover, experience, equipment and staff requirements
 - Supervision and monitoring of the project.
 - Preparation of Contractors' Interim Payment Certificates (IPC's).
- Client's Name: IFAD**
- March 2006- April 2006:** **Design Engineer** Samfya Luwingu via Lubwe Project. Producing detailed drawings for the vertical and horizontal alignment of the road using Road Maker and Model maker software.
- Pavement Engineer** for the periodic maintenance of Lusaka-Kabwe and Mukobeko Road. Responsible for carrying out visual assessment for the roads and also involved in carrying out pavement evaluation using the Falling Weight Deflectometer (FWD) equipment.
- 2005 – Date** **Engineer** (Highway).Design and supervision of Feeder and Trunk Roads in different parts of the nation.
- Dec 2001- Jan 2002** **Roads Department-Lusaka (HQ)**
Trainee Engineer on the Highway Management System of the Roads Development Agency on attachment with **BCHOD Consulting Engineers** World Bank Funded - Performing various soil tests in the Materials Laboratory of the Roads Department. Tests done included Unconfined Compressive Tests (UCS), DCPs, Atterberg Limit tests, Sieve Analysis, Sand Replacement and CBR tests
- Jan 2003 – Mar 2003** **BCHOD Consulting Engineers**
Trainee Bridge Engineer Participated in the inventory and Condition assessment of about 1,500 bridges and major culverts around the country for input in the Bridge Management Systems(BMS) software developed by Africon Engineering Consultants.
- Assistant Surveyor** Mongu-Senanga Road for the setting out and supervision of three major culverts and side drain. Responsible for accurate setting out of the three (3No.)Box culverts, supervision of the

concrete works and reinforcement arrangement as per approved standard drawings of the project. Supervised concrete works on the construction of a trapezoidal lined side drain on the road.

Under Graduate Experience:

Dec 2001 to Jan 2002

Roads Department-Lusaka (HQ)

Trainee Engineer- Performing various soil tests in the Materials Laboratory of the Roads Department. Some tests done included Unconfined Compressive Tests (UCS), DCPs, Atterberg Limit tests, Sieve Analysis, Sand Replacement, CBR tests etc.

Jan 2003 to Mar 2003

BCHOD Consulting Engineers

Trainee Bridge Engineer Participated in the inventory and Condition assessment of about 1,500 bridges and major culverts around the country for input in the Bridge Management Systems (BMS) software developed by Africon Engineering Consultants.

Dec 04 to Feb 05

Assistant Surveyor on the Mongu Senanga Road (M10) for the setting out and supervision of three major culverts and side drain. Responsible for accurate setting out of the three (3No.)Box culverts, supervision of the concrete works and reinforcement arrangement as per approved standard drawings of the project. Supervised concrete works on the construction of a trapezoidal lined side drain on the road.

Languages:

Language	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent
Tonga	Good	Good	Good
Nyanja	Excellent	Good	Fair
Bemba	Excellent	Excellent	Excellent



10th May 2013

Messrs Silverlands Ranching Limited
Zambia

Re: DAM CONSTRUCTION AT SILVERLANDS RANCHING IN ZIMBA

Reference is made regarding the above subject matter.

Following the meeting we had with Mr. Andrew Huck on 8th March 2013 in Lusaka, the site visit conducted by Mr. Imbwae and a subsequent meeting held in Zimba on 3rd April 2013, with various stakeholders regarding the proposed construction of a dam.

We wish to advice that we have taken note of the concerns about the possible wide throw back of water into farm 2815, our farm. The said development will not affect the operational activities on our farm in any way and we therefore have no objection with your undertaking the dam project.

It is our sincere hope that the project will be of immense benefit not only to ourselves but to the rest of the community.

We, therefore, wish you every success.


Your faithfully,


John Imbwae.
MANAGING DIRECTOR

Farm 682/C LUSAKA WEST
P.O. Box 51003
Lusaka
ZAMBIA

Tel: 260211212175/6
Cell: 260 977 777732
Cell: 260 977 827425


5m H889 6/76 DR 10b

REPUBLIC  **OF ZAMBIA**

CERTIFICATE OF TITLE

No.:.....214831.....

Farm No.....1901.....



DR 1A



No. 214831

Registered No. 1901/13

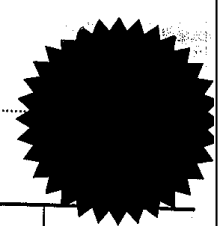
THE LANDS AND DEEDS REGISTRY ACT (Section 45)

CERTIFICATE OF TITLE

THIS Certificate, dated the NINETEENTH day of APRIL two thousand and THIRTYEEN under the hand and seal of the Registrar of the Lands and Deeds Registry of Zambia WITNESSETH that SILVERLANDS RANCHING LIMITED A Company incorporated in Zambia and having its registered office at Lusaka is a tenant or lessee for the unexpired residue of a term of 99 years from the first day of October 20 1979 (subject to such reservations, restrictions, incumbrances, liens, estates and interests as are notified by memorial underwritten or endorsed hereon) of and in ALL that

Piece of land in extent 1224.0237 hectares more or less being Farm No. 1901 situate in the Southern Province of Zambia which piece of land is more particularly delineated and described on Diagram No. 373 of 1954 except and reserved all minerals oils and precious stones whatsoever upon or under the said land.

Registrar



Memorials

Table with 4 columns: Date of Document, Date of Registration, Registered No., and Cancellation. The first row contains data for document 24/07/1980, registration 29/07/1980, and registered number 1901/7. The description in the fourth column reads: 'Subject to the exceptions reservations restrictions restrictive covenants and conditions mentioned contained or referred to in a lease (a copy of which is attached hereto) made between The President of the Republic of Zambia of the one part and FORSYTH'S ESTATE LIMITED of the other part.'

PTO

EXAMINED
M. S. Datta
LANDS DEPARTMENT

C. T. No 49461
LF/1
Stocked by Lands
4m G88 2/70 S & T

1901/7

29.7.80



Lease No... *25068*
Province... SOUTHERN
FARM... No. 1901.....

THIS LEASE MADE the... *24th* ... day of... *July* ...
nineteen hundred and... *Eighty* ... BETWEEN THE
PRESIDENT OF ZAMBIA (hereinafter called 'the Lessor') of the one part and
FORSYTH'S ESTATE LIMITED a Company incorporated in Zambia and
having its registered office at Kitwe
(hereinafter called 'the Lessee' which expression where the context so admits
includes... **its successors in title and permitted assigns**
.....) of the other part.

WITNESSETH as follows:

1. In consideration of the sum of K.....now paid by the Lessee to the Lessor receipt whereof the Lessor doth hereby acknowledge and of the rent hereinafter reserved and the covenants and conditions hereinafter contained the Lessor hereby demises unto the Lessee ALL THAT piece of land in extent...Twelve hundred and twenty-four decimal point nought.....

two three seven (1224.0237) hectares. (3024.639) acres.....

more or less being..... Farm.....No. 1901.....

situate in.....Southern..... Province of Zambia which piece of land is more particularly delineated and

described on.....Diagram.....No. 373 of 1954.....

attached to...these presents and thereon bordered red.....

(hereinafter called 'the said land') TO HOLD unto the Lessee for the term of

Ninety-nine (99)..... years from the first day of..... October.....

nineteen hundred and.....Seventy-nine..... (hereinafter called 'the said term').

YIELDING AND PAYING therefor during the said term the rent as hereinafter provided.

EXCEPTING AND RESERVING out of the demise hereby made all minerals, mineral oils and precious stones whatsoever upon or under the said land.

2. The Lessee for... itself, its successors in title and permitted assigns..... hereby covenants with the Lessor as follows:

(1) To pay all such rates taxes assessments and impositions whatsoever as may hereafter become payable in respect of the said land according to law.

(2) To permit during the said term the Lessor or any person or persons authorised by the Lessor to enter on the said land at any reasonable time during the day for the purpose of inspection or to lay or have access to water mains drains sewer pipes telegraph or telephone wires and electric mains of all descriptions whether the same or any of them be overhead or underground provided that just and fair compensation shall be paid by the Lessor to the Lessee for any loss or damage occasioned thereby.

(3) To pay on or before the execution of these presents the sum of K. 102-30.....being rent for the period from the date of commencement of the said term to the..... thirtieth day of..... September.....nineteen hundred and..... Eighty and thereafter a yearly rent of K. 102-30.....on the thirtieth..... September.....day of.....in

- (4) Within a period of 24 months from the date of commencement of the said term to erect on the said land a good and substantial buildings to the approval of the local authority and to the value as assessed by the local authority of not less than K..... and to complete the foundations thereof within 12 months from the date of commencement of the said term.
- (5) At all times during the said term well and sufficiently to repair cleanse uphold maintain and keep any messuage or buildings which may be erected on the said land and all additions thereto and the walls fences sewers drains and amendments and to execute at the Lessee's own cost all such sanitary and other works as may from time to time be lawfully required by the local authority.
- (6) Except with the prior written consent of the Lessor not to assign sublet mortgage charge or in any manner whatsoever encumber or part with possession of the said land or any part thereof or interest therein or concerning the same or attempt so to assign sublet mortgage charge encumber or part with possession of the said land.
- (7) Except with the prior written consent of the Lessor not to use the said land or the buildings thereon or to be erected thereon or any part thereof for any purpose other than for... **Agricultural and Grazing purposes and purposes ancillary thereto**

3. The Lessor hereby covenants with the Lessee that the Lessee paying the rent..... hereby reserved and observing and performing the several covenants and conditions herein on the Lessee's part contained shall peaceably hold and enjoy the said land during the said term without any interruption by the Lessor or any person lawfully claiming under the Lessor.

4. PROVIDED ALWAYS and it is hereby mutually agreed as follows:

- (1) If and whenever the rent hereby reserved or any part thereof shall be in arrear and unpaid for twenty-eight days after the same shall have become due (whether legally demanded or not) or if the Lessee shall at any time make default in the observance of any of the covenants and conditions herein contained on the Lessee's part to be performed or observed it shall be lawful for the Lessor to re-enter upon the said land and hold the same as of his former estate as if this Lease had not been made but without prejudice to any right of action or remedy of the Lessor in respect of any prior breach non-performance or non-observance of any of the Lessee's covenants or conditions herein contained.

IN WITNESS WHEREOF.....
CIKAKULA TENFORD ASAFU BANDA.....

Commissioner of Lands of the Government of Zambia for and on behalf of the
President has hereunto set his hand and seal and, ... FORSYTH'S ESTATE LIMITED
has hereunto been affixed.....

on the day and year first before written.

SIGNED SEALED and DELIVERED

by the said.....

CIKAKULA TENFORD ASAFU BANDA.....

for and on behalf of the President of
Zambia in the presence of:

Witness..... *B. N. LUNGU*.....

Address..... P.O. Box 69, Lusaka.....

Occupation..... Civil Servant.....

The Common Seal of FORSYTH'S ESTATE

LIMITED was hereunto affixed.....

.....

.....

in the presence of:

.....

.....

.....

DIRECTOR

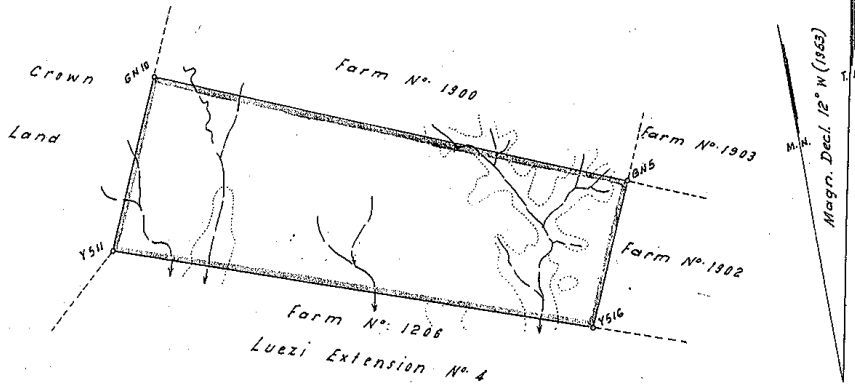
SECRETARY



Date... 6.4.54

P. H. Green
Senior Surveyor

Plan No. 1901
 General Plan No. 222 A



Rect. Area... 3024.632... Acres
 Curt. Area... Acres
 Total Area... 3024.632... Acres

Sides Chains of 66 English feet	Angles of Direction			Co-ordinates		
	°	'	"	Beacon No.	Y	X
GN ¹⁰ - GN ⁵	190	26	41	GN ¹⁰	-70207.86	-86956.82
GN ⁵ - Y516	60	27	23	GN ⁵	-50750.95	-90766.65
Y516 - Y511	19	8	73	Y516	-51953.42	-96672.71
Y511 - GN ¹⁰	7	26	4	Y511	-71656.60	-94074.86



The above figure lettered... GN¹⁰ - GN⁵ - Y516 - Y511 - GN¹⁰
 bordered... R.C.P. represents... 3024.632... Acres, more or less, of land being the Farm No. 1901
 named... Situate in the... SOUTHERN... Province, Northern Rhodesia,
 and bounded as shown above.

Framed from actual survey made in July - August 1953

by *P. H. Green*
 Land Surveyor

APPROVED:
P. H. Green
 Director of Surveys
 Date... 6. April 1954

Appendix 10: Conflict Resolution procedure and grievance record

Steps	Process	Description	Time Frame	Other Information
Step 1	Identification of Grievance	Face to face Phone, letter, Recorded during community interaction Other (e.g. public meeting)	1 Day	CLO telephone number, email and contact address for stakeholders to contact in the event of them wishing to register a grievance. This should be included in materials distributed to communities.
Step 2	Grievance assessed and logged	Significance assessed Recorded in log	5 to 7 days	Significance Criteria Level 1- one off event Level 2 – complaint is widespread or repeated Level 3 – any complaint (one off or repeated) that indicates breach of law or policy, or that could result in damage to reputation
Step 3	Grievance is acknowledged	Acknowledgement of grievance through appropriate medium (e.g. letter, phone call or face to face).	Immediate or 10 to 14 days	Depending on how the Grievance is submitted this may happen at time of submission.
Step 4	Development of response	Grievance assigned to appropriate people for resolution Response developed with input from relevant people	5 to 7 days 14 days	
Step 5	Response signed off	Response approved at levels appropriate to significance	14 days	Sign off levels Level 1 – CR Manager Level 2 – CR Manager Level 3 – CR and General Manager Level 3 (International) – Board of Directors
Step 6	Communication of response	Response or update of progress on resolution	14 days	
Step 7	Complaint Response	Response to the complaint recorded in grievance log Confirm with complainant that grievance can be closed or determine what follow up is necessary		
Step 8	Close grievance	Record final sign off of grievance according to significance If grievance cannot be closed, return to Step 2 or recommend third-party arbitration		Final sign off on by CR Manager for all levels

Grievance Record			
Grievance Number:	Date Submitted:	Target Date for Resolution:	
Name:			
Address and Contact Details			
Grievance Received By:			
Name of Grievance Coordinator:			
Description of Grievance:			
Assessment of Grievance Level:		Notification to Head of Community Relations ?	Y/N
Actions to Resolve Grievance			
Delegation to:			
Action	Who	When	Completed Y/N/Date
Response/Resolution:			
Strategy to Communicate Response:			
Sign-Off:			
Date:			
Conclusion			
Is complainant satisfied?	Y/N	Comments from Grievance Coordinator	
Grievance Closed?	Y/N	Grievance Resubmitted?	Y/N
Signature of HCR:		Date:	
Date:		New Grievance Number:	