SCOPING REPORT FOR PROPOSED SUGARCANE PLANTATION FARMING PROJECT AT LUSU COMMUNAL AREA, ZAMBEZI REGION

(APP-001188)

Assessed by:
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This Study Report on the Environmental Impact Assessment (EIA) study report is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management Act, 2007 and the Environment Impact Assessment and Audit Regulations, 2012.

November 2019

DECLARATION

The Consultant submits this study report on the Environmental Impact Assessment (EIA) Study report for Desert Lusu Salk Sugar Sugarcane the project proponent. I certify to the best of my knowledge that the information contained in this report is accurate and truthful representation as presented by the client.

NYEPEZ Consultancy CC REG. No. CC/2016/07561

Signature: _____

Proponent:

I, **Desert Lusu Salk Sugar** do certify to the best of our knowledge that information contained in this report is accurate and truthful representation.

P.O. Box 35195 - Pioneers Park, Windhoek, Namibia Signed: _____ Signed on: _____ day of: _____ 2020

ABBREVIATIONS

CBNRM	Community Based Natural Resource Management
DEA	Department of Environmental Affairs
DoF	Directorate of Forestry
DWAF	Department of Water Affairs and Forestry
DWSSC	Directorate of Water Supply and Sanitation Coordination
EA	Environmental Assessment
EIA	Environmental Impact Assessment
MET	Ministry of Environment and Tourism
MLR	Ministry of Land Reform
NACSO	Namibian Association of CBNRM Support Organisation
NGO	Non-Governmental Organisation
NNF	Namibia Nature Foundation
NRM	Natural Resource Management
NORED	Namibia's regional Electricity Distributor
MAWF	Ministry of Agriculture Water and Forestry
AMTA	Agro-Marketing and Trade Agency
FPBHs	Fresh Produce Business Hubs
NSFR	National Strategic Food Reserve

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SITE ASSESSEMENT

DESERT LUSU SALK SUGAR- SUGAR PLANTATION FARMING PROJECT: LUSU COMMUNAL AREA

Proposed Land Use: Sugarcane Plantation and factory farm and produce sugar.

Total Area:6000 hectares of land at Lusu Communal area in the Zambezi Region.

EXECUTIVE SUMMARY

Desert Lusu Salk Sugar Investor intends establishing a Sugarcane Plantation and factory farm and produce sugar under their Company on 6000 hectares of land at Lusu Communal area in the Zambezi Region. The project area is situated about 50km southwest of the town of Katima Mulilo. The area is within the Katima Rural Constituency, in the Lusu communal area in the Zambezi Region.

Desert Lusu Salk Sugar has secured a 6000-hectare piece of land to use for production of Sugar plantation and factory for sugar production. The company has received a 99-year lease agreement from the local communities, the land of which is administered particularly by the local chiefs whose authority is governed by the Ministry of Urban and Rural Development of Namibia.

Desert Lusu Salk Sugar is a registered close corporation owned by partner companies from a previously disadvantaged background, who have interest in sugar production. Its main objectives are to contribute its share towards ensuring economic growth, food security in the country as well as creating employment for Namibians. The main business activities include Sugarcane Plantation and factory farm production of sugar.

Growth in agricultural productivity in sub-Saharan Africa including Namibia has been cited as vital to poverty reduction and to the achievement of the Millennium Development Goals (MDGs), as emphasized in the World Development Report titled Agriculture for Development. The company's business interests are geared towards the production of agricultural products. Its underlying vision is to contribute towards achieving food security in Namibia by utilising vast virgin lands in the Zambezi region of the country particularly Namibia's untapped water resources in the form of the mighty Zambezi, Chobe and Linyanti river.

About 80% of Namibia's agricultural products are imported, mainly from South Africa, which makes the country heavily dependent on imports. In order to be able to make a significant contribution towards the growth of the Namibian economy and thus wealth creation, agricultural production/output has to increase manifold.

In order to address this scenario of import dependency and improve on the country's food security, the Government of the Republic of Namibia (GRN) has embarked on the Green Scheme Programme whose objectives are to promote agricultural production and the development and implementation of a fresh produce production co-ordinating and marketing infrastructure in the country.

In order to implement its business objectives, **Desert Lusu Salk Sugar** want to establish an agricultural farm which entails the production of Sugarcane plantation and factory of producing Sugar in the Zambezi region. The business owners have a wealth of knowledge and experience in agricultural management and other various sectors that contribute significantly to the economy.

Scope of Activities

The field study was designed to determine the impacts of (a) construction of a reservation tank or borehole on the farms connected to Zambezi river, (b) construction of roads and electricity grids, (c) agricultural activities, (d) Planned and unplanned human settlements, (e) storage and (f) socio-economic activities in the project area on the environment.

Taking into account the multi-sectoral nature of the planned project activities and the vastness of the farm, the assessment was conducted to:1) assess the impacts of the various project activities on the socio-cultural norms of the local community, 2) Ecological**:** to assess the impacts of the various project activities on the ecological status of the area, and 3) Infrastructure**:** to assess the impacts of infrastructure development on the ecological and social aspects of the area. For primary data collection, Participatory Rural Appraisal (PRA) tools (direct observations and consultations) were applied. Secondary data collection involved use of topographic maps, project reports, administrative reports and textbook materials.

The major impacts the project will have on the environment will mainly arise from construction of a factory, storage facility and erection of the water-pipe line from the river to the farm, road and electricity grids, factory and, human settlement, irrigation and agriculture production.

The Project Business plan:

On the farm, the Sugarcane will be cultivated under irrigation on 6000ha (Six thousand hectares). The Sugarcane will be processed and packed on the farm and distributed around in the country for sale. The Sugar will be cultivated on an open land under irrigation. The sugarcane production produce will be established over the span of the project development phases.

Processing:

The processing operations will workers shelters, vehicle or machinery packing area, and sugarcane storage facility and a factory. Administration office will be based in Katima Mulilo. A properly designed bio degradable sewage system will be implemented to produce grey water for dust suppression on the gravel roads.

The sugar processing plant will consist of the following installations

- Parking and administration
- Cane yard section
- Mill house
- Process house
- Boiler house
- Spray pond
- Bagasse holding facility
- Distillery
- Bagasse co-production
- Effluent treatment
- Workshop
- Firefighting section

Operations:

The project will consist of one (1) fully functioning farm with own infrastructure. The farm will employ +-700 permanent staff and 300 unskilled workers plus 100 temporary employees throughout the phases of getting the business up and running. Employees will be transported to and from accommodation by contractors.

The main operations will be irrigation of Sugarcane Plantation production, packaging and a dispatch facility. Compost will be processed and spread on the irrigation fields. The farm will have irrigation and dry land agriculture. The workers shelter & ablution facilities, storage and a dispatching place. It will be served with a bio degradable septic sewage system.

Scope of Work

The approach taken for the assessment was to consider the major components of the project and then predict their impact on the environment. The scope of work was therefore to assess the impacts of the following activities in the project area:

1. Construction Pipeline from Zambezi river to the site.
2. Construction of Water reservation tanks on the farm
3. Construction Workers shelter, storage, internal roads and electricity grids
4. Agricultural activities
5. Planned and unplanned human settlements

1. INTRODUCTION

1.1 Background

Desert Lusu Salk Sugar as Investor intends establishing a Sugarcane Plantation and factory farm and produce sugar under their Company on 6000 hectares of land at Lusu Communal area in the Zambezi Region. The project area is situated about +-50km southeast of the town of Katima Mulilo. The area is within the Katima Rural Constituency, in the Lusu communal area in the Zambezi Region.

The proposed project is aimed at producing sugar products for local markets in the region, country as well as for exports to neighbouring countries in Southern Africa. Desert Lusu Salk Sugar saw an urgent need to undertake this project having observed the varsity open fertile flood landscape in the region, the none existence of this project in the country and the high demand sugar have both local and international.

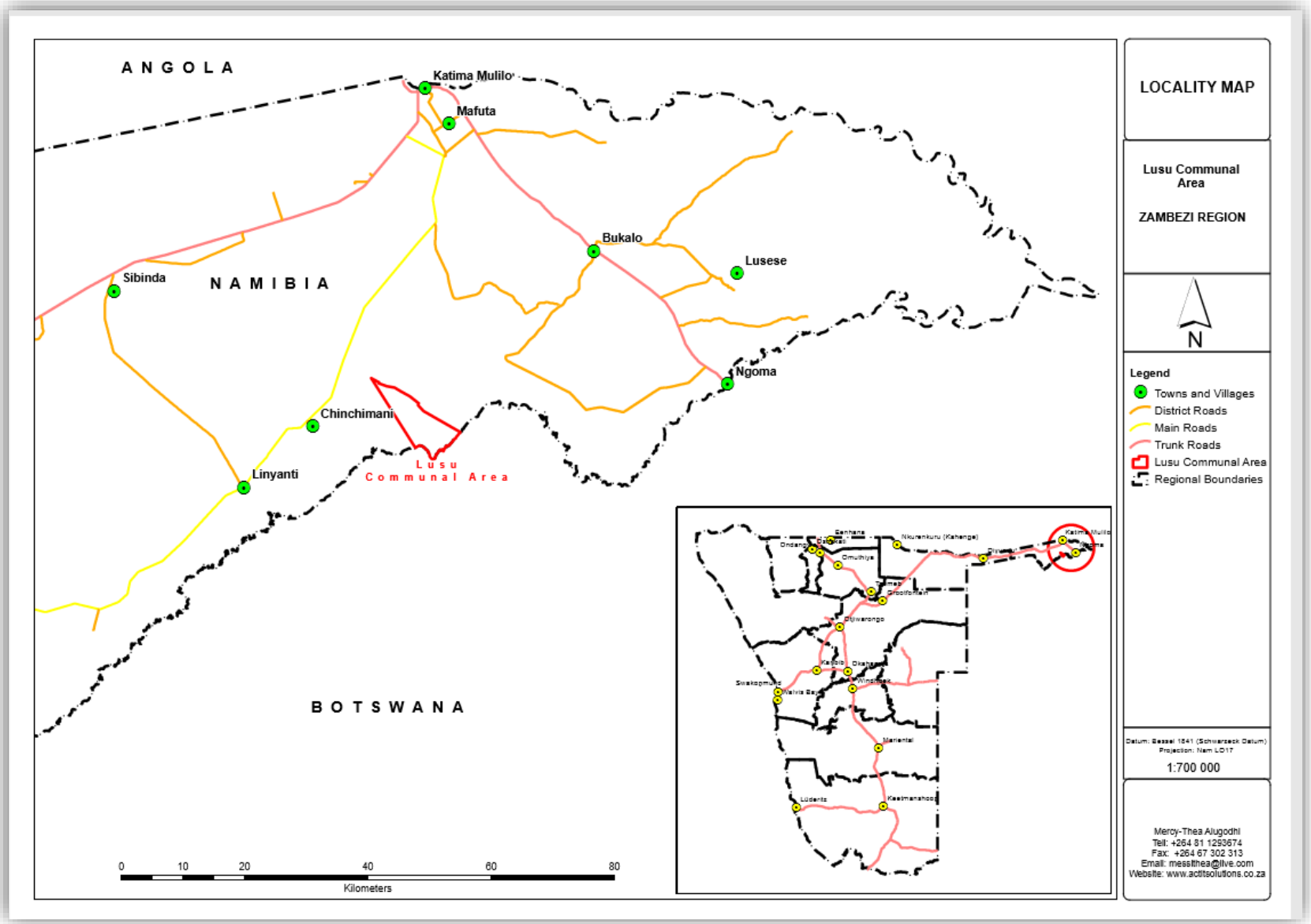
This site falls under the jurisdiction of the Zambezi Communal Land Board (ZCLB) and an application for right of Leasehold was lodged with the ZCLB who will verify, measure and register the piece of land. A joint venture agreement shall be signed upon approval of the Leasehold between investors, the landowners and other benefits that will be directed to the community. The project has already received endorsement from the land owners, the Chief of Mafwe traditional authority as well as the Hon. Governor of the Zambezi Region.

According to the Draft Environmental Management plan of the Lusu communal area shows that the site falls within the livestock and agricultural zone in which the following activities are permitted: grazing, farming and residential activity and there is no conservancy that exists in the area.

In accordance with Namibia's Environmental laws, an Environmental Scoping study of the proposed development needs to be undertaken and an Environmental and Social Management Plan (ESMP) prepared for submission to MET in order to obtain environmental clearance for the development to proceed.

The developers (Desert Lusu Salk Sugar) of the proposed farming project appointed Nyepez Consultants to conduct the Environmental Assessments and develop an Environmental and social Management Plan (ESMP) and accompanying report for the proposed agriculture farming project. An Environmental Scoping Study was undertaken to identify key biophysical

and social concerns related to the project. During February- March 2018, the consultant conducted site visit and communicated with a range of stakeholders to determine these issues or concerns and this report contains such findings.


ANGOLA
NAMIBIA
BOTSWANA
Katima Mulilo
Mafuta
Bukalo
Lusese
Sibinda
Ngoma
Chinchimani
Linyanti
Lusu Communal Area
0 10 20 40 60 80
Kilometers
LOCALITY MAP
Lusu Communal Area
ZAMBEZI REGION
N
Legend
Towns and Villages
District Roads
Main Roads
Trunk Roads
Lusu Communal Area
Regional Boundaries
Datum: Bessel 1841 (Schwarzeck Datum)
Projection: Nam LD17
1:700 000
Mercy-Thea Alugodhi
Tel: +264 81 1293674
Fax: +264 67 302 313
Email: messithea@live.com
Website: www.actitsolutions.co.za

Lusu Communal Area
Area: 6000Ha
ZAMBEZI REGION
NAMIBIA
0 1 2 4 6 8
Kilometers
LOCALITY MAP
Lusu Communal Area
ZAMBEZI REGION
N
Legend
Towns and Villages
District Roads
Main Roads
Trunk Roads
Lusu Communal Area
Datum: Bessel 1841 (Schwarzeck Datum)
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1.2 Investors profile

Desert Lusu Salk Sugar is a registered close corporation owned by partner companies from a previously disadvantaged background, who have interest in sugar production. The shareholders in the Company are; Desert Sugar Group (Pty) Ltd, (2) Lusu Farming (Pty) Ltd and (3) Salk Street Investment CC

1.3 Brief Description of Production

Desert Lusu Salk Sugar intends to farm only Sugar Plantation through Irrigation system. statistics has shown that the local demand of Sugar production is unsaturated and it will be the first project of this nature in the Country. The project will be implemented through a phased system of the total hectares proposed for production, 1,000 hectares is proposed to be on the basis of a Joint Venture (JV) with local farmers, serving as:

• a nursery to produce good quality seed cane for Lusu growers; and
• for training and development of Community growers.

The rationale and benefits of the project are:

• Sugar cane yield potential: The area has the potential to produce high yields of sugar cane under irrigation;

• Electricity; The co -generation of electricity can contribute to CeNored's electricity requirements

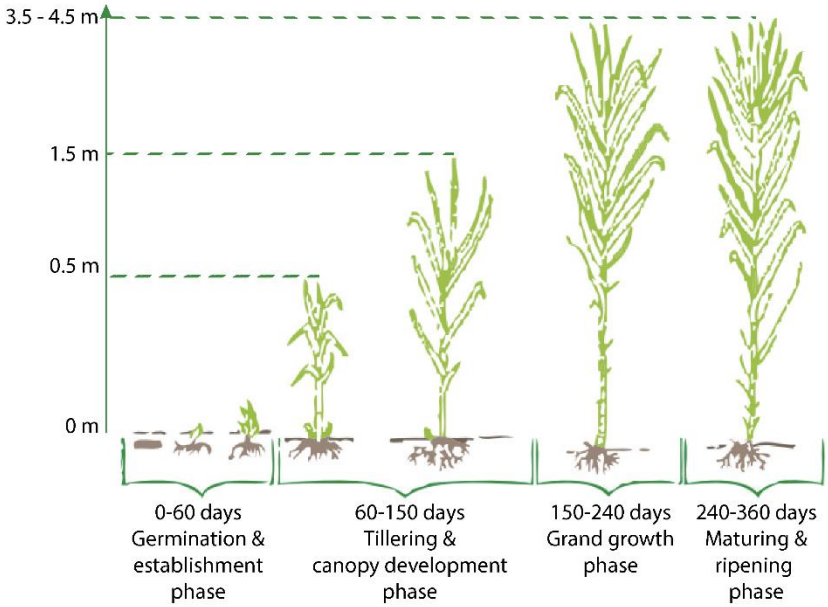
• **Direct investment:** Provisional estimates are that the investment will be of the order of N$ 1.4 billion, excluding public infrastructure investment in roads, bulk water supply, electricity and communication grids and the like: Phase 1 – N$ 800 million o Phase 2 – N$ 600 million

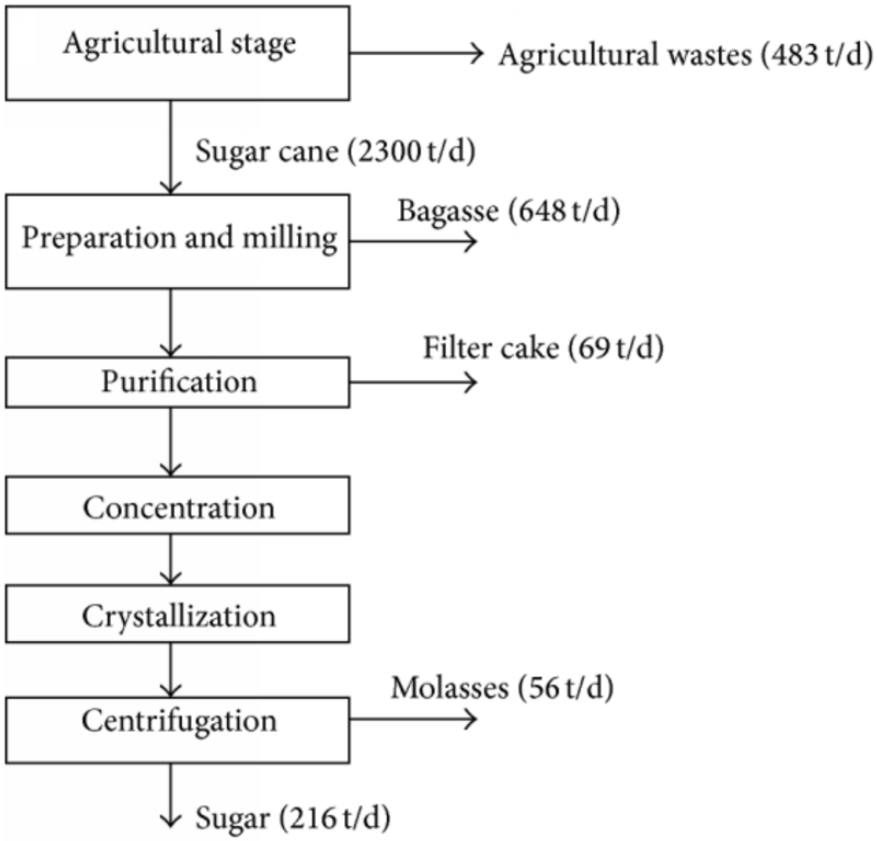
• Employment; The following estimates of employment creation and indirect benefit have been made:

- Direct employment – 1000 permanents
- Indirect – 100 temporals
- Dependents - 500

- **Remuneration:** It is estimated that about R100 million will be spent on salaries and wages in both the farming and factory operations;
- **Farm economy:** The local economy will be stimulated by approximately N$ 400 million per annum in farm income;
- **Farmer development:** Development of local farmers will take place, following correct farming and business management practices;
- **Community development:** Community empowerment and upliftment will occur as more revenue flows through the community and businesses are developed;
- **Skills development:** The project will be a draw card for attracting expertise into the area, which will facilitate skills transfer to local people;
- **Agri business development:** There will be secondary spin -offs in the development of local businesses (planting, harvesting, transport, shops, etc.) and other services; and
- **Contributor to energy needs:** The project will play a significant role in meeting the medium- and long-term power supply needs of the country. This is set within the context of Government's directive that 30% of new generation capacity will be developed by the private sector.

Figure 1: Sugarcane plantation production phases


3.5 - 4.5 m
1.5 m
0.5 m
0 m
0-60 days
Germination &
establishment
phase
60-150 days
Tillering &
canopy development
phase
150-240 days
Grand growth
phase
240-360 days
Maturing &
ripening
phase


Agricultural stage
Agricultural wastes (483 t/d)
Sugar cane (2300 t/d)
Preparation and milling
Bagasse (648 t/d)
Purification
Filter cake (69 t/d)
Concentration
Crystallization
Centrifugation
Molasses (56 t/d)
Sugar (216 t/d)

1.4 Consideration of sugar against other alternatives

Choice amongst options: The following alternatives have been assessed in terms of reasonableness, practicality, feasibility and viability.

• **Status quo** – the natural resource base without the development of irrigation has limited ability, given the low rainfall and high summer temperatures, of providing a sustainable agricultural production platform that has the capacity to address the endemic poverty experienced by the people of the area.

• **Tourism and eco/adventure tourism** – this is considered as one of the few economic options available to those portions of Lusu area not suitable for agriculture. These areas are along the floodplains, where pans occur. This activity can exist as a stand-alone activity to that of the irrigated sugar cane and is not considered an alternative to the project but an activity that can co-exist with the project.

• **Conservation** – the floodplain conservation efforts are hampered by survivalist pressure on the population with few other alternatives combined with the impact of the dam in controlling and regulating river flows. This approach without the development of irrigation and economic development opportunities on the alluvial terraces away from the sensitive pan system along the river will result in a continued degradation of the floodplain with further encroachment pressure by the growing population. In short conservation of the Linyanti River system of pans will only be successful if local people can have alternate income generating opportunities, which the project will provide.

• **Cattle production systems** – these are extensive with low level of productivity and commercial off-take at about 4 % of herd size annually. This compares with a 20% norm for commercial herds. The Zambezi Region's Department of Agriculture is promoting the farming of livestock but again this activity can co-exist and even be supported by the project as sugar cane tops could be used as a source of feed and the creation of irrigation infrastructure provides the infrastructure that could support pasture and animal feed production.

• **Other cropping options** – other forms of farming has been tried with limited success since the late 1990s. It can reasonably be expected that farmers on dry land will continue to grow Maize & mahangu without other better options. Food crops such as vegetables and maize are expected to benefit from the irrigation infrastructure and be grown in areas adjacent to the cane production area.

1.5 Terms and reference

The terms of reference for this Environmental Assessment is to determine the potential bio-physical and social impact emanating from the construction and operation of the proposed farming project. The aims and objectives of the assessment are:

6. To establish and describe the known ecological baseline conditions for environmental, health and social conditions existing in the project area from secondary information and a reconnaissance site visit
7. To conduct an environmental impact identification and assessment and to provide a description of the likely environmental impacts of the proposed project during the construction and operation phases
8. To also demonstrate that the Environmental Assessment complies with the current and/or expected Namibian legislation requirements for environmental, social performance and health.
9. To identify and draft actions for environmental and social management plan of the proposed farming project
10. To identify and document mitigation measures to minimise identified adverse environmental impacts

Based on the above the Environmental & Social Management Plan (ESMP) lists those management actions that are needed to ensure that undue or reasonably avoidable adverse impacts of the planning, construction and operations of the project are prevented and that the positive benefits of the project are enhanced or increased. It also gives responsibilities and will be used as a checklist to monitor compliance at the site

.

2. LEGAL REQUIREMENTS

The Department of Environmental Affairs (DEA) in the Ministry of Environmental and Tourism (MET) regulates all Environmental Assessment activities as outlined in the Environmental Management Act of 2007 (EMA) and Environmental Management Regulations of 6 February 2012. The Environmental Management Act (EMA) sets out the objectives of EIAs in Namibia and makes provisions, among other things, for the listing of activities that may not commence without an environmental authorization.

Key policies currently in force include:

- Namibia's Environmental Assessment (EIA) Policy for Sustainable Development and Environmental Conservation (1995).
- The Minerals Policy of Namibia (2002).

The proponent appointed Nyepez Environmental Consultants to undertake the Environmental Scoping Assessment (ESA) in order to obtain an Environmental Clearance Certificate (ECC) for the above proposed project in Henties Bay. The competent authority is the Ministry of Environment and Tourism: Department of Environmental Affairs (MET: DEA).

2.1 Applicable Laws and Policies

In the context of listed activities for infrastructural development in Namibia, there are several laws and policies currently applicable. Each of these is discussed in detail below.

ENVIRONMENTAL MANAGEMENT ACT

To enforce the policy on EIAs, the Environmental Management Act (EMA) (7 of 2007) has been compiled but is yet to practically come into force because the required regulations are still in draft form. The EMA is expected to improve the management of impact assessments in Namibia through the establishment of an environmental commissioner, who will approve environmental plans and through requiring government agencies to work as a cohesive decision-making agent to ensure long term sustainable resource use.

THE WATER ACT

The Water Act (54of1956) regulates the abstraction of groundwater for mining purposes. This Act is also an example of the older legislation which does not meet the needs of Namibia's modern development patterns. In recognition of this, the Water Resources Management Act (24of2004) has been drafted and published. It is still to come into force. This Act is more relevant to addressing Namibia's geo hydrological and climatic contexts.

THE NAMIBIA WATER CORPORATION

The Namibia Water Corporation Act (12of1997) charges the corporation to supply bulk water, based on need and availability. The corporation is also charged with the duty of conserving water resources in the long-term.

THE FOREST ACT

The Forest Act (12 of 2001) allows for the declaration of protected areas in terms of soils, water resources, plants and other elements of biodiversity. This includes the proclamation of protected species of plants and the conditions under which these plants can be disturbed, conserved, or cultivated.

PARKS AND WILDLIFE MANAGEMENT BILL

The Parks and Wildlife Management Bill (2009) aims to provide a legal framework for the sustainable use and maintenance of Namibia's ecosystems, biological diversity and ecological processes; and repeals the Nature Conservation Ordinance (4 of 1975). This Bill allows the Namibian Ministries of Environment and Tourism, and Minerals and Energy, to allow mining to take place within parks subject to the relevant assessments and authorizations.

NATURE CONSERVATION ORDINANCE

The Nature Conservation Ordinance (4 of 1975) provides for the declaration of protected areas and protected species.

NATIONAL HERITAGE

The National Heritage Act (27 of 2004) provides protection and conservation of places and objectives of significance, as all archaeological and paleontological objects belong to the state.

THE UNITED NATIONS CONVENTION ON BIOLOGICAL DIVERSITY

This over–arching international convention is relevant to biodiversity conservation and management.

3. THE ENVIRONMENT ASSESSMENT PROCESS

This chapter outlines the broad technical and public participation processes that has been followed throughout this environmental assessment process.

3.1 Technical Process Followed During the Scoping Phase of The EIA Process

The EIA is part of the scoping study of the proposed project. The findings of the EIA will also assist engineering design team in taking into consideration potential environmental impacts. During the scoping stage the technical assessment will focus much on identifying issues of concern. These issues will be taken into considerations during impact assessment process. The following has been conducted:

1. Desktop review of the proposed project and available information from the client.
2. Meeting with the client and project team to discuss project specifications.
3. A biophysical assessment of the study area.
4. Public consultation meeting held at the site on 16 December 2019.
5. Background Information Document available for the public.
6. Draft of Scoping report available for the public.

3.2 EIA Evaluation Method

Before the project commences, an authorization is required from the Department of Environmental Affairs (DEA), Ministry of Environment and Tourism, in line with the Environmental Management Act of 2007 and the EIA Regulations No 30, 6 February 2012. Therefore, the proposed development is a listed activity and an EIA must be undertaken. The application for the Environmental Clearance Certificate (ECC) will be submitted to DEA. The following subheading describes what will be covered in the Scoping and Environmental Assessment.

The assessment criteria ensure that a comprehensive assessment of potential is undertaken in order to determine the overall impacts significance. The following criteria should be taken into consideration:

- The nature of impact i.e. positive, negative, direct, indirect;
- The extent and location of the impact;
- The duration of the impact i.e. short term, long term, intermittent or continuous;
- The magnitude/intensity of the impact occurring;
- The extent to which the impact can be reversed;
- The degree to which an impact may cause irreplaceable loss of a resource;
- The cumulative impacts;
- The mitigatory of potential impacts; and
- The significance of the impact on local, regional or global level.

Mitigation measures should subsequently be identified and recommended for all impacts to reduce the overall impact significantly to an acceptable level, where applicable. Mitigation measures should aim to address the following:

- More environmentally sound designs, concepts, layouts, technologies, etc., are investigated and implemented, if feasible;
- Environmental benefits of proposed activity are enhanced;
- Negative impacts are avoided, minimized or enhanced; and
- Residual negative impacts are within acceptable levels.

4. PLANNED PROJECT ACTIVITIES AND RECOMMENDED MITIGATION MEASURES

The project activities include those during the pre-construction (planning & setting up site camps before construction), construction and operational phases of the proposed Agricultural facility expansion. Each activity has potential impacts on the environment hence the following mitigation measure must be respected all three phases.

4.1 Pre-Construction Phase

- **Mapping:** all sections of the proposed route have been mapped in detail.
- **Fence:** the mapped section will be temporarily fenced in order to constrain construction activities.
- **Plant relocation:** a search and rescue for any plant species of high conservation status. Environmental site officer must be appointed to oversee storage and relocations of these plants.
- **Clearing and grubbing:** the removal of all vegetation and topsoil in preparation of stable foundation for new construction works as well as along the proposed area and in areas set aside for construction camps.
- **Access road construction**: this will involve making access road for construction vehicle to make use. In this case it will not be necessary as there is already an existing road. However, since they will be an increase in number of vehicles to site dust may be an issue – gravel road needs to be watered daily.

4.2 Transportation of Materials to Site

Road transport: Material sources outside the study area will be transported to site using the main road (Katima Linyanti tarred road) by means of delivering these materials to site.

4.3 Establishment of Construction Site Camps

Construction of temporary camps: these will be established by each contractor, and involve clearing of small vegetation, fencing of camps and construction of storage rooms and vehicle parking areas. The camps will be electrified, and ablution and potable water provided. The exact number and location of these camps is not determined yet. An Environmental Management Plan (EMP) will be drafted as part of the EIA to describe parameters such as the following:

- A plan from the contractor is required, detailing the layout of site facilities, such as chemical toilets, areas for stockpile of materials, storage for hazards materials and provision of containers.

- All waste generated will be storage in skip containers during construction phase and only a private registered waste collector will be allowed to transport waste from site to dumpsite. Any other waste will be stored in wheel bins as per provision by the Desert Lusu Salk Sugar.
- All hazard waste such as chemicals and other solutions, will be transported to a registered dumpsite in Walvis Bay upon consultations with the relevant authority.
- Fuel, gas will be stored in a secure area in a steal tank supplied and maintained by fuel suppliers in accordance with the law.
- Suitable washing and facilities and sanitary arrangements at site offices, workshops and construction sites will be provided. Sanitation facilities for the camps will comprise either prefabricated septic tanks.
- Water for human consumption will be available at the site office.

4.4 Construction Phase

4.4.1 Earthworks

Clearing of vegetation: vegetation along the proposed area will be cleared and grubbed.

4.4.2 Borrow Pit Establishment

Existing borrow pits designated by the local authority will be used. No new borrow pits will be established. If they will be a need to establish new borrow pits, will be done in accordance with the local authority upon consultations.

4.4.3 Road Construction

No new access road or tracks to be establish, all contractors are to use the already existing access road to the school site. Any road construction or upgrade to the access gravel road such as earthworks, construction of pavement layers or drainage structures will be done in accordance with Roads Authority standards and requirements for roads and bridge works.

4.4.5 Site Removals and Rehabilitation

Site Removal consists of the removal of all building material, temporary structures and any other waste generated the school during construction. All such materials must be removed from site and disposed of appropriately in accordance with the municipal procedures in place. Infrastructure such as storage structures or containers, workshops maybe left behind to be used by the project, if requested and agreed upon.

4.5 Operational Phase

Considering that the proposed developmental activity is situated within the Communal Land of Lusu, under Mafwe Traditional Authority, provisions for utilities such as water supply, electricity and sanitation connections will be connected to the already existing grid with is within a short distance of 2 kilometres.

Nyepez Consultancy CC promotes the idea of zero waste to dumpsite by encouraging its clients through waste recycling initiatives. It is with this background we advise the client to develop a waste management policy to guide the patrons of Sugar Processing Project on how to deal with waste. We encourage initiatives such as waste segregation, reduce, reuse and recycle.

5. PROJECT DESCRIPTION

5.1 Introduction

Desert Lusu Salk Sugar with interests in the production and distribution of sugar in the Southern Africa and Region has proposed to establish by putting up a sugar factory in the flood plains of Lusu Communal Area, for the purposes of milling sugar cane and producing both brown and white sugar and other related by-products.

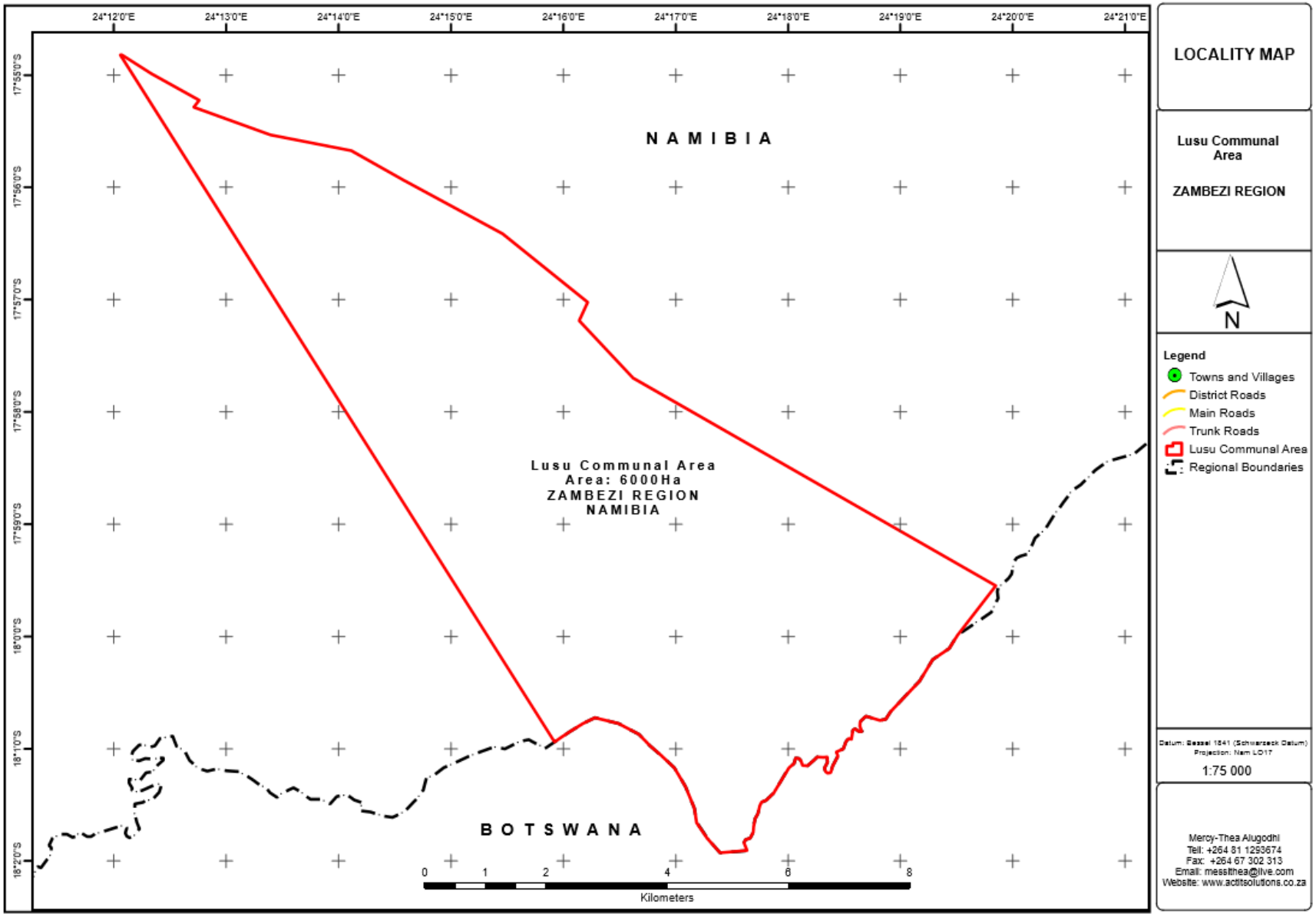
The company is planning to establish a 2500 TCD (Tonne Sugar Cane crushed per day) capacity factory to produce around 45,000 tons of both brown and mill white sugar as well as molasses. The project aims at supporting the out growers in the Southern region to produce high quality sugar cane by providing assistance in terms of land preparation extension services, seed and fertilizers. Desert Lusu Salk Sugar has a future plan of continuously expanding the milling operations and also venturing into power generation and ethanol production. The sugar factory will be located on Project site at Lusu Village or Communal Area. The proposed project will create employment and business opportunities to the local economy and country at large. The proposed site covering 6000 hectares is located approximately 1km to the East of Lusu village road.

Area under Cane – 6 000 Ha

Cane produced – 500 000 tons/ year

Sugar produced – 20 000 tons / year

Ethanol produced – 2 million litres / year


LOCALITY MAP
Lusu Communal Area
ZAMBEZI REGION
N
Legend
Towns and Villages
District Roads
Main Roads
Trunk Roads
Lusu Communal Area
Regional Boundaries
1:75 000
NAMIBIA
BOTSWANA
Lusu Communal Area
Area: 6000Ha
ZAMBEZI REGION
NAMIBIA
24°12'0"E
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17°58'0"S
17°59'0"S
18°0'0"S
18°1'0"S
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0 1 2 4 6 8
Kilometers
Mercy-Thea Alugodhi
Tel: +264 81 1293674
Fax: +264 67 302 313
Email: messithea@live.com
Website: www.actitsolutions.co.za

The initial manpower required for the proposed sugar mill will be about 500 workers whose number will increase as the factory gains momentum. However, the establishment of the sugar mill is expected to support the livelihood of more than 50,000 people comprising of farmers and their families, farm laborers, vehicle operators, traders which will support the overall economic development in Zambezi region and the wider region.

The overall purpose of the project is to increase Namibia's competitiveness in the sugar sector and to meet domestic sugar demand including addressing the current deficit using local resources. The choice of the proposed site is justified because Lusu & surrounding Communal area is endowed with suitable natural conditions for increased sugarcane production. It is also justified by the vision and mission of Zambezi Integrated Rural Land Use Development Plan to encourage and promote industrialization in the county. The ultimate aim of the aim is to support efforts for Namibia to meet the existing sugar deficit and reverse the current trend of continuous importation of sugar into the country thereby draining the country's foreign exchange and job exportation. The specific aims of the project are to:

d) Expand production of sugar cane in the Lusu Communal Area and out-growers' fields.

e) Construct, establish and operate a modern and competent sugar industry.

f) Create employment for operating the sugar processing mill by engaging professionally qualified individuals and hard-working Namibians in Zambezi Region.

The buildings in the sugar factory will be constructed in accordance with the National Building Code. All the constructions will be done under the guidance and supervision of a qualified Project Engineer. The construction of the factory buildings will involve the use of concrete stub column bases as designed in the approved structural drawings. The factory walling's shall be fabricated from mild steel universal beams sizes of 240mm x 240mm x 89kg/m which shall include the bracings as necessary to contain the iron sheet cladding in IT5 profile.

The factory roofing shall be of steel trusses with iron sheet roof covering in IT4 profile secured onto Z purlins. The UC 'H' beams for the wall height of approximately 12m height shall be welded together with mounting plates drilled and bolted to RC concrete stub column bases. The factory floor shall be reinforced by BRC, A142 mesh. The factory will be surrounded by a 7m high perimeter wall. The above specifications may vary during detail engineering by the civil architect.

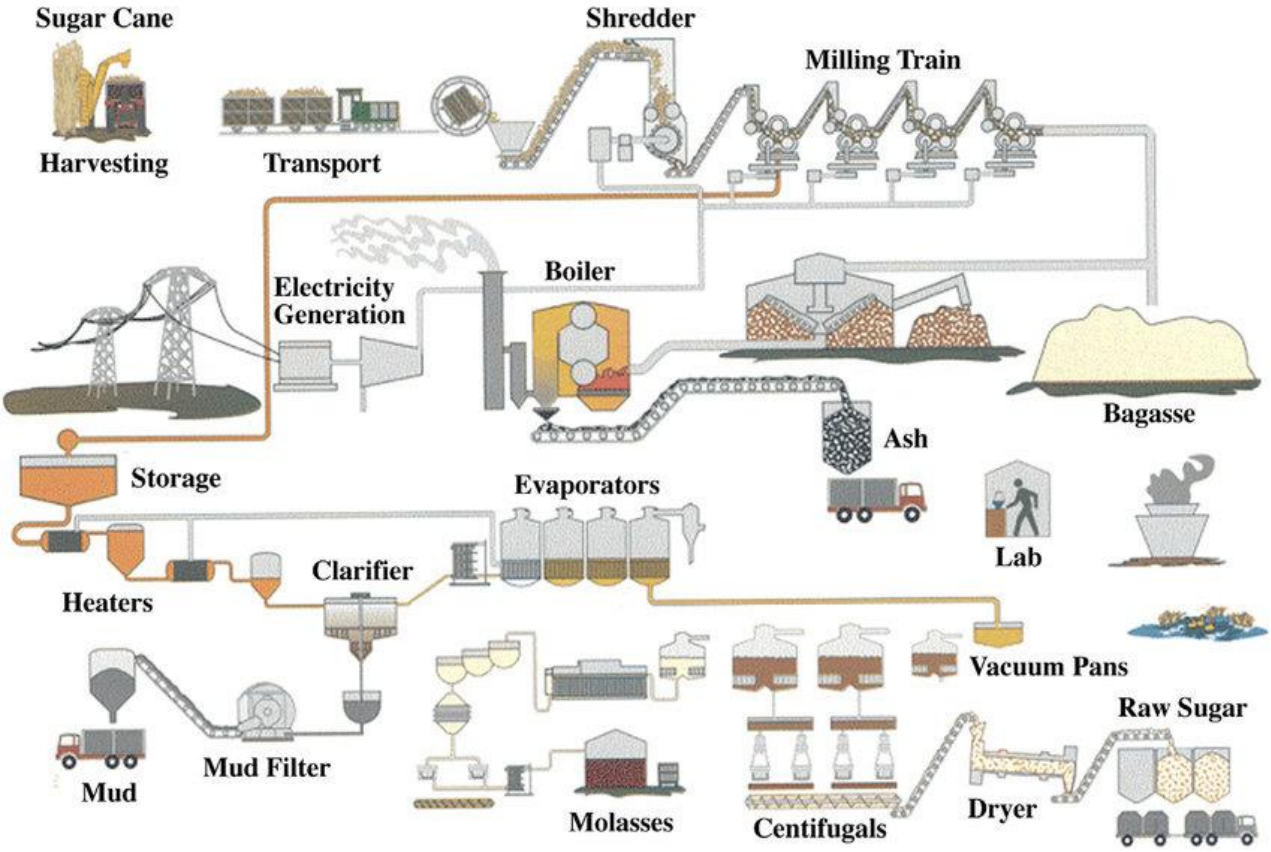
5.2 Proposed operations

The Figure below shows the overall operational flowchart in the sugar sub-sector sector. The flow chart begins with the growing of sugarcane by farmers which is later harvested for two purposes, namely for; a) production of sugar for the market, and b) use of cane as seed for subsequent plantings. The sugar cane usually consists of 70% water, 14 - 16% fibre, 10-13% sucrose and 2.7% soluble impurities.

Figure 2: overall operational flowchart

Studies have shown that only 10% of the sugar cane will eventually be processed into commercial sugar. The proposed Lusu sugar factory in Lusu Communal area will be expected to generally operate for most of the year based on sugarcane supply with allowance for the machinery servicing.

Figure 3: Overall operational process



5.3 Sugar cane farming

Sugar cane supply for the Desert Lusu Salk sugar factory in Zambezi Region (Lusu Area) is expected that sugarcane growing for supply to the Desert Lusu Salk factory will be undertaken as a monoculture with no crop breaks. Communities in Lusu have opted to shift to sugar cane farming and other cash crops due to poor prices and unaffordable inputs. The farm will use the mechanical land preparation approach to prepare their land for sugarcane cultivation. The cane varieties to be grown in the proposed project area will be determined by the agronomist. The sugar cane cultivation will mainly rely on rain-fed cultivation. Sugarcane weeding will be done both manually and mechanically by use of tractors.

Disease control in the sugar farms will be undertaken by use of herbicides including sencor and round-up to be mixed in the ratio of 2:2 in 160 litres of water per hectare. Desert Lusu Salk will provide fertilizers to boast the soil fertility in order to enhance the yields. This will include muriate of potash applied at a rate of 50 kg/ha as well as di-ammonium phosphate (150 kg/ha), urea (100kg/ha) and calcium ammonium nitrate (80kg/ha). The agrochemicals will be applied properly through the

extension services provided by Desert Lusu Salk Sugar in order to ensure minimum environmental impact.

5.4 Sugarcane transportation

The Desert Lusu Salk Sugar factory in Lusu will process up to 2,500TCD, which will be obtained from co-operative societies. Sugarcane delivery will be undertaken Desert Lusu Salk Sugar tractors and contractors if necessary. The key cane delivery will be undertaken along the existing road network with the Katima Linyanti road as the main artery. Small farmers will be paid on the basis of the tonnage of cane delivered to the factory. Mature cane will be cut manually through hand cutting. Hand cutting is one of the most common method and key source of employment in the Sugar production industry. The cane will be cut at ground level, the leaves removed and the top trimmed by cutting off the last mature joint. The cane will then be loaded and transported to the factory by use of tractors. The remnant biomass will be retained in the farm as part of internal manure. The tractors are the best option because they can maneuver their way along the Lusu project area gravel road which is usually impassable during rainy seasons. Desert Lusu Salk Sugar will ensure the cane will be delivered to the sugar factory as soon as possible to avoid cane deteriorates rapidly after cutting and cannot be stored for latter processing without excessive deterioration of the sucrose content.

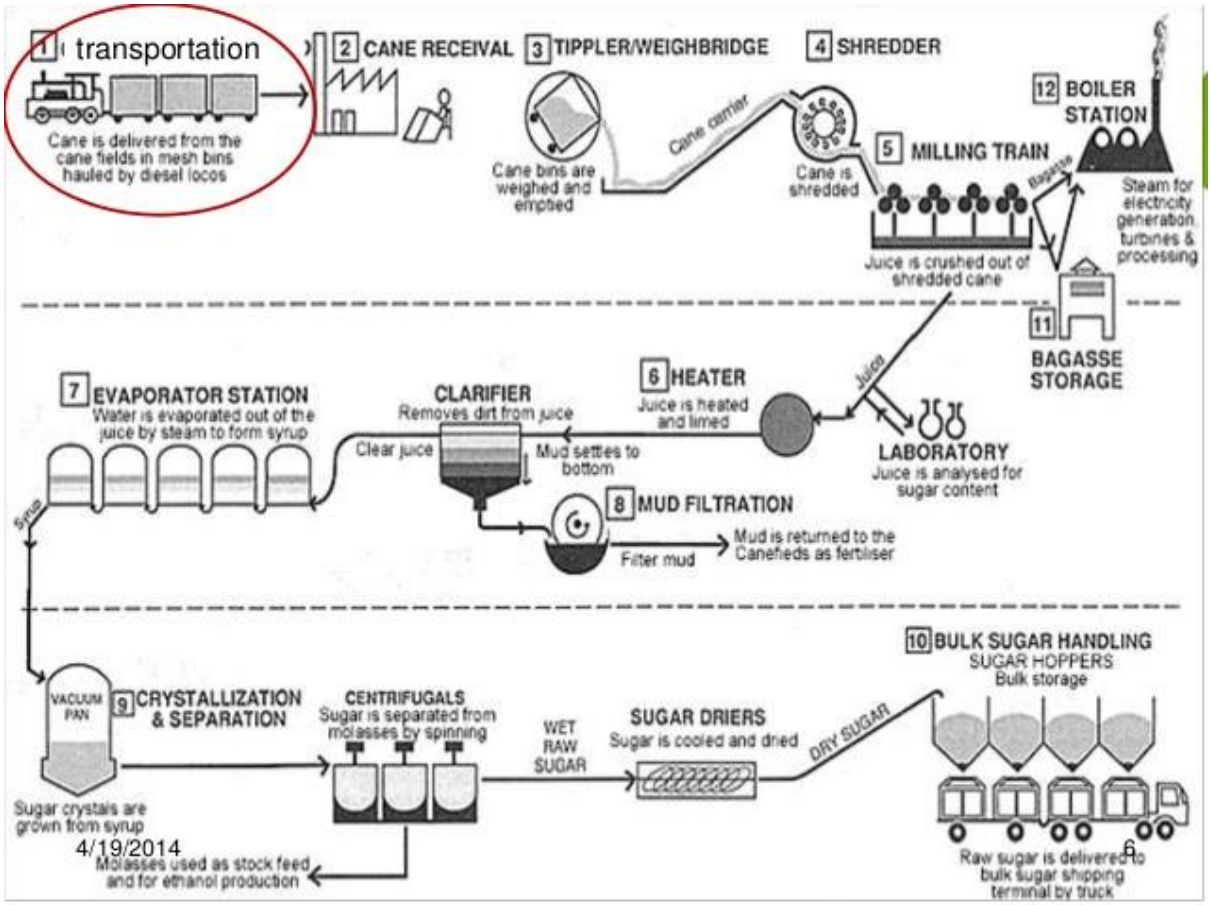


Figure 4: Sugarcane Transportation System

5.5 Cane weighing

The sugar cane will initially be delivered to the factory premises initially by tractors due to the state of the road and in future by trucks and trailers. The vehicles will enter the factory premises at a gate to be opened immediately at the edge of the proposed site and then proceed to the weighbridge where the cane weight will be recorded by weighbridge clerks. The cane-weighing will be done as transparently as possible using a modern and well calibrated weighbridge. It will then be off loaded at the cane yard using gantry cranes, while care is taken to ensure that the trash and other extraneous materials are removed from the cane, before loading the product on the cane table awaiting paddling. During this stage maximum care will be taken to ensure that cane is processed within 48hrs after harvesting in order to ensure that it is in a fresh state. Laboratory tests will be carried out to establish brix, pol, among others before cane is offloaded onto the mill. Old and fibrous cane will be rejected at the cane yard.

5.6 Sugarcane processing

Raw sugarcane from the farm is usually refined in a sugar factory for human consumption. Figure above (page 37) shows the process flow chart in sugar processing with the key activities as; a) cane cleansing and grinding, b) juicing, c) clarifying, d) evaporation, and e) crystallization. The main inputs in sugarcane processing include; a) raw sugar, b) water, c) sulphur, c) limestone (calcium carbonate), and d) energy. The proposed sugar processing operations in the Desert Lusu Salk sugar factory in Lusu area are highlighted below.

5.6.1: Cleansing and grinding

The sugar cane stalks will be delivered, weighed and then transferred by an auxiliary carrier or conveyor belt to the cane shredder trap (magnetic iron separator) where any metallic materials, which can damage the crushers will be trapped. It will then proceed to the various preparatory devices and the prepared cane delivered into elevators/belt conveyor to feed in to the first mill of the milling train (Plate 2-3). The milling train continue to extract the maximum sucrose from the prepared cane with addition of hot water spray in last two mill which called compound imbibition system. After final extraction of sucrose from the last mill the bagasse is discharge into bagasse elevator leading to boiler/bagasse storage. The bagasse will be properly secured in a well prepared baggase holding area. During milling operation, the spillage of sucrose rich juice will be controlled in order to avoid the release of high BOD and COD effluent into the environment. This will be addressed by washing of the cane before crushing under a closed loop system. The leachate if any from bagasse holding area will be treated as detailed in Section 2-11 and discharged to NEMA standards prescribed.

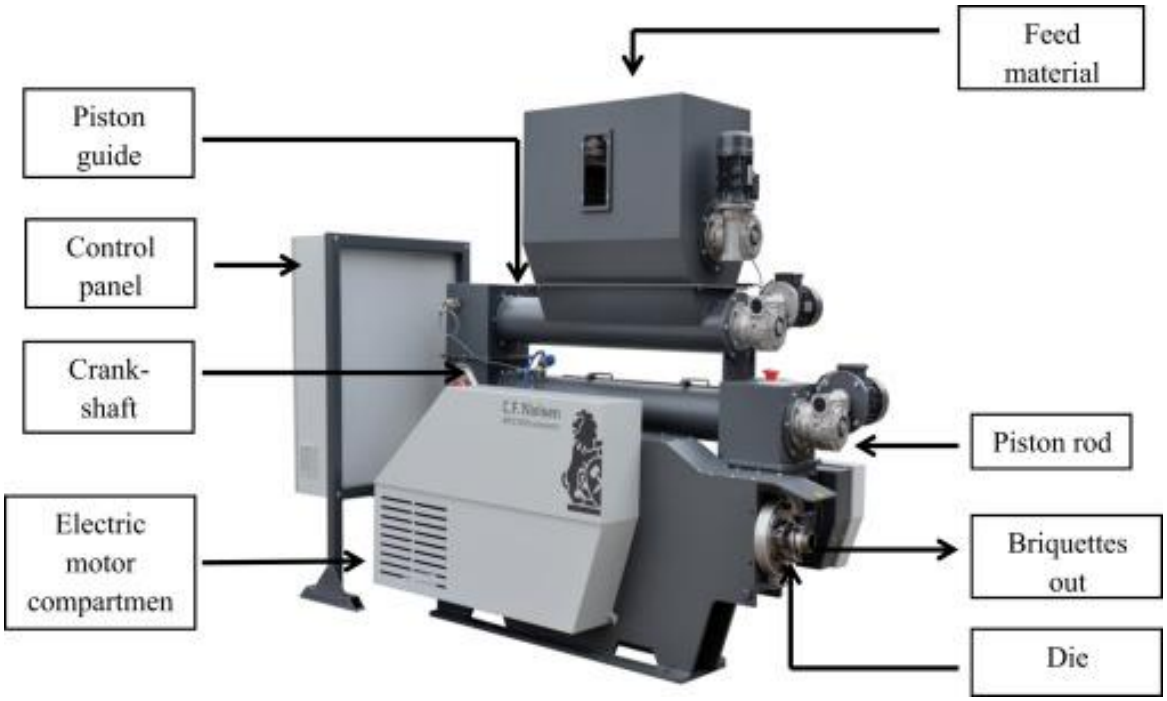


Figure 5: Illustration of a Sugarcane grinding machine

5.6.2: Juicing

The extracted juice is called primary and secondary juice. The primary and secondary juice mixed in the mixed raw juice tank and pumped to rotary juice screen to remove cush-cush from the juice. The strained juice is pumped to process through mass flow meter for juice treatment. This juice is called mixed juice. The mixed juice is taken into primary heating following by liming and secondary heating. After secondary heating the juice is flashed in its flash tower for de-aeration and then reach the juice clarifier to separate clear juice and solids. To speed up the settling rate suitable flocculent is added around 3 ppm before entry to juice clarifier. The clear juice from top layer of each compartment of the clarifier is drawn to falling film evaporators to concentrate this thin juice from 12 brix to 65 brix. The mud from bottom of each compartment taken into the rotary vacuum filters to extract maximum sucrose from this cloudy muddy juice and filtered residual is called filter mud. The extracted juice is further sent to defecation tank to follow the further treatment along with secondary juice.

5.6.3: Clarification

In the Juice clarification for producing raw sugar the major clarification chemical used only is milk of lime. This is added in lime defecation vessel under controlled automation to ensure required level of pH of the final outlet juice. This limed juice is heated up to 102 C before flash tower. This will be the common juice heating practice in the factory involving the clarification of sugarcane juice for pure syrup production. The clarification process is required in order to reduce particles in sugarcane juice before concentrating in evaporator to produce pure syrup. This will involve the addition of carbon dioxide (CO2) and lime solution to the primary heated juice to forms calcium carbonate (CaCO3) which will precipitate non-sugar debris (fats, gums and wax) from the juice. This precipitate is called filter mud and it will be separated from the juice by in rotary vacuum filter. The juice will then be filtered to remove any remaining impurities. The chemical reaction, which occurs under controlled conditions and as the calcium carbonate is precipitated, may result in some organic impurities such as gums, amino acids and colour components which will be removed from the sugar syrup. The key environmental concern at this stage is the emission of lime dust into the environment as dust but this will be properly controlled in the Desert Lusu Salk sugar factory.

5.6.4: Evaporation

The clear juice will then be concentrated into syrup by boiling using steam in a process called evaporation. The main aim of this is water removal by multiple effect evaporation. Multiple effect evaporation is the scheme where the juice is boiled in series 4 or 5 vessels, with the steam being fed to vessel 1 only. The vapour from vessel 1 will boil the juice in vessel 2 and the vapour from 2 will boil the juice in 3, and so on until vapour from the final vessel goes to waste and the sugar is crystallized in vacuum pans (Figure 23). In this stage, some smoke will be produced at the factory in the form of a mixture of particulate matter and gases such as carbon dioxide and others like, H2S and CO. The effect of this shall however, be minimized by discharging it using high elevation steel chimney constructed to an appropriate height of not less than 5m as recommended by the Factories Act. The height of the Desert Lusu Salk Sugar factory chimney is will be around 44m above the ground level.

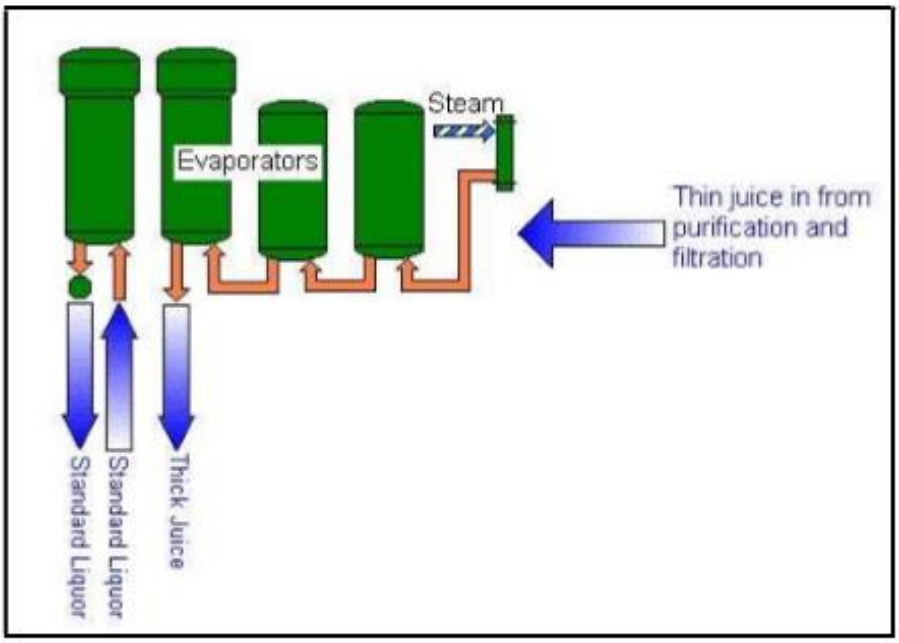


Figure 6: Multiple effect evaluation

5.6.5: Crystallization

Crystallization of sugar is one of the most vital steps in sugar milling which involves the formation of solid crystals. In the crystallization stage, the syrup will be boiled at low temperatures under partial vacuum and some sugar seeds added which will cause the development and growth of sugar crystals and the outcome is called massecuite. This will involve the feeding of pulverized sugar into the pan as the liquid evaporates, causing the formation of a thick mass of crystals. The crystals will then be spun dry in a centrifuge to produce crystal sugar.

Crystallization is not only a means to convert the sucrose to a more usable form, but also an important refining step since pure sucrose tends to crystallize out of the solution, leaving most of the impurities in the associated syrup. The process will be undertaken under reduced pressure of 7590kPa to allow a reduced boiling temperature (60-70◦c) in order to avoid the formation of coloured compounds. The vacuum condition will be achieved by use of an air pump and vapour contact condenser. At this stage, there is a likelihood of the release of some particulate matter to the environment but this will be controlled as much as possible. The packaging of milled sugar may also involve emission of particulate matter and use of non-biodegradable packaging (polythene) which is harmful to the environment especially at the point of use.

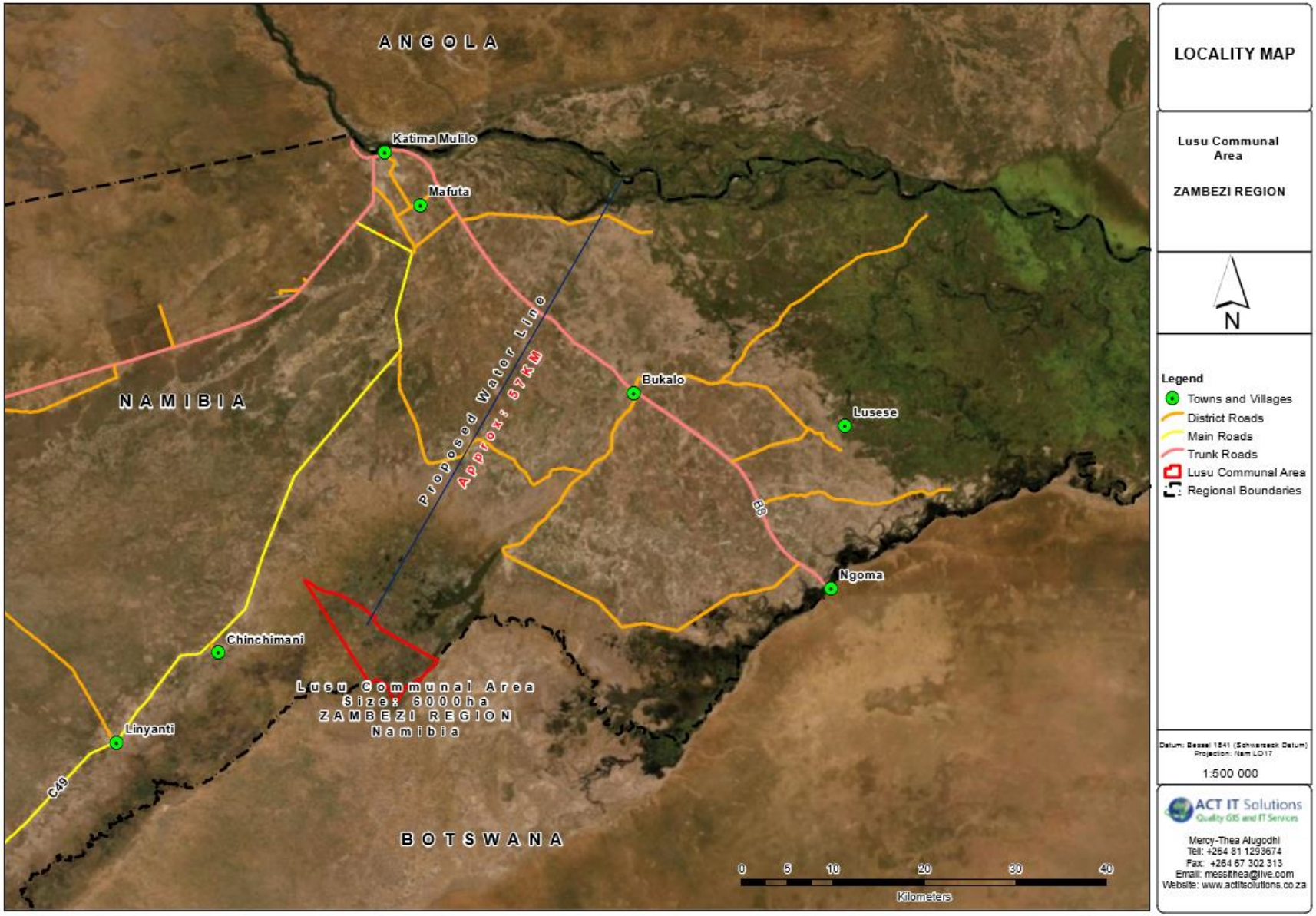
5.7 Energy supply

The Desert Lusu Salk sugar factory will depend heavily on the bagasse for boiler and furnace start-up operations with minimal use of wood to avoid deforestation. The amount of bagasse produced by the factory is estimated to be adequate to provide the amount of heat required for the boilers. Bagasse will constitute the main source of fuel for processing, with its combustion being undertaken in a closed environment thus making it possible for complete combustion for higher energy saving and minimal aerial discharges. In the future, the live steam generated from the baggase fired boilers will be fed in to a steam turbine for electricity generation to meet the factory needs with any excess distributed to other uses through the Zambezi Regional Power. It is expected that power generated from the steam turbine alternator will be sufficient to meet the entire electric power requirement for the total operation as well total lighting requirements.

At the initial stages, the Desert Lusu Salk Sugar will also be commissioned to install a transformer to handle 960 KVA which will be the power requirement for the factory. The power supply will be obtained via a transformer from the main line along the Katima Linyanti road or directly to the proposed factory. This will mainly be a power backup as the factory is expected to eventually generate sufficient power for its own needs.

5.8 Water supply

The factory will require significant volumes of water from about 4500 m3 per day to 7500 m3 per day in order to sustain various factory processes as shown in Figure below. During initial startup of milling, in the absence of hot condensate from cane, the maximum water intake shall be around 7500 m3/day after which the volume will reduce significantly. The proponent will therefore apply for a permit from the Ministry of Agriculture Water & Forestry (MAWF) to abstract and utilize approximately 7500m3 of water per day from Zambezi River which is located approximately 51km from the proposed factory site. This is a permanent river originating from Kavango Delta with a catchment area of about 804km2. Its main tributaries include Linyanti river, Kwando and Chobbe rivers the bank of the Zambezi River is well stabilized and with thick riparian vegetation including reeds. The installation of the water pumping station will be undertaken carefully to avoid the disturbance of the riverine wetland. The proponent will acquire a bout 0.80ha land parcel next to the river on which the water abstraction will be undertaken and a water abstraction license for the water abstraction.


ANGOLA
NAMIBIA
BOTSWANA
Katima Mulilo
Mafuta
Bukalo
Lusese
Ngoma
Chinchimani
Linyanti
C49
B8
Proposed Water Line
Approx: 57KM
Lusu Communal Area
Size: 6000ha
ZAMBEZI REGION
Namibia
0 5 10 20 30 40
Kilometers
LOCALITY MAP
Lusu Communal Area
ZAMBEZI REGION
N
Legend
Towns and Villages
District Roads
Main Roads
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Lusu Communal Area
Regional Boundaries
Datum: Bessel 1841 (Schwarzeck Datum)
Projection: Nam LO17
1:500 000
ACT IT Solutions
Quality GIS and IT Services
Mercy-Thea Alugodhi
Tel: +264 81 1293674
Fax: +264 67 302 313
Email: messithea@live.com
Website: www.actitsolutions.co.za

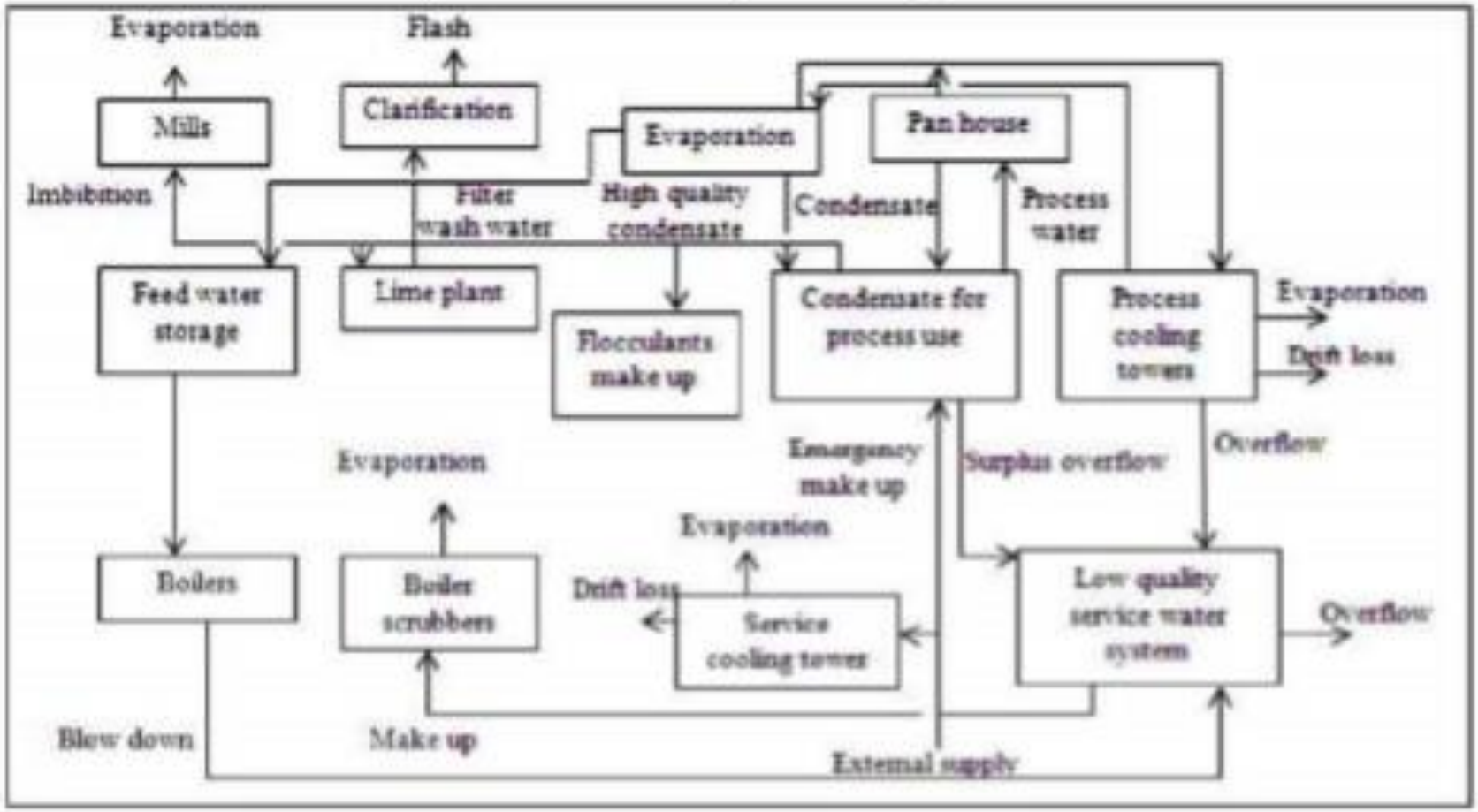


Figure 7: Illustration of amount of water & evaporation

When the factory is finally in full operation, almost 50 % of water in the closed circuit will be recirculated which will mean limited water abstraction from the river. The design of the Desert Lusu Salk sugar in Lusu project area will also include appropriate strategies for rainwater harvesting, storage and water recycling in line with a number of government policies.

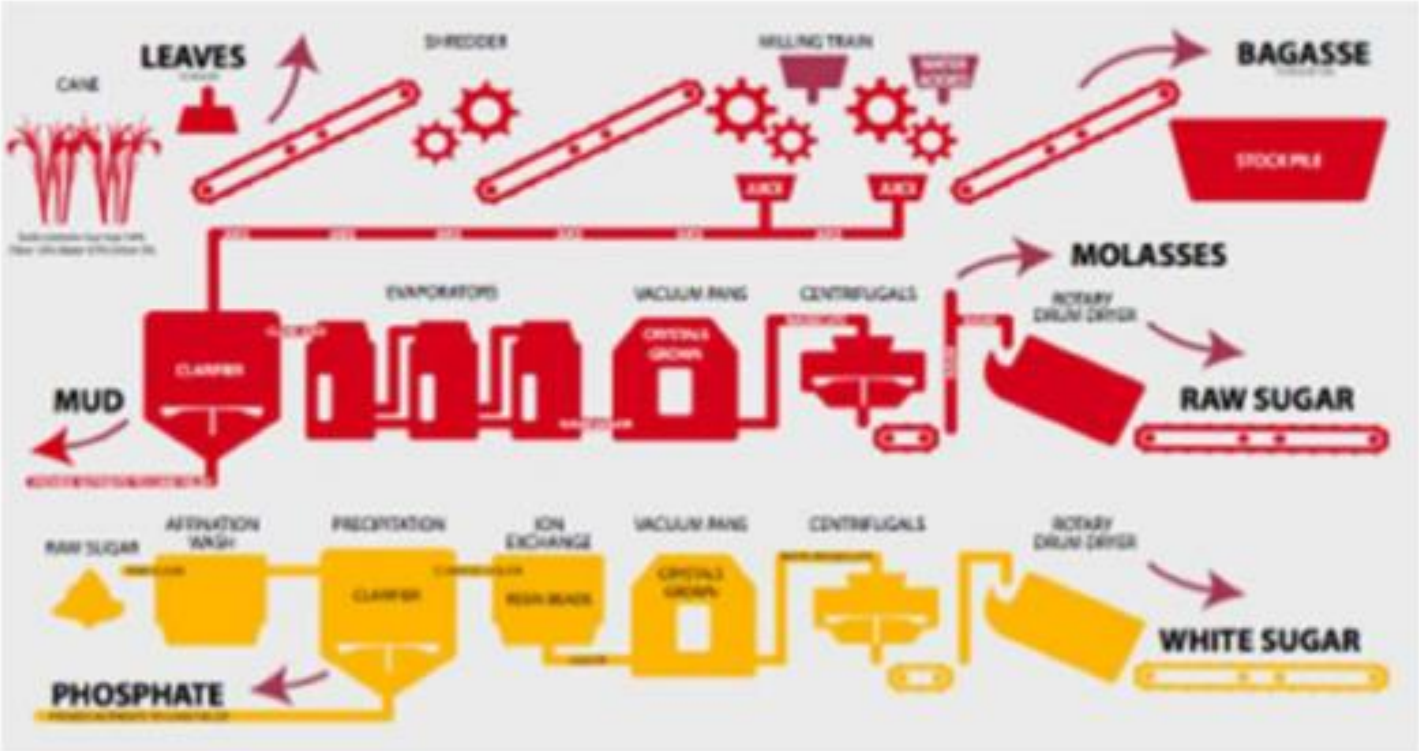
5.9 Storm water management

Large water flow from the factory environment will be collected and diverted from the area using cut off and storm water drains. Some of the locations for this will include the collection of water from a higher area and the prevention of such runoff flowing down the slope, or the taking care of runoff water from factory roadside drainage. The water from these drains shall then be discharged into the Stream at the lower edge of the factory site where all the natural flow is to. Continuous monitoring of the water quality in the stream will be undertaken to ensure that water pollution does not occur.

5.10 Solid waste management

The key solid wastes and by-products expected from the Desert Lusu Salk sugar processing plant in Lusu will include baggase, and filter or press mud as shown in the Figure above. Baggase is cane milling waste fibre matter whose content will be about 33 to 34 % of the cane. Desert Lusu Salk is planning to re-use the bagasse which is the residual woody fiber of the cane as fuel for boilers and lime kilns at the factory. The excess baggase will be exported to the Windhoek Paper Mills. In the latter stages, bagasse maybe used to generate power through cogeneration. Bagasse and biogases residue is primarily used a fuel source for the boilers in the generation of steam. The baggage will be stored in a well-designed holding area before reuse at the Desert Lusu Salk sugar factory in Lusu or transportation to the Windhoek Paper Mills. The leachate from the bagasse holding area will be treated as explained above.

The filter mud will be used for the production of dry filter cake to be used as a fertilizer and source of cane wax. The filter cake will be distributed to the sugar cane for recycling. The disposal of non-biodegradable matter, such as waste chemical and fertilizer containers, waste papers, used materials, waste packaging materials, kitchen and domestic wastes, will be undertaken by a NEMA registered Katima Mulilo disposal site.



The solid wastes disposal will be conducted as follows:

Solid wastes (such as plastic bags, cement bags, water bottles, building rubbles) generated from Lusu Sugar Plantation farming project site will be disposed to the Katima Mulilo designated dumping sites (located +- 52 kilometres) from the project site, permission to dispose these materials will be acquired from the Katima Mulilo Town council in Katima Mulilo. However, precaution measures such as wheel bins and black waste plastic bags will be placed on the farm where such material will be disposed or collected before being transported to the dumping site

5.11 Sewage Treatment and Disposal

Another development that will be undertaken at the site under the construction phase of the farming project will be development and/or the construction of the workers shelter, the factory and a storage facility for the harvested produce at the farm. The main administrative office building will be based in the town of Katima Mulilo but a small safelight office will be established at the farm and will contain one (1) office and secretary. Thus, the entire building shall contain four (4) toilets. As a result, a 80 000 L septic tank will be installed to absorb the liquid waste produced from the building

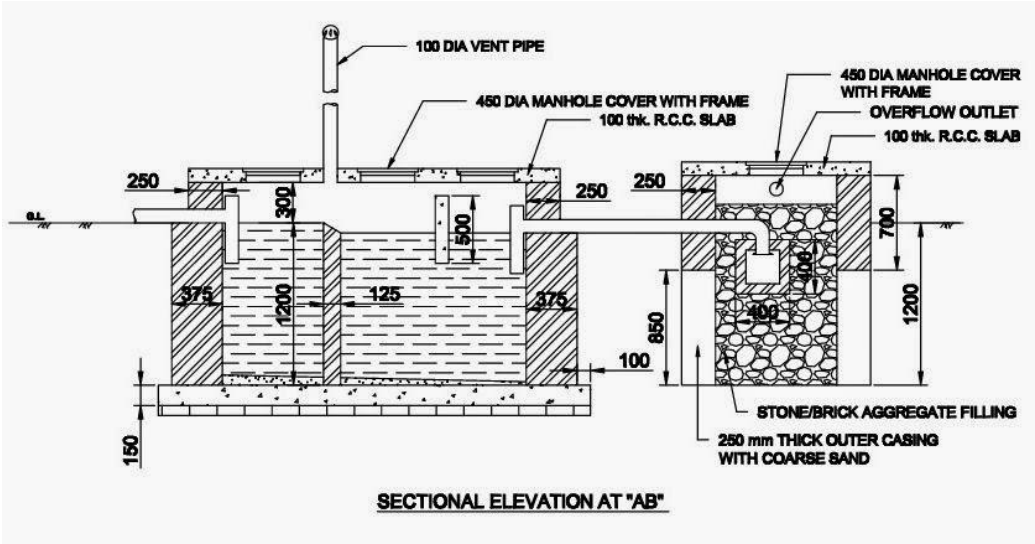


Figure 8: 80 000 L septic tank to be installed

The administrative building block will contain a large 80 000litre septic tank which will be installed about 4 meters underground, it is estimated that the capacity of the septic tank can take about to 20 years for it to reach its fullest capacity.

5.12 Staff housing

Temporal staff housing for workers and security services (guards) will be constructed. Corrugated and wooden materials will be used to construct these structures. The temporal housing will accommodate up to twenty workers (20) and workers will be accommodated on a rotational or shift basis.

5.13 Workforce

The factory workforce requirements will include both permanent and casual workers. The projected initial number of permanent staff will be approximately 700 while the casual workers will be around 300. There will be three shifts in a day and each will require 400 staff for operations. There will also be a general shift for administrative and housekeeping staff. The future requirement in terms of manpower is expected to be over 1000 people.

6. THE AFFECTED ENVIRONMENT

The affected environment is a rural area that is inhabited by permanent residents, migrant workers, subsistence and emerging commercial farmers. The area to be targeted in this project lies on the eastside of the Lusu Communal area. Local communities have identified about 6000 ha of irrigable land within which the project is proposed.

The project footprint has been the subject of varying degrees of impact in terms of habitation/dwellings, subsistence farming; including growing of crops and grazing of cattle and harvesting of natural resources.

Due to these impacts the area cannot be considered undisturbed or pristine in its natural state. Refer to figure below for a depiction of the current land use within the project area, which indicates a large amount of existing subsistence cultivation.

Figure 9: Land uses in the sorrounding area

7. LAND OWNERSHIP& LOCALITY

This site falls under the jurisdiction of the Zambezi Communal Land Board (ZCLB) and an application for right of Leasehold will be lodged with the ZCLB who will verify and measure the piece of land. The project has already received endorsement from the Lusu sub-traditional authority, the Hon. Councillor of Katima Rural Constituency and the Chief of Mafwe Traditional Authority, as well as the Hon. Governor of the Zambezi Region.

According to the baseline information of the area, the site falls within the agricultural and open floodplain zone in which the following activities are permitted: grazing and farming activity and there is a **NO** conservation that exists in the area. The project area is between two conservancies, Namely Bamunu & proposed Siluka Conservancy, **therefore No consent from any of the two-conservancy management was required**.

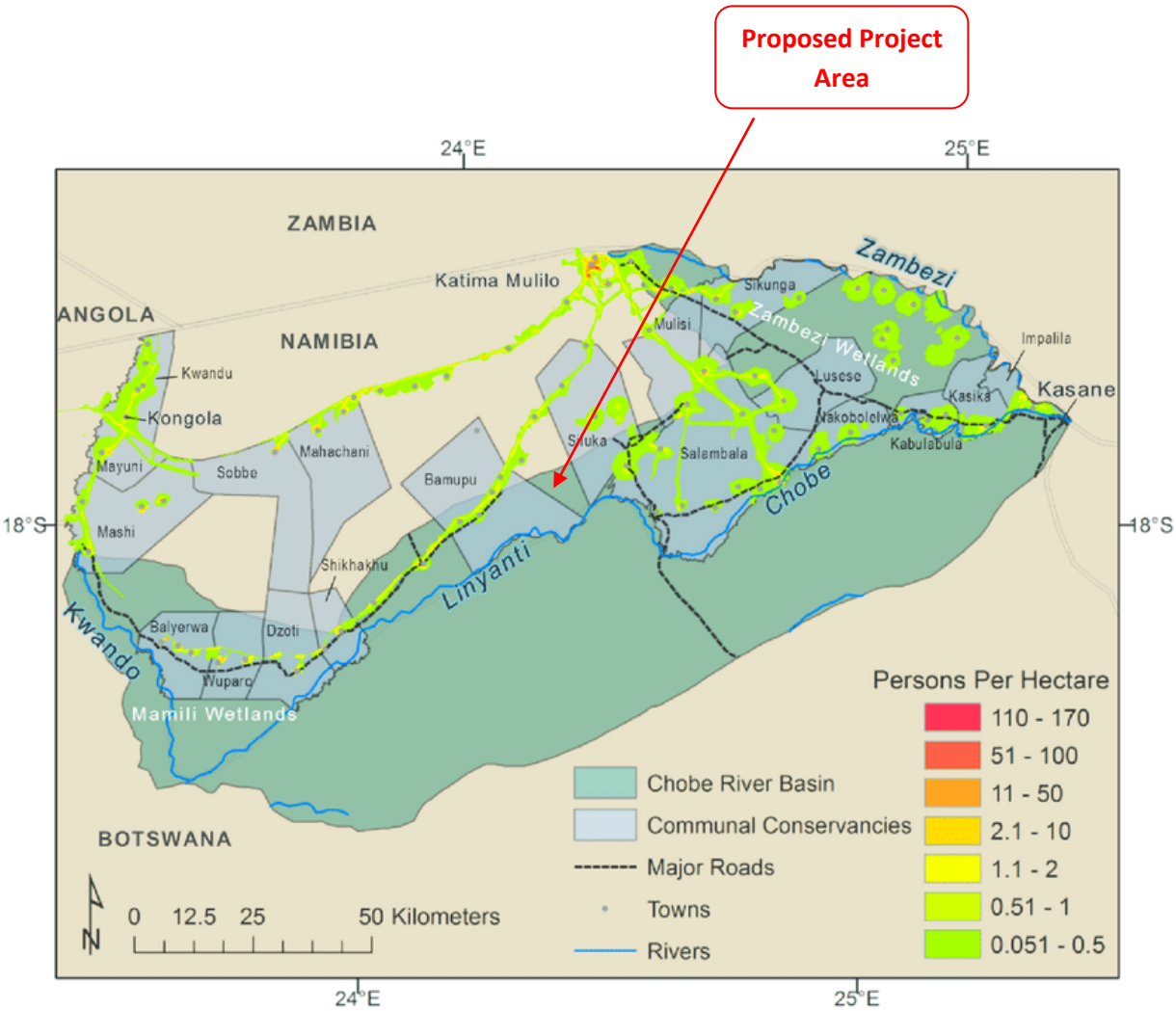


Figure 10: Project site locality area

8. PROJECT BASELINE INFORMATION

8.1 Introduction

In the following sections the current biological, physical and socio-economic conditions of the study area are discussed and their sensitivities to change are considered

8.2 Climate of Zambezi Region

The climate of the area is fundamental; in determining the availability of water and also reveals much about its ecological sensitivity and resilience to change. The climate data below (table 1 below) is typical for eastern Zambezi and is expected to occur at the farming production site.

The Zambezi Region is one of the 14 regions of Namibia, located in the extreme north-east of the country. It is largely concurrent with the Caprivi Strip and takes its name from the Zambezi River that runs along its border.

The area soils are loam-to-sandy with no rock and have clay content of between 20% and 30%. Thus, Desert Lusu Salk Sugar will adapt its irrigation and cultivation practices in order to prevent compaction of the soil. It will also implement sound crop rotation practises to increase soil fertility as well as controlling the prevalence of pests and diseases.

On the climatic conditions in the region, the annual seasonal rainfall occurs between October and April with a mean seasonal rainfall of 646 mm (Mwazi, 2017). Findings of the analyses show that the highest amount of rainfall received was 1464 mm during the 1957/ 1958 season and the lowest received during the same period was 269 mm during the 1964/ 1965 season. The humidity is also the highest in Namibia and a hot tropically humid climate dominates, making the region the greenest in the country hence classified as subtropical. Rivers and swamps are plentiful and dominate the landscape.

During the summer months the average temperature lies between 20°Cand 35° C during the night and day respectively. In winter the day temperature rises to 28° C, but at night the temperature can drop up to 7° C or even 1° C. Frost does not occur though. During the summer months the Zambezi region has an average of 8 – 10 rainy days a month, whilst during the months of June to August hardly any precipitation is received since these are the dry conditions months.
The Zambezi Region has 'a higher rainfall, less evaporation and a warmer winter than the rest of Namibia, providing a home to many tropical to subtropical plants that are unable to survive elsewhere in Namibia' (Mendelsohn & Roberts, 1997).

According to the National Agriculture Policy (1995), scarce productive land and fragile soils, coupled with limited water resources and an erratic rainfall regime are the principal features of Namibia's agriculture. The country can be divided into four ecological zones:

Table 1: sensitivities and potential impact related to climate

Environmental	Description	Sensitivities	Potential impact of the project

feature			
Rainfall	• Highly variable thunderstorms • Two distinct seasons – a dry season April to November and shorter wet season from end of November to April –Rain peak in January & February • 550-600 mm per year • Tropical climate with less evaporation • Evaporation highest in September and October (Mendelsohn *et al* 1997)	• Flooding (April – July) • Risk of flooding very high	• The lodge will cause an increase in water demand
Temperature	• Average daily temperature vary between 20 in summer and 5ºc in winter • Highest temp between Sept and Nov, with maximums between 32 and 40 ºc • Frost is unusual • Coldest temperatures. measured in July with an average daily maximum of 6ºc (Mendelsohn et al 2009)	• High temperatures in summer • Contributes to high evaporation rate	Health and safety of the workforce
Wind direction	Prevailing wind direction is South easterly but north easterly winds are also experienced	• Dust generation during dry seasons due to soil texture	• Increased dust

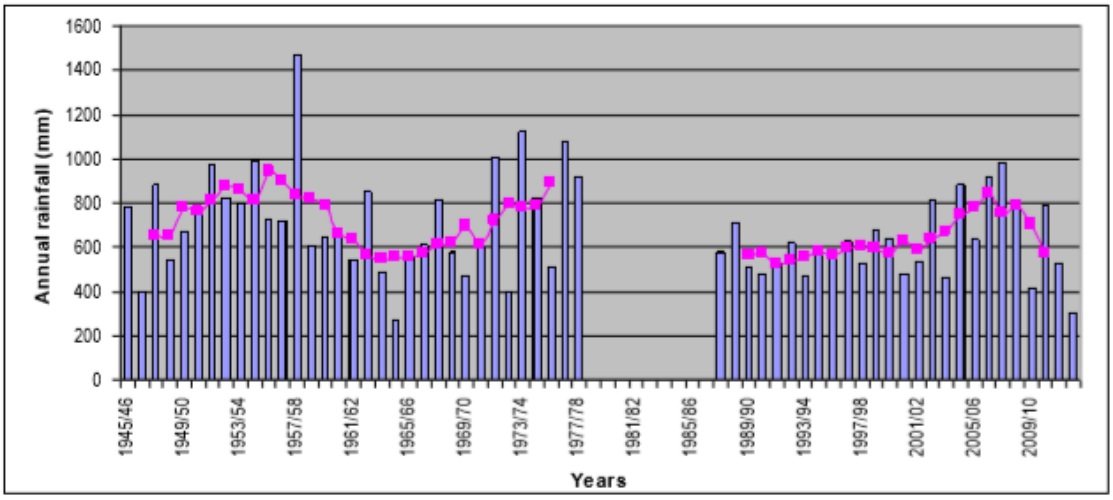
8.3 Rainfall

Rainfall averages about 700 mm per year in the wetter north-east, and about 500 mm in the southern Zambezi Region. The climate can be divided into two main seasons – a dry season between April and September, and a wet season which stretches from end October to early April. Rainfall, as in the rest of Namibia, is highly variable, with standard deviation values from 30–40% (Mendelsohn et at, 1997). For example, the long-term rainfall record from Katima

Mulilo (1945–present, with a 9-year gap in the 70s-80s) shows annual totals over 1,000 mm in four of the years, and falls less than 400 mm in three years. This variability directly affects the livelihoods of farmers, exposing them to the risk of crop failure and poor grazing in some years, and floods in others.

Thus, Desert Lusu Salk Sugar intend to grow through irrigation to avert climatic conditions that may be unsuitable for rainfed production.

Figure 11: Zambezi Region Annual Rainfall over years



Note: moving 5-year average (pink). Note the general above-average rains in the 1950s, 1970s and early 2000s.

8.4 Temperature, Evaporation, Wind and Solar

Temperatures are moderate during summer months in the Zambezi Region mostly due to cloudy conditions in these months. The highest temperatures are between September to November when there is less cloud cover and average daily maximums of 32-35oC can be reached. In the winter months, the region has a more moderate winter than the rest of Namibia with maximum daily temperature of between 18 -25 oC and minimum temperatures of 5 oC. Frost is unusual in the Zambezi Region, but may occur in some years in low-lying river valleys, especially in the western part of the region (Mendelsohn & Roberts, 1997).

The highest rate of evaporation takes place during September to October when it is hot, dry and clouds are sparse. The potential evaporation of 2,500mm is over four times the volume of water normally provided by rain (Mendelsohn et al, 1997).

8.5 Soils

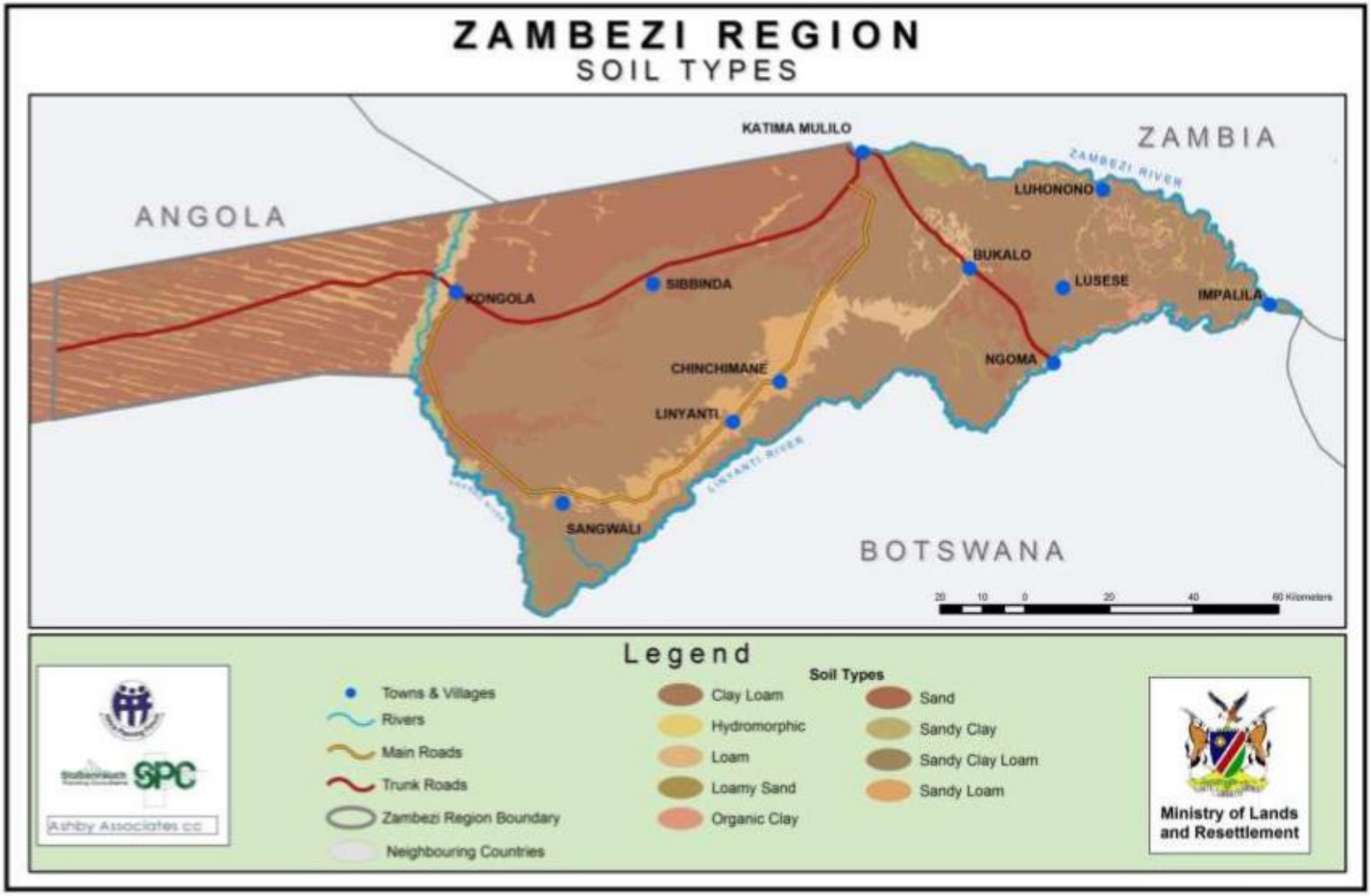
The Zambezi Region is characterised by the Kalahari Basin, which consist of sand dunes. Soil types in the Zambezi were classified largely on the basis of their textures, with soils consisting of varying amounts of sand and clay having different textures. At the one end of the spectrum are the heaviest soils with a high content of clay in areas, which are regularly flooded. Water does not penetrate or drain away easily because the clay is so dense and therefore these areas hold water for longer periods. On the other end of the spectrum are the pure sands that do not hold moisture for long. Between these two extremes are a range of intermediate soils – loams, clay-loams, sandy clays- and such intermediate soils also offer the best opportunities for cultivating crops as they retain water to some degree and have fairly high levels of nutrients (Mendelsohn et al, 1997).

According to the Zambezi Integration Rural Land Use Plan et al:

The project site proposed for the project is therefore characterized by flat and clay loamy soil which is fertile soil suitable for both sugarcane, cash cropping, horticulture crops and vegetables. These give rise to heavy and more fertile soils which are generally yellowish red sandy clays.

"Highly irrigable soils of the form of fertile clay loamy soils and open floodplains are dominant in the study area. These soils are dark grey in appearance, noncalcareous and have an average soil depth in excess of 1,5 m, have mield infiltration rates and offer a high available moisture content. These soils can be described as clayey, loamy and sandy alluvial soils with an irrigation classification rated as good to excellent.

The various soils within the study area are addressed in more detail under the report "Zambezi Integration Rural Land Use Plan"compiled by the GIZ and Ministry of Land Reform.


ZAMBEZI REGION
SOIL TYPES
ANGOLA
ZAMBIA
BOTSWANA
KATIMA MULILO
LUHONONO
BUKALO
LUSESE
IMPALILA
NGOMA
KONGOLA
SIBBINDA
CHINCHIMANE
LINYANTI
SANGWALI
ZAMBEZI RIVER
LINYANTI RIVER
20 10 0 20 40 60 Kilometers
Legend
Towns & Villages
Rivers
Main Roads
Trunk Roads
Zambezi Region Boundary
Neighbouring Countries
Soil Types
Clay Loam
Hydromorphic
Loam
Loamy Sand
Organic Clay
Sand
Sandy Clay
Sandy Clay Loam
Sandy Loam
Ashby Associates cc
Ministry of Lands and Resettlement

8.5 Vegetation

The texture of soil, the depth, the nutrient content, the concentrations of salts and the ability to hold water affect the kind of plants found in an area (Mendelsohn et al, 1997). Water drains through sand easily, washing nutrients away and leaving both the sands and many grasses low in nutrients. The six land types within the Zambezi Region form broadly six vegetation communities: open water, floodplains, riverine woodlands, Mopane woodlands, Kalahari woodlands and Impalila woodlands. Within each of the six broad vegetation communities, certain plant types exist better than in others. The Caprivi Atlas shows an assessment of the potential values of each of these variations in terms of its potential for crop cultivation, livestock farming, conservation and other non-agricultural subsistence values of these resources (Mendelsohn et al, 1997). Based on the above, Lusu communal area have the following characteristic;

Table 2: Vegetation characteristics in Lusu communal area

	Potential Value for:			
Vegetation Unit	**Crop Cultivation**	**Livestock Farming**	**Other**	**Conservation**
Open Water	+	+	++	+++
Floodplains				
Bukalo-Liambezi grassland	+++	++	+	++
Chobe grassland-hummock mosaic	++	++	+	+
Chobe swamp grassland	++	++	+	+
Chobe wetland	+	+	++	++
Dry Mamili grassland	++	++	+	++
Kwando-Linyanti grassland	+++	+++	+	++
Okavango-Kwando grassland	++	+++	+++	+++
Wet Mamili grassland	++	++	+	++
Zambezi floodplain channels	+	+	++	++
Zambezi floodplain grassland	++	++	+	+
Zambezi transition grassland	++	++	+	+
Zambezi woodland	++	+	+++	+++

i. Hydrology and Drainage

The Lusu project area drainage System is supported by the Zambezi, Chobbe & Linyanti river flood water plains, which runs from the North to the South of the area. During dry season the area is often dry but during rainy season rain waters usually spread through the areas of Lusu floodplains which gives a good source of water for agricultural crop farming.

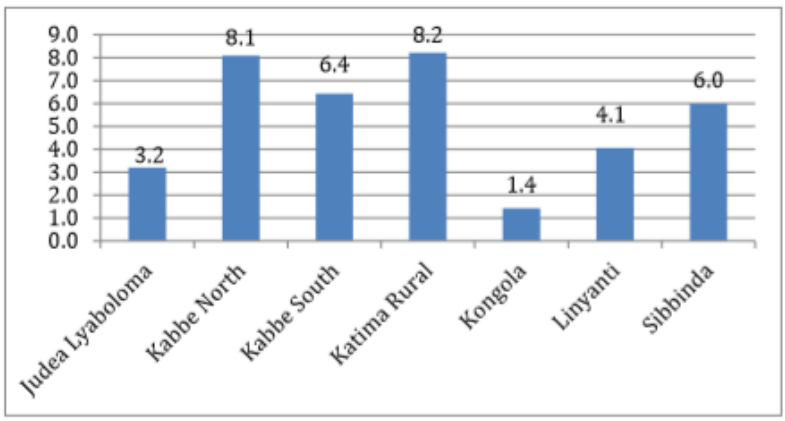
ii. Topography

The Lusu project area, is situated on an average high landscape at an altitude range of 10m to 15m above sea level. The terrain of the project area is relatively flat with associated with savannah grassland.

iii. Demography

The 2000-hectare of the land of Lusu (within Katima Rural constituency) has about 300 households with an average of 3-4 people per household. Population distribution is concentrated at the administrative centre of Chinchimani settlement area with the availability of social services such as schools, government offices and small shops.

Figure 12: population densities for Constituuency in Zambezi Region



Note: Kongola and Judea Lyaboloma Constituencies had the lowest population densities (1.4 and 3.2 persons per km² respectively) as much of the land comprises of National Parks and the State Forest where only a limited number of people are permitted to live.

iv. Socio-Cultural

The indigenous people at Lusu and surrounding areas are the Mafwe ethnic group under the leadership of Mafwe Traditional Authority. Three indigenous languages are spoken by the people around this area. which is Subia, mbalangwe and Silozi . Livelihood of the people in this area depends firstly on their economic dependence on ancestral land. This can be clearly seen in their sense of traditional ownership of land and unrestricted access to the use of the natural resources in the area through various traditional practices.

Secondly is their strong decentralized traditional leadership hierarchy. The Chief is the head of a clan with the Mafwe- Ngambela and Natamoyo(acting as advisors to the chief) and the Silalo Indunas at Lusu area or sub-khuta (Headmen) acting at the ground level on behalf of the chief. Among other responsibilities, the senior headmen are charged with the responsibility of administering land and the local people on behalf of the chief

v. Socio – Economic setting

The livelihood strategies of the people at Lusu is the same as the rest of the people in Zambezi Region. where people largely depend on agricultural activities and collection of non-wood forest products. Maize, Mahangu, beans and Sorghum as well as Cassava is the main crop grown in the area. Other crops grown in medium to small quantities include groundnuts, finger millet, and sweet potatoes. Livestock though being a source of livelihood is only practiced on a small-scale Animals mostly reared include goats, pigs, chickens and ducks. Honey and mushroom collection are another off-farm income generating activities the people depend on for livelihood.

vi. Changes to the environment

The proposed project will have slight impact in terms of changing the environment state of biodiversity. These changes are viewed to be minimum. The project area is land that was used for subsistence agriculture farming few years ago. The land comprises of an open land associated with clay loamy soil, with small shrubs and grassland. Hence the project area was land that was cleared previously by substance farms or communities of Lusu area. As a result, the commissioning of the project will have very little negative effect to the vegetation and flora on the site.

The project will however bring about new changes in terms of infrastructural development such upgraded gravel roads, power supply to the area, employment creation to local residents and

communities and many other socio-economic activities that will accompany the development of the farm.

vii. Development activities around the project

The current state of the proposed project area for the farm shows that there are few subsistence small farm holds about seven that are situated about 1kilomtre on the South Western part from the project site. at the Eastern part of the project, there are no human activities as the adjacent area is the River or border between Namibia and Botswana side. From the project area or site, the border line is situated about 500 meters to the East. The proposed project will have slightly impact on the activities of wildlife as the project area will be fenced to protect the production of the sugar plantation & factory. The following table shows the type of mammal's wild animals likely to be found in the surrounding areas of the project

Table 3: Mammal Species in surrounding area of Lusu

Shrews	Swamp Musk Shrew	*Crosiduramariquensis*
	Tiny Musk Shrew	*Crosidurafuscomurina*
	Giant Musk Shrew	*Crosidura (occidentalis)*
Elephant Shrews	Four-toed Elephant-shrew	*Petrodromustetradactylus*
	Short-snouted Elephant-shrew	*Elephantulusbrachyrhynchus*
Elephant	African Savanna Elephant	*Loxodonta africana*
Bats	Peter's Epauletted Fruit Bat	*Epomophoruscrypturus*
	Percival's Short-eared Trident Bat	*Cloeotispercivali*
Monkeys, Baboons and Bushbaby	Vervet Monkey	*Cercopithecus pygerrythrus*
	Chacma Baboon	*Papioursinus*
Pangolin	Pangolin	*Manis temminckii*
Hares and Rabbits	Scrub Hare	*Lepus saxatilis*
Molerats	Damaraland Mole-Rat	*Cryptomysdamarensis*
Squirrels	Tree Squirrel	*Paraxeruscepapi*
Porcupine, Canerat and Springhare	Cape Porcupine	*Hystrixafricaeaustralis*

Dormice, Rats and Mice	Woodland Dormouse	*Graphiurusmurinus*
Carnivores	Aardwolf	*Proteles cristatus*
	potted Hyena	*Crocuta crocuta*
	Leopard	*Panthera pardus*
Zebra	Plains Zebra	*Equus (burchellii) quagga*
Pigs	Bushpig	*Potamochoeruslarvatus*
Hippopotamus	Hippopotamus	*Hippopotamus amphibius*

9. FINDINGS/IMPACTS

The assessment considered the major components of the project & how they would impact upon the environment. The components considered include construction of road and electricity grid, factory and human settlements, irrigation and agriculture production.

9.1 Impact of Road Construction

The road infrastructure development in the Sugar Plantation project area will comprise the expansion of the existing primary feeder roads and the construction of a network of internal access road as described below.

9.2 Extension of the Road width

The extension of the road width, which is expected to be carried out on the one primary feeder road (described below) should upgrade their capacity from largely on-way to two-way traffic flow.

9.3 Opening up of Access Roads

The proposed agricultural development extensions will require the opening of the largely virgin land for access road construction. Intensive construction of the roads (about 6m wide) will take place in the zones occupied by small and medium-scale holdings, around this scale of agricultural production requires road accessibility for the farm stand.

The development of the above road infrastructure is likely to have significant impacts both in the short- and long-term. Table 1 summarizes these impacts (both during and after construction) and the suggested mitigation measures.

9.3.1 Ecological Impacts

Vegetation clearing and mechanized material excavation will result in soil erosion. This is considered less significant in the project site, as the area is flat and have no river catchments found. More intensive access road development is the in the long-term are likely to cause disruptions to wildlife habitats and the migratory bird routes due to its proximity to the local forests and conservation areas.

9.3.2 Social Impacts

The development of the primary roads is likely to attract a proliferation of unplanned roadside settlements both within and outside the project area for commercial and social benefits. Areas with a considerable density of settlements along these routes are likely to experience growth.

Table 4: Analysis of short-term and long-term impacts

POTENTIAL IMPACTS	HOT SPOT	MITIGATION MEASURES
Soil erosion as a result of vegetation removal:	All sloppy areas were the roads pass across catchments.	- Construction of lead-off and storm drains and culverts.
Population increase along the road resulting in poor land use.	Areas along the roads	Systematic farm allocation along the roads to reduce haphazard settlement Establishment and maintenance of road reserves
Accident risks associated with vehicular traffic and transport.	Populated areas along the roads	Establishment of speed controls and placement of road signs. Public awareness of road safety
Creation of new pathways for disease vectors affecting humans and animals	All livestock rearing farms and human settlements.	Establishment of veterinary check-points and provision of veterinary extension services. Sensitization of people on all health

		risk and prevention measures.
Disruption/destruction of wildlife though interruption of migratory routs, disturbance of wildlife habitats and noise related problem.	Bamunu & Siluka conservancy Management Area	Establishment of a conservation plan through which the general design of infrastructure in the area be well structured.
Opening up of avenues for poaching activities	Bamunu & Siluka conservancy	Formulation of a Community based Management plan. Establishment of the whole Bamunu & Siluka conservancy as buffer zone as opposed to the proposed 1 km stretch.

9.4 Construction of Electricity Grids

The Project area will have one (1) proposed electricity supply lines which is intended to service all farming activities at the project site as well as the small-scale agriculture. The development of this three-phase transformer grid system (to be connected to the existing Lusu Community village electricity grid) as described below will require the clearance of vegetation to create a way leave; the latter will measure 20 m in width throughout the grid line.

9.5 Way Leave Development Impacts

- ***Ecological impacts***: there is likely to be a significant disruption of the water retention capacity of the soils, hence affecting the groundwater systems. Way leave clearance, particularly in the project areas and, is likely to cause disruptions of wildlife habitats within the in-animal corridor movement trails

- ***Social Disruptions***: Considering customary relationships within the road network, the way leave will likely accelerate the dislocation of existing settlements. These disruptions may ultimately affect the social and economic linkages for the direct affected households.

Social and economic exclusion of the communities without access to electric power is likely to occur in the long run if demand factors are not accompanied by strong equity considerations.

The management of the inputs discussed above ought to address the cross impacts of the way leave and road reserve expansion.

Table 5: Impacts of way leave development

IMPACTS	HOT SPOTS	MITIGATIONS
Soil erosion as a result of vegetation removal along the way-leaves.	The project site area and surrounding areas	○ Vegetation clearing and early burning just after the rainy seasons. ○ Clearing to be limited to allocated and specified areas
Dislocation of settlements along the way-leave.	Communities around Lusu Sugar Plantation project area,	○ The path of the way-leave should be negotiated with the affected communities to minimize inconveniences ○ Where possible compensation to affected party be given for major losses.
Physical Disruption of wildlife habitats	○ Protected areas	○ Grid layout should be discussed with Ministry of Environment, IRDNC and community LDCC. ○ No Grid should be constructed in the National park for wildlife.

9.6 Social-Economic Impact

The proposed activities for Sugar Plantation at the farm are likely to impart both negative & positive impacts in the areas concerned. From infrastructure point of view, socio-economic impacts will arise from social amenities that will be provided will include services such as job creation, schools, health centers, etc.

9.7 Employment Creation

One of the expected most positive impacts is the creation of employment for the local community members. It is envisaged that more than 90% of the unskilled labour will be recruited from within the Farming unit surrounding area. For skilled labour, priority will be given to Namibian with suitable qualifications before engaging expatriates. It is also anticipated that more jobs are expected to be created as the project progresses.

Project members of staff will also plough salaries and wages into the local economy directly through purchases of various goods and services which may benefit thousands of people directly or indirectly. The anticipated breakdown of possible job opportunities;

Construction	–	200 for 2 years (temporal)
Agriculture	-	700
Factory	-	300
Indirect	-	1000

9.8 National Economy

The project is expected to attract many potential investors (both local & foreign) who will bring substantial capital in the area. The injection of such capital investment will have far-reaching multiplier effects on the national economy. Similarly, the export of various agro-products will significantly improve the foreign exchange status of the country.

9.9 Health Services

As investors implement their activities in the Farm, it is envisaged that there will also be some improvement in the provision of health services in the project surrounding area of Lusu. This will be achieved through support existing health centers.

Expected impacts on health in the area will be positive & negative. The positive aspects of the impact will be improved health services as a result of rehabilitation &support of old and new clinics respectively. On the other hand, negative impacts could arise from increased interaction between project workers (who may come from outside) and locals.

9.10 Education Services

The positive impacts on education will arise from improved education infrastructure for Lusu combined School. Improvement in educational services will encourage pupils to attend classes and will also attract teachers to work in the area. Further, job creation for parents will improve their household income base that will in the end benefits their school going children's. As a result of improved household income base, parents will be encouraging their children to attend school and dissuade them from opting for caterpillar collection during school days. The perceived increase in population in the area would result in shortage of educational services in the area.

Table 6: Impacts of siting of factory facilities

IMPACT	HOT SPOTS	MITIGATION
Aggravation of solid waste problems in the area.	Area around project area at Lusu – Area planned for a Sugar plantation & factory	○ On farm designate site for solid waste disposal. ○ Subject the industrial developments to specific EIA

9.11 Impacts of Irrigation

The main purpose of constructing water reserves on the project area is to store & provide water for both Sugarcane plantation throughout the year for. Irrigation will thus ensure efficient, increased and sustained sugarcane production. Apart from the water reservoirs, other sources of water for irrigation is the river, and underground water, which are readily available within the Farm.

Irrigation can basically be defined as "the artificial watering of plants." Awareness of negative impacts likely to arise from irrigation is very crucial in ensuring sustainable development in the Farm. Impacts of immediate importance include soil erosion, salination of irrigation land and water bodies, water logging, and leaching of soil nutrients, proliferation of weeds, pollution & contamination of local groundwater.

9.12 Soil Erosion

Soil erosion is the displacement of soil materials on the ground surface by action of moving water or air. Water movement on the ground surface causes water erosion, which is our area of concern. This impact can be exhibited by

1. Loss of cultivable land
2. Deterioration of water resources on cultivable land
3. Loss of soil fertility as a result of washing away of humus and natural nutrients
4. Flooding of valley bottoms and silting of dams, rivers and ponds.

9.13 Leaching of Nutrients

Where the soils are porous, as is the case with sandy soils, leaching of soil nutrients, agro-chemicals and chemical fertilizers increases. It must be noted that the parent rock of the Farm is sandstone.

9.14 Pollution & Contamination of local ground water

Irrigation in itself will further enhance the infiltration of chemical fertilizers & other agro-chemicals into the groundwater. It must be noted that boreholes have been largely recommended as sources of safe drinking water. If, therefore, these chemicals infiltrate the water, then both shallow wells and boreholes will be unsafe as sources of water for human use.

9.15 Proliferation of weeds

Weed seed and plant material is generally transported by water. When irrigation occurs, this weed seed and plant material is easily drawn out of the watercourse and deposited on arable land. Some of the weed will also grow profusely along water furrows creating a bridge for insects and disease vectors for the intended crops. A good example is the water hyacinth weed, which has been a headache to deal with in many rivers and Zambezi region.

All the above impacts have a very negative effect on the environment. It is therefore incumbent upon all the developers to ensure that they develop the conservation buffers and put in place erosion control measures in order to minimize factors that may lead to land degradation irrigation.

Table 7: Impact of irrigation

IMPACTS	HOT SPOTS	MITIGATION MEASURES
Soil erosion especially on sloppy grounds	Irrigated lands round dams and rivers	o Putting up of level-bunds on irrigated lands to ensure infiltration and reduction of run-off o Regulation of water application to avoid over watering o Create buffers of about 20 – 40 m width between cultivated land and the rivers, streams
Water logging of soils	Irrigated lands round dams and rivers	Installation of and maintenance of adequate drainage system for removal of excess water
Salination of soils	Irrigated lands round dams and rivers	o Application of appropriate cultivation method o Ensure that irrigated lands are not over water logged. o Cultivation of crops with salinity tolerance especially fruits
Leaching of soil nutrients	Irrigated lands round dams and rivers	Avoid over watering and replace nutrients through crop rotation organic fertilizer application
Proliferation of weeds	Mainly drainage lines	o Maintenance of drainage lines through weed removal o Construct drainage line with brick linings (this also applies furrow irrigation) o Monitor presence of prolific weeds such as Water Hyacinth
Deterioration of water quality in the rivers & contamination of local ground water	Downstream areas and local water tables	o Improved water, management, agriculture practices and control of inputs (Biocides & chemical fertilizers) o Frequent checking & control of the parameters for water quality and quantity

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10. SOCIO ECONOMIC PROFILE

10.1 Benefits and economic of the farming project

In the nutshell and on the national level, the overall objectives for agriculture production activities in the country, in line with the National Agriculture policy among other are to help attain the national objectives, the overall goal of the National Agricultural Policy is to increase and sustain the levels of agricultural productivity, real farm incomes and national and household food security, within the context of Namibia's fragile ecosystem. 21, and for the majority of Namibians to enjoy improvements in their current standard and quality of living, the objectives of the National Agricultural Policy are to:

1. achieve growth rates and stability in farm incomes, agricultural productivity and production levels higher than the population growth rate;
2. ensure food security and improve nutritional status;
3. create and sustain viable livelihood and employment opportunities in rural areas;
4. improve the profitability of agriculture and increase investment in agriculture;
5. contribute towards the improvement of the balance of payments;
6. expand vertical integration and domestic value added for agricultural products;
7. improve the living standards of farmers and their families, as well as farm workers;
8. promote the sustainable utilization of the nation's land and other natural resources; and
9. Contribute to balanced rural and regional development based on comparative advantage.

As a result, the developer and also the applicant will and have signed a contractual agreement on the benefits for monthly and annual payments. These contractual agreements are entered between the developers and the respective sub-khuta of Lusu. A separate agreement between the Mafwe traditional authority and investors or developer shall be signed before the inception of the project.

However, a leasehold rental fee will also per paid to the Zambezi Communal Land Board as per the communal Land Reform Act No.5 of 2002. The rental per month to the land board will be paid in the account opened by the GRN through the Ministry of Land Reform.

This project will also result in a joint venture agreement with each community in terms of how the project will assist them on farming activities on their subsistence farming units. As a result of the long-term mutual relationship between the investors and community will be developed. Significant community empowerment such as training on farming, community gardens, assistance for education financial assistance will also be offered to the community.

10.2 Agriculture production

Agriculture in the northern communal areas offers the greatest potential for intensification and diversification. Focusing in these areas will lead to increased productivity and the stabilization of yields, and will contribute towards the attainment of household food security and a reduction in the need for food imports. To achieve agricultural growth, communal farmers need to be integrated into domestic and export markets as a priority. They also need improved access to vital rural infrastructure and essential agricultural development services. Recognising the importance of women in agricultural productions, detailed gender analysis of farming systems will be undertaken to facilitate the development of gender specific strategies for increased household food security.

Considering Namibia's highly variable climatic conditions, the realization of the country's potential for agricultural growth depends on effective drought preparedness planning and responsive drought management. The risk of rainfed production failure is high. This necessitates approaches to farming based on technically and economically sound frame investments which will stabilize yields and farm incomes. Such approaches will be promoted through appropriate agricultural support services and long-term multi-level agricultural development planning.

Presently, livestock, cash crops and horticulture vegetable production represent the foundations for the growth of agricultural incomes, exports and rural employment in Namibia. They also contribute to import substitution and household food security. The crucial significance of meat and grain production justifies the concentration of Government resources on the promotion of these two commodities, at least in the immediate future.

11. STAKEHOLDER AND COMMUNITY CONSULTATIONS

Public participation forms an important component of the environmental Assessment process. It is defined by the Environmental Management Act (2007), as a '*process in which potential interested and affected parties area given an opportunity to comment on or raise issues relevant to specific matters.*

Public participation notices were placed on local notice boards and advertised in national newspaper media. The advert was in the New Era &Confident newspapers on the 14th & 28th November 2019 respectively. Also, the list of Interested & affected parties 'stakeholder community meeting is hereby attached as *appendix*.

Communication with stakeholders about the proposed farming production facility was facilitated through the following means: The stakeholders were identified in terms of relevance to the project and who could serve as a source of information

A public consultation meeting took place on the **23 December 2019** between the Community members, Line Ministries, stakeholders, the traditional Authority and investors, to discuss issues and concerns regarding the proposed farming project and also raised concerns and proposals to mitigate the problems.

A total of **39** people or stakeholders attended the meeting (see attached attendance list dated 23 December 2019 ***(see Letters for invitation to I & APs),*** The following key stakeholders were also invited to the public consultation meeting ***(see Letters for invitation to I & APs):***

1. The Zambezi Regional council
2. Ministry of Forestry
3. Ministry of Environment and Tourism
4. Ministry of Agriculture water affairs
5. Ministry of Trade & Industry
6. Bamunu & Siluka conservancy
7. Lianshulu Sub-khutas, and Mayeyi Traditional Authority
8. IRDNC (Integrated Rural Development for Nature Conservation)
9. Ministry of Land Reform

Figure 13: Public participation meeting: Lusu sub-khuta. 23.12.2019

A summary of the issues and concerns that were raised by the interested and affected parties is listed below. The purpose of presenting the issues raised by participants in this section is simply to:

1. Ensure transparency regarding the concerns that have been expressed;
2. Ensure that all issues raised are properly addressed in the EIA, ESMP and mitigation measures proposed.

Issues dominated the discussions range from:

1. Employment Creation
2. Water abstraction – the fear that abstraction of high volumes might dry the Zambezi river or the river flow
3. Clearing of valuable plant species – the concern for removal of sensitive and protected plant species in the area and the effect to the biodiversity thereof
4. Wildlife corridors and wildlife conflict – that project will hinder and disturb the movement routes of elephants, buffalos and other small animals migrating from Botswana to Namibia. The impact large animals such as Elephants and Buffalos will have on the project if developed.

5. Wildlife habitat – concerns were raised regarding the destruction of wildlife habitats or the living environment of animals, ecosystem and the ecology as the project area's locality is few kilometres (1.5km) to the Bamunu & Siluka conservancy
6. Ownership of the land (proposed project site) and grazing of livestock
7. Direct and indirect benefits from the proposed project
8. Soil type (in terms of the suitability for the proposed farm)
9. Effects of climate change as a result of deforestation

12. MAJOR IMPACTS IDENTIFIED

12.1 Deforestation and ecosystem impacts

Namibia is the driest sub-Saharan country in Africa. Forested areas are therefore restricted to the northern east where high rainfall is experienced. Limited information about Namibian forests are available, but according to a world bank report of 2012, the area of forested land in Namibia in January 2010 was 72,900 km² (http://www.tradingeconomics.com). This is 8.85% of Namibia's surface in 2010 and it has decreased by approximately 5,200km² since January 2003. This roughly translates into a 1% rate of deforestation per year

12.2 Grazing for Livestock

Having the farming project in communal areas is believed to affect the grazing land for livestock in certain areas as most of the land earmarked for the project consists of few trees whilst the large portion of the area is open savannah grassland suitable and often used for grazing purpose.

Through consultations with the community, it was discovered that the proposed project site for Sugarcane Plantation does not infringe in the land for livestock grazing. Thus, alternative or mitigation measure are proposed to be put in place, whereby communities will use a nearby commonage suitable for grazing which is located few kilometres from the project site. The developer or farm owners have agreed to leave some open spaces on the farm which will be fenced to allow livestock movement to access other grazing sites.

12.3 Groundwater Surface Water and Soil contamination

In terms of vulnerability of the soil and groundwater there are two main features of importance. These areas (1) the clay loamy soils of the areas are prone to high level of leaching and (2) a middle-low water level in the areas. One main factor may impact on underground water and soil. These are (1) spilling of fuel, oil or hydraulic fluids when earth moving machines area fuelled or repaired on the site.

Table 8: level of impacts

7.4 Sustainability / Potential Appraisal			
Impact on Ecological & Socio Economic	Level of Impact		Comments
	Positive	Negative	
Creation of Employment	High	None	+-300 unskilled local workers for (debushing) of all project sites and an estimate of ±700 skilled & semi-skilled permanent workers during the operational phase of the project
Grazing& cattle corridors	N/A	None	An alternative nearby commonage suitable for grazing which is located few kilometres from the project site.
Abstraction of water	High	None	The water will be extracted from the sub channel connected to main Zambezi, Chobbe flood water & Linyanti river, thus serves the purpose for the irrigation
Water Pollution (Pesticides /chemicals)	High	Low	Pesticides will be used to eliminated fugal bacteria's attacking crops, the pesticide will be mixed in irrigated water at a reasonable quantity that will not contaminate ground waters

Tenure insecurity & land use disputes	Limited	N/A	Area is to be registered under a leasehold for a period of time for leasing to the investors, there are currently no land use activities in the proposed project area

Key Consideration Area

1. Contribute to local economy
2. Employment Creation
3. Local level economic empowerment

13. IMPACT ASSESSMENT AND MITIGATION

This chapter discusses the Desert Lusu Salk project impact for Sugarcane Plantation farming on both the biophysical and socio economic and cultural environment within the project's area of influence. A matrix was used to establish the likely changes effected by the project on the environment. Results obtained were then analysed and assessed to establish significant, major and minor impacts. The following criterion was used:

1. The Sensitivity of the environmental element being impacted
2. The spatial extent of the impact
3. The severity/intensity of the impact
4. The duration of the impact
5. The Probability/frequency of occurrence of the impact or source of impact.

Furthermore, impacts were characterized according to the phase of the project implementation as follows:

1. Impacts associated with preparatory and construction phase
2. Impacts associated with Operational Phase
3. Impacts associated with Decommissioning and Closure Phase

Impact significance characterization was determined at four levels namely: Non- Significant, Low Significant, Moderately Significant and highly significant impacts. Impact characterization definitions adopted for the study were as follows:

(i) ***Highly Significant impact***: A frequent Impact and or one with highly severe effects.

(ii) Moderately Significant Impact: A frequent impact of moderate severity.

(iii)Low Significant Impact: An infrequent impact of moderate severity.

(iv) Non- Significant Impact: An improbable impact or one with non-severe effects.

(v) Severe Impact: impact infringing on legal provisions or established social norms and with widespread effect i.e. impact affecting areas outside the immediate confines of the defined project area.

(vi) Moderately Severe Impact: Impact causing serious but reversible damage and result in moderate public outcry.

(vii) Non-Severe Impact: Impact not subscribing to any of the above.

Project impact identification and their spatial extent were restricted to the following classes:

Environmental impacts: these included impacts on Air quality, surface & ground water, soils, flora, fauna and avifauna. Impacts of chemical application on the surrounding communities and settlements in Lusu area.

Mitigation measures aimed at preventing, reducing, compensating and/or managing the impacts were identified for all significant impacts with monitoring activities proposed for residual impacts of the project in the event that Sugarcane Plantation ceases the operations of the farms

13.1 Biophysical Environment

The impacts on the biological and physical environment of the project area have been detailed in accordance with the three project implementation phases i.e. preparatory and construction, operation and decommissioning and closure. The impact characterization details of each evaluated impact according to Nature of impact (positive, direct/ indirect and reversible/ irreversible), timing, duration, spatial extent, likelihood, frequency and sensitivity are given in the foregoing.

Although the significance rating of the most of the impacts can be reduced considerably to a "low significance" by implementation proper mitigation measures the proponent should however understand that a "low significance" impact still exerts pressure on the environment and therefore the proponent should intend to go above and beyond the prescribed mitigation and management measures provided in this report by aiming to improve the remaining environment. There are specific policies and guidelines that address environmental issues related to the development. The policies and guidelines were referred to in the legal section. The FAO guidelines for fields projects (FAO, 2012) will be used during the assessment.

Table 9: Environmental categories for FAO field projects

Environmental Category	**Environmental and Social Impacts**	**Environmental Analysis or Assessment Required**
Category A	Significant, or irreversible adverse impacts	Mandatory **environmental impact** assessment
Category B	Less significant adverse impacts that may be easily prevented or mitigated	**Environmental analysis** to identify more precisely potential negative impacts
Category C2	Minimal or no adverse impacts	No further environmental and/ or social analysis or assessment required

Based on the above FAO's categories of field project analysis, the proposed farming project at Lusu falls under category B, which or where environmental analysis is required to analysis to identify more precisely potential negative impacts. The following box below specify the type of projects under Category B, which according to FAO (2012) do not require a full EIA but will require further deepening of environmental or social considerations, depending on the expected magnitude of risks. In many cases, the analysis would aim at gathering additional information in sufficient detail so as to be able to discuss concretely how risks could be addressed and minimized (and possibly eliminated) in the project design.

13.2 Preparatory and construction phase impacts

Surface Water Quality

There are no permanent wetlands in the **6000Ha** extent of Lusu project site. No rivers or streams traverse within the farm land. However, the nearest river close to the project site is the Zambezi river is located +-50km from the site on the Northern side of Lusu area. Therefore, Chemical application activities and poor management of soils resulting into erosion and also from water runoff especially during rainy season may pose a risk of surface water contamination over a long period. This impact if it occurs will be minimal or negligible considering the land orientation and water drainage systems in the area. The other possibility is that of storm water flowing along road way drains and across the farm land. This impact is also considered minimal.

Ground Water Quality

Desert Lusu Salk Sugar intends water reservoir for purposes of supporting the Sugarcane plantation project and production during winter season. The project site has rich underground water resource as evidenced from the historical information obtained from the previous owners of the farms. Desert Lusu Salk Sugar project site currently have water reservoirs constructed on the site as it's not operational. Petroleum handling at the farms specifically the handling of fuels (diesel) at the fuel storage tank, leakages of oils from farm machinery, vehicles and handling of used oil at the workshop is likely to result into ground water contamination through introduction of hydrocarbons into the soil and direct infiltration into ground water. During the rainy season, fuel and oil spills if not properly handled, they will end up in the soil and eventually in ground water. This impact may affect both the proposed project site and surrounding areas as they share the same underground water aquifer. The impact will be regional since the area shares the same underground water aquifer.

Impact significance: *Moderate*

Ambient Air Quality

The main access tarred road to other areas beyond Lusu farm **does not** pass within the project site boundaries.

This means there will not be any potential increased of traffic on the road situated close to human settlements or surrounding areas hence the low levels of dust which shall not affect the air quality of the area. Movement of construction vehicles during access road development, rehabilitation, clearing of

vegetation, sinking of boreholes, construction and other support infrastructure may result in low levels of dust and exhaust fumes from motor vehicles and machinery on site. Ploughing and tilling, transportation of materials and construction of all ancillary facilities will certainly generate appreciable amount of dust. This impact will be regional as it may affect both the proposed project site and its vicinity.

Impact significance: *Low*

Soil Contamination

Poor management of fresh and used oils will also certainly contaminate the soil. This impact will be regional as it may affect the proposed project sites and its vicinities. The poor management of effluent from the factory from wash water may contaminate ground water and soil within the farm area. This impact is considered localised and of low magnitude.

Impact significance: *Low*

Soil erosion

A smaller part of the farm land at Lusu will be cleared for agricultural activities and construction of other infrastructure. The Clearing of vegetation, construction of access roads and infrastructure will result into possibilities of soil erosion. This impact will be local as it will be restricted to the proposed project site. Soil erosion will eventually result into poor soil fertility as the nutrients will be leached out.

Impact significance: *Low*

Noise

Transportation of farm implements, use of dozers, graders, tractors and any other equipment in vegetation clearing, and construction of infrastructure will result into noise generation. This impact will be regional as it may go beyond the proposed project site. Operations of machinery will be restricted to day light (between 07:00 to 18:00hours) at all farming blocks and machinery will be regularly serviced to emit sound with the acceptable audible frequencies.

Impact significance: *Low*

Land Use

Construction of all necessary farm infrastructures will certainly have a positive impact on land use. Land use will change from idling and transformed to its intended purpose of commercial agricultural activities under the management of Desert Lusu Salk Sugar.

Damage to agricultural lands/fisheries

This impact is unlikely to occur as Lusu Sugarcane plantation farm have **no** streams or rivers with fish likely to be destroyed by the project. Irrigation water will be obtained through river seasonally and water stored in reservoirs. Desert Lusu Salk Sugar plantation farm will be developed in line with appropriate farming methods that will not result in indiscriminate use of land.

Impact significance: *Low*

Flora

Clearing of vegetation will certainly reduce the number of trees in the area. Some of trees that will be cleared are endangered specifies. It is almost impossible or very difficult to replace the endangered species at any time. Most of the trees in the farm will and some were cleared because the Desert Lusu Salk Sugarcane Plantation farm was proposed. Impact on flora will be localised.

Impact significance: Low

Fauna

The impact on fauna is likely as there are frequent large animal movement (such as elephants, buffalos, kudus) within the surrounding area of the project site or in the vicinity which are sensitive to such developments. Other animals present are those that are able to survive even with such developments. Examples are birds, rabbits, lizards, rodents, snakes and smaller animals. Impact of construction and operation activities will be localised

Impact significance: *moderate*

Landscape and Visual characteristics

Construction of new infrastructure will certainly result in change in aesthetics of Lusu farming unit. Clearing of certain portions of vegetation and construction of different farm infrastructure will certainly have an impact on the landscape and visual characteristic of the proposed project sites. This impact will be local. The landscape and visual characteristics will change drastically.

Impact significance: *High*

Public Safety

The development and revamping of the farm for Sugarcane Plantation will result in the influx of people around the project areas seeking employment and business opportunities. This will result in increased crime rates in the areas. Vehicular movement and farm equipment may possibly cause accidents to members of the public who may illegally stray into the farm area. Open boreholes are certainly a danger to public safety Desert Lusu Salk Sugar **intend** to engaged the (Masokotwani Police branch) for Namibian Police Service through the Ministry of Safety & Security to offer manpower and that the company will request for police patrols in the areas to help reduce incidents of crime and theft. This request to the Namibian police will be laid once the construction commences upon approval.

Impact significance: *Moderate*

Archaeology and cultural sites

There are no archaeological sites in proposed project site area. Archaeological sites having items such as cultural relics, iron and Stone Age objects, old caves, artistic work and paintings, spiritual and worshiping items, churches, traditional places may possibly be damaged during construction phase if found within the vicinity of the project site. Thus, the farm Lusu Communal area have no historical, cultural and archaeological sites within the farm, therefore, this impact is very negligible.

Impact significance: *Low*

Hazardous Waste

Fresh and used machinery oil is likely to be spilled into the soil during the construction phase depending on the management of these items. Other hazardous waste such as expired chemicals, batteries, electronic waste and filters will also be generated. The impact will be localized.

Solid Waste

Construction packaging material (e.g. cement bags), off cuts from steel, trees, rubble and domestic waste will be generated during construction. This impact will be local.

Sewerage Waste

Use of toilets whether pit latrines or advance will result into sewer waste being generated. This may possibly have affected ground water quality in the vicinity of the pits. This impact is minimal and will be localized.

13.3 Operational phase impacts

Surface Water Quality

There may be possibility of surface water contamination resulting from water runoff containing chemical residues of pesticides and herbicides from the farming operation. The other possibility is that of storm water flowing along road way drains and across the farm land. Effluent water from the factory clean up may also affect surface water quality. This water will finally sink or percolate into the soil. It is therefore unlikely that there will be surface water pollution resulting from the any activities from the farm and any associated activities.

Impact significance: *Low*

Ground Water Quality

Handling of fuels at the fuel storage tank, leakages of fuel from vehicles and handling of used oil at the workshop may lead to ground water contamination by hydrocarbons. Incorrect handling of fresh fuels and used oil may lead to leakages of fuel into the soil and in an event of rains and/ or storm water these hydrocarbons will end up in the soil and eventually in ground water. Application of fertilizers, insecticides, fungicides and herbicides will certainly result into soil contamination and with rain water and storm water these chemicals will contaminate ground water. This impact may be regional as areas in the proposed project site may be affected.

Impact significance: *Low*

Ground water drawdown

The primary contributor to the availability and presence of groundwater resources in Zambezi region is rainfall. The porosity, permeability and hydraulic conductivity of the soils in the area guarantees constant recharge to the groundwater and consequent availability. The entire Zambezi region and surrounding areas in particular have experienced uniform rainfall regime over a long period which

provides sufficient recharge potential for the aquifer although seasonal groundwater level fluctuations may occur as the result of the spatial variability of the rainfall as well as due to pumping.

Pumping of water for irrigation from the Zambezi river will not be continuous. This will be so in order to allow the recharge of the underground aquifer. Water will be stored in a reservoir (tank) with 10000m3 storage capacity. Irrigation water will then be abstracted from this reservoir at determined times. During the rainy season, pumping will be at its minimum since all the fruits & vegetable will be grown using rainfall. This will allow the water table to replenish the water table.

Impact significance: *High*

Ambient Air Quality

High wind velocities may also result into dust generation from the bare land that has been cleared of its vegetation. This may happen even during off season periods of farming or when the land is idle during the window period of the rotation system that will be used at the farm.

Vehicular movement through the proposed access roads within the farming Unit may lead to dust generation. Ploughing and tilling, transportation of materials (inputs and out puts), will certainly generate appreciable amount of dust. This impact will be regional as it may affect both the proposed project site and its vicinity. This will be a nuisance.

Impact significance: *Low*

Soil Contamination

Poor management of fresh and used oils will also certainly contaminate the soil. This impact will be regional as it may affect the proposed project site and its vicinity. It is also possible that soil contamination may occur due to inappropriate handling of chemicals such as fertilizer, insecticides, fungicides and herbicides. In the event of rain or irrigation leading to water runoff, these chemicals may percolate through surface soils causing contamination.

Soil Erosion

Poor maintenance of access roads and drainages may result into continuation of soil erosion. Soil erosion may be from storm water and or high velocity winds. This impact will be local as it will be restricted to the proposed project site. Soil erosion will eventually result into poor soil fertility as the nutrients will be leached out.

Impact significance: *Low*

Noise

Transportation of farm implements and products, use of farm equipment in ploughing and tilling, application of fertilizers, insecticides, fungicides and pesticides, pumping of water, and any other activity associated with the operational phase will certainly result into noise generation. This impact will be regional as it may go beyond the proposed project site. The impact will be low as operations will be restricted to working hours only i.e. from 07:00 to 17:00 hours.

Land Use

The use of tilling, ploughing and transportation of farm inputs and outputs, built infrastructure, pumping of water from Water reservoirs, supply of electricity and any other activity that will be carried out on the farm lands at operational phase will certainly have a positive impact on land use. Land use will change from the dormancy period it has undergone the last ten years to commercial agricultural activity. Land use will bring about the needed infrastructural development and economic enhancement in the Lusu area. This is a positive impact on the land as it will generate income.

Flora

During operational phase it is possible that invasive flora species may be introduced accidentally into the proposed project site and in the vicinity of the proposed project site. The agents of this invasive specifies may not be necessary the developer but may be from the out-grower scheme that will be initiated and encouraged by the development.

Impact significance: *Low*

Fauna

The land or area where the proposed Sugarcane Plantation farming is to be implemented has being in use for subsistence farming activities for many years and has no large or endangered animal species that will be impacted by the development thus the operational phase activities will have no significant impact on fauna on the proposed project site or in the vicinity which are sensitive to such developments. Only small animals may be impacted by the revamping and operational activities on the farm. These animals may include birds, rabbits, lizards, rodents, snakes and squirrels. The impact if any will be localised to the project sites.

Landscape and Visual characteristics

The landscape and visual characteristics of the project sites will change drastically. Use of access roads, buildings, tilling and ploughing, irrigation system, growing of fruits and use of machinery at the farm will certainly have an impact on the landscape and visual characteristic of the proposed project sites. This impact will be localised.

Public safety and occupational health risk

Movement of haul vehicles, farm machinery such as tractors and circular movement of the centre pivots may cause serious occupational health risk to workers on site and also to the public. The fuel storage facility and an open area may also be a source of public safety hazard resulting from fire and physical injuries respectively.

Archaeology and cultural sites

Operational phase activities are unlikely to have any impact to archaeological and cultural sites as they are located away from the project site. The impact of activities on the site will be insignificant.

Hazardous Waste

The management of fresh and used machinery oils if not adequately addressed may result in contamination of soils and subsequently ground water within the farm sites or workshop and/or oil storage area. This may be so also in the fuel storage facility. Other waste will be obsolete and expired chemicals, fertilizers and empty chemical containers. The impact will be localised to the above stated area.

Solid Waste

Domestic and Biomass waste will be generated during operational phase. This impact will be local. The domestic waste generation is negative while the biomass generation is a positive impact. The biomass may be used as an energy source with appropriate technology that may be considered by Desert Lusu Salk Sugar.

Sewerage Waste

Waterborne toilets will be used at the farm at Lusu (where an workers shelters will be developed) and will be connected to a septic tank-soak away system. In other operation centres where applicable, the farm will construct Ventilated Improved Pit latrines (VIP's).

These operations will result in the generation of sewer waste. This may possibly affect ground water quality in the vicinity of the project site.

Impact significance: *Low*

13.4 Impact of out grower scheme to local farmers

Construction Phase

The impact is negligible and insignificant at this stage.

Operational Phase

Engagement of local people in the farming of sugarcane, and cash crops production on out grower scheme basis will help boost productivity, enhance local farmers' incomes and subsequently improved lives and reduced poverty.

In terms of magnitude, likelihood, extent and frequency, the impact is considered significant, possible, confined to the project site surrounding and an annual occurrence respectively.

13.5 Improved Local Authority Revenue base

Construction Phase

Desert Lusu Salk Sugar will make statutory contributions to the Lusu local communities through service delivery of employment creation. The Namwater, CENORED, and line Ministries will benefit through payment of land rates, taxes, and other licences to be issued for compliance. The impact is considered significant at this stage.

Operational Phase

Through payment of various levies and revenues, full operations of the farm will improve the financial standing of the Local communities, the Zambezi region and country as well as other regulatory agencies.

In terms of magnitude, likelihood, extent and frequency, the impact is considered significant, possible, confined to the project site surroundings and an annual occurrence respectively.

Rating Key:

1. Frequency of occurrence of the impact is rated from 1 to 5

1-lowest

2-low

3-meduim

4-high

5-very high

B. Sensitivity of the occurrence refers to the response that the impact will receive from the affected parties. This is rated from 1 to 5. With 1 representing the minimal response to the impact while 5 represents the highest response level to the impact.

Environmental Aspect	Potential Impact	Environmental Impact Characterisation						
		Nature	**Likely hood**	**Timing**	**Duration**	**Extent**	**Frequency**	**Sensitivity**
Surface Water Quality	Storm water contamination	1. Negative 2. Direct 3. Irreversible	likely	Preconstruction to distant future	Short term	Regional	2	1
Ground Water Quality	Ground water contamination	1. Negative 2. Direct 3. Irreversible	likely	Near-future	Short term	Regional	1	5
Drawdown	Reduction in drawdown levels	1. Negative 2. Direct 3. Irreversible	unlikely	Near-future *(operations)*	Short term	Regional	1	5
Ambient Air Quality	Contamination of ambient air with dust	1. Negative 2. Direct 3. Irreversible	Certain	Pre- construction to near future	Short term	Regional	3	3
Soil	Contamination of soil with hazardous waste	1. Negative	likely	Pre- construction	Medium	Local	2	3

Contamination	(used oil)	2. Direct 3. Irreversible		to near future	term			
	Contamination of soil with Pesticides, fungicides and herbicides	1. Negative 2. Direct 3. Irreversible	unlikely	Start of operational to near future	Medium term	Local	1	4
Soil Erosion	Lose of soil fertility as a result of soil erosion by wind and or by water	1. Negative 2. Direct 3. Irreversible	likely	Pre- construction to near future	Permanent	Local	3	4
Noise	Generation of Noise	1. Negative 2. Direct 3. Irreversible	certain	Preconstruction to near future	Medium term	Regional	2	3
Land Use	Change of land use	1. Negative 2. Direct 3. Irreversible	certain	Start of operational to closure	Medium term	Local	2	4
Flora	Clearing of vegetation	1. Negative 2. Direct 3. Irreversible	certain	Pre - construction	Permanent	Local	1	5

	Introduction of Invasive Species	1. Negative 2. Direct 3. Irreversible	possible	Pre - construction	Permanent	Regional	2	5
	Extinction of endangered species	1. Negative 2. Direct 3. Irreversible	certain	Pre - construction	Permanent	Regional	2	5
Fauna	Loss of fauna	1. Negative 2. Direct 3. Irreversible	certain	Pre - construction	Permanent	Regional	1	5
	Interruption of animal corridors	1. Negative 2. Direct 3. Irreversible	unlikely	Pre- construction to operational phase	Permanent	Regional	2	5
	Loss of endangered fauna species	1. Negative 2. Direct 3. Irreversible	unlikely	Pre - construction	Permanent	Regional	1	5
Archaeology and cultural sites	Damage and removal of archaeological sites	1. Negative 2. Direct	unlikely	Pre - construction	Permanent	Local	1	4

		3. Irreversible						
	Damage and removal of Cultural Sites	1. Negative 2. Direct 3. Irreversible	unlikely	Pre - construction	Permanent	Local	1	4
Public Safety	Danger to the community from farm equipment	1. Negative 2. Direct 3. Irreversible	Possible	Preconstruction to near future	Medium Term	Regional	2	4
Landscape and visual characteristics	Change to landscape and visual characteristics	1. Negative 2. Direct 3. Irreversible	Certain	Pre- Construction	Medium Term	Local	1	4
Hazardous Waste	Generation of hazardous waste such as used oil, chemical containers, batteries, florescence tubes, filters etc.	1. Negative 2. Direct 3. Irreversible	Certain	Pre- construction to operational phase	Short Term	Local	2	4
Solid Waste	Generation of Solid Waste from plant biomass	1. Negative 2. Direct 3. Irreversible	Certain	Operational Phase	Medium Term	Local	1	4

	Generation of Domestic Waste	1. Negative 2. Direct 3. Irreversible	Certain	Pre – Construction to Mid Future	Short Term to Medium Term	Local	3	3
Sewerage Waste	Generation of Sewer Waste	1. Negative 2. Direct 3. Irreversible	Certain	Pre – Construction to Mid Future	Short Term to Medium Term	Local	3	3
Surface Water Quality	Surface water contamination	1. Negative 2. Direct 3. Irreversible	Unlikely	Pre – Construction to Mid Future	Short Term	Regional	3	1
Ground Water Quality	Contamination of ground water	1. Negative 2. Direct 3. Irreversible	Possible	Near-future	Short Term	Regional	1	5

14. ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Impact Assessment Regulations require the developer to provide an Environmental and Social Management Plan. An EMP is a document where all the measures that are required for environmental protection, which will include the mitigation measures and the monitoring plan, will be found for easy reference. The aim of an environmental management plan is to avoid, minimize, or ameliorate effects or impacts resulting from project implementation and where possible, enhance beneficial effects.

This EMP seeks to limit the interaction of disturbed with undisturbed lands at Lusu Sugarcane farm project site and through the various processes of project implementation, restore the disturbed land to a predetermined form of land-use or to a productivity level similar to that occurring prior to disturbance.

The Environmental Management Plan for the management of the identified environmental impacts associated with this project consists of three main components:

1. Implementing the Impact Mitigation Plan.
2. Monitoring the implementation of the EMP.

14.1 Impact Mitigation Plan

The impact mitigation plan allocates the responsibilities for implementation of the proposed mitigation measures to the various stakeholders and indicates at what stage in the project they should be performed. The Plan is presented in this section and it addresses the negative impacts generated by the project and presents the associated cost estimates of mitigating the adverse impacts. The key components of the proposed impact mitigation plan are:

(i) Surface and ground water quality management

(ii) Soil erosion Control

(iii) Vegetation and Flora

(iv) Wildlife and Fauna Habitats

1. Bush fires

2. Noise and vibrations
3. Occupational Health and safety
4. Land use and Soil
5. Air Quality
6. Landscape, land use and Aesthetics

Socio-economic components of the mitigation plan include:

(i) Cultural and Historic Sites

(ii) Employment and conditions of service

14.2 Surface and ground water management

Surface and ground water are an important component of agricultural, ecological and human use of the land in the farming unit. The aim of the water management program is to ensure that where practical, flows into and through the project sites is maintained and that ground water sources (boreholes within the farms) are used efficiently to prevent inconsistent draw down of water during abstraction. The following will be undertaken to protect surface and ground water:

1. An effective drainage system will be put in place to capture all waste water.
2. Oil spillages from vehicles and machinery will be avoided on site. Compliance with the Hazardous Waste Regulations will be priority.
3. A good and effective monitoring system will be put in place during operations. Regular surface and ground water samples will be collected and analysed. Bi-annual results will be submitted to the Namibian Environmental directorate.
4. Ensuring that boreholes and septic tanks are at least 60 meters apart.

14.3 Soil erosion control

The Desert Lusu Salk Sugar farming area have soils with less likelihood of soil erosion. However, the nature of the soil in high rainfall or winds may be prone to erosion. The cultivation methods to be

employed by Desert Lusu Salk Sugar will ensure less risk of soil erosion and runoff water to nearby farms and settlements

14.4 Vegetation and Flora

The farming project site has large portion of disturbed arable land as a result of seasonal floods and because land has been used for cultivation. Most of the flora was cleared for purposes of cultivating crops during operations by comm unity members. A number of management initiatives shall be implemented to reduce further potential impacts and disturbance to flora and vegetation. These include clearly marking and restricting access to areas of high conservation value; concentrate the farming operations to already cleared land for cultivation purposes.

14.5 Wildlife and Fauna habitats

Due to previous farming and other anthropogenic activities in the project area, the area has minimum large animals that will be disturbed or likely to migrate due to the farming activities to be undertaken by Desert Lusu Salk Sugar. However, in the event that the small identified animals are threatened, it is most likely that the species will tend to migrate from the areas of greatest activity during site preparation and operation but will return during the night and more stable years of the operations. The selected potential impacts on fauna will be reduced by restricting disturbance and clearing of habitats to the minimum required for safe and efficient operations of the farm and progressively rehabilitating disturbed areas to re-establish habitats for the animals.

14.6 Bush fires

The impact of bush fires is more significant in the dry season as the risk of flora and fauna disturbance and threat is high. This is so because the flora and grass are dry and of little moisture likely to provide more means of fuel for ignition. Other than ignition, and fuels, other factors such as season, wind pattern and proximity with human settlements will play an important role in open burning. Such factors will need to be ascertained as appropriate timing of burning may facilitate a good burn and at the same

time minimize air pollution impact. Consideration of the regional factors will enable classification of the area in terms of air pollution risks. All workers will be warned of the dangers of deliberate ignition of fires and its impact on wildlife, crops and other natural resources.

14.7 Noise and vibrations

Operation of machinery at the farm will have little impact on the local surrounding community as the noise levels to be emitted will be within the acceptable audible levels. The settlements around the farm are at reasonable distances unlikely to receive destructive noise levels. The team will also ensure that only well serviced machinery, trucks and tractors are used to avoid generating noise levels that are above the recommended limit. Operations will be limited to day time only.

14.8 Employment and conditions of service

Desert Lusu Salk Sugar will employ up close to 1000 workers at full implementation of the project. In accordance with its employment policy, this will constitute thirty (30%) of women. The company will uphold the government directive under the labour laws to pay all workers the stipulated minimum wage. Further, the company will observe all labour related regulations pertaining to normal working hours and other conditions of employment.

14.9 Cultural and Historic Sites

Lusu Sugarcane Plantation farm have no cultural, historical or archaeological sites within the farm area that may be disturbed by the project implementation from pre-construction to decommissioning phases.

15. THE IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Table below outlines the management of the environmental elements during the planning and operational phases. Section 2 provides a brief summary of the management of the farming project. Contents of these tables could be incorporated into a HSEQ management system. The proponent would be responsible to assign the responsibilities and ensure that the tasks are executed

Environmental Aspect	Objectives	Monitoring frequency	Mitigation and enhancement measures	Responsible person	Monitoring costs (N$)
PREPARATION & CONSTRUCTION PHASE					
Surface Water Quality	To protect contamination of storm water.	Seasonal	Construction of proper drains alongside access roads and drains within the farm land and operation areas.	Operations Director	4,200
Ground Water Quality	To protect ground water contamination from oil spills and chemical run off.	Quarterly	Drip trays will be used when removing used oils from equipment waiting servicing.	Farm Manager	3,400
			Fuel storage tanks will be placed in a banded wall and concreted surface. The bunding shall have a volume equivalent to 110% the volume of the fuel tank. A sump shall be constructed in such a way as to drain any oil that has spilled	Farm Manager	
			Used oil storage facility shall be kept under lock and key, concreted and bunded	Farm Manager	
			Drainage systems in the farm will be constructed to prevent chemical runoff during irrigation and rainy season	Farm Manager	
Drawdown	To reduce the impact of draw down.	During borehole drilling & test pumping	Boreholes shall be located and drilled in such a way as not to increase the impact of drawdown. Boreholes will be sighted in areas within the farm away from shallow wells to protect shallow wells from	Farm Manager	

			drawdown.		
Ambient Air Quality	Reduction of gas and fumes from borehole drilling and diesel machines	Quarterly	Diesel equipment to be equipped with gas absorbers	Farm Manager	2,200
			Use of low Sulphur content fuel (diesel) will be prioritised	Farm Manager	
	Suppression of dust from construction sites and access roads	Weekly	The farm shall have a water bowser which shall be used to suppress dust on the main road and other access roads and construction sites where there is dust.	Farm Manager	
			If available molasses will be sprayed on roads and construction sites to suppress dust formation. Emissions and dust levels will be monitored by way of periodical air sampling using mobile dragger pump. Results will be submitted to DEA quarterly.	Farm Manager	1,400
Soil Contamination	To protect soil from contamination from fresh and used oil spills, and fuel.	Quarterly	Refuelling & repair of construction equipment will be done in designated areas and periodic maintenance will be done on all equipment to avoid oil leaks getting into the soil	Farm Manager	
			Drip trays will be used in maintenance areas to drain used oil from equipment.	Farm Manager	
			Fresh and used oil will be stored in separate and lockable shades whose floors shall be concreted	Workshop manager	

			A bioremediation plan shall be established for the purpose bioremediation of oil contaminated soils.	Farm Block Manager	3,000
Soil Erosion	To protect the soil from erosion	Monthly	Storm water drains will be constructed around construction sites to collect storm water and there by prevent soil erosion	Farm Manager	
			Access roads and the plant periphery will be left with trees and this will protect soil erosion	Farm Manager	
Noise	Minimise Noise to acceptable levels	Monthly	All farm equipment will be subject to a routine maintenance to ensure they are in good working order, hence minimising noise levels. Restrict operations to day time only.	Farm Manager	
			Employees shall wear ear muffs or ear plugs and other necessary Personal Protective Equipment (PPE).	Farm Manager	3,000
	To protect workers from noise exceeding acceptable levels	Monthly	Periodical monitoring of noise levels shall be conducted.	Farm Manager	
			Selection of low noise level equipment when purchasing farm and workshop equipment will be first priority.	Farm Manager	
			Trees along access and periphery roads shall left intact to shield and reduce noise levels	Farm Manager	
Land Use	To rehabilitate the farm area and try to restore to its	Annually	The mitigations here shall only come at closure. Buildings like the farm house, workers houses, fuel storage facility, used oil storage	Operations director	1,000

	original state.		shed and the mini workshop will be demolished, area cleared and rehabilitated. The centre pivot shall be removed and the other irrigation equipment removed also. Pumps shall be roved and boreholes caped. The farm land shall be re-vegetated and or allowed to naturally re-vegetate.		
Flora	To protect the local flora where possible.	Quarterly	The project will be implemented mostly to utilise spaces or land which was already cleared in the farm blocks	Farm Manager	1,800
Fauna	To protect local fauna.	Quarterly	Noticed fauna in the proposed project site will be preserved by taking it to areas that will remain undisturbed.	Farm Manager	1,200
Archaeology and cultural sites	To protect cultural heritage from damage	Project Inception	Any cultural heritage site discovered during construction will be preserved and the cultural heritage commission informed accordingly.	Farm Manager	1,500
Public Safety	To minimise health and safety risks.	Quarterly	Pre-employment and regular medical examinations will be carried out on all farm employees to ascertain their health.	Farm Manager	1,450
			All plant equipment will be subject to a routine maintenance programme to ensure they are in good working order, hence minimising health and safety risks.	Farm Manager	
			All workers including contractors will be subject to wearing appropriate personal protective equipment (PPE) depending on the	Farm Manager	

			work type and place		
			All workers to go through safety and health inductions upon employment.	Farm Manager	
	To protect members of the public from hazards associated with construction activities.		Only authorised workers will be allowed to enter construction areas. No members of the public will be allowed to enter construction sites as well as the farm premises	Farm Manager	
			"Danger" warning signs to be placed in different points along the boundary of the farm and along the access road.	Farm Manager	
			Warning signs to be written in symbols, English and Vernacular language for easy interpretation.	Farm Manager	
Landscape and Visual characteristics	To protect visual characteristics of the landscape.	Project inception	Where there shall be no roads and buildings, the visual characteristics of the landscape shall not be altered.	Farm Manager	1,100
Hazardous Waste	To safely keep generated hazardous waste and dispose of appropriately	Throughout Project	Used oil and used batteries storage areas shall be constructed according to environmental guidelines. Lockable, concreted and bunded shed shall be constructed.	Farm Manager	1,200
Sewerage Waste	To protect sewer waste from contaminating the soil and	Throughout Project	A septic soak way system shall be constructed to treat sewer waste since farming block & surrounding areas are not serviced by	Farm Manager	1,250

	or ground water		municipal infrastructure		
Solid Waste	Dispose solid waste at construction site accordingly	Throughout Project	Metallic and timber off cuts will be stored in designated areas and sold or given to authorised scrap metal dealers or given to the locals for domestic use.	Health officer	1,450
			Cement empty bags and containers will be re-used or returned to supplier for re-use.	Farm Manager	
Occupational health and safety issues	Protection and safety of workers during construction	Throughout the project	Number of construction workers provided with protective equipment such as helmets, safety shoes, gloves and eye glasses as appropriate. Number of injuries, lost days, and fatalities of construction workers and others.	Contractor's Occupational Health and Safety Officer	1,450
Loss of residential & business housing units, and other properties	Compensation for loses	Construction phase	Pay compensation for the affected properties based on the current market value or according to the Regulations	Developers (Desert Lusu Salk Sugar)	Upon evaluation of the loses& agreement
Loss of farmlands	Compensation for loses	Construction phase	Pay compensation for the loss of income benefits from affected farmlands according to the Regulations	Developers (Desert Lusu Salk Sugar)	Upon evaluation of the loses & agreement
OPERATIONAL PHASE					
Surface and ground Water	To protect contamination of	Quarterly	Proper maintenance of storm water drains along access roads and	Operations Director	

Quality	surface and ground water		drains within the farm land		
			The transport of hazardous materials to and from farm will be done in accordance with laid down procedures. Requirements will Include: documentation and inventory control through chain of custody; emergency response training for spills.	Farm Manager	
			Only designated transport routes shall be used to transport chemicals such as fertiliser, fungicides, herbicides, fuel, used oil, fresh oil, lime and pesticides to and from the farm.	Farm Manager	
			Contracted transporters of chemicals shall be licenced with Ministry of Mines & Energy	Farm Manager	
			Contracted transporters of petroleum products shall be licenced with the Energy Regulation Board	Farm Manager	
			Application of fertilisers, fungicides, pesticides and herbicides will be in accordance will the law and guidelines.	Farm Manager	
Drawdown	To protect the locals from being affected by the effect of drawdown on their water supply wells.	Monthly	A drawdown monitoring programme will be put in place	Farm Manager	
			Locals will be informed how far from the farm should they put their wells.	Farm Manager	
			Boreholes in the farm to located far away from residential areas	Farm Manager	

			where locals are likely to put boreholes. A minimum of 300 metres away is recommended.		
Ambient Air Quality	To prevent contamination of air due to dust emissions from vehicles and trucks operating on dirt roads	Quarterly	The farm shall have a water bowser which shall be used to suppress dust on access roads and construction sites where there is dust.	Farm Manager	1,250
			If available molasses will be sprayed on roads and construction sites to suppress dust formation	Farm Manager	
	Low fume and gas emissions		Trees will be left along access roads and on the periphery of the proposed project site to act as a wind breaker and thereby reduce dust levels	Farm Manager	
			Diesel equipment to be equipped with gas absorbers	Farm Manager	
Soil	Protection of soil from contamination by hazardous waste	Quarterly	Hazardous waste shall be kept in a lockable, concreted and bunded storage facility	Farm Manager	
	Protection of Soil from contamination by fertiliser, pesticides, fungicides and herbicides	Quarterly	Pesticides. Herbicides, fertiliser and fungicides shall be kept in a properly constructed area with proper ventilation, concreted floor, bunded and lockable shed	Farm Manager	
			Application of these chemicals shall follow the right procedures	Farm Manager	
Soil Erosion	To protect the soil from	Quarterly	Storm water drains will be periodically maintained to collect storm	Farm Manager	

	erosion		water and there by prevent soil erosion.		
			Access roads and the plant periphery will be left with trees and this will protect soil erosion	Farm Manager	
Noise	To minimise noise levels to acceptable levels	Quarterly	All farm equipment will be subject to a routine maintenance programme to ensure they are in good working order, hence minimising noise levels.	Farm Manager	1,450
	To protect workers from noise exceeding acceptable levels		Employees will wear appropriate ear protection in workplaces where noise levels exceed the minimum requirement Desert Lusu Salk Sugar management will enforce the use of PPE in the farm.	Farm Manager	
			Trees left along access roads and the farm periphery will not only act as a wind breaker but also sound proof.	Farm Manager	
Land Use	Protect land from being used in other ways	Throughout project life	The Lusu farm will be strictly for commercial farming of crop, vegetables and other items such as soya beans, wheat, maize. Any other use will be prohibited.	Farm Manager	
Flora	To protect the local flora where possible	Throughout project life	All the trees left after the construction phase shall not be cut for whatever reason. A procedure for cutting of trees shall be put in place. Progressive planting of trees shall be carried out and encouraged in areas where trees had been carelessly cut.	Farm Manager	

	Extinction of endangered plant species.		Identified Endangered plant species shall be preserved and planted elsewhere at all costs if possible.	Farm Manager	
	Protection from introduction of invasive species		No invasive or alien species shall be introduced on this farmland in accordance with the invasive species act.	Farm Manager	
Fauna	To protect local fauna.	Throughout project life	Noticed fauna in the proposed project sites will be preserved relocating it to areas that will remain undisturbed	Farm Manager	
Archaeology and cultural sites	To protect cultural heritage from damage	Throughout project life	Any cultural heritage site discovered during operational phase other than the existing grave site will be preserved and the cultural heritage commission informed accordingly	Farm Manager	
Public Safety	To minimise health and safety risks.	Throughout project life	Pre-employment and regular medical examinations will be carried out on all farm employees	Farm Manager	3,000
	To protect members of the public from hazards associated with construction activities		All plant equipment will be subject to a routine maintenance programme to ensure they are in good working order, hence minimising health and safety risks	Farm Manager	
			All workers whether contractor or not will be subject to wearing appropriate personal protective equipment (PPE) depending on the work type and place	Farm Manager	
			All workers to go through safety and health inductions when just	Farm Manager	

			employed		
	To protect members of the public from hazards associated with construction activities	Throughout project life	Only authorised workers will be allowed to enter construction areas. No members of the public will be allowed to enter construction sites.	Farm Manager	
			"Danger" warning signage to be placed in different points along the boundary of the farm.	Farm Manager	
			Warning signs to be written in symbols, English and vernacular language.	Farm Manager	
Landscape and Visual characteristics	To protect visual characteristics of the landscape	Throughout project life	Where there shall be no roads and buildings, the visual characteristics of the landscape shall not be altered	Farm Manager	
Loss of farm and grazing lands	Compensation to loses	Throughout the project	Pay compensation for loss of land, structures, and income benefits from affected lands	Developers (Desert Lusu Salk Sugar)	
Hazardous Waste	To safely store and handle generated hazardous waste	Throughout project life	Used oil and batteries storage areas shall be maintained according to environmental guidelines. Lockable, concreted and bunded shed shall be used.	Farm Manager	
Sewerage & effluent Waste	To protect sewer waste from contaminating the soil and/or ground water	Throughout project life	A septic soak way system shall be used to treat sewer waste. HDPE lined effluent ponds will be constructed on the farm for bio-treatment of effluent.	Farm Manager	

Solid Waste	Disposal of solid waste	Throughout project life	Biomass from the plants will be stored and energy generation options evaluated	Farm Manager	
			Domestic solid waste will be disposed of at the Katima Mulilo disposal site in accordance with the waste management regulations	Farm Manager	
Unforeseen impacts	Unexpected impacts	Throughout project life	Identify unforeseen socio-environmental impacts of the project and propose remedial measures and/or Advise construction contractor regarding unforeseen environmental issues of the project	Farm Manager	
DECOMMISSIONING AND CLOSURE PHASE					
Ambient Air Quality	Contamination of ambient air with dust	Quarterly	Progressive and natural re-vegetation shall be done and this will protect land from winds and that result into generating of dust.	Farm Manager	
Soil Erosion	To protect the soil from erosion	Quarterly	Storm water drains will be periodically maintained to collect storm water and there by prevent soil erosion	Farm Manager	
			Access roads and the plant periphery will be left with trees and this will protect soil erosion	Farm Manager	
Land Use	Change of land use	Bi-annual	Demolition of all surface infrastructures, grading and re-profiling of the surface and re-vegetation will be done. If possible, land use will change to the original one.	Farm Manager	

Public Safety	Danger to the community from farm equipment	Monthly	All farm equipment removed and infrastructure will be demolished. Areas requiring rehabilitation rehabilitated. Bore holes shall be caped.	Farm Manager	3,000
Landscape and Visual characteristics	Change to landscape and visual characteristics	Quarterly	Demolition of all surface infrastructures, grading and re-profiling of the surface and re-vegetation will change the landscape and visual characteristics	Farm Manager	
Solid Waste	Generation of Domestic Waste	Quarterly	Domestic solid waste will be disposed of at Katima Mulilo disposal sites according to the waste management regulations.	Farm Manager	
Sewerage Waste	To protect sewer waste from contaminating the soil and or ground water	Quarterly	A septic tank-soak way system shall be used to treat sewer waste	Farm Manager	

16. DECOMISSIONING PHASE

Upon the successful operation of the farm by Desert Lusu Salk Sugar, the closure objective will be to restore the farm site to its natural state. This will be a transitional change over a period of time in order to restore the land to its original state. Lusu Sugarcane plantation farm will have to be restored to a condition which is safe, stable and minimizes environmental impacts on the flora, fauna, water, and soil and air quality. The area must as a minimum not negatively affect the socio-economic status of the local residents close to the project areas. Other objectives of the closure plan are to:

1. Protect future human, flora and fauna health and safety.
2. Minimize or prevent biophysical and social environmental degradation.
3. As far as practical, return the site to the pre-farming land use (sustainable woodland) or another appropriate alternative, and
4. Minimize any adverse socio-economic impacts. Generally, closure objectives covering public health and safety, landform (soils) and vegetation will be developed as outlined in the table below.

Desert Lusu Salk Sugar intends to undertake the Sugarcane plantation farming project through the 25-year lease as stipulated by the Namibian government land Reform Act no 5 of 2002. All relevant local and regional regulatory bodies such as Namibian Environmental Management commission, Zambezi Regional Council, government departments and other relevant local authorities and/or interested parties will be informed beforehand when the event that Desert Lusu Salk Sugar decides to abandon the implementation of the project for any predicted or unforeseen circumstances. A detailed final closure plan will be submitted for approval to the Ministry of Environment, directorate of Environmental Affairs.

The following sections describe the activities to be undertaken by Desert Lusu Salk Sugar to successfully bring the project to a close taking into consideration all the environmental, physical and socio-economic impacts that may arise during this phase.

Dismantling of equipment and farm machinery

All the farm machinery, and auxiliary equipment on site will be dismantled to manufacturer specifications in a well-planned manner in order to avoid contamination of soil, air and water and to eliminate the physical hazards associated with the equipment and machinery to be dismantled and relocated

Movement of re-usable farm machinery

Desert Lusu Salk Sugar does not operate any other ventures in Namibia that will require the use of the machinery relocated from the Zambezi region Farm project. The machinery salvaged from Zambezi region farming units will be moved, lease or sold to an appropriate farming operation that will utilise the equipment.

Demolition of the Farm infrastructure

The administration building, storage, workshop, chemical stores, farm house, workers quarters and other concrete related infrastructure will be demolished accordingly. This will be done systemically in order to recover as much reusable construction material as possible. The rabble resulting from this demolition will be used to level the ground and refill and re-profile the septic tanks and soak away system that will be utilized as a sewerage management facility during the operation phase. General cleaning of the areas formerly occupied by the demolished structures will be conducted to be coupled with grading and levelling the ground to pave way for tree replanting.

Installation of warning signage and symbols

In order to maintain safety and reduce the risk of physical accidents from trespassers, the areas considered to pose accident risks will have warning signage installed to prevent injury and restrict access to the site. This will also be done for the main access road that traverses through the farm.

17. CONCLUSIONS AND RECOMMENDATIONS

17.1 Conclusion

Agricultural production has proven itself time and again as a powerful instrument for socio-economic development. Community farming and irrigation projects are important tool in alleviating poverty and providing alternative livelihoods, especially in Namibia's community areas with a low rate of unemployment.

These specific areas have a lot of potential as an agricultural crop production. And there is need for more some irrigation farm establishments that do not only provide economic benefits to the communities but also offer socio-economic benefits to the local communities with minimised ecological impacts.

Since the proposed site falls within the Zambezi region which is rated as a second poorest region according to the regional poverty profile (NPC, 2004) the surrounding communities can only benefit from the proposed agricultural in terms of increased long-term quality of life.

17.2 Recommendations

Development related impacts must be prevented or mitigated by implementing strict monitoring and control. All permits and approval must be obtained from the relevant ministries or authorities for the operation of the farm. It is imperative that the mitigation measures as set out in the ESMP be implemented during the planning (layout design) construction and operational phases to prevent unnecessary damage to the natural environment.

The ESMP should be added to all contractors' agreements and be signed by such contractors. The recommendations made in this report places the developer under a legal obligation to ensure that all mitigation measures are implemented and followed through during construction and operation of the farms

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