HARVESTING OF INVADER BUSH FOR THE PRODUCTION OF WOODCHIPS (BIOFUEL), NAMIBIA

ENVIRONMENTAL MANAGEMENT PLAN

Prepared by:

Prepared for:

July 2022

Project:	**HARVESTING OF INVADER BUSH FOR THE PRODUCTION OF WOODCHIPS (BIOFUEL), NAMIBIA: ENVIRONMENTAL MANAGEMENT PLAN**	
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Report Approval	 **André Faul** Environmental Assessment Practitioner	

I _____, acting as a representative of Organic Energy Solutions (Pty) Ltd hereby confirm that I approve the Environmental Management Plan as presented in this document. All material information in the possession of the proponent that reasonably has or may have bearing on the report was provided to the consultant.

Signed at _____ on the _____ day of _____2022.

_____ CY/2006/0564

Organic Energy Solutions (Pty) Ltd Company Registration Number

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LIST OF ABBREVIATIONS

°C	Degrees Celsius
AIDS	Acquired Immune Deficiency Syndrome
DEA	Directorate of Environmental Affairs
DWA	Department of Water Affairs
EA	Environmental Assessment
ECC	Environmental clearance certificate
EIA	Environmental Impact Assessment
EMA	Environmental Management Act No 7 of 2007
EMP	Environmental Management Plan
EMS	Environmental Management System
GDP	Gross Domestic Product
GPT	Geo Pollution Technologies
HIV	Human Immunodeficiency Virus
HMV	Heavy Motor Vehicle
HSEQ	A Health, Safety, Environment and Quality Policy
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
m	Meter
m^3	Cubic meter
MEFT	Ministry of Environment, Forestry and Tourism
MSDS	Material Safety Data Sheet
PPE	Personal Protective Equipment
SANS	South African National Standards
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

GLOSSARY OF TERMS

Competent Authority - means a body or person empowered under the local authorities act or Environmental Management Act to enforce the rule of law.

Construction - means the building, erection or modification of a facility, structure or infrastructure that is necessary for the undertaking of an activity, including the modification, alteration, upgrading or decommissioning of such facility, structure or infrastructure.

Cumulative Impacts - in relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Effluent - Liquid waste originating from domestic, industrial, agricultural or mining activities that has been treated in a wastewater treatment facility and released into the environment in a dam, an evaporation pond, an aquifer, a river, the sea or onto the surface of the ground.

Environment - As defined in the Environmental Assessment Policy and Environmental Management Act - "land, water and air; all organic and inorganic matter and living organisms as well as biological diversity; the interacting natural systems that include components referred to in sub-paragraphs, the human environment insofar as it represents archaeological, aesthetic, cultural, historic, economic, palaeontological or social values".

Environmental Clearance Certificate (ECC) - certificate (and its associated conditions) issued in terms of the environmental management act, authorising a listed activity to be undertaken.

Environmental Management Plan (EMP) - A working document on environmental and socio-economic mitigation measures, which must be implemented by several responsible parties of the project.

Environmental Management System (EMS) - An Environment Management System, or EMS, is a comprehensive approach to managing environmental issues, integrating environment-oriented thinking into every aspect of business management. An EMS ensures environmental considerations are a priority, along with other concerns such as costs, product quality, investments, PR productivity and strategic planning. An EMS generally makes a positive impact on a company's bottom line. It increases efficiency and focuses on customer needs and marketplace conditions, improving both the company's financial and environmental performance. By using an EMS to convert environmental problems into commercial opportunities, companies usually become more competitive.

Groundwater - Water - (a) occurring naturally below the surface of the ground; or
(b) pumped, diverted or released into a cavity for storage underground.

Hazard - Anything that has the potential to cause damage to life, property and/or the environment. The hazard of a particular material or installation is constant; that is, it would present the same hazard wherever it was present.

Landfill area – For purposes of this document the landfill refers to an area where slaughterhouse waste is buried.

Mitigate - The implementation of practical measures to reduce adverse impacts.

Proponent (Applicant) - Any person who has submitted or intends to submit an application for an authorisation, as legislated by the Environmental Management Act no. 7 of 2007, to undertake an activity or activities identified as a listed activity or listed activities; or in any other notice published by the Minister or Ministry of Environment & Tourism.

1 INTRODUCTION & BACKGROUND

Organic Energy Solutions (Pty) Ltd (the Proponent), as part of Ohlthaver & List Energy, was commissioned by its sister company Namibia Breweries Limited (NBL) to evaluate the feasibility of harvesting invader bush to provide woodchips (biomass) for use as a fuel source in NBL's processing facility boilers. Subsequently, the Proponent developed and environmental management plan (EMP) and obtained an environmental clearance certificate (ECC), dated 05 February 2019, for the harvesting of invader bush species across five privately owned farms affected by bush encroachment. The initial EMP includes all activities required in terms of mechanical bush harvesting, maintenance of support infrastructure, operational equipment and labour management. Implementation of the project has been conducted over all the areas initially identified, including some additional areas. Operations see bush harvesting initiatives moving from site to site, clearing approximately 400 ha per annum.

The Proponent requested Geo Pollution Technologies (Pty) Ltd (GPT), as independent environmental consultant, to apply for the renewal of their ECC for bush harvesting initiatives mainly in the Khomas Region. As such, and in line with the current requirements of the Ministry of Environment, Forestry and Tourism (MEFT), this EMP was updated in line with current and future target areas and all its typical operational activities. The updated EMP was prepared in line with the Environmental Management Act No. 7 of 2007 (EMA) and its regulations as published in 2012.

The EMP is a tool used to take pro-active action by addressing potential problems before they occur. This limits potential future corrective measures that may need to be implemented and allows for application of mitigation measures for unavoidable impacts. This document should be used as an on-site reference document during all phases (planning, construction, operations and decommissioning). All monitoring and records kept should be included in bi-annual reports to ensure compliance with the EMP and the conditions of an ECC. Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may need to be undertaken. The Proponent implements numerous policies and standards to ensure protection of health, safety environment and quality. These should be used in conjunction with the Environmental Management Plan. Relevant regulations and guidelines must be adhered to and monitored regularly as outlined in the EMP.

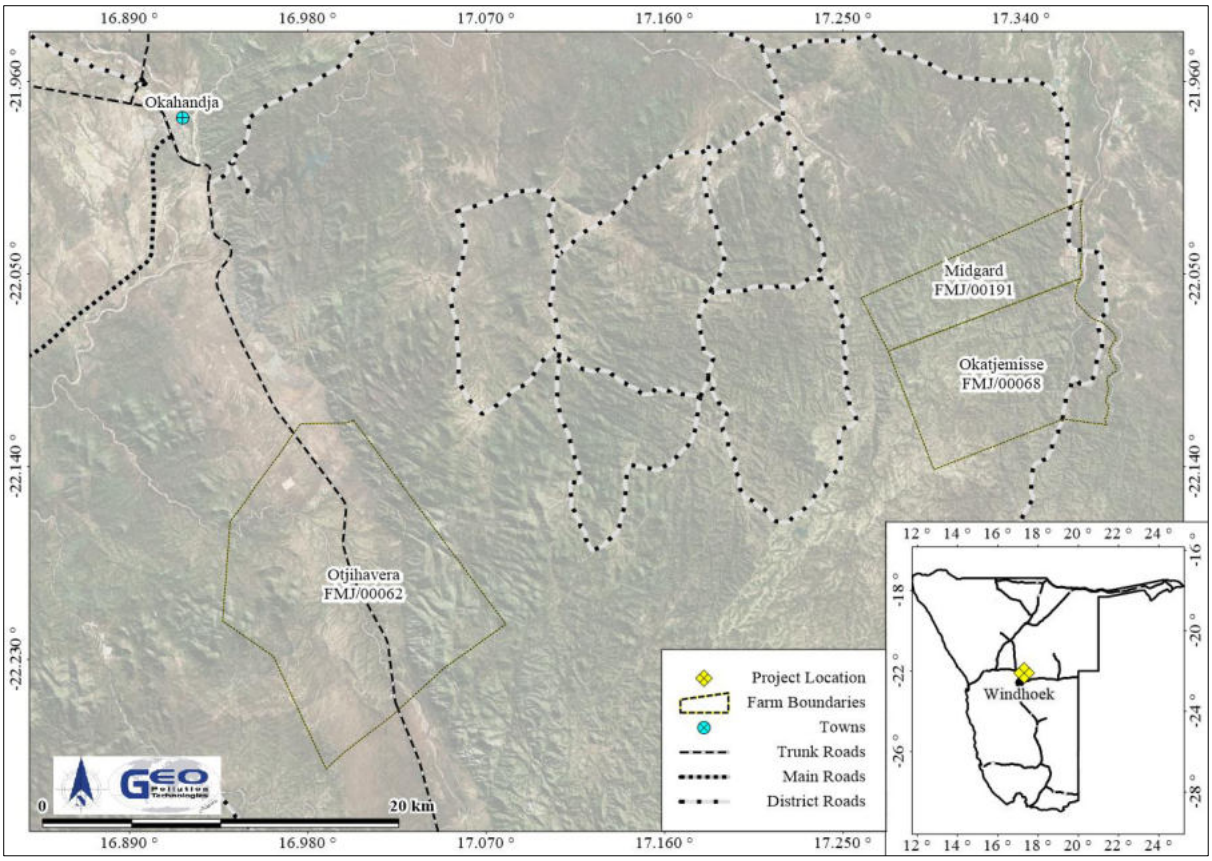

Figure 1-1 Project location

2 SCOPE

The scope of the EMP is to:

- Provide a brief overview of all components and related operations related to bush harvesting initiatives.
- Summarise the legal and regulatory framework within which the bush harvesting initiatives operate.
- Provide a brief overview of the environment, i.e. the physical, biological, social and economic conditions, potentially impacted by the bush harvesting and related operations.
- Identify a range of management actions which could mitigate the potential adverse impacts to acceptable levels.
- Provide sufficient information to the relevant competent authorities and the MEFT to make informed decisions regarding the bush harvesting project and the renewal of the ECC.

3 PROJECT DESCRIPTION

The main objective of the bush harvesting project is to provide biofuel to Namibia Breweries Limited (NBL) to utilise in their boiler. A separate environmental assessment and related EMP were drafted for the bush harvesting operations in 2016 (De Beer, 2016). The initial ECC was awarded on the basis on this EMP. The biomass harvesting operations conducted by the Proponent has been ongoing since 2016, involving sourcing and harvesting of invader bush and chipping and supplying the material to NBL. Due to the nature of operations, no one location can be ascribed to the project. Harvesting operations move from one harvested area to the next unharvested area. However, target areas have been identified for the short to medium term future and include the following farms within the Khomas and Otjozondjupa Regions:

- Portion 4 of the Farm Otjihavera No. 62 (current operations) (Khomas),
- Farm Midgard No. 191 (Otjozondjupa), and
- Farm Okatjemisse No. 68 (Otjozondjupa).

The following sections provide a brief overview of the main operational activities.

3.1 IDENTIFICATION AND HARVESTING OF ENCROACHER BUSH

The project initially conducted all bush identification and harvesting operations internally, utilising a hydraulic grab and cutter fitted to an excavator. However, due to soil degradation and biomass volume concerns, these operations are now subcontracted to an operator with another, more suitable, harvesting method. A trained bush roller operator is contracted to identify the biomass resource and trees to be retained and then mechanically crushing the identified resource to the ground, using the conventional bush roller. The same machine is then used to rack and stack the cut trees in an orderly fashion in windrows to dry.

Photo 3-1 Felled encroacher bush

Photo 3-2 Windrows of cut encroacher bush

3.2 CHIPPING AND STOCKPILING

Once the felled material has reached the optimal moisture content, it is ready to be chipped. An excavator with a forestry grab feeds the stacked material into a mobile drum chipper which conducts the in-field chipping. The woodchips are fed onto a tractor-drawn trailer which transports the material to a stockpiling area. Larger woodchips are required by NBL and therefore the stockpiled material is screened to separate the fines. The screened material (larger wood chips) is loaded and transported to NBL. The residual fines are placed on a compost heap on site. This material is at times used to cover soil (especially to reduce dust generation) in harvested areas, or provided to the land owners, or sold.

Photo 3-3 Excavator with forestry grab

Photo 3-4 Mobile drum chipper

Photo 3-5 Stockpiled wood ships

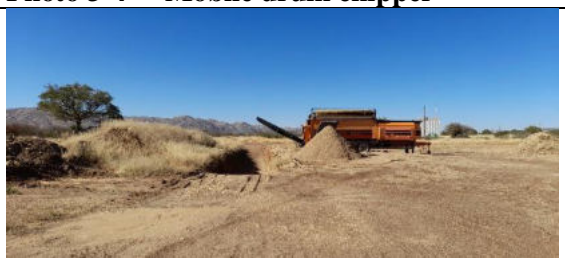

Photo 3-6 Screened fines materials next to loading dock

3.3 INFRASTRUCTURE COMPONENTS

The mobile nature of operations require support infrastructure which may be easily transported and assembled to the various areas of operations. For each area to be harvested (approximately 200 ha area) a contractors camp and stockpiling site is established. The stockpiling area requires the establishment of a loading bay, which is excavated, and the placement of mobile steel

containers for parts and machine storage. A mobile fuel unit is kept on site as well as mobile water tanks which may be used for firefighting.

Contractor's camps are usually located close to the stockpile area as to minimize visual impacts, improve security aspects and contain the operational impact to a reduced footprint. All camps comprise the erection of tents and establishment of ablutions (shower and toilet). As per agreement with the landowner, either a french drain soak away system is constructed or a mobile chemical toilet erected. All water is sourced from the land owners in suitably sized tanks for general use. A kitchen area is cordoned off next to a container which forms part thereof. A generic layout followed for each camp establishment is presented in Figure 3-1 while infrastructure components are listed in Table 3-1.

Table 3-1 Main infrastructure components

Infrastructure	Description
Mobile diesel storage unit	2 m^3 steel tank on a trailor
Firefighting tanks	500 litre mobile tank
Shower and outdoor water heating system	1,000 litre water tank supplies water to an enclosed and screened outdoor water heating system for the shower
French drain / chemical toilet	One french drain connected to a flush toilet or one chemical toilet is provided per site (dependant on site and landowner)
Steel container	Two to three steel containers are placed on site
Loading dock	One loading dock established per site
Stockpile area	1500m^2

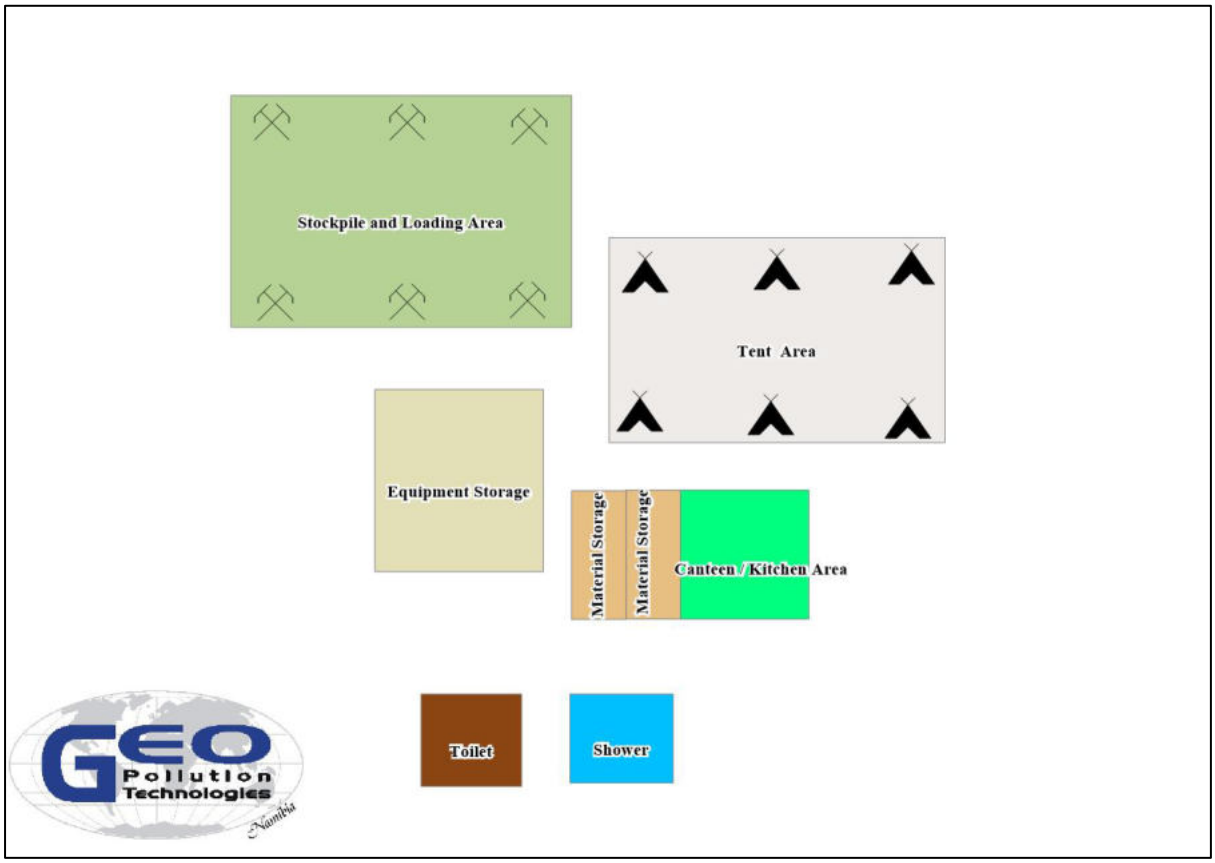

Figure 3-1 Generic site layout

Photo 3-7 Firefighting tank

Photo 3-8 Establishment of ablution facilities

4 ADMINISTRATIVE, LEGAL AND POLICY REQUIREMENTS

4.1 NAMIBIAN LEGISLATION

To protect the environment and achieve sustainable development, all projects, plans, programmes and policies deemed to have adverse impacts on the environment require an ECC, as per the Namibian legislation. The legislation and standards provided in Table 4-1 to Table 4-2 govern the environmental assessment process in Namibia and/or are relevant to bush harvesting.

Table 4-1 Namibian law applicable to the bush harvesting

Law	Key Aspects
The Namibian Constitution	♦ Promote the welfare of people. ♦ Incorporates a high level of environmental protection. ♦ Incorporates international agreements as part of Namibian law.
Environmental Management Act Act No. 7 of 2007, Government Notice No. 232 of 2007	♦ Defines the environment. ♦ Promote sustainable management of the environment and the use of natural resources. ♦ Provide a process of assessment and control of activities with possible significant effects on the environment.
Environmental Management Act Regulations Government Notice No. 28-30 of 2012	♦ Commencement of the Environmental Management Act. ♦ List activities that requires an environmental clearance certificate. ♦ Provide Environmental Impact Assessment Regulations.
Petroleum Products and Energy Act Act No. 13 of 1990, Government Notice No. 45 of 1990	♦ Regulates petroleum industry. ♦ Makes provision for impact assessment. ♦ Petroleum Products Regulations (Government Notice No. 155 of 2000).
The Water Act Act No. 54 of 1956	♦ Remains in force until the new Water Resources Management Act comes into force. ♦ Defines the interests of the state in protecting water resources. ♦ Controls and permits the disposal of effluent. ♦ Numerous amendments.
Water Resources Management Act Act No. 11 of 2013	♦ Provide for management, protection, development, use and conservation of water resources. ♦ Prevention of water pollution and assignment of liability. ♦ Not in force yet.

Law	Key Aspects
Forest Act (Act 12 of 2001, Government Notice No. 248 of 2001)	♦ Makes provision for the protection of the environment and the control and management of forest fires. ♦ Provides the licencing and permit conditions for the removal of woody and other vegetation as well as the disturbance and removal of soil from forested areas.
Forest Regulations: Forest Act, 2001 Government Notice No. 170 of 2015	♦ Declares protected trees or plants. ♦ Issuing of permits to remove protected tree and plant species.
Local Authorities Act Act No. 23 of 1992, Government Notice No. 116 of 1992	♦ Define the powers, duties and functions of local authority councils. ♦ Regulates discharges into sewers.
Public and Environmental Health Act Act No. 1 of 2015, Government Notice No. 86 of 2015	♦ Provides a framework for a structured more uniform public and environmental health system, and for incidental matters. ♦ Deals with Integrated Waste Management including waste collection disposal and recycling; waste generation and storage; and sanitation.
Labour Act Act No 11 of 2007, Government Notice No. 236 of 2007	♦ Provides for Labour Law and the protection and safety of employees. ♦ Labour Act, 1992: Regulations relating to the health and safety of employees at work (Government Notice No. 156 of 1997).
Hazardous Substances Ordinance Ordinance No. 14 of 1974	♦ Applies to the manufacture, sale, use, disposal and dumping of hazardous substances as well as their import and export. ♦ Aims to prevent hazardous substances from causing injury, ill-health or the death of human beings.
Pollution Control and Waste Management Bill	♦ The bill aims to prevent and regulate the discharge of pollutants to air, water, and land. It further aims to promote the establishment of a system of waste management, and enable Namibia to meet its international obligations. Only unrecyclable and unusable materials will be disposed of at a designated disposal site.

Table 4-2 Relevant multilateral environmental agreements

Agreement	Key Aspects
Stockholm Declaration on the Human Environment, Stockholm 1972.	♦ Recognizes the need for a common outlook and common principles to inspire and guide the people of the world in the preservation and enhancement of the human environment.
1985 Vienna Convention for the Protection of the Ozone Layer	♦ Aims to protect human health and the environment against adverse effects from modification of the Ozone Layer are considered ♦ Adopted to regulate levels of greenhouse gas concentration in the atmosphere.
United Nations Framework Convention on Climate Change (UNFCCC)	♦ The Convention recognises that developing countries should be accorded appropriate assistance to enable them to fulfil the terms of the Convention.
Convention on Biological Diversity, Rio de Janeiro, 1992	♦ Under article 14 of The Convention, EIAs must be conducted for projects that may negatively affect biological diversity.

Listed activities which require an ECC application (Government Regulation No 29 of 2012) related to this project include the following:

Section 4 of Government Notice No. 29 of 2012: Forestry Activities

- 4. The clearance of forest areas, deforestation, aforesteatation, timber harvesting or any other related activity that required authorisation in terms of the Forestry Act 2001 (Act No.12 of 2001) or any other law: Biomass harvesting is subject to harvesting permits as issued under the Forestry Act.

The regulation is considered in conjunction with a publication by the MEFT: Directorate of Forestry: *Forestry and Environmental Authorisation Process for Bush Harvesting Projects.* The document not only provides generic mitigation measures which should be included in related EMPs, but also defines categories for projects requiring environmental clearance. It is stated that medium-sized bush harvesting operations, covering an area between 150–5,000 hectares, need to obtain environmental clearance from DEA. While If an individual harvests individual areas that are less than 5,000 ha, but they contribute to a larger project that covers an area greater than 5,000 ha, then the activities fall into category 3 (which requires a full environmental assessment). Large bush harvesting operations, covering an area greater that 5,000 ha need to obtain an ECC based on an environmental assessment. To date the project has conducted biomass harvesting over an approximate area of 2,500 hectares. Continued operations for the next three years is estimated over approximately 2,000 hectares across target areas.

Section 9 of Government Notice No. 29 of 2012: Hazardous Substance Treatment, Handling and Storage

9.2 "Any process or activity which requires a permit, licence or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste." The Proponent stores fuel in a mobile unit on site.

4.2 ADDITIONAL POLICIES AND STANDARDS

Guidelines related to septic tanks and french drains systems are implemented by the Department of Water Affairs, Ministry of Agriculture, Water and Land Reform (DWA 2008):

Department of Water Affairs and Forestry, Code of Practice: Volume 1, Septic tank Systems.

Of importance related to the placement of the french drains are the following:

- May not be closer than 2 m and 5 m from buildings and boundaries respectively. In areas where municipal by-laws apply, these must be taken into full consideration.
- Must be located downhill from wells or springs.
- May never be closer than 500 to 800 m from any water resource or water supply - larger distances are preferred where possible. If closer, a proper environmental impact assessment (EIA) study to motivate this must be produced by a reputable consultant in this field.
- May not be considered for swampy areas, nor in areas subjected to flooding.
- Must be located where there is a large area available with good soil penetration, serving as disposal field.

5 ENVIRONMENTAL MANAGEMENT PLAN

The purpose of this section is to list the most pertinent environmental impacts that are expected from the planning, operational, construction and potential decommissioning activities associated with the bush harvesting project.

5.1 OBJECTIVES OF THE EMP

The EMP provides management options to ensure impacts of the operations are minimised. The objectives of the EMP are:

- to include all components of planning, construction activities and operations related to bush harvesting;
- to prescribe the best practicable control methods to lessen the environmental impacts associated with the bush harvesting project;
- to monitor and audit the performance of relevant operational personnel in applying such controls; and
- to ensure that appropriate environmental training is provided to responsible operational personnel.

5.2 IMPLEMENTATION OF THE EMP

Section 5.3 and section 5.5 outline the management of the environmental elements that may be affected by the different activities. Impacts addressed and mitigation measures proposed are seen as minimum requirements which have to be elaborated on. Delegation of prevention and mitigation measures as well as reporting activities should be determined by the Proponent and included in the EMP. The EMP is a living document that must be prepared in detail, and regularly updated, by the Proponent as the project progress and evolve.

The EMP and ECC must be communicated to the site managers. A copy of the ECC and EMP should be kept on site. All monitoring results must be reported on as indicated. Reporting is important for any future renewals of the ECC and must be submitted to the MEFT. Renewal of ECC will require six monthly reports based on the monitoring prescribed in this EMP.

Various potential and definite impacts will emanate from the planning, operations, construction (care and maintenance) and decommissioning phases. The majority of these impacts can be mitigated or prevented. The prevention and mitigation measures are listed below.

5.3 LAND OWNER AGREEMENT

The agreement with the relevant landowners will be based upon a neutral, mutually beneficial scenario, in which the farmer neither pays for the de-bushing (harvesting) nor receives any payment for the harvested materials. For reasons of 'fair treatment' it is envisaged that the harvesting activities are relocated every 6 to 12 months, but not without considerations of logistical and terrain suitability. Aspects of the documented agreement should include, as a minimum, agreements on the following:

- Access agreements and management of access control (including closing of gates etc).
- Biomass species to be harvested.
- General agreement on harvesting method on site.
- Water and any service provision.
- Sensitive or special areas of exclusion.
- Waste management.
- Fire protocol.
- Decommissioning infrastructure to be retained or dismantled (french drain, loading dock etc.).
- Any other provision as required by the land owners.

5.4 MANAGEMENT OF IMPACTS: PLANNING PHASE

The following section provides management measures for the planning activities related to the bush harvesting operations and maintenance. During the phases of planning for operations, construction and decommissioning of the project, it is the responsibility of the Proponent to ensure they are and remain compliant with all legal requirements. Planning is therefore required prior to and during the construction, operational and decommissioning phases. The Proponent must also ensure that all required management measures are in place prior to and during all phases, to ensure potential impacts and risks are minimised. The following actions are recommended for the planning phase and should continue during various other phases of the project:

- Ensure that all necessary permits from the various ministries, local authorities and any other bodies that govern bush harvesting and related activities are in place and remains valid. This includes harvesting and transport permits from the Directorate of Forestry as well as a consumer fuel certificates from the Ministry of Mines and Energy.
- Ensure a contractor management program is in place and that it includes the EMP.
- Employees to adhere to relevant sections of the EMP, as applicable to their scope of work and general operations.
- Make provisions to have a Health, Safety and Environmental Coordinator or similar to oversee implementation of the EMP, occupational health and safety as well as general environmental related compliance at the site.
- Corporate communication processes to be followed in the event of complaints from public entities.
- Have the following emergency plans, equipment and personnel on site where reasonable to deal with all potential emergencies:
    - Risk management / mitigation / EMP/ emergency response plan and HSE Manuals;
    - Adequate protection and indemnity insurance cover for incidents;
    - Relevant safety standards;
    - Procedures, equipment and materials required for emergencies.
- Ensure availability of sufficient funds or insurance for spill clean-up or pollution remediation if ever required.
- Establish and / or maintain a reporting system to report on aspects of construction activities, operations and decommissioning as outlined in the EMP.
- Submit bi-annual reports to the MEFT to allow for ECC renewal after three years. This is a requirement by MEFT.
  Update the EIA and EMP and apply for renewal of the environmental clearance certificate prior to expiry.

5.5 MANAGEMENT OF IMPACTS: OPERATIONS AND CONSTRUCTION (MAINTENANCE)

The following section provides management measures for both the operational phase and the construction activities related to the bush harvesting project.

5.5.1 Skills, Technology and Development

During various phases of operations, training will be provided to a portion of the workforce to be able to conduct certain tasks according to the required standards. All labour employed on site is skilled. Development of people and technology are key to economic development. During normal operations, employees will enhance their working expertise while some individuals may be identified for promotion and additional skills development and training.

Desired Outcome: To see an increase in skills of local Namibians, as well as development and technology advancements in the bush harvesting industry and local community.

Actions

Enhancement:

- If the skills exist locally, contractors must first be sourced from the town, then the region and then nationally.
- Skills development and improvement programs to be made available.
- The Proponent must employ local Namibians from the area where possible. Deviations from this practise should be justified appropriately in accordance with the Immigration Control Act, 1993.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Record should be kept of training provided.
- Ensure that all training is certified or managerial reference provided (proof provided to the employees) inclusive of training attendance, completion and implementation.
- Bi-annual summary report based on employee training.

5.5.2 Economic Resilience and Employment

The project has and will lead to changes in the way revenue is generated and paid to the national treasury. The project contribute to the local national GDP, of Namibia. Skilled labour will be required for the operations and maintenance / construction activities associated with the project. Employment increases individual and societal economic resilience through, not only the payment of wages, but also contributions to social security and fringe benefits.

Desired Outcome: Contribution to the national treasury and remuneration of temporary and permanent employees as per the Labour Act. Continued contributions to social security.

Actions

Enhancement:

- The Proponent must employ local Namibians from the area where possible. Deviations from this practise should be justified appropriately in accordance with the Immigration Control Act, 1993.
- If the skills exist locally, employees must first be sourced from the town, then the region and then nationally.
- Develop and maintain a contractor management program, inclusive of compliance reviews of service level agreements etc.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Bi-annual summary report based on employee records and financial contributions to the various institutions such as social security, receiver of revenue etc.

5.5.3 Demographic Profile and Community Health

Greater economic prosperity, as linked to the successful operations, may lead to a change in the demographic profile of a local community. Change may result from an influx of job seekers over time and densification of informal settlements. Community structures may change with an increase in population while the economic profile will be adjusted as the employment structure of the area is changed. The project contributes minimally to such change which may affect the demographic profile. Employees, as well as the local communities within which the project is implemented, may be exposed to factors such as communicable disease like HIV/AIDS. The presence of mobile equipment may potentially increase the risk of criminal and socially deviant behaviour such as vandalism.

Desired Outcome: To prevent the occurrence of social ills and prevent the spread of diseases such as HIV/AIDS.

Actions:

Prevention:

- Personnel should be properly educated about the impact of HIV / AIDS and other communicable diseases.
- Any person making themselves guilty of violence, harassment or any other activity deemed inappropriate by the landowner, must immediately be removed from the site.
- Intoxicating liquor or drugs of any kind may not be used or supplied on site to or by any person related to project.
- Ensure sanitation facilities and all related sanitation requirements are available and maintained for all employees.
- Appointment of reputable contractors.

- **Responsible Body:**
  - Proponent

Data Sources and Monitoring:

- Facility inspection sheet for all areas which may present environmental health risks, kept on file.
- Bi-annual summary report based on educational programmes and training conducted.

5.5.4 Health, Safety and Security

Activities associated with operations and maintenance / construction are reliant on human labour and therefore health and safety risks exist. Activities such as the operation of bush harvesting and chipping equipment, vehicles and machinery, as well as handling of hazardous chemicals pose risks to employees. Pollution incidents related to chemical, fuel or effluent spillages may pose a public health risk. Security risks will be related to unauthorized entry, theft and sabotage.

Sites may be located within rural areas and occurrences of wild animals, including venomous species of snakes and scorpions are possible. Encounters with these wild animals, may pose risks to staff.

Desired Outcome: To prevent injury, health impacts and theft.

Actions

Prevention:

- All health and safety standards specified in the Labour Act should be complied with.
- Implement and maintain an integrated health and safety management system, to act as a monitoring and mitigating tool, which includes:
  - operational, safe work, first aid and medical procedures;
  - job hazard analysis and standard operating procedures where required;
  - emergency response plans and drills;
  - housekeeping programmes;
  - MSDS's and signage requirements (PPE, flammable etc.);
- Selected staff should be trained in first aid and first aid kits must be readily available together with the contact numbers for emergency ambulance and professional medical services. The first aid kit should include an aspivenom pump and be accessible for all staff.
- Clearly label dangerous and restricted areas as well as dangerous equipment and products.
- Drivers must comply with all road safety regulations, including avoiding overloading and speeding, and wearing safety belts. No driving to be conducted at night.
- Provide all relevant employees with required and adequate PPE such as protective glasses, gloves, closed shoes, hard hats and overalls.
- Ensure legal appointments, of appropriately qualified and trained personnel, are in place for all necessary maintenance and specialised operational activities.
- Staff should be educated / trained on human wildlife conflict management and not to confront wild animals or other potentially venomous / dangerous animals that may be encountered on site. Education should include provisions not to kill snakes, scorpions or any other animals.
- Accommodation / eating areas should be kept clean at all times, garbage placed in closed containers to avoid attracting vermin and insects.
- Security procedures and proper security measures must be in place and equipment and goods must be locked away on site or be placed in a way that does not encourage criminal activities (e.g. theft).

Mitigation:

- Report any injuries or incidents to the appropriate manager and take appropriate action (e.g. first aid, transport to medical facility, etc.).

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Health and safety management system
- Evidence of first aid training.
- Protective gear being worn (intermittent documentation).

- First aid kits accessible.
- Any health, safety and security incidents must be recorded with remedial action taken and actions to prevent future occurrences.
- A bi-annual report should be compiled of all incidents reported. The report should contain dates when training were conducted and when safety equipment and structures were inspected and maintained.

5.5.5 Fire

Failing electrical components of machines, maintenance and construction activities, incorrect chemical storage, outdoor water heating systems, kitchen operations, etc. all can result in accidental fires. Vehicles can also ignite dry vegetation if sufficient heat (e.g. exhaust pipes). Such a fire can cause veld fires spreading to neighbouring properties when dry vegetation is abundant.

Desired Outcome: To prevent property damage, veld fires, possible injury and impacts caused by uncontrolled fires.

Actions:

Prevention:

- Prepare a holistic fire protection, prevention and response plan. This plan must include evacuation plans and signage, an emergency response plan and a firefighting plan and should tie in with existing procedures of the farm owners.
- Personnel training (safe operational procedures, firefighting, fire prevention and responsible housekeeping practices). Regular training for site staff on fire prevention and control, especially in the dry season.
- Maintain firefighting equipment at approved intervals and keep a maintenance register.
- Ensure good housekeeping to reduce fire risks associated with accumulated waste materials, dry vegetation, etc.
- A portable fire fighter must be available at each work site with water supply and pumps to deal with fire.
- Open fires may only be permitted in a designated facility at the site camp. The campfire must be extinguished when staff go to bed, or leave the camp.
- No cigarette butts, matches or any other burning object may be thrown into the veld.
- Combustible refuse must be burnt in a drum. An area of 3 metres must be cleared of grass around such a drum. The drum may not be left unattended until the fire is extinguished and a lid has been placed on the drum.
- Ensure all fuel and chemicals are stored and handled according to MSDS and SANS instructions.

Mitigation:

- Implement the fire response plan in the event of a fire; notify the farm owner/ manager and deploy beaters/backpack sprayers immediately. Notify neighbours in case of potential spreading of a fire to nearby farms.
- Quick response time by trained staff will limit the spread and impact of fire.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Fire-fighting equipment available at base camp, on vehicles close to bush harvesting area.
- In-house fire protection, prevention and response plan.
- A register of all fire related incidents must be maintained. This should include measures taken to ensure that such incidents do not repeat themselves.
- Evidence of a fire-fighting training events. Written instructions regarding fire prevention accessible.
- A bi-annual report should be compiled of all incidents reported. The report should contain dates when fire drills were conducted and when fire equipment was tested and maintained and when training was conducted.

5.5.6 Air Quality –Dust

Various components of the operations involve the exposing of soil, excavation and stockpiling thereof and movement there over. All such activities may be conducive to dust generation. Additional activities which may generate dust relate to the screening out of fines and the turning and management of compost material.

Desired Outcome: To prevent any nuisance; health impacts and collision risks associated with dust.

Actions

Prevention:

- Operations to consider excessively windy conditions. Dust generating operations (e.g. movement of HMV over exposed soil) to be limited during period of strong wind.
- Existing roads and track to be used, travelling on already compacted soil layers.
- Provision of PPE such as protective glasses.

Mitigation:

- Dust management measures employed may include wetting of road and spreading of composted material over exposed soil. However, all and any mitigation measures should be agreed upon with the land owner.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Maintain a complaints register and record any complaints related to dust received.
- Document any incidents which may have occurred due to dust interference.
- Bi-annual reporting on complaints and actions taken to address complaints and prevent future occurrences.

5.5.7 Liquid Waste – Sewage Effluent

Sewage originates from ablution facilities and kitchens. It is disposed of via french drain systems except for areas where chemical toilets are required (on sites within the groundwater control area) or unless another alternative is requested or presented by a land owner. Sewage effluent especially may present a contamination risk if in close proximity to utilised groundwater resources such as boreholes. Failed operations (storage unit failure) or transport of chemical toilets, when used, present an incident and contamination risk

Desired Outcome: To reduce the volume of sewage produced, and to adequately contain and treat sewage to prevent pollution of the environment and to prevent health hazards associated with the french drain soak away systems.

Actions

Prevention:

- The septic tanks / french drain soak away systems should be designed and operated according to the general guidelines set forth in the *Department of Water Affairs and Forestry, Code of Practice: Volume 1, Septic tank Systems*.
- Ensure all ablution facilities are connected to the system to prevent groundwater contamination.
- Instruction and education in terms of chemical toilet use and operation to be made clear to employees and site manager.
- No foreign objects, hazardous chemicals, fuels or excessive amounts of cooking grease may enter the sewage system.
- Use bio-degradable, septic tank friendly cleaning chemicals where available.

Mitigation:

- Communication to relevant land owners and or authorities in the event of any sewage spill (from chemical toilet) or noted contamination from any soak away system.
- Develop and implement a water management programme, which includes water use reduction measures, monitoring of water utilised and consumption volumes and regular inspections and maintenance of the water system (such as shower heads and flushing mechanisms).

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A register of system maintenance should be kept.
- Location of all systems should be documented.
- All information and reporting to be included in a bi-annual report.

5.5.8 Solid Waste

Solid waste generated on site is largely general and or domestic waste. Maintenance waste can include discarded or obsolete equipment, fuels and contaminated rags and materials. Some wastes can be dangerous / hazardous such as obsolete or expired chemicals, hydrocarbon contaminated material and rotting food waste, etc. General and domestic waste is kept separate from hazardous waste and usually transported from site to a municipal landfill. Old oils are transported from site to a waste oil collection point while minor contaminated materials are burned. Alternative and or additional waste management measures may be agreed upon with a land owner as and when requested. The bush harvesting process itself does not generate any waste.

Desired Outcome: To reduce the amount of waste produced, and prevent pollution and littering.

Actions

Prevention:

- Develop and implement a waste management program, this should include waste reduction and recycling initiatives and regular inspection and maintenance of waste storage and disposal areas.
- All employees should be educated on proper waste handling and disposal and importantly on the segregation of waste according to the different waste streams and their appropriate disposal locations.
- Ensure adequate temporary waste storage facilities are available that prevents waste being blown away by wind and prevent scavenging (human and non-human) of waste.
- Used oils, fuel, paints, grease and solvents should be stored in drums or other suitable containers, which must be labelled, sealed and removed from the site to an appropriate disposal site or recycling facility.
- All hazardous materials, including chemical container disposal, should be conducted as per their MSDS instructions.
- Should any structures be decommissioned, all waste and infrastructure should be disposed of at a pre-approved landfill site.

Mitigation:

- Waste should be disposed of regularly.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A register of hazardous waste disposal should be kept. This should include type of waste, volume as well as disposal method/facility.
- Any alternative waste management measure required by a land owner should include a risk assessment conducted by the Proponent, both the management measure and related risk assessment should be included in EMP documents kept on site.
- Any complaints received regarding waste should be recorded with notes on action taken.
- All information and reporting to be included in a bi-annual report.

5.5.9 Ecosystem and Biodiversity Impact

Indiscriminate harvesting of trees could result in the loss of protect tree species, large trees and an ecological imbalance if a heterogeneous mix of trees is not retained. Such changes may result in a localised change of habitat. Vibrations and general movement of heavy motor vehicles and machines may be disturbing to wildlife while having the potential to run over slower and smaller species, or destroy breeding locations such as nests.

Desired Outcome: To avoid pollution of and impacts on the ecological environment.

Actions.

Prevention:

- Adhere to all conditions or requirements of forestry permits.
- Protected trees must be marked (e.g. with hazard tape) and all staff must know that marked trees are out of bounds. Avoid harvesting protected trees.
- All trees taller than 4 m, or with a stem diameter greater than 18 cm at the base, must be retained. Large dead trees should also not be cut. The only exception is if the vegetation consists entirely of encroachers that are all over 4 m. In such a case, the Proponent should follow the formula for desired density after thinning as prescribed by the MEFT (Appendix A). All sites where *Terminalia sericea* and *Acacia fleckii* are dominant, should be harvested according to the formula TE per hectare = 3 ×annual rainfall. (TE - Tree equivalent is a woody tree or bush of 1,5 m (3 m tree represents 2 TEs, 0,75 m tree represents 0,5 TEs)).
- Bush harvesting should aim to leave a heterogeneous mix of trees and bush. The veld that remains should have a variety of tree species (including some of the encroacher species), of different size classes, and spaced so that there are some open patches and some dense patches, to provide a variety of habitats for animals.
- Nests of large raptors (e.g. eagles, vultures) must be avoided by at least 100 m. If such nests are found, the clump of vegetation around them should not be harvested.
- Reptiles such as tortoises and pythons move very slowly. Staff, especially vehicle and bush roller operators, should look out for such animals and avoid causing harm to them.
- Strict conditions prohibiting harvesting and poaching of fauna and flora (on neighbouring and operational farms) should be part of employment code of conduct. This includes prohibitions or regulations on the collection of firewood. Killing of livestock or wildlife, and setting of snares, is prohibited. Anyone caught involved in such activities should be reported on as it may constitute a criminal offence. All employees and contractors to be made aware of the implication of poaching.
- Disciplinary actions to be taken against all employees failing to comply with contractual conditions related to poaching and the environment.
- To prevent the loss of livestock or impact wildlife movement patterns, fences may not be damaged and gates should always be left in the manner found.
- All fuel and chemical storage to be conducted as per relevant SANS or MSDS instructions to prevent ecological damage.

Mitigation:

- Mitigation measures related to waste handling and the prevention of groundwater, surface water and soil contamination should limit ecosystem and biodiversity impacts.

Responsible Body:

- Proponent
- Contractor

Data Sources and Monitoring:

- Photographic record be kept of sites prior and after bush harvesting initiatives (Correct level of harvesting, adequate numbers of trees and islands remain.).
- A copy of all harvesting permits kept on file.
- Any incidents related to poaching to the be documented and reported on.
- All information and reporting to be included in a bi-annual report.

5.5.10 Soil structure disturbance and / or contamination

Operations will see continued movement of heavy motor vehicles across the site and around the operations, compacting topsoil and increasing runoff potential. Contamination of soil may occur as a result of vehicles leaking fuel, oil or hydraulic fluids and the spillages or incorrect disposal of chemicals.

Desired Outcome: To prevent soil contamination, soil structure disturbance and erosion or loss of soil fertility.

Actions

Prevention:

- No bush cutting permitted on slopes steeper than 12.5% (i.e. 1-in-8). Bush cutting is also not recommended on slopes of 5 – 12.5% (i.e. between 1-in-20 and 1-in-8).
- No bush cutting permitted within 100 m of a watercourse, pan or spring apart from seasonal pans of which the floor thereof may be cleared.
- Machinery should always move along contours as far as possible, not directly up and down slopes when moving between harvesting areas.
- Bush encroachment on sandy soil should be thinned less vigorously than on non-sandy soils, as the trees are responsible for most of the soil fertility. All sites where *Terminalia sericea* and *Acacia fleckii* are dominant, should be harvested according to the formula TE per hectare = 3 ×annual rainfall. (TE - Tree equivalent is a woody tree or bush of 1,5 m (3 m tree represents 2 TEs, 0,75 m tree represents 0,5 TEs)).
- All machinery and vehicles should be properly maintained to be in a good working condition during operations.
- Employ drip trays and spill kits when servicing / repairs of equipment are needed.
- Standard operating procedures should be developed and implemented for the use of hazardous materials.
- All chemical should be stored in a sufficiently bunded area and a register maintained of all stored chemicals and their volumes.
- During excavation of the loading dock, topsoil should be stored separated from subsoil in heaps. Stripping of topsoil soil be conducted in the driest condition possible (to avoid compaction of the topsoil). Stockpiles should not be positioned within the root or crown spread of trees, or adjacent to ditches, watercourses or existing or future excavations. Soil will have a natural angle of repose of up to 40° depending on texture and moisture content but, if stable stockpiles are to be formed, slope angles will normally need to be less than that. For stockpiles that are to be grass seeded and maintained, a maximum side slope of 1 in 2 (25°) is appropriate.
- Investigate the flood risk posed by changes in topography and devise a flood management strategy to protect infrastructure and people, prevent erosion and prevent water from carrying pollutants away from the site.
- Where necessary; anti-erosion infrastructure shall be utilised to minimise erosion along access routes.
- All vehicular movement shall be restricted to the agreed upon access routes.

Mitigation:

- Where appropriate, the waste from the chipping process should be re-used. E.g fines from the wood chipping could be re-distributed in the harvested areas, so that nutrients are returned to the soil.
- Spill clean-up means must be readily available on site as per the relevant MSDS for all chemicals and fuels and spills should be cleaned immediately.
- Any fuel spillage of more than 200 litres must be reported to the Ministry of Mines and Energy.
- Any erosion gullies due to the results of operations should be documented and repaired.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A report should be compiled bi-annually of all spills or leakages reported. The report should contain the following information: date and duration of spill, product spilled, volume of spill, remedial action taken.
- All reporting to be included in a bi-annual summary report.

5.5.11 Groundwater and Surface Water Contamination

Groundwater is utilised in the area and may be compromised by contamination. Contamination of groundwater can occur should untreated or partially treated effluent (sewage), decomposing biological waste (if buried) or spilled chemicals or fuels seep into the soil and ultimately the groundwater. Such contamination includes small-scale, local pollution patches (e.g. fuels, oils, greases) caused by spillages and servicing of machinery. The Proponent is responsible for daily checks and for emergency procedures to be executed in case of a leak on the mobile storage unit.

Any contaminants may be washed into surface drainage channels and earth dams during rainfall events.

Desired Outcome: To prevent the contamination of surface and groundwater.

Actions

Prevention:

- French drains should be designed and operated according to the general guidelines set forth in the *Department of Water Affairs and Forestry, Code of Practice: Volume 1, Septic tank Systems*.
- If temporary toilet facilities (preferably chemical toilets) are used at the camp site, they shall be sited away from any water body. The contractor should ensure that the toilets are emptied of waste and cleaned on a bi-weekly or weekly basis, depending on how full they are.
- Surface water sources may not be used for any personal hygiene –washing/recreational activities.
- See the material safety data sheets available from suppliers for disposal of contaminated products and empty containers. All hazardous waste chemicals' holders, requiring a triple rinse system for disposal purposes, should have the rinse water collected in a separate system as per MSDS specification.
- Standard operating procedures should be developed and implemented for the use of hazardous materials.
- Proper training of employees and of operators of machinery and vehicles must be conducted on a regular basis (fuel and chemical handling, spill detection, spill control).
- All machinery and vehicles should be properly maintained to be in a good working condition during operations.
- Employ drip trays and spill kits when servicing / repairs of equipment are needed.
- Washing and cleaning of any vehicle, machine or part thereof, should be conducted over a suitable covered area. No contaminated wash water should be allowed to flow into any surrounding areas.

Mitigation:

- Incidents of possible contamination of ground- or surface water should be reported to the landowner and a suitable remediation system agreed upon.
- Spill clean-up means must be readily available on site as per the relevant MSDS for all chemicals and fuels.
- Any fuel spillage of more than 200 litres of fuel must be reported to the Ministry of Mines and Energy.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A report should be compiled bi-annually of all spills or leakages reported. The report should contain the following information: date and duration of spill, product spilled, volume of spill, remedial action taken.

5.5.12 Water supply

All water supplied for domestic and general use, is sourced from the local farm owners who draw water from existing boreholes. No additional boreholes will be necessitated by operations.

Desired Outcome: To utilise water sustainably and ensure an adequate supply of water remains available and uncontaminated.

Actions

Prevention:

- Water may only be taken from private or government-owned property on a basis agreed and documented upon between the Proponent and custodian of the water resource.
- Surface water sources may not be used for any personal hygiene –washing/recreational activities.
- The water must be clean, potable and free of suspended material and substances which could put health at risk.
- Water sourced or supplied on one farm, may only be used on that farm as agreed by the local farm owners. No water may be sold or supplied to another farm.

Mitigation:

- Develop and implement a water management programme, which includes water use reduction measures, monitoring of water utilised and consumption volumes and regular inspections and maintenance of the water system (such as shower heads and flushing mechanisms).
- Periodic testing of water from the onsite water reservoir to determine quality and microbial proliferation problems.
- Should the water storage tank be contaminated, sterilisation, flushing and cleaning of the tank should be performed.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Record water use statistics and water quality monitoring results

5.5.13 Visual Impact

Debushing activities have an immediate and drastic visual impact. Cleared areas and stockpiled material is starkly different to surrounding natural areas. Heavy duty machinery and dust plumes which may accompany operations, may result in an altered appearance and or mechanised area. However, once harvesting is completed and the harvested areas allowed to regenerate, the overall visual impact is much improved. Visibility in harvested areas are is increased. The impact is further associated with the aesthetics of the site, and the structural integrity of infrastructure. The camp sites and related infrastructure is usually relatively isolated from receptors and will thus have a low visual impact.

Desired Outcome: To minimise aesthetic impacts associated with the active debushing.

Actions

Prevention:

- Systematic and planned operations to be executed in an orderly fashion, ensuring any and all stockpiles are kept neat and maintained.
- All associated operations, such as refuelling, dust management and secondary operations such as the chipper and composting operations, to be conducted in an orderly fashion without scarring of the environment and clear indications of restricted areas.
- All materials and machines used on site, to be stored in an orderly and neat fashion when not in use.
- Regular waste disposal, good housekeeping and routine maintenance on infrastructure (such as storage containers) will ensure that the longevity of structures are maximised and a low visual impact is maintained.
- Minimal lighting required for safe conditions should be used at night and it must be directed downwards to ensure a minimal visual impact.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- A maintenance record should be kept of all infrastructure.
- A report should be compiled of all complaints received and actions taken.

5.5.14 Traffic

Operations will increase traffic, especially HMV to and on the site when collecting material. Increased traffic escalates potential incidents and accidents at farm access roads. Slow moving traffic (tractors) and HMVs significantly increase collision risks.

Desired Outcome: Minimum impact on traffic and no transport or traffic related incidents.

Actions

Prevention:

- Vehicle movement shall be restricted to approved routes and off road driving shall be avoided as far as possible.
- No roads shall be cut through river or stream beds and only existing roads to be used to access all areas on the farm.
- All vehicles owned by the Proponent to operate within the Traffic and Transport Act regulations, specifically also in terms of roadworthiness.

Mitigation:

- If any traffic impacts are expected, traffic management should be performed to prevent these.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Any complaints received regarding traffic issues should be recorded together with action taken to prevent impacts from repeating itself.
- A bi-annual report should be compiled of all incidents reported, complaints received, and action taken.

5.6 DECOMMISSIONING AND REHABILITATION

Decommissioning will be required for each farm when operations on such a farm is completed. However, decommission of the project per se, is not foreseen during the validity of the ECC.

Decommissioning for each farm will entail the complete removal of all infrastructure including the camp site and related amenities , not forming part of post decommissioning land use (or as required by the land owner). Any pollution present on the site must be remediated. The impacts associated with this phase include noise and waste production as structures are dismantled. Noise must be kept within WHO standards and waste should be contained and disposed of at an appropriately classified and approved waste facility and not dumped in the surrounding areas. Continued aftercare of the harvested areas remain the responsibility of the land owner.

5.7 ENVIRONMENTAL MANAGEMENT SYSTEM

The Proponent could implement an Environmental Management System (EMS) for their operations. An EMS is an internationally recognized and certified management system that will ensure ongoing incorporation of environmental constraints. At the heart of an EMS is the concept of continual improvement of environmental performance with resulting increases in operational efficiency, financial savings and reduction in environmental, health and safety risks. An effective EMS would need to include the following elements:

- A stated environmental policy which sets the desired level of environmental performance;
- An environmental legal register;
- An institutional structure which sets out the responsibility, authority, lines of communication and resources needed to implement the EMS;
- Identification of environmental, safety and health training needs;
- An environmental program(s) stipulating environmental objectives and targets to be met, and work instructions and controls to be applied in order to achieve compliance with the environmental policy; and
- Periodic (internal and external) audits and reviews of environmental performance and the effectiveness of the EMS.
- The EMP.

6 CONCLUSION

The project has a positive impact on the agricultural sector in the affected areas and also contributes to the sustainable use of encroacher bush. It provides employment opportunities and skills development to a local workforce with continued training documented and executed.

Negative impacts associated with the operations and maintenance / construction activities can successfully be mitigated. Implementing a safety, health, environment and quality (SHEQ) policy has contributed to effective management procedures to prevent and mitigate impacts. All regulations relating to debushing initiatives and those pertaining to support services such as the construction and operations of french drains, storing of fuel, health and safety, etc., should be implemented. Groundwater and soil pollution must be prevented at all times and this requires adequate treatment of wastewater in the french drains. Fire prevention should be key and fire response plans must be in place and regular training provided. Any waste produced must regularly be removed and/or disposed of. Beneficial use or recycling of waste should be investigated / promoted where possible. Hazardous waste must be disposed of at an approved hazardous waste disposal site.

The updated EMP should be used as an on-site reference document for the operations of the project. Parties responsible for transgressing of the EMP should be held responsible for any rehabilitation that may need to be undertaken. The Proponent could use an in-house environment management system in conjunction with the EMP. All operational personnel must be taught the contents of these documents.

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Appendix A: Bush Thinning Formula (As per MEFT Guidelines)

Recommended density of trees after bush thinning

This annex defines what level of bush thinning is most appropriate, to achieve the goal of ecological restoration of rangelands. The information is categorised according to the main encroacher species. It uses a formula based on 'tree equivalents' (TEs) and average annual rainfall. A TE is defined as a woody tree or bush of 1,5 metres height. Therefore a 3 m tree represents 2 TEs. A 0,75 m tree/ bush represents 0,5 TEs.

Main principles for bush thinning

- All bush thinning should aim to leave a heterogeneous mix of trees and bush. The veld that remains should have a variety of tree species (including some of the encroacher species), of different size classes, and spaced so that there are some open patches and some dense patches, to provide a variety of habitats for animals.
- Bush thinning should be carried out in a phased approach so that the system is not shocked by an abrupt change from dense bush to open veld.
- All protected plants as listed in Annex 2 should not be harvested for bush thinning, however, exceptions can be made in cases of high densities. Felling of such plants (e.g. Colophospermum mopane) should be done under strict supervision by Forestry officials.
- If arboricides are going to be used, foliar (leaf spray) and stem-applied arboricides are recommended. Pellets should not be used, as they tend to get washed along the surface by rain, and end up in non-target areas.
- Dry river beds tend to carry more trees, and larger trees. Forestry regulations state that trees should not be killed within 100 m of a river course. Thinning is required in densely encroached river margins, but one should leave a higher density of trees than on the adjacent habitat. It is especially important to leave the large trees and protected species along a river course. The exception to this is *Prosopis*, which invades river beds, and should be eradicated completely.
- Judicious thinning should leave behind a sufficient number of trees (following the formulas provided below) to create a stable savanna that does not need major intervention at short intervals after the initial thinning.
- Training of the work force is necessary before harvesting starts, so that workers know which trees to target and which to avoid. Work teams need to be managed so that any excessive harvesting or killing of the wrong species is noticed and corrected.

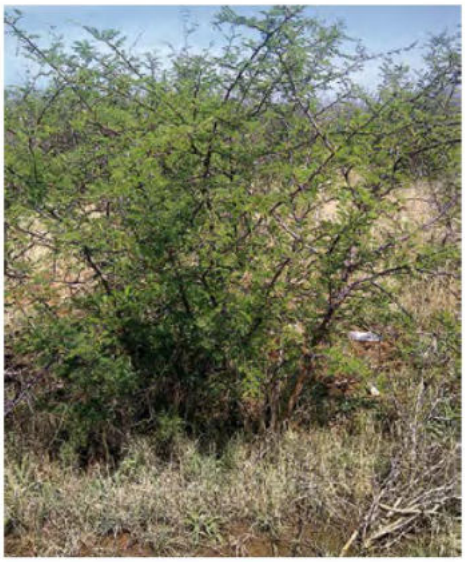
DOMINANT ENCROACHER SPECIES

Acacia (mellifera, reficiens, luderitzii, erubescens, fleckii, nebrownii)

- Leave all trees greater than 18 cm diameter (measured at ground level).
- Leave all protected species.
- Leave enough Acacias so that the total density of TEs per hectare = 1.5 times the average rainfall. I.e. in an area with ~400 mm rain, the total density of all trees should be ~600 TEs / ha.
- In sandy substrates, leave enough Acacias so that the total density of TEs per hectare = 2 times the average rainfall. I.e. in an area with ~400 mm rain and sandy soil, the total density of all trees should be ~800 TEs / ha.

DOMINANT ENCROACHER SPECIES

Dichrostachys cinerea

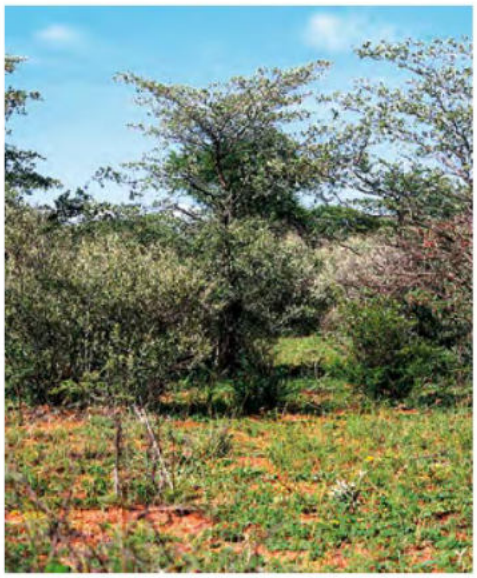


Open veld in Windhoek with a few medium-sized *Dichrostachys* trees and *Combretum apiculatum* trees. Hidden in the grass are small *Dichrostachys* trees that should be thinned out.

- Leave all trees greater than 18 cm diameter (measured at ground level). Any *Dichrostachys* greater than 10 cm diameter (these are the taller individuals) should also be left.
- Leave all protected species.
- Leave enough *Dichrostachys* so that the total density of TEs per hectare = 1.5 times the average rainfall. I.e. in an area with ~400 mm rain, the total density of all trees should be ~600 TEs / ha.
- Protect the soil by packing brush.
- Aftercare is essential to prevent re-infestation.

DOMINANT ENCROACHER SPECIES

Terminalia sericea



- Leave all trees greater than 18 cm diameter (measured at ground level).
- Leave all protected species.
- Leave enough *Terminalias* so that the total density of TEs per hectare = 3 times the average rainfall. I.e. in an area with ~400 mm rain, the total density of all trees should be ~1,200 TEs / ha. This recognises the high importance of the trees in supplying nutrients to the sandy soil.
- Remember that a large *Terminalia sericea*, approximately 6 m high, is 4 TEs.

DOMINANT ENCROACHER SPECIES

*Mopane**

- Leave all trees greater than 18 cm diameter (measured at ground level).
- Leave all protected species.
- Leave enough mopanes so that the total density of TEs per hectare = 2 times the average rainfall. I.e. in an area with ~400 mm rain, the total density of all trees should be ~800 TEs / ha. This recognises the importance of mopanes as fodder.
- All cases where thinning is planned in mopane-dominated veld, especially where the veld is degraded (e.g. lack of grass, soil erosion), the area should first be inspected by Forestry officials or a bush expert, to assess the level of harvesting that should be done. It might be advisable in such conditions to leave more trees than 2 times the annual rainfall as specified above.

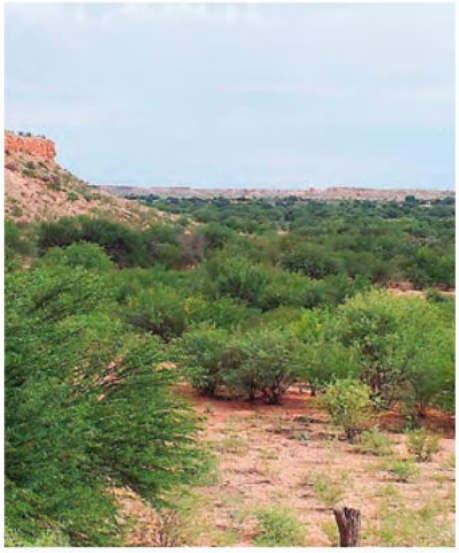
DOMINANT ENCROACHER SPECIES

Rhigozum trichotomum

- Leave all other tree and bush species, including all protected species.
- Leave enough *Rhigozum* so that the total density of TEs per hectare = 2 times the average annual rainfall. I.e. in an area with ~200 mm rain, the total density of all trees and bushes should be ~400 TEs / ha.
- Remember that a *Rhigozum* bush is usually ~0.75 m tall, i.e. 0.5 TE. If there are no other trees or bushes, the density of *Rhigozum* should be ~800 bushes / ha.

DOMINANT ENCROACHER SPECIES

Prosopis



Prosopis trees in the Auob River at Gochas. Note that they are not confined to the river; they are also invading areas beyond the river bed.

- Take out all *Prosopis* trees.
- Use only approved methods, such as manual chopping or responsible use of arboricides. Do not use polluting methods such as applying engine oil to stems which have been cut.

Appendix B: Curriculum Vitae

ENVIRONMENTAL ASSESSMENT PRACTITIONER **Quzette Bosman**

Quzette Bosman has 16 years' experience in the Impact Assessment Industry, working as an Environmental Assessment Practitioner and Social Assessment practitioner mainly as per the National Environmental Legislation sets for South Africa and Namibia. Larger projects have been completed in terms of World Bank and IFC requirements. She studied Environmental Management at the Rand Afrikaans University (RAU) and University of Johannesburg (UJ), including various Energy Technology Courses. This has fuelled a passion towards the Energy and Mining Industry with various projects being undertaken for these industries. Courses in Sociology has further enabled her to specialize in Social Impact Assessments and Public Participation. Social Assessments are conducted according to international best practise and guidelines. Work has been conducted in South Africa, Swaziland and Namibia.

CURRICULUM VITAE QUZETTE BOSMAN

Name of Firm	:	Geo Pollution Technologies (Pty) Ltd.
Name of Staff	:	QUZETTE BOSMAN
Profession	:	Social Impact Assessor / Environmental Assessment Practitioner
Years' Experience	:	16
Nationality	:	South African
Position	:	Senior Environmental Consultant
Specialisation	:	ESIA & ESMP; SIA
Languages	:	Afrikaans – speaking, reading, writing – excellent
		English – speaking, reading, writing – excellent
		German –speaking, reading - fair
First Aid Class A		EMTSS, 2017
First Aid LSM		OSH-Med International 2022
Basic Fire Fighting		EMTSS, 2017
Basic Industrial Fire Fighting		OSH-Med International 2022

EDUCATION AND PROFESSIONAL STATUS:

BA	Geography & Sociology	: Rand Afrikaans University, 2003
BA	(Hons.) Environmental Management	: University of Johannesburg, 2004
Course	Energy Technology and World Policy	: University of Johannesburg, 2004 - 2005
Course	Environmental Impact Assessment	: Centre for Environmental Management, North West University 2005
Course	Succeeding as a First Time Supervisor	: Associate Management Services, 2008

PROFESSIONAL SOCIETY AFFILIATION:

Namibian Environment and Wildlife Society
International Association of Impact Assessors South Africa (IAIA SA)
Member 2007 - 2012
Mpumalanga Branch Treasurer 2008/2009

OTHER AFFILIATIONS
Mkhondo Catchment Management Forum (DWAF): Chairperson 2008-2010
Mkhondo Water Management Task Team (DWAF): Member 2009

AREAS OF EXPERTISE:

Knowledge and expertise in:

- environmental impact assessments, social impact assessment and social management planning
- project management
- community liaison and social monitoring
- public participation / consultation, social risk management
- water use licensing
- environmental auditing and compliance and environmental monitoring
- strategic environmental planning

EMPLOYMENT:

2015 - Present	:	Geo Pollution Technologies – Senior Environmental Practitioner
2014-2015	:	Enviro Dynamics – Senior Environmental Manager
2010 - 2012	:	GCS – Environmental Manager (Mpumalanga Office Manager)
2007 - 2009	:	KSE-uKhozi - Technical Manager: Environmental
2006 -2007	:	SEF – Environmental Manager
2004 - 2005	:	Ecosat – Environmental Manager

PUBLICATIONS:

Contract reports	: +190
Publications	: 1