# APP-004993

# IRRIGATION BASED AGRICULTURAL ACTIVITIES AND ENVIRONMENTAL RELEASE OF GENETICALLY MODIFIED MAIZE AND COTTON ON FARMS NEUSCHWANGSTEIN, OSSA AND BENDER, OTJOZONDJUPA REGION

## ENVIRONMENTAL MANAGEMENT PLAN

**Assessed by:**

**Assessed for:**

**WF Lubbe**

November 2024

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| **Project:** | **IRRIGATION BASED AGRICULTURAL ACTIVITIES AND ENVIRONMENTAL RELEASE OF GENETICALLY MODIFIED MAIZE AND COTTON ON FARMS NEUSCHWANGSTEIN, OSSA AND BENDER, OTJOZONDJUPA REGION: ENVIRONMENTAL MANAGEMENT PLAN** | |
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# 1 BACKGROUND AND INTRODUCTION

Geo Pollution Technologies (Pty) Ltd was appointed by W F Lubbe (the Proponent) to undertake an environmental assessment to ultimately develop an environmental management plan (EMP) for the existing agricultural activities and environmental release of genetically modified maize and cotton on farms Neuschwangstein FMB/00353, Ossa FMB/01397 and Bender FMB/00356 in the Otjozondjupa Region (Figure 1-1). The main commercial activities of the Proponent on the farm includes crop cultivation and livestock farming. An additional planned activity by the Proponent is the cultivation of genetically modified (GM) maize and cotton. For purposes of crop cultivation, the Proponent utilizes approximately 343 ha of which 30 ha is purposed for irrigation. Pending the outcome of a hydrogeological specialist study, the total hectares of land to be irrigated simultaneously, may be increased. Irrigation is from three production boreholes by means of centre pivot irrigation systems. The main operational activities include:

- land preparation,
- planting (including proposed planting of GM maize and cotton),
- water abstraction and irrigation,
- fertilizer application and pest control,
- harvesting,
- packaging and transporting activities specific to each crop,
- cattle, sheep and potentially other livestock farming, and
- bush clearing and charcoal production (only as part of rangeland management).

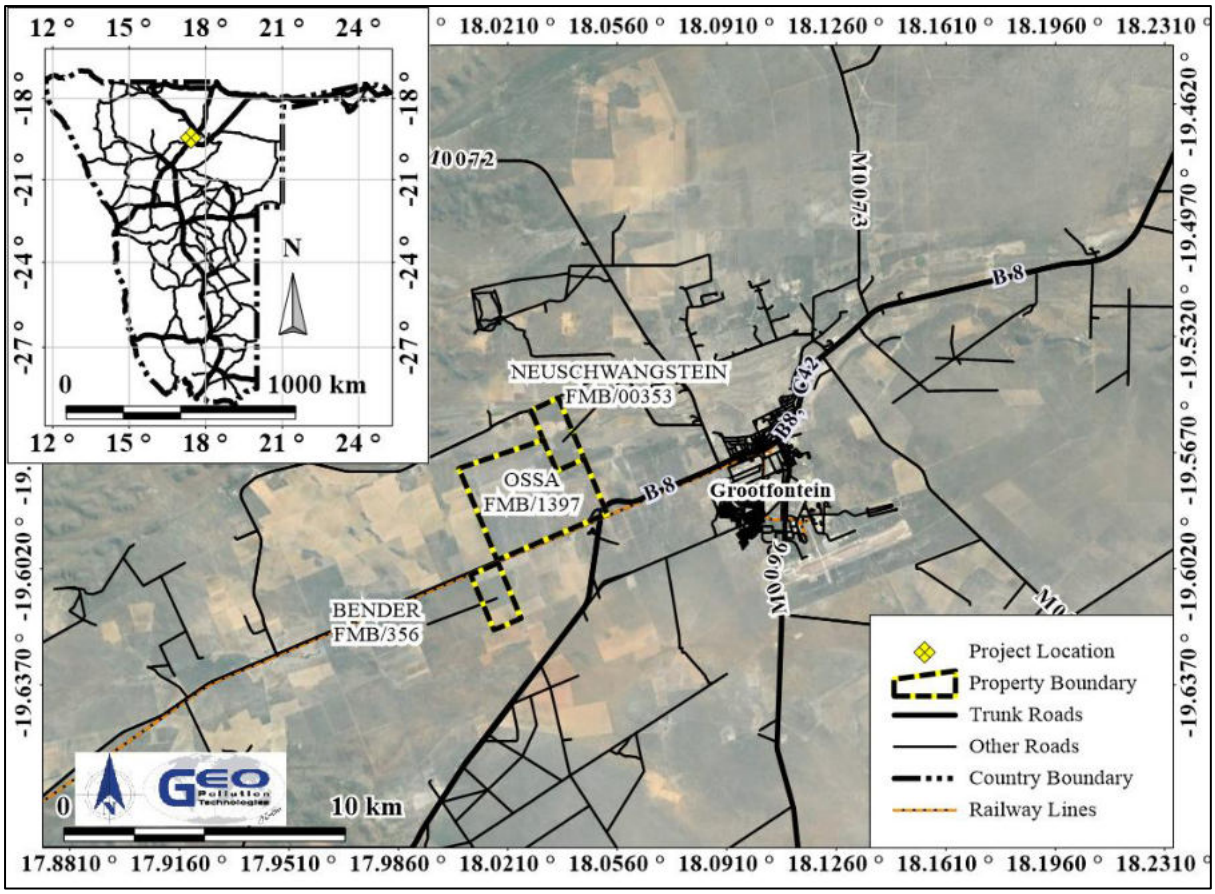


**Figure 1-1 Project location**

# 2 ENVIRONMENTAL MANAGEMENT PLAN

The EMP provides management options to ensure impacts of the agricultural and related activities on the farming unit are minimised. An EMP is a tool used to take pro-active action by addressing potential problems before they occur. This should limit corrective measures needed, although additional mitigation measures might be included if necessary. The environmental management measures are provided in the descriptions below. These management measures should be adhered to during the execution of various activities on the farming unit. This section of the report is also presented as a stand-alone document for easy reference. All personnel taking part in the operations of the farm should be made aware of the contents of this section, to plan the operations accordingly and in an environmentally sound manner.

The objectives of the EMP are:

- to include all components related to operational and possible construction activities of the farming unit;
- to prescribe the best practicable control methods to lessen the environmental impacts associated with the farm;
- to monitor and audit the performance of operational personnel in applying such controls; and
- to ensure that appropriate environmental training is provided to responsible operational personnel.

Various potential and definite impacts will emanate from the operations, maintenance/construction and decommissioning phases. The majority of these impacts can be mitigated or prevented. The impacts, risk rating of impacts, as well as prevention and mitigation measures are listed below.

As depicted in the tables below, impacts related to the operational phase are expected to mostly be of medium to low significance and can typically be mitigated to have a low significance. The extent of impacts are largely site specific to local and are not of a permanent nature. Due to the nature of the surrounding areas, cumulative impacts are possible and the most important of these are potential groundwater and biodiversity/ecological impacts.

## 2.1 PLANNING

During the phases of planning for the operations, maintenance/construction and decommissioning of the farming unit, it is the responsibility of the Proponent to ensure they are and remain compliant with all legal requirements. 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 all other phases of the project:

- Ensure that all the necessary permits from the various ministries, local authorities and any other bodies that governs the operations, maintenance/construction and decommissioning activities on the farm remain valid. These include the water abstraction permit, consumer installation certificate and permit for environmental release of GM maize and cotton.
- Ensure all appointed contractors and employees enter into an agreement, which includes the EMP. Ensure that contractors, sub-contractors, employees and all personnel present on site understand the contents of the EMP.
- Make provisions to have a Health, Safety and Environmental (HSE) Coordinator to implement the EMP and oversee occupational health and safety as well as general environmental related compliance.
- Make provision for a community liaison officer to deal with complaints.
- Have the following emergency plans, equipment and personnel on site, where reasonable, to deal with all potential emergencies:
    - EMP, risk management plan, emergency response plan and HSE manuals;
    - Adequate protection and indemnity insurance cover for incidents;
    - Procedures, equipment and materials required for emergencies (e.g. firefighting, first aid, etc.).

- Establish and maintain a fund for future ecological restoration, specifically for instances of environmental damage caused during operations including pollution remediation where required. Should project activities cease completely, and future land-use will not involve agriculture, the funds should be utilised to remove all redundant infrastructure and waste.
- Establish and/or maintain a reporting system to report on aspects of operations, maintenance/construction, and decommissioning as outlined in the EMP. Keep monitoring reports on file for bi-annual submission to MEFT in support of environmental clearance certificate renewal applications. This is a requirement by MEFT.
- Appoint a specialist environmental consultant to update the environmental assessment and EMP and apply for renewal of the environmental clearance certificate prior to expiry.

### 2.1.1 Revenue Generation in the Professional Sector

Consulting and professional services are engaged with for assistance in applications for new permits and renewal of existing permits such as the water licensees, fuel storage and environmental clearance certificates. In addition, specialist irrigation systems, pumps and implements used by the agricultural project, require specialist and professional services. Such services may further be extended to pest control for operations, and accounting and legal services for administrative processes. All of these services are paid for and therefore the agricultural project contributes to revenue generation in the local and national sectors. In addition, during many of these processes, such as per the renewal of water licenses, information is generated which informs and facilitates planning of the Proponent as well as affected parties and governmental agencies.

**Desired Outcome:** Contribution to national treasury and increased economic resilience in the local and national professional sector.

**Actions**

**Enhancement:**

- Contract local Namibians where possible.
- Adhering to permit and license conditions on reporting.
- Deviations from this practice must be justified.

**Responsible Body:**

- Proponent

**Data Sources and Monitoring:**

- Service providers' contracts or agreements or records be kept.
- All reporting, monitoring and information sharing records kept on file.

### 2.1.2 National Development Goals: Water, Agriculture and Land Use Planning

The agricultural project pins down key development goals and challenges which were identified as part of the Namibian development goals. It may be considered as an agricultural / irrigation project which aims at generating income from foreign sectors by providing the most value per resource (water, soil and labour). In addition, the project is located in line with the regional planning initiatives which identified the location as an area for agricultural development. The project will further contribute to the national climate change combatting initiatives through crop diversification and proposed resilient crop cultivation. Developing of the agricultural sector was identified as one of the core plans within the NDPs for Namibia. The agricultural project therefore is considered to be a positive contributor to achieving national development goals.

**Desired Outcome:** Continued contribution to the development of the region as well as implementation of project activities in line with NDPs and Vision 2030.

**Actions**

**Enhancement:**

- Liaison with local and national governmental agencies through appropriate financial and social responsibility reporting.
- Increase recycling initiatives and incorporate additional greenhouse gas reduction activities such as conservation tillage and climate smart agriculture.
- Infrastructure maintenance and development such as, road servitude, water- and sanitation system developments (provision to employees) and node development. Where possible, public and private partnership regarding projects should be considered.

**Responsible Body:**

- Proponent

**Data Sources and Monitoring:**

- All project contributions towards regional development, inclusive of communications held with relevant authorities, to be kept on file.
- Monitoring of borehole water levels and water abstraction (monthly) and submit to the relevant custodian on a quarterly basis.

### 2.1.3 Skills and Development

Training is essential to all aspects of the operations. Relative to responsibility, every employee requires the skillset to conduct tasks which form part of the operation. General skills in cattle handling, for example, may be acquired through on the job training and guidance from skilled workers. Progressive training in terms of, for example, safe pesticide application or specialised equipment handling (such as tractor operator) may require additional resources to aid in the training such as demonstrations, manuals and explanations. The skills and training of employees allow them to conduct certain tasks safely and or according to the required standard for continued operations.

**Desired Outcome:** To see an increase in skills of local Namibians, as well as development and technological advancements in the agricultural industry.

**Actions**

**Enhancement:**

- Sourcing of employees and contractors must first be at local level and if not locally available, regional or national options should be considered. Deviations from this practice must be justified.
- Inform employees about parameters and requirements for references upon employment.
- Provide managerial references for unofficial training or skills transfer when conducted.
- Relative to their responsibilities, provide on-farm training for all staff involved in irrigation management, including but not limited to:
  - Correct agricultural techniques
  - Emergency procedures
  - System monitoring for problem identification
  - System maintenance
- Relative to their responsibilities, provide on-farm training for all staff involved in pesticide application / agrochemical , including but not limited to:
  - The safe transport, handling and storage of pesticides
  - Warning and advice pictograms commonly used on pesticide labels
  - Disposal of leftover pesticide and or pesticide containers
- Ensure first-aid and fire-fighting training for a portion of the workforce.

**Responsible Body:**

- Proponent
- Contractors

**Data Sources and Monitoring:**

- Keep records of all training provided to employees.
- Ensure that all training is certified or managerial references provided (proof provided to the employees) inclusive of training attendance, completion and implementation.
- Include all information in a bi-annual report.

### 2.1.4 Revenue Generation and Employment

Skilled and unskilled labour are required for the operations and maintenance/construction activities associated with the farming unit. Importantly, employment provided is permanent and long term and in some instances, generational. The use of GMO maize and cotton is expected to increase the success rate and nett economic benefit of operations. However, due to the variability of GMO seed prices, input costs etc, the nett benefit will vary year on year. It is nonetheless foreseen, based on historic cultivation of GMO in other developing countries, that the overall revenue generation capacity will be increased, contributing to the sustainability of operations and related employment. Livelihoods are thus sustained and the spending power of the local community increased. Through continued long term employment, economic resilience is enhanced of individual employees.

Through employment, the Proponent also contributes to the Social Security while significant contributions are also made to the Namibian Revenue Services. Revenue is generated through the sale of products on national and international markets.

**Desired Outcome:** Contribution to national treasury and provision of employment to local Namibians.

**Actions**

**Enhancement:**

- The Proponent must employ local Namibians where possible.
- If the skills exist locally, employees must first be sourced from the area, then the region and then nationally.
- Deviations from this practice must be justified.

**Responsible Body:**

- Proponent

**Data Sources and Monitoring:**

- Bi-annual summary report based on employee records.

### 2.1.5 Ideas and Aspirations

There are various controversies and viewpoints related to GMO cultivation and consumption. Therefore, care was taken during the public notification of the project, to clearly stipulate the intension of the Proponent to cultivate GMO maize. In addition groundwater used for irrigation in Namibia, is another contentions issue of deliberation among especially the farming communities. The main point of concern relates to the available groundwater reserves and whether adequate reserve determinations are available for the various aquifers. Both of these issues were raised, by a lesser percentage of IAPs contacted, verbally, during notification discussions. Both concerns have the potential to significantly affect the ideals and aspirations of those concerned.

Of particular concern to some of the neighbours, is possible cross-pollination and the related effects therefore. In such instances, the future economic aspirations of the particular party may be affected since the current price of GM Maize is lower than that of conventional maize. The different pricing schedule for conventional and GM maize stems from the pricing schedule adopted for South Africa. However, the Namibian non-GMO premium is much higher than in South Africa. The current difference in price for maize per ton, is 8%. A complex factoring system was employed by the Namibian Grain Producers Association to reach this difference. It takes into account yields per hectare, national markets as well as allowances for drought conditions This in turn results in greater pressure on consumers to whom this cost is carried forward. This aspect therefore not only affect the different maize producers, but also the consumers. Whether for or against the cultivation of GMO, ideas and aspirations of parties are affected. Some, such as adjacent land owners, more than others.

**Desired Outcome:** Continued sharing of activity plans with IAPs and governing agencies. Maintaining an open door policy with neighbours and employees.

**Actions**

**Mitigation:**

- Information sharing about the project's progress should be made available to governmental agencies, interested and affected parties and the IAPs, The Proponent and affected parties should use the information generated during the environmental assessment to realistically plan for future growth. Open communication regarding future development should be maintained.
- Contractor's tenders to include best practise requirements for construction safety, security and environmental management. Pollution, poaching and unauthorised habitat destruction to carry contractual penalties.
- The Proponent must employ Namibians where possible. Deviations from this practise should be justified appropriately.
- A community liaison officer should be appointed during the construction phase especially to facilitate community grievances and concerns.

**Responsible Body:**

- Proponent

**Data Sources and Monitoring:**

- Records kept of all information shared with authorities, neighbours and employees.

### 2.1.6 Agricultural Produce

The project is in line with the objectives of Namibia's NDPs and contributes to the economy of, and food security in, Namibia. Locally produced crops decrease the amount of crops that needs importing. Cultivation of GMO maize and cotton is expected to increase annual crop yields due to decreased insect damage, especially during a heavy infestations or plagues, and less competition with weeds. Less weeds and especially problematic grasses, also provide a cleaner crop yield.

**Desired Outcome:** Maximum contribution to the food security and economy of Namibia. Provide a positive contribution to the trade balance of Namibia by reducing the amount of imported produce and exporting higher value products.

**Actions:**

**Enhancement:**

- Teach employees on sustainable farming practices to enable the spread of knowledge and skills and thereby increase the productivity of small-scale farming as well.
- Diversification and continuous improvement to maximise sustainability of the farm.

**Responsible Body:**

- Proponent

**Data Sources and Monitoring:**

- Bi-annual reporting on educational programmes and training conducted.

### 2.1.7 Health, Safety and Security

Daily operational and intermittent maintenance and construction activities on the farming unit are reliant on human labour. Such activities have varying degrees of health and safety risks. Examples include the operation of vehicles and machinery with moving parts, such as harvesters, and the handling of hazardous chemicals with inherent health hazards, such as pesticides and fuel, when ingested, inhaled or physical contact occur. Encounters with wild animals, and especially venomous species like snakes, may pose risks to employees. The provision of personal protective equipment, and the intended use thereof, is paramount. Security risks relates to unauthorized entry on the farming unit, theft and sabotage.

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

**Actions**

**Prevention:**

- Implement and maintain an integrated health and safety management system, to act as a monitoring and mitigating tool.
- Comply with all health and safety standards as specified in the Labour Act and related legislation.
- Clearly label dangerous and restricted areas as well as dangerous equipment and products such as agrochemicals.
- Lock away or store all equipment and goods on site in a manner suitable to discourage criminal activities (e.g. theft).
- Provide all employees with required and adequate personal protective equipment (PPE) where required.
- Ensure that all personnel receive adequate training on the operational procedures of equipment and machinery and the handling of hazardous substances.
- Train selected personnel in first aid and ensure first aid kits are available on site.
- The contact details of all emergency services must be readily available.
- Implement a maintenance register for all equipment whose malfunction can lead to injury or exposure to hazardous substances.
- Apply and adhere to all industry specific health and safety procedures and regulations applicable to the handling of food produce for markets.

**Mitigation:**

- Treat all minor work-related injuries immediately and obtain professional medical treatment if required.
- Assess any safety problems and implement corrective action to prevent future occurrences.

**Responsible Body:**

- Proponent
- Contractors

**Data Sources and Monitoring:**

- Record any incidents with the actions taken to prevent future occurrences.
- Compile a bi-annual report of all incidents reported. The report should contain dates when training was conducted and when safety equipment and structures were inspected and maintained.

### 2.1.8 Fire

Construction activities, failing electrical infrastructure, mechanical operations and fires outside of designated areas, may increase the risk of the occurrence of unplanned and / or uncontrolled fires, which may spread into the nearby fields and surrounding farms. Lightning may cause natural fires during the dry season. Farming operations do not present the same fire risk as operations which include charcoal production in the greater area. Uncontrolled fires which have generated in other areas will present a risk to existing and prosed operations.

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

**Actions**

**Prevention:**

- Maintenance of firebreaks, especially along fences and the power line servitude.
- Prepare a holistic fire protection and prevention plan. This plan must include evacuation plans and signage, an emergency response plan and a firefighting plan.
- Ensure fire-fighting equipment are maintained in good working order at all times. Ensure such equipment is readily available / unobstructed access.
- Personnel training (safe operational procedures, firefighting, fire prevention and responsible housekeeping practices).
- Ensure all flammable chemicals are stored according to material safety data sheet (MSDS) and SANS instructions and all spills or leaks are cleaned immediately.
- Maintain regular site, mechanical and electrical inspections and maintenance.
- Maintain firefighting equipment and promote good housekeeping.
- Notify the farmers' association as well as all surrounding farmers if planned burns (e.g. to create firebreaks) are planned.
- Allow fires used for purposes such as cooking (by staff) in designated areas only.

**Mitigation:**

- Implement the fire protection and firefighting plan in the event of a fire.
- Quick response time by trained staff will limit the spread and impact of fire.

**Responsible Body:**

- Proponent
- Contractors

**Data Sources and Monitoring:**

- Maintain a register of all incidents on a daily basis. Include measures taken to ensure that such incidents do not repeat themselves.
- Compile a bi-annual incidents report. The report should also contain dates when fire drills were conducted and when firefighting equipment were tested and training given.

### 2.1.9 Noise

Noise is generated by various operational and possible construction activities. Machinery like generators, machinery, vehicles and harvesters cause elevated noise levels that may result in hearing impairment after long term exposure. Activities are generally remote from receptors other than the Proponent, his employees and their families residing on the farming unit. The nature of the noise is related mainly to the ongoing operations and mechanical maintenance, typically on a farm.

**Desired Outcome:** To prevent any nuisance and hearing loss due to noise generated.

**Actions**

**Prevention:**

- Follow Health and Safety Regulations of the Labour Act and/or World Health Organization (WHO) guidelines on maximum noise levels (Guidelines for Community Noise, 1999) to prevent hearing impairment.
- Regularly service all machinery to ensure minimal noise production.

**Mitigation:**

- Hearing protectors as standard PPE for workers in situations with elevated noise levels.

**Responsible Body:**

- Proponent
- Contractors

**Data Sources and Monitoring:**

- Health and Safety Regulations of the Labour Act and WHO Guidelines.
- Maintain a complaints register.
- Bi-annual report on complaints and actions taken to address complaints and prevent future occurrences.

### 2.1.10 Waste Production

Various waste streams result from the operational and possible construction and maintenance activities. Waste may include hazardous waste associated with hydrocarbon products and chemicals, as well as soil and water contaminated with such products. Construction waste may include building rubble and discarded equipment. Domestic waste will be generated by the residents and employees on the farm. Most of the farming related waste can be re-used and or recycled, however certain waste, such as empty pesticide containers are hazardous and should be disposed of according to hazardous waste requirements.

Waste presents a contamination risk and when not removed regularly may become a health and/or fire hazard and attract wild animals and scavengers. Sewage is a form of liquid biological waste that needs disposal.

Since no official waste disposal facilities, especially for hazardous waste, are available, all waste that cannot be re-used are burned at dedicated waste sites.

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

**Actions**

**Prevention:**

- Implement waste reduction measures. All waste that can be re-used/recycled must be kept separate.
- Ensure adequate temporary storage facilities for disposed waste are available.
- Prevent windblown waste from entering the environment.
- Prevent scavenging (human and non-human) of waste at the storage facilities.
- Educate employees on the importance of proper waste handling and disposal.

**Mitigation:**

- Waste should be disposed of regularly and at appropriately classified disposal facilities, this includes hazardous material (empty chemical containers and contaminated materials, soil and water).
- Discarded waste should be disposed of and burned regularly at a dedicated site to reduce health and pollution risks.
- Empty chemical containers that may present a contamination/health risk must be treated as hazardous waste. Workers should not be allowed to collect such containers for purposes of storing water or food. This can be achieved by puncturing or crushing such containers prior to disposal.
- Liaise with the applicable authorities regarding waste and handling of hazardous waste.
- Ensure all ablution facilities are connected to properly constructed septic tank systems to prevent groundwater contamination.

**Responsible Body:**

- Proponent
- Contractors

**Data Sources and Monitoring:**

- Maintain a register of disposal of hazardous waste. This should include type of waste, volume as well as disposal method/facility.
- Record any complaints received regarding waste with notes on actions taken.
- All information to be included in a bi-annual report.

### 2.1.11 Ecosystem and Biodiversity Impact

Agriculture and related activities are ongoing on the farming unit. Possible expansion is planned on existing cleared areas and no further impacts on vegetation are thus expected from additional land clearing. Rangeland improvement is an ongoing endeavour as part of the aftercare program, while cattle numbers are continually evaluated to avoid the risk of overgrazing.

Irresponsible pesticide use, for example as method of vermin control, may impact on scavengers such as vultures and in the long run on top predators through biomagnification in higher trophic levels. Similarly, the use of insecticide on crop fields may also affect non-target species. It would therefore be advantageous to use GM maize and cotton which, for example in the case of BT Maize, target a certain problem species. Less insecticide can be applied to reduce the risk of harm to non-target species. Over-abstraction of groundwater may potentially have devastating effects on plant and animal populations reliant on it. It not only include the drying up of springs, dying of trees and migration or dying of animals, but also the lowering of cave water levels.

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

**Actions.**

**Prevention:**

- Strictly adhere to pesticide application instructions and use pesticides only for the purposes for which it is registered and marketed. Importantly, pesticides should not be used to kill vermin unless specifically registered for that purpose, and even then alternative, environmentally friendly methods should be investigated and used.
- Restrict access to pesticides, insecticides and any other material which can be used by poachers.
- Prevent spray drift by applying pesticides during calm weather conditions.
- Ensure the employees applying pesticides are trained and / or skilled in the application thereof.
- Educate all contracted and permanent employees on the value of biodiversity and strict conditions prohibiting harvesting and poaching of fauna and flora must be part of employment contracts. Include prohibitions or regulations on the collection of firewood.
- Regular inspection of fences, game footpaths and other sites for snares, traps or any other illegal activities.
- Ensure all fuel, oil, hydraulic fluid and waste oil handling (e.g. servicing of vehicles or refuelling) is conducted on impermeable or bunded areas or make use of drip trays where such structures are not present.

**Mitigation:**

- For construction activities, if any, contain construction material to a designated laydown area and prevent unnecessary movement out of areas earmarked for clearing and construction.
- Report any extraordinary animal sightings to the MEFT.
- Prevent scavenging of waste by fauna.
- Take disciplinary action against any employees failing to comply with contractual conditions related to poaching and the environment.

**Responsible Body:**

- Contractor
- Proponent

**Data Sources and Monitoring:**

- Report on all extraordinary animal or plant sightings or instances of poaching.
- Keep frequent records of borehole water levels and abstracted water volumes to identify any trends or consistent reduction in water levels.
- Compile a bi-annual report on all monitoring results.

### 2.1.12 GM Crops becoming Invasive

Concerns have been raised regarding the possibility of GM crops establishing themselves outside of farmland with the potential of becoming invasive. After decades of planting traditional maize and cotton, no instances of this have been recorded and it is highly unlikely that the GM cultivars will be any different. Neither maize nor cotton has any closely related species occurring naturally within Namibia, thus further decreasing the possibility of them establishing and becoming invasive.

**Desired Outcome:** To prevent the unintended proliferation of GM maize or cotton outside dedicated crop fields.

**Actions**

**Prevention:**

- Contain GM seeds and prevent spillages during transport.
- Spill clean-up plan where accidental spills occur during transport.
- Prevent theft of GM crop seeds.

**Mitigation:**

- Refer to GM cultivation contingency plans for the handling and transport of GM seeds.

**Responsible Body:**

- Proponent

**Data Sources and Monitoring:**

- Spill management plan.
- Record all spills and include maize strain, date, location and spill clean-up measures with photo records.
- Submit the spill report to the NCRST.

### 2.1.13 Pesticides Resistance

In GM crop fields, pesticide resistance has been reported in insects (against Bt proteins) and weeds (against glyphosate). This is however no different from pesticide resistance reported in non-GM crop fields. Over reliance on the use of glyphosate and the lack of crop and herbicide rotation by farmers, in some regions, contribute to the development of weed resistance. In order to address this problem, and maintain good levels of weed control, farmers have increasingly adopted more integrated weed management strategies incorporating a mix of herbicides, other herbicide tolerant crops and cultural weed control measures. These include, using other herbicides together with glyphosate rather than solely relying on glyphosate; using herbicide tolerant crops that are tolerant to other herbicides, such as glufosinate; and using cultural practices such as mulching. These add cost to the GM herbicide tolerant production systems compared to about 10-15 years ago, although relative to the current conventional alternative, the GM herbicide tolerant technology continues to offer important economic benefits.

**Desired Outcome:** To delay, or ideally prevent, the onset of pesticide resistance in insects and weeds.

**Actions**

**Prevention:**

- Develop and implement an insect and weed resistance management plan in collaboration with the seed supplier.
- The plan should among others include.
    - All farmers must adhere to the refuge strategy as stipulated by the GM seed supplier.
    - As part of the insect resistance management plan, intermittently apply insecticides to kill any pest insects that may have developed Bt resistant traits.
    - Application of glyphosate herbicide as per the prescribed concentration (i.e. not lower or higher concentrations as this may be ineffective) and application procedures.
    - Weed control prior to planting which should include herbicides of alternative active ingredients to allow killing of weeds that may have developed resistance to glyphosate.
    - Weed control prior to its production of viable seeds.
    - Cleaning of farm implements to prevent distribution of potential resistant weeds.
    - Crop rotation.

**Responsible Body:**

- Proponent HSE Officer, seed supplier

**Data Sources and Monitoring:**

- Insect and weed resistance management plan kept on site.
- Regular inspection of all fields to ensure early detection of extraordinary damage to crops that would indicate Bt resistance.
- If Bt resistance is expected, implement the insect resistance management plan and notify the NCRST and seed supplier.
- Inspection of all fields after application of glyphosate to ensure early detection of surviving weeds that may indicate resistance.
- If glyphosate resistance is expected, implement the weed resistance management plan and notify the NCRST and seed supplier.
- Keep record all instances of suspected insect or weed resistance. Note at least the species, date, extent and measures taken.
- Keep record of all instances of insecticide and herbicide application as a measure to combat weeds or to prevent / delay resistance in insects and weeds. Note at least the date, insecticide and/or herbicide used, concentration of active ingredients as applied, and the reason for application.

### 2.1.14 Soil Disturbance and Contamination

Without good and suitable soil, existing and proposed farming operations will not be possible. All farming operations have an impact on the soil, some by a lesser degree and others more extensively. Cattle require drinking posts. At these sites there is usually an accumulation of manure which undergoes frequent trampling. Similarly, septic tank-french drain systems may affect the soil, especially if not properly constructed and maintained. In these areas the soil structure and composition may be affected. Overgrazing may lead to soil degradation and erosion. However, crop cultivation has a much more significant impact on not only soil structure, but also composition. Land preparation techniques involve tillage of all areas while infrastructure establishment may necessitate earthworks. Once the dryland crop field have been established, the Proponent further employs no-till (conservation tillage) practises, limiting further soil disturbance. Irrigated fields, however, have higher occurrences of soil compaction which require conventional tillage. Soil is compacted by mechanical activities such as planting, crop spraying and harvesting as well as livestock being allowed on the field after harvesting.

Once crop fields have been established, the addition of agrochemicals may change the soil composition. Fertiliser is added for certain elements lacking in the existing soil while pesticides may remain in the soil until broken down. In some instances, the irrigation itself, which is often more than the natural rainfall, may further alter the soil composition as the water dissolves of reacts with elements of the soil.

Apart from the crop and cattle related activities, hydrocarbon spills and leaks from machinery, equipment or failing fuel storage infrastructure may also affect the soil composition. All of the processes have the potential to contaminate the soil rendering it less feasible for crop cultivation.

**Desired Outcome:** To prevent the contamination, compaction, erosion, or structure disturbance of soil.

**Actions**

**Prevention:**

- Appoint reputable contractors.
- Vehicles may only be serviced on a suitable spill control structure.
- Regular inspections and maintenance of all vehicles to ensure no leaks are present.
- Ensure all waste oil handling is conducted on impermeable or bunded areas.
- Follow prescribed dosage of fertilizers and pesticides / herbicides and to avoid over application. Where possible application decision should be based on soil testing and plant analysis. Fertiliser application should consider soil temperature and moisture content and not be applied to severely compacted soils.
- Maintain sewerage systems and conduct regular monitoring.
- All hazardous waste must be removed from the site and disposed of timeously at a recognised hazardous waste disposal facility, including any polluted soil or water.
- All hazardous chemicals and fuel should be stored in a sufficiently bunded area, as per MSDS requirements.
- Where possible, soil compaction from stock grazing and/or heavy machinery movement should be minimised.
- Restrict heavy machinery to designated areas.
- Retain appropriate indigenous vegetation buffers along soil berm and cut-off trenches.
- Increased crop residue left in the soil where possible.

**Mitigation:**

- All spills must be cleaned up immediately.
- Consult relevant MSDS information and a suitably qualified specialist where needed.

**Responsible Body:**

- Proponent
- Contractors

**Data Sources and Monitoring:**

- Maintain MSDS for hazardous chemicals.
- Continued visual monitoring for soil compaction.
- Soil should be sampled and analysed annually to ensure the correct amounts of fertilizer is applied and soil and groundwater quality is maintained.
- Registers be kept by the Proponent on the type, quantities and frequency of application of fertiliser, pesticides and any other chemicals utilised in crop production.
- A register of all incidents must be maintained on a daily basis. This should include measures taken to ensure that such incidents do not repeat themselves.
- All spills or leaks must be reported on and cleaned up immediately.

### 2.1.15 Groundwater and Surface Water Contamination

Leakages and spillages of hazardous substances from vehicles, waste oil handling and accidental fuel, oil or hydraulic fluid spills during the operational phase may contaminate the environment. Increase of nutrient levels (from over application of fertilizers or pesticides) in the soil that can leach to the groundwater. Runoff from over-irrigation and or rainfall events may carry chemical components, such as fertilisers and or pesticides from the site. Pollution due to sewerage system overflow or leakage may further put the groundwater at risk.

**Desired Outcome:** To prevent the contamination of groundwater, surface water and soil.

**Actions**

**Prevention:**

- Appoint reputable contractors.
- Vehicles may only be serviced on a suitable spill control structure.
- Regular inspections and maintenance of all vehicles to ensure no leaks are present.
- All hazardous chemicals and fuel should be stored in a sufficiently bunded area, as per MSDS requirements.
- Ensure all waste oil handling is conducted on impermeable or bunded areas.
- Follow prescribed dosage of fertilizers and pesticides / herbicides and to avoid over application.
- Maintain sewerage systems and conduct regular monitoring.
- All hazardous waste must be removed from the site and disposed of timeously at a recognised hazardous waste disposal facility, including any polluted soil or water.
- Train and or guide persons involved with the sewerage systems, or any related effluent system, in terms of maintenance and operation to ensure the system is operated effectively.

**Mitigation:**

- All spills must be cleaned up immediately.
- Consult relevant MSDS information and a suitably qualified specialist where needed.

**Responsible Body:**

- Proponent
- Contractors

**Data Sources and Monitoring:**

- Maintain MSDS for hazardous chemicals.
- Soil should be sampled and analysed annually to ensure the correct amounts of fertilizer is applied and soil and groundwater quality is maintained.
- Groundwater should be sampled and analysed to test for nitrate concentrations from the fertilizers and for traces of chemicals used in pesticides and herbicides.
- Registers be kept by the Proponent on the type, quantities and frequency of application of fertiliser, pesticides and any other chemicals utilised in crop production.
- A register of all incidents must be maintained on a daily basis. This should include measures taken to ensure that such incidents do not repeat themselves.
- All spills or leaks must be reported on and cleaned up immediately.

### 2.1.16 Groundwater Abstraction

Groundwater abstraction is a very sensitive topic in a dry country where the value of land is drastically reduced if no or unusable groundwater is present on the land. Abstraction of groundwater must be done in a sensible way not to impact on other groundwater users that depend on such groundwater. This includes water abstracted for human and animal use, irrigation, and also ecosystems that depend on groundwater. A typical groundwater balance was compiled to illustrate the potential consequences of over abstraction of groundwater, see Appendix C. Recharge to the area is considered to be comparatively high.

In a typical groundwater environment, a water balance would consist of inflow and outflow of the groundwater system. Over time, an equilibrium (or steady state) is normally reached with rising water tables following good recharge events and declining water tables when recharge is below average. Inflow into the system would typically be from infiltration following rainfall in the area and in upstream areas. Outflow would be comprised of water leaving the system through springs and as outflow over the lower boundary of the groundwater system as well as evapotranspiration losses. Groundwater abstraction through boreholes is important as this is normally necessary to sustain human and animal demands where such users became essentially dependant on the abstracted groundwater as a reliable and sustainable source.

Typical consequences of over abstraction will include a lowering in the water table. This may further lead to the drying up of boreholes, springs, and shallow wells. Vegetation will also be impacted where such vegetation has access to groundwater.

**Desired Outcome:** To utilise the groundwater sustainably.

**Actions**

**Prevention:**

- Spread the water abstraction points over a larger area to diffuse the impact.
- Monthly water level monitoring as well as rainfall measured and recorded.
- Maintain safe abstraction rates prescribed by test pump evaluations (an abstraction permit with prescribed rates from the MAWLR is a requirement for this project).
- All irrigation infrastructure meets water license requirements related to flow meters, and limits on flow rate, volume and area irrigated.
- Regular maintenance of the irrigation system and related infrastructure be conducted. Where flow meters need to be replaced, the MAWLR should be informed accordingly.
- Continual monitoring for blocked nozzles or emitters, leaking hydrants or hoses, irrigator alignment etc.
- Soil moisture assessment conducted along with daily visual checks for excessive runoff or ponding.

**Mitigation:**

- Reduce abstraction when the water levels nears 5 m below the average rest water level of each borehole.

**Responsible Body:**

- Proponent

**Data Sources and Monitoring:**

- Monthly boreholes rest water level monitoring.
- Rainfall records
- Baseline values should be reviewed every three years based on all historic water level data.
- A summary report on all monitoring results must be prepared.
- The Proponent supply monitoring returns to the MAWLR, as required by the permit.

### 2.1.17 Visual Impact

Agricultural activities are, and will continued to be, conducted across farmland that have already been used for this purpose over the last 60 years, or longer. Cultivated areas are demarcated on old topographic maps, indicating that the area has long since been recognised as an agricultural area. Satellite imagery of 1985 confirm these agricultural areas on the property which is surrounded by similar operations. Expansion areas will therefore add to the existing landscape character. Apart from the landscape character, the radio mast, as recently erected by the Proponent for communication purposes, can be seen from a distance. The structure, which is 24 m high have greater bearing on aviation navigation. Therefore, the Civil Aviation Authority was notified about its presence. No further requirements related to its operations were received. The mast, although visible from nearby receptors such as neighbours, is unlikely to cause any visual disturbance. The structure has no highly reflective aspects and is not located close to a public road.

**Desired Outcome:** To minimise aesthetic impacts associated with the farm.

**Actions**

**Mitigation:**

- Regular waste disposal, good housekeeping and routine maintenance on infrastructure will ensure that the longevity of structures are maximised and maintain a low visual impact.

**Responsible Body:**

- Proponent
- Contractors

**Data Sources and Monitoring:**

- Compile a bi-annual report of all complaints received and actions taken.

### 2.1.18 Cumulative Impact

Possible negative cumulative impacts (i.e. the build-up of minor impacts to become more significant) associated with the operational phase and any maintenance/construction activities are mainly linked to traffic, reduction in soil and groundwater quality and groundwater availability. The cumulative increase in employees in the area may put more pressure on biodiversity as a result of poaching or harvesting of plant and animal products. The cumulative positive impacts from farming in the Otjozondjupa Region relates to increased and sustained employment, revenue generation and overall improved living conditions and livelihoods as a result of increased spending power.

**Desired Outcome:** To minimise cumulative all impacts associated with the farm.

**Actions**

**Mitigation:**

- Addressing each of the individual impacts as discussed and recommended in the EMP would reduce the cumulative impact.
- Reviewing biannual reports for any new or re-occurring impacts or problems would aid in identifying cumulative impacts. Planning and improvement of the existing mitigation measures can then be implemented.

**Responsible Body:**

- Proponent

**Data Sources and Monitoring:**

- Reviewing monitoring results based on all other impacts will give an overall assessment of the impacts of the operational phase.

### 2.2 DECOMMISSIONING AND REHABILITATION

Closure and decommissioning of agricultural and related activities on the farm as a whole is not foreseen during the validity of the environmental clearance certificate or in the near future. However, it is more likely that certain components may be decommissioned. Decommissioning is therefore included for this purpose as well as the fact that construction activities may also include modification and decommissioning of infrastructure. Future land use after decommissioning should be assessed prior to decommissioning and rehabilitation initiated if the land would not be used for future purposes. Should decommissioning occur at any stage, rehabilitation of the area may be required. Decommissioning will entail the complete removal of all infrastructure including buildings and irrigation infrastructure. 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. Waste should be contained and disposed of at a dedicated waste disposal site and not dumped in the surrounding areas. The EMP for the farm will have to be reviewed at the time of full decommissioning to cater for changes made to the site and to implement guidelines and mitigation measures.

### 2.3 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;
- Periodic (internal and external) audits and reviews of environmental performance and the effectiveness of the EMS; and
- The EMP.

# 3 CONCLUSION

The EMP should be used as an on-site reference document for the operations of the farm. Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may need to be undertaken. The Proponent could use an in-house Health, Safety, Security and Environmental Management System in conjunction with the EMP. All operational personnel must be taught the contents of these documents.