ENVIRONMENTAL MANAGEMENT & MONITORING PLAN

PROPOSED INTEGRATED ANIMAL & CROP FARMING ACTIVITIES & RELATED INFRASTRUCTURE AT MUBIZA VILLAGE, KATIMA MLILO, NAMIBIA

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Figure 1: Google Map of the proposed Mubiza Village Integrated Farming System (Animal and Crop Farming)

1. BY WAY OF AN INTRODUCTION

The Scale of Potential Impacts of Aquaculture

As with any human development, the proposed integrated animal and crop farming initiative poses certain risks to the environment if not implemented along principles of sustainability. Although it is known that aquaculture can lead to significant environmental impacts, especially when practiced at large scale and where production takes place in environmentally "*open*" systems, the environmental risk profile of present-day Integrated Framing System (IFS) is however comparatively low. It is therefore important to recognize the relatively minor contribution of aquaculture impacts related to the scale and degree of impacts in global agriculture, human population growth and industrial development. Nevertheless, aquaculture impacts can cause environmental damage in certain instances if left unchecked and unmanaged.

This Report, Environmental Management and Monitoring Plan (EMMP), looks at certain generic good practices that can be applied in the planning and operation of the proposed IFS Mubiza venture to ensure greater environmental sustainability.

In general, the impacts of aquaculture relate to effects on water, its direct and indirect impacts on biodiversity and ecosystems and the effects of disease. Other effects such as aesthetic disturbance and the cumulative impact of IFS together with other users of natural resources and water also need to be considered. Most of the potential negative impacts of IFS can however be mitigated effectively through planning, including inter alia proper site and technology selection and sound management.

Viewing this degree of effective mitigation with the positive social and economic aspects of aquaculture is important when evaluating environmental risks associated with the sector, especially in light of the fact that that aquaculture can play an important role in matters such as food security, economic development and alleviation of pressures on natural fisheries.

2. INTEGRATED PLANNING - MUBIZA VILLAGE FARM

Integrated, flexible and detailed planning is required to ensure the successful authorisation and sustainable operation of the proposed development. In this process, the resource as well as social and ecological issues should influence the concept formulation to the same extent as the technical and financial matters. This planning is based on a feedback process in which designs and plans will be continuously tested against the applicable resource and - , social and ecological matters so that the concept can be modified to best achieve a proposed venture or project in which negative impacts can be avoided or minimised. The following sections highlight certain environmental planning matters that the development religiously followed.

2.1. Macro-Planning

People, economic activities, social needs, infrastructure and natural resources are not evenly distributed across the landscape and these variations impact directly on economic growth, social justice and the ability of the natural environment or ecology to support human activities.

No definite zoning or macro-planning initiatives have been developed specifically for aquaculture, but there is a strong drive towards the recognition and development of aquaculture nodes (especially for marine aquaculture). Nevertheless, it was found important to consider applicable overarching macro-planning structures and frameworks (such as spatial development plans, integrated development plans and the range of available geographic biodiversity information resources) when planning and positioning a new aquaculture venture. This consideration is / was best achieved through consultation with local, regional and provincial authorities that oversee such planning frameworks.

2.2. Micro-Planning and Site Selection

Although the criteria for the selection of IFS sites differ greatly, the aim in site selection for the proposed aquaculture was based on the selection of an area that will be economically viable, socially acceptable and ecologically sustainable. The following are a few of the considerations in terms of environmentally responsible aquaculture site selection and planning:

- **Legal Tenure to Land (and Water)**

As aquaculture activities require both land and water, the planning for this development will considered its requirements in terms of land ownership or other legal tenure. Legal access to water of sufficient volume and quality is also required.

WATER:
THE WHOLE DEVELOPMENT WILL BE SUPPLED WITH BOREHOLE WATER
6 X boreholes will pump almost 50,000m3 per week for domestic consumption

Legal Land Tenure

The project would be undertaken by Mwaka Integrated Farming CC, who is the proponent with blessings from the Mubiza Traditional Authority, as enshrined under the Communal Land Reform Act 5 of 2002. The Statutory or Legislative Rights allow the proponent to undertake this development

This site falls under the jurisdiction of the Zambezi Communal Land Board (ZCLB) / Zambezi Regional Council, and an application for right of Leasehold was lodged with the ZCLB who consented to the development. The project has already received endorsement from the Mubiza Village Authority traditional authority.

According to the baseline information of the area, the site falls within the **agricultural** and **forest zone** in which the following activities are permitted: grazing, farming and residential activity and there is no a conservation that exists in the identified area. There are no **wildlife corridors** on the identified piece of land. The proposed project site falls within the settlement and cropping area of the communal lands, hence the consent by the Mubiza Village Authority to the project.

– **Physical Suitability and Access**

The resource upon which the proposed development depends is located in relatively inhospitable area which is the Zambezi Valley or Escarpment. For this reason it was / is imperative to ensure that the proposed development site is suitably and safely accessible.

Apart from considering the climatic, geological and topographical suitability when locating and planning this development, consideration has been be given to **hydrological** aspects such as **flooding, tidal actions** and **currents**, to which there were none and therefore scoped out.

– **Service and Infrastructure Needs**

Integrated Farming System as a project requires adequate services and infrastructure such as roads, electricity, water, solid waste removal and sewage services. It is important that these services are catered for or included in the planning of this development.

Figure 1: *Google Map of the proposed Mubiza Village Integrated Farming System (Animal and Crop Farming)*

– **Environmental Capacity and Value**

The capacity of the receiving environment relates to the degree to which environmental services (e.g. assimilation of nutrients) are available in a sustainable manner. For aquaculture, the required environmental service capacity relates to many aspects ranging from water requirements, nutrient assimilation capacities, social capacities, etc. These natural resources and services often have multiple users that require consideration in planning.

The environmental value of a proposed site can be defined by many aspects that include species diversity, biodiversity, levels of endemism, land use, heritage, social values, aesthetic value, robustness of the environmental services, nature of the resources and more. All of these aspects were brought into consideration, predominantly in site and technology selection and thereafter in the planning and development of an aquaculture venture.

Article 95(l) of the Namibian Constitution maintains a wide range of environmental geographic information resources that should be consulted in this regard and should be used to determine generic aspects that include proximity to freshwater ecosystem priority areas , critical biodiversity areas, ecological support areas, threatened ecosystems, protected areas and the ecological role of the site in its regional context.

Of importance is that the potential impacts of proposed aquaculture development also be seen in context to the cumulative impacts of other activities (other users) and the effects that such cumulative impacts could have on environmental health and the environmental capacity.

– **Social Aspects**

Access to human resources in terms of availability, empowerment, qualifications, experience and proximity has been assessed as part of this EIA process prior to its development.

As operating any project in disharmony with surrounding communities is likely to contribute significantly to long-term failure, the potential social effects of the development has been considered in planning.

- **New jobs will appear**, minimizing the problem of **unemployment**; human labor will be needed throughout the year.
- One of the expected most positive impacts is the creation of employment for the local community members. It is envisaged that more than **90% of the unskilled labour will be recruited from within the catchment area**.
- For **skilled labour, priority will be given to Namibians** with **suitable qualifications** before engaging **expatriates**. It is also anticipated that more jobs are expected to be created as the project progresses.
- **Project members of staff** will also plough salaries and wages into the local economy directly through purchases of various goods and services.
- The proposed activities are likely to impart both negative & positive impacts in the area. From infrastructure point of view, socio-economic impacts will arise from social amenities that will be provided will include services such as job creation, schools, health centres, etc.

– **Economic Aspects**

The availability and sustainability of financial resources to undertake this initiative is a budgetary issue that is not addressed in this Report, apart from cautioning against the potential environmental risks posed by aquaculture ventures which fail due to a shortage in financial resources. **(It is also important to note that many IFS ventures are predisposed to financial failure due to a misinterpretation or misunderstanding of the importance around resource assessment and integrated best practice planning).**

- The project is expected to attract many **potential investors** (both local & foreign) who will bring substantial capital in the area.

- The injection of such capital investment will have far-reaching multiplier effects on the **national economy.**
- Similarly, the **export of various agro-products** will significantly improve the **foreign exchange** status of the country.

– **Scale**

In planning, the scale of operations is an important consideration, determined by many factors that include the financial means, the location, the limitations posed by husbandry, the availability of stock, the markets, the required technologies and more.

– **Feasibility**

As with the economic aspects above, this guideline does not address matters related to feasibility. However, as feasibility related aspects (e.g. transport and logistical constraints, the availability of markets, competition and more) can cause direct and indirect environmental impacts, aquaculture proponents are cautioned in this regard.

In Namibia, a lack of proper feasibility planning around fingerling or spat needs and aquaculture feeds is a major contributor to aquaculture failure, which could have environmental consequences.

3. THE SURROUNDING BIOPHYSICAL ENVIRONMENT

3.1. Managing Spatial Impacts

Generally, the potential aesthetic impacts related to the proposed crocodile farming and related infrastructure development are limited, but need consideration from the perspective of all stakeholders. Regardless of the production system and extent of the development's footprint, land has since been secured from the local traditional leadership (as the first step).

The potential spatial impacts of the development relate mainly to multiple land uses, land use and biodiversity planning and aesthetic matters.

Proposed Good practices for spatial planning include/d:

- The selected site is **less environmentally sensitive** and with as **little conflict** as possible with **natural processes, biodiversity and ecosystem functionality, critical biodiversity areas, ecological support areas,** threatened ecosystems and protected areas have been avoided during the planning phases.
- As an inland initiative, preference has been given to the proposed site since its related to sub-quaternary catchments
- T**he selected site do not pose land and resource use conflicts with other users** and that conflicts posed by other users is considered fairly and with due consideration of all development rights.
- The **incorporation of all stakeholders** in the environmental authorisation process
- Ensured that all **users** of **land, water and natural resources** in and around a proposed project site can provide inputs into **spatial matters**.

- The use of **unobtrusive structures** in the **design and construction** of the proposed aquaculture facility **(including the use of unobtrusive colours).**
- The positioning of the proposed deve;lopment so that it falls outside of the line of general sight where it can cause aesthetic impacts.

3.2. Vegetation (Flora)

Vegetation management refers mainly to the approach required in dealing with the vegetation within and around aquaculture facilities.

Proposed Good practices for the management of vegetation include:

a) Insofar as is practically possible, **only indigenous vegetation** will be used on and around the proposed aquaculture facilities. Alien, but especially invasive species should be avoided and removed by means of an active and **on-going alien vegetation control programme**. (In this regard special care should be taken around the **introduction and use of invasive aquatic plants** that are often found on freshwater farms).
b) Where **virgin** or **sensitive vegetation** occurs on or in proximity to the projects, access to these areas should be limited where possible.
c) **Cut, trimmed, mowed** and **felled vegetation** must either be removed to a **suitable disposal site** or **composted on site** for further application.
d) **Cut vegetation** can also be used as **brush pack** in the control of **erosion,** but care must be taken to **prevent the spread of seed of alien species** in this manner.
e) **The burning of vegetation** is discouraged, unless done under **favorable climatic condition**s and with the **permission** of the **Mubiza Crocodile Farm Disaster or Fire Management Services.**

3.3. Non-Production Animals (Fauna)

Apart from the impacts related to the introduction of aquaculture organisms, the proposed development may also impact on **fauna** through its presence and operational activities in any particular environment. These impacts could be caused by environmental changes, which could be caused by changes in water quality or quantity and by impacts on predatory animals.

Impacts related to **predatory animals** usually occur as a result of predators taking advantage of aquaculture facilities to obtain easy prey. While the intention is to prevent predator access to aquaculture facilities, predator conflicts could lead to the uncontrolled killing or injury of these animals.

Proposed Good practices for the management of fauna include:

• Wherever practically possible, and where animals do not pose a risk to the facilities, they must be accommodated and be granted freedom of movement and existence. **Catching of wild animals**, by any means, is illegal if done:

- **Without the required permit** and should **not be considered** unless authorized or done in conjunction with the relevant delegated authorities.

- Where **electrified and other fences** are used, these should be of a **design that does not injure, harm or kill animals.**
- **Infrastructure** (reservoirs, etc.) must be designed and built in such a manner so as to **prevent drowning, injury, harm or death of animals.**
- Unless specifically permitted **no animals may be shot, trapped, killed, bewildered, injured, poisoned or harmed in any manner**.
- **Acceptable deterrents** may be used to **discourage animals from entering into or inhabiting access to aquaculture facilities**.
- **No animals (including predatory animals) may be poisoned**. The only exception to this is in the responsible **control of vermin,** in which case recognised poisons may be used in the prescribed manner.
- **Crocodile feeds** and other **production resources** that may attract animals should be **stored** in such a manner so as **to prevent access and so as to prevent animals from becoming trapped, killed or harmed**.
- **Operators** must ensure that **feed and equipment stores do not become overrun with rodents or other pests**. A **responsible control program** for such vermin must be implemented.
- Where **trapping of predatory animals** is required, only traps that do not cause harm to the animals should be used. Such trapping must be done in consultation with local conservation authorities and in accordance with welfare guidelines.
- Where **netting i**s used to keep birds from entering into aquaculture facilities or where predator nets are used around cage culture facilities, **the netting should be clearly visible and prevent entanglement, injury or death**.

3.4. Soil Management

Ignorance of the importance of soil management in and around aquaculture can cause significant infrastructure damage, stock loss and negative environmental impacts.

Proposed Good practices for the management of soil include:

a) **All soils must be stable, protected from erosion and maintained as a suitable growth medium for natural vegetation** where applicable.
b) Where **vegetation is removed**, this should be done in a **phased manner** to **prevent unnecessary destabilization and erosion**.
c) When undertaking any **earthworks**, the **topsoil must be stripped separately** and **retained for later re-use. Topsoil stockpiles must be stable and free of invasive alien vegetation**.
d) Following the **exposure** of any **soils for construction, shaping or other activities**, a **suitable vegetation cover must be established if appropriate**. Where appropriate, **straw stabilization or hydro seeding with environmentally compatible plants may also be used to prevent erosion.**
e) **Barren soils should be tilled, treated with fertilizer or compost** and **vegetation cover encouraged** and **irrigated (with waste water from crocodile ponds).**
f) **The upper contours of aquaculture facilities (and at intervals on the lower contours of large or steep sites), should have storm water cut-off trenches. Water must exit storm water trenches below the production facilities in a manner that does not cause downstream erosion or degradation**. Soil in the storm **water trenches** must be **protected from secondary erosion by means of suitable flow speed inhibition**. This can be done by **stone packing, vegetation establishment, brush packing** or through the c**hannel design characteristics.**

g) Where applicable, **slopes with a gradient exceeding 2:1 should be protected from erosion.** This can be accomplished with **good vegetation cover, brush packing, sand bagging, retaining walls, log stepping**, etc. The chosen method will depend on the availability of materials and the degree of instability.
h) Any erosion must be treated without delay.
i) **Paths and roads must be formalized** and **stabilized against erosion** by means of **suitable materials, compaction and functional design**. **Storm water cut off trenches can be used to prevent erosion.**
j) Where slipways, pontoon launches, jetty ramps and similar water-soil interfaces are used for aquaculture purposes, these should be **stabilized to prevent soil erosion caused by water of waterlogged conditions.**

3.5. Sensitive Areas

Many aquaculture facilities are established alongside sensitive ecological areas such as tidal zones, the coastal zone, reefs, estuaries and estuarine functional areas, water tributaries, wetlands, catchment areas, rivers, etc. **(HOWEVER, THE PROPOSED DEVELOPMENT IS ESTABLISHED IN A COMMUNIAL AREA / INLAND)**.

However, in order to achieve good practice, the following points should be considered:

- Where possible, **avoidance** of these sensitive areas is a **first priority**.
- Where **ecological services are employed directly** in aquaculture production, **particular care must be taken in ensuring that such ecologies and the related biodiversity is not disturbed in an unsustainable manner.**
- In general, **access to sensitive areas surrounding aquaculture facilities should be kept to a minimum** and employees should be **educated to their sensitivity.**
- Sensitive areas should not be used as **storage areas** or **sites for old, disused or periodically disused equipment.**
- Sensitive areas should not be used for the **dumping of waste of any nature (including vegetation matter such as mowed grass)**.
- Natural features such as **outcrops, rock faces, trees and natural vegetation** should be protected when found in proximity to aquaculture facilities.
- All **historical buildings, all fossils, archaeological and paleontological materials, graves and burial grounds, wetlands, mountain catchments, forests, dune habitats and inter-tidal zones** are protected by law and may not be **disturbed** in any manner without authorisation to do so.

3.6. Fire Management

Fire is a potential risk to all aquaculture facilities. This fire risk must be minimized, while the necessary emergency procedures and emergency equipment to deal with fire, must be on hand and in a working order at all times.

Proposed Good practices for the management of fire include:

- An **appropriate number of fire extinguishers and firefighting equipment must be available at aquaculture facilities**. In particular, **working firefighting equipment** must be **available** where **hydrocarbon fuels** or other **flammable substances** are stored and used.
- All **"hot" works (welding, gas cutting, etc.) must be done with a working fire extinguisher close on hand**.

- **Employees** should be made aware of the **fire risks associated with smoking** and **dedicated smoking areas should be implemented**.
- **Fire** should not be used for the **incineration of waste,** unless this has been specifically **authorised**.
- A **Fire Contingency Plan** must be **developed** and **made known to all employees**. This plan must include the **location and operation of firefighting equipment**, the **identity of a responsible and trained staff member** that will act as the **fire marshal, the contact numbers of firefighting and emergency services** and the **site evacuation procedures.**
- **Contact numbers** for the **nearest firefighting and emergency services** must be **clearly displayed** in an **accessible** area.
- Where facilities are surrounded by **vegetation,** care should be taken against **natural fires** by means of **fire breaks** and the provision of appropriate **firefighting equipment**.

3.7. Noise, Light and Odours

Noise generation by the proposed activities is generally minimal, but can become a disturbance when the activities take place in close proximity to human settlements. Likewise, **odours are generally not problematic in aquaculture, except in certain processing activities, in certain instances in the cleaning of production facilities and filters or when ponds are laid fallow**.

Excessive light pollution is generally limited in aquaculture and lights are usually used for security purposes only.

Proposed Good practices for the management of these aspects include:

- Where appropriate and practically possible, **pumps, aerators and other noise generating devises should be equipped with a sound dampening cover**.
- **All pumps, aerators and other noise generating devices (including motor vehicles) should be in good working order to prevent excessive noise.**
- The use of **noise dampening methods** such as the planting of **windrows** should be considered if noise generation becomes excessive.
- **All employees** should be made aware of the fact that **unnecessary noise, light and odour pollution should be prevented** by means of **responsible conduct**.
- Where **practically possible** the **source of potential light or noise pollution should be placed in areas where they will cause the least possible disturbance.**
- **Above average noise generation** should be **limited to normal business hours**.
- **If odours are generated from the proposed facilities**, efforts should be made to **limit the impact on surrounding settlements, communities and operations.** This can be done by **taking cognizance of wind direction and speed, ensuring that odour generating activities are completed in as short a space of time as possible and by ensuring that any dead aquaculture organisms** (or unused feed) are disposed of responsibly.

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3.8. The Infrastructure Environment

Integrated Framing Systems operations require a certain degree of infrastructure and service arrangements that range from **access routes, sewage, electricity supplies and refuse removal**. Generally, service related impacts from crocodile farming activities are limited, especially if development takes place in a manner that makes use of existing service infrastructure and within areas of existing development.

- **3.8.1 Aquaculture Production Systems**

The crocodile or aquaculture sector employs a range of production techniques in many different culture systems that range from tanks to ponds, cage culture systems and more. It is important that this development be managed with the interest of the production organisms and the surrounding environment in mind.

Proposed Good practices for the management of production systems include:

- **Production systems** should be **designed and constructed in a manner that allows for the safety of employees and the surrounding environment**, as well as the **safety and welfare of the farmed organisms**.
- Aquaculture production systems should be **structurally sound and not leak unnecessarily**.
- Aquaculture systems should be **readily accessible for daily operations**.
- Aquaculture systems should be **designed and constructed in a manner that prevents the escape of production organisms**. **All piping and in – or outflow points should be fitted with suitable strainers or screens.**
- Where **electricity** is used, the **electrical installations must be safe and regularly maintained**.
- Where **cover netting** is used, **this must be of a type that does not pose a threat to animals**. Consideration must be given to **mesh size, colour, structure, rigidity, UV and weather resistance**.
- Where **ponds or tanks** are used, c**onsideration must be given to aspects associated with drainage (e.g. receiving areas for drainage water and drainage efficiency)**, with **inflow and outflow control** and with the **prevention and control of flooding or overflow**.

- **Pond walls** and **sides** must be of a **suitable slope and construction to prevent erosion (including wind and wave erosion).**
- **Rooting trees should not be planted close to ponds and moles and crabs should be controlled to ensure pond soil stability.**
- **Aeration apparatus (e.g. agitators, paddlewheels, etc.), pumps and water inlets should be placed and managed so as to prevent internal erosion of ponds**.
- **Rafts, drags and lines** must be **inspected regularly** to ensure **integrity of the structure and anchorage**.
- **Raft platforms must be kept in good order** (**clean, free of unnecessary equipment, etc**.) and must provide a safe working environment. The necessary safety equipment (e.g. life rings) must be kept on the rafts in an accessible position.

- **3.8.2. Roads, Access and Security**

Access to aquaculture facilities should be controlled for security reasons and to prevent the uncontrolled movement of individuals and vehicles that may cause ecological degradation.

Proposed Good practices for the management of these aspects include:

- Where possible, **access routes to aquaculture facilities should be fitted with a gate or other form of access control**. **Prohibition of entry for unauthorized persons should be displayed and enforced**.
- Where applicable, **perimeter fences** and **boundaries should prevent access to unauthorized persons**.
- **Facilities and stores should be kept locked when a site is not occupied.**
- **Roads must be maintained in a stable, dust free condition by compaction, watering, grading and asphalt coverage where necessary**. A **stable, erosion free driving surface** must be created. **The creation of multiple tracks and the incremental increase of road width,** though not keeping to and maintaining the existing roads, **should not be allowed.**

- **3.8.3 Buildings and Storage**

To ensure that the nature and structural characteristics of buildings and storage areas are environmentally compatible, consideration should be given to these aspects in design and construction.

Proposed Good practices for the management of buildings and storage include:

a) **Unauthorized access** to buildings and stores should be controlled to prevent theft and vandalism.
b) **Buildings should be regularly maintained** so that they remain **structurally safe** and **aesthetically acceptable**.
c) **Responsible rodent** and **vermin control programs** must be employed in **buildings and storage areas**.
d) **Sufficient ventilation** must be provided in buildings and stores.
e) **Buildings and stores must be equipped with the necessary firefighting** and **first aid equipment** and the **applicable emergency contact numbers clearly displayed**.

- **3.8.4 Electricity and Communications**

Communication networks and electrical installations must be managed and maintained in a condition that is safe to the environment and the people working in and around any IFS facilities. Where service providers are responsible for electrical supplies or communication facilities, these providers must be inducted to ensure that they undertake their activities in a safe and environmentally responsible manner.

- **3.8.5 Domestic Water, Sewerage and Ablution Facilities**

This section deals with the water supplies outside of that required by the IFS production activities. This includes water supplies for sewerage systems, landscaping, general washing, drinking, etc.

Proposed Good practices for the management of these aspects include:

a) Where water is not provided by a service provider, **care must be taken that supplies are adequate** (in volume and quality) and that the **extraction** thereof is **legally compliant**. **An adequate supply of safe drinking water must be ensured.**
b) **Water for landscaping** should be used **sparingly** and, where possible, be **sourced from aquaculture discharges** or from **grey water generated by washing and other non-sewerage activities**.

c) **Water must be used sparingly**. **Taps must be closed when not in use**, while **taps and pipes** must be **maintained** to prevent **leakage and waste.**
d) **Non-hazardous wash water** must be led into the sewerage system (where appropriate and legal to do so) or disposed of in areas where there is no potential for environmental risk.
e) **If water has been contaminated with hazardous chemicals,** it may **not** be released into the environment. This water must be kept in conservancy tanks for disposal at suitable hazardous chemical disposal sites.
f) **Provision must be made for the responsible management and treatment of sewerage**. The first choice would be for linkage into a formal sewerage system, failing which the use of sewerage conservancy or bio-remedial systems of adequate capacity and functionality may be considered. In rural areas, French or soak-away systems may be used if this is done responsibly and without contamination to groundwater resources.
g) **Conservancy, bio-remedial, French or soak-away systems should not be located in water rich areas**. Generally, these systems should be at least **50 meters** from any aquaculture production water and preferably **downstream** from production activities.
h) **Sewerage infrastructure** should be well **planned, well maintained and the layout thereof mapped**.
i) **Sewerage pipes must be buried** at an **appropriate depth** so that they do not interfere with the **surface activities,** while remaining practically accessible for maintenance and repair.
j) **Conservancy tanks** must be **emptied regularly** to prevent **overfilling and spillage.**
k) The use of **recognised biological accelerators** in conservancy tanks and soak-away systems is recommended.
l) **Ablution facilities** must be kept in a **clean, neat and hygienic condition.**
m) **Hazardous chemicals, dead aquaculture organisms** and other **non-sewerage materials** may not be dumped into sewerage systems.

3.8.6. Refuse and Waste

Crocodile farming produces various waste streams, which can be categorized as follows:

- General waste (feed bags, paper, plastic, glass, etc.).
- General organic waste from landscape maintenance.
- Production related organic waste (old feed, dead aquaculture organisms and material / sludge removed from filtration and sump units).
- Sewerage and non-production related waste water.
- Production related waste or effluent water.
- Post production and processing waste.
- Hazardous waste materials and chemicals.

Waste management must be formalized to ensure that it does not cause pollution and potential environmental degradation.

Proposed Good practices for the management of these aspects include:

General waste must be collected into suitable **water, wind and animal proof waste containers** so that it can be removed to a disposal site on a regular basis. **All waste management activities, including waste removal service providers and the sites used for waste disposal must meet the necessary legal requirements.**

a) Where possible, **general waste should be separated into glass, paper and plastics** so that these can be **recycled**.

b) Waste should not be allowed to litter aquaculture facilities or the **surrounding areas** and **waste containers should be emptied regularly to prevent overfilling.**

c) A culture of **waste reduction, collection and recycling** must be instilled with all employees by means of guidance and example.

d) Vegetation matter from landscaping activities must be removed to a **suitable disposal site or composted for later use.**

e) The following approach applies to production related organic waste:

- Old feed should be disposed of via composting (for small volumes) or via a formalised waste disposal system (for large volumes).
- Small numbers of dead organisms can be disposed via a subterranean pit, dug out in an area that is poor in groundwater. Each disposal must be followed by copious amounts of lime and one pit should not receive more than 30 kg of biomass per month. Large volumes of dead organisms can be disposed of by incineration if done responsibly, safely and with prior notification to local and district authorities and surrounding landowners. Certain local and district authorities also have facilities for the disposal of such organic matter.
- Filter waste should preferably be composted and not disposed of via postproduction water resources. Due to the potential for contamination of soil or groundwater with salt the composting of marine aquaculture filter wastes must be done with care.

f) Where **postproduction** and **processing waste** (e.g. intestines, heads, blood, etc.) is generated, it should be dealt with in one or more of the following manners:

- For **small volumes** (i.e. less than 50 kg. per week), a system of liming and burying or incineration (with authorisation) may be employed, provided that this does not cause **groundwater pollution** or other **impacts** of significance (e.g. health risks, odours, etc.).
- For large volumes (i.e. more than 50 kg. per week), it is recommended that a **silage system** be employed, which can **liquefy and stabilise waste material by grinding and lowering the pH**. This silage can then be incorporated into fertilisers or animal feeds.
- A suitable **bulk service provider** may be contracted to remove processing waste.
- Waste may be removed to a **recognised disposal site** equipped to deal with the waste type.
- Waste may be **incinerated,** provided that it is formalized and legally compliant.

g) Hazardous waste (e.g. expired chemicals) must be **disposed** of via an **approved hazardous waste disposal site.**

3.9. Handling Chemicals and Fuels

Various chemicals, medicinal substances or treatments (including hormones, anaesthetics, disinfectants etc.) and hydrocarbon fuels are used in aquaculture. These chemicals could pose environmental threats such as toxic contamination, damage to the ecology, bioaccumulation and more. Aquaculture chemicals are also a significant factor which influences safety, consumer acceptance and the marketability of products.

Proposed Good practices for the management of these aspects include:

a) **Care must be taken in the storage and handling of all chemicals and hydrocarbon fuels** (petrol, diesel, oils, etc.). In certain instances the methods of storage are prescribed by the South African National Standards (SANS) or by other legislation such as Health and Safety Regulations GN 156/1997 (GG 1617)

b) **Only recognised and registered chemicals may be used as treatments, medicines, herbicides, insecticides, pesticides and for other purposes**. The use of chemicals must be responsible and in accordance with the prescribed application methods.

c) **Material Safety Data Sheets (MSDS)** or **medicine datasheets** must be readily available and referenced during use, storage and disposal.

d) B**ait type pesticides should be used with care to prevent poisoning of non-target species.**

e) **Chemicals must be stored in a dry, well ventilated, secure and lockable area,** which is in **compliance with the Occupational Health and Safety Act and other applicable legislation**. Only **authorized employees** may have access to such stores.

f) **Chemicals should be recorded in a chemical and medications register**, indicating the date of purchase, batch number, use and expiry date. **Expired products and empty chemical containers must be disposed of responsibly** at a **recognized disposal site** for these materials and according to the directions provided in the MSDS or datasheet.

g) It is recommended that **chemicals and fuels not be used near water**, or in water logged areas, as this poses a particular threat to **biodiversity** and **aquatic ecosystems** (this excludes chemicals and treatments that are specifically for use in water).

h) **Fuels must be stored in suitable containers in a safe and lockable storage facility that allows for the containment of any spillage**. Storage methods for small and bulk volume fuels are prescribed by the SANS.

i) **Mixing or handling areas for treatments or chemicals and filling areas for fuels must allow for the containment, treatment or removal of any spillage. Non-spill funnels** should be used and these may not be cleaned in a manner that causes environmental contamination.

j) **Absorbents and remedial materials should be available and used on any spills**.

k) **Care must be taken to ensure that fuel devices do not leak**. Any leaks must be repaired without delay and the necessary hydrocarbon absorbents used on contaminated areas.

l) **Protective gear and clothing must be provided to employees that work with dangerous chemicals and treatments** (as per the Health and Safety Regulations GN 156/1997 (GG 1617) and Public Health Act 36 of 1919)

m) Working firefighting equipment must be available in and around any chemical and hydrocarbon fuel stores.

n) Aquaculture operators should be encouraged to reduce their reliance on therapeutic chemicals through the use of **sound husbandry practices aimed at disease and stress prevention**. **More emphasis should be placed on preventive measures where the use of chemicals is a last resort when other measures have proved to be inadequate.**

o) **Responsible use of therapeutics** and **treatments** in aquaculture is characterized by:

- o Chemical application based on an accurate diagnosis.
- o The use of an appropriate compound and application method.
- o Chemical dosage for the minimum effective time.
- o The keeping of records and evaluation of treatments.
- o An awareness of potential chemical residues.

p) Chemicals should be used for **specific and not general purposes**. The use of **chemical cocktails** should not be permitted.

q) Where required, **assistance should be sought from an aquaculture veterinarian** in the use of **therapeutics and treatments.**

r) **Dosages, application methods and the resultant outcome of all treatments should be known and recorded in a treatment register.**
s) In the use of **chemicals, consideration must be given to the potential for residues and the need for withdrawal periods before marketing and consumption of the aquaculture products**.
t) **Employees should be trained in the handling and use of chemicals** and they should be provided with the required **protective gear.**
u) **To prevent the development of disease resistance,** the **prophylactic use of antibiotics should be avoided**.

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4. THE PRODUCTION AND HUSBANDRY ENVIRONMENT

4.1. Sustainable Production Capacities

The capacity of the receiving environment for aquaculture is a measure of the ability of the natural resources and ecological services to accommodate the activity sustainably. Although production volumes are determined by many factors (e.g. markets, production space, feed, etc.), it is often limited, from an environmental perspective, by the availability of space, oxygen and water. Whatever the limiting factor, it is important to operate within sustainable production capacities to prevent environmental degradation.

Good practices for the management of production capacities include:

- To prevent environmental degradation through aquaculture generated water pollution, it is recommended that the **sustainable production capacities** of an operation be **determined** in relation to the **available water resources.**
- Where **water discharge** takes place, care must be taken that the **legal water quality criteria** are met. Where applicable, some form of **postproduction water treatment** can also be used (e.g. **sedimentation or filtration**).
- **Forward planned** and **suitable species** and **system specific stocking densities** should be **maintained** in relation to the **availability of resources** such as **water** and with due consideration of **animal welfare.**
- Consideration must be given to **pond positioning** to make optimal use of suitable environmental factors (e.g. **water displacement**), while **preventing pollution by overshooting the assimilative or ecological capacity** (which can be calculated through an assimilative or carrying capacity model). Organic material from the ponds may enrich a **benthic ecosystem**, resulting in **increased biological oxygen demand** and the formation of **anoxic sediments** and a **reduction in macrofauna biomass, abundance and species composition**. The degree of severity of such benthic impact is determined by many factors, which include the amount of freeboard under a cage system, local currents or water displacement ratios and more.
- **In determining sustainable production capacities, it is important that a distinction be made between "contamination" and "pollution".** Contamination is a trait of aquaculture, but this does not necessarily imply that aquaculture causes pollution. The boundary between these regimes is defined by many factors that include the robustness of the receiving environment and the degree of environmental change that is acceptable.
- It is important that the **environmental capacity** for aquaculture be **monitored and redetermined** on a continuous basis to **support decision-making** and **adaptive management.**

4.2. Water and Water Monitoring

Integrated Farming Systems activities add nutrients, metabolites and other wastes to the water column, which creates the potential for water quality deterioration. These impacts could include the **creation of eutrophic zones, fluctuations in dissolved oxygen, algal blooms, changes in species composition and more**.

Proposed Good practices for the proper management of water include:

a) Ideally, the **quality of water that enters the facility should be comparable with the quality of water that exits the operation**.
b) In certain instances, the **treatment of discharge water may be required to achieve the stipulated discharge quality criteria**. Such treatment may include sedimentation, decantation, biological oxidation, filtration (chemically, physically and biologically), water recycling, nitrification, foam fractionation, carbon absorption, ion exchange, algal systems, ozone and more. Materials removed by water treatment and filtration should be used for composting (where appropriate) or disposed of responsibly.
c) The use of **discharge water for irrigation or in hydroponics can also be beneficial to the environment**.
d) Where practical, the regular moving (site rotation) of cage culture systems may reduce localized water quality impacts.
e) Feeding must be strictly controlled through a specific feeding regime that **maximizes feed conversion efficiency, limits direct feed wastage and above normal faecal and metabolite releases from the production organisms.**
f) Samples of the inlet and outlet water of production facilities should be analyzed for the following constituents (this being the minimum set of constituents which may be supplemented by conditions set through authorizations and licenses):

- pH.
- Temperature (°C).
- Dissolved Oxygen (mg/l).
- Ortho- and Total Phosphate as Phosphorous (mg/l).
- Nitrate as Nitrogen (mg/l).
- Nitrite as Nitrogen (mg/l).
- Ammonia as Nitrogen (mg/l).
- Chemical Oxygen Demand (mg/l).
- Biological Oxygen Demand (mg/l).
- Electrical Conductivity (mS/m).
- Suspended Solids (mg/l).

g) As an inland initiative, the water in which the production takes place and the d**ownstream water should be sampled and analysed for the abovementioned constituents**.
h) Water quality analyses should be **conducted at least once in six months**
i) Where **significant water quality impacts are detected**, this can be addressed by **lowering the stocking densities, correcting the feeding rates, feed types and feed management, by increasing water displacement or by the moving of operations.**

4.3. Species and Escape

The introduction of non-native or genetically different (including hybrids, genetically modified organisms and improved strains) aquaculture species into an environment could cause significant ecological disturbances, the introduction of new diseases, invasion and genetic pollution. This coupled with the unseen and unpredictable ability of some species to escape, makes the choice and management of aquaculture species important.

Good practices for the proper management of species include:

a) Where possible, preference should be given to locally indigenous and nonthreatened species for aquaculture as opposed to alien, extralimital and invasive species for farming in controlled production environments.
b) Prior to the commencement of the proposed activities, use of the target species must be authorised in terms of the applicable legislation.
c) When stocking aquaculture organisms, care must be taken to prevent secondary species from being accidentally introduced with the target species.
d) No live organisms may be transported to or from aquaculture facilities without a **transport permit from the applicable authorities**.
e) Unless specifically authorised, **broodstock or organisms for farming may not be collected from the wild (local rivers)**.
f) Aquaculture species that are able to **hybridise** should not be farmed together, while species that are able to hybridise with indigenous species in the surrounding environment should not be used as production candidates.
g) Where practical, the potential for **genetic impacts** should be established and if found to be significant, such species should be avoided.
h) Prior to the **purchase and stocking of crocodiles**, the **disease and parasitic status and risk of the species must be investigated in context to the area from which it originates,** the area to which it will be taken and the degree to which any potential disease may pose a threat to the surrounding environment.
i) Adequate steps must be taken to prevent the escape of crocodiles, especially from the **hatchery environment** where individual crocodiles may be very small. **In this regard, regular inspection of production infrastructure and escape barriers is important. Escape barriers may include netting, grids, screens, strainers, sand and other filters, predator ponds, chemical treatment areas, soak away systems, etc. Barriers should be adequate to prevent escape during flooding, overflows and during other unforeseen circumstances.**

4.4. Feeds and Feeding

Feed and feed management is a primary cause of direct and indirect pollution of water resources used for IFS in the name of crocodiles in this case. The management and responsible use of feed is not only an important environmental consideration; it is also a key factor in determining the financial viability of most aquaculture ventures.

Proposed Good practices for the management of feeds and feeding include:

a) Only **registered crocodile feeds** should be purchased from **recognised feed companies** that produce **high quality feeds of which the ingredients, composition and manufacturing methods are known.**
b) **Feeds should be balanced, low in phosphorous and the nutrients should be highly attainable through digestion and absorption**.
c) Feeds should be **low** in **inedible fines (dust) and should be water stable**.
d) **Feed producers** should provide the **date of manufacture, information pertaining to the ideal storage conditions and estimated shelf life**.
e) Where practical, a **feed traceability programme should be employed** in which the **batch of feed** can be matched to a **specific feeding period** and a **specific batch**
f) Feed stores should be **lockable to prevent theft.**
g) Feed should be stored and used on a **"first-in-first-out"** basis to prevent unnecessary **aging and deterioration in quality.**
h) **Feed storage areas** should be **well ventilated, dry and free of vermin that can damage, contaminate and consume feeds**. **Dampness and heat can also damage feeds**.
i) It is good practice to store feeds on **individually stacked pallets** that can allow for **full ventilation** of feed bags that would otherwise be in direct contact with floor and wall surfaces.
j) **Feed types and feeding strategies** are specific to each **species, to the culture conditions, climate and growth stage. In this regard, feed types and feeding rates should be recorded daily so that feed conversion efficiency can be calculated and monitored.**
k) **Water quality monitoring** should be **correlated and checked** against feeding rates and production biomass so that adjustments can be made to the feeding program if required.
l) **Palatable feeds** of the correct pellet or grain size should be used to ensure low levels of **feed loss**. Other factors such as **feed position (e.g. floating or sinking**), **water stability and feeding time** of day must also be considered to **minimise feed wastage.**
m) **Feeding tempo and methods** should be suited to the specific species, while feed distribution in a production unit must be even to ensure that all individuals are fed.
n) Uneaten feed is a sign of over-feeding and this should be corrected on the feed program.
o) Employees that are responsible for feeding should be **well trained in feed application** so that they can **detect subtle changes in feeding behaviour**. If feeding is not active it may be necessary to suspend, delay or modify the feeding program.
p) Where **automated or demand feeding devices are used**, care must be taken to prevent over feeding and the feed application must be monitored in relation to production performance.
q) Where **unprocessed feeds are used** (e.g. trash fish or vegetable matter), special care must be taken to prevent over feeding and the maintenance of water quality.

4.5. Disease Management, Treatments and Mortalities

Integrated Farming Systems is prone to diseases, which are a real threat, not only because of its potential impact on production, but also due to the potential of infecting other organisms in the environment. Disease should be managed around prevention and prepared strategies for treatment. If mortalities occur (natural, through disease or other factors) the management thereof is important to prevent environmental impacts.

Proposed Good practices for the management of these aspects include:

- Namibia subscribes to the **Aquatic Animal Health Code**, issued by the **Office International des Epizooties (OIE)** and therefore this international disease code applies. None of the identified diseases in this code are permitted and are notifiable by law. If an identified disease is detected, the nearest **State Veterinarian** must be informed immediately.
- No aquaculture organisms should be introduced from an **unrecognizable source or a source** for which the disease status cannot be verified.
- No live organisms may be **transported to or from aquaculture facilities** without a **transport permit** from the applicable authorities.
- Prior to the purchase and stocking of any organisms, the **disease and parasitic status and risk of the species must be investigated in context to the area from which it originates**, the area to which it will be taken and the degree to which any potential disease may pose a threat to the surrounding environment. In certain instances the introduction of aquaculture organisms may require specific veterinary assessments, treatments and quarantine measures.
- When new juveniles or broodstock are introduced, it is advisable that these be **quarantined to diagnose**, **investigate, monitor and treat potential diseases and parasites**. This should be done under supervision of a **veterinary professional.**
- Mubiza operators should **monitor** the **health status of aquaculture organisms** as part of the **daily operational activities**. This includes **water quality monitoring and the monitoring of the production conditions in addition to symptomatic monitoring of behavior** that should be supported by sampling, diagnostic dissection, microscopic investigation and more.
- It is advisable that a **health assessment** be conducted on aquaculture facilities by an **aquaculture veterinarian, at least twice a year** or as directed through the conditions of any particular authorisation.
- Although **medical treatment** should never replace **sound husbandry and hygiene**, treatment of aquaculture diseases must nevertheless be done by **recognized methods and where applicable**, under the guidance of a **qualified aquaculture veterinarian**. All treatments must be **recorded in detail to reflect the date, treatment methods, substances, dosages and outcome.**
- If a **disease breakout occurs,** production systems should be **isolated from each other and the surrounding environment.** If required, a **qualified aquaculture veterinarian** should be consulted to assist with further management inputs and treatments.

  - Where possible, the following practices can be implemented to reduce the risk of aquaculture disease:
  - Screening or quarantine of broodstock for known pathogens and parasites.
  - Appropriate treatment of broodstock prior to entering the hatchery environment.
  - Isolation and separation of production sectors with independent water supplies and equipment.
  - Installation and use of foot baths and hand washing facilities for employees.
  - Regular disinfection of equipment and working areas.
  - Restrictions on access to foreign vehicles and people.
  - Management of bird and predator populations that could be disease carriers.
  - Minimizing the potential for disease vector hosts to enter the aquaculture system.

- As it is not possible to eliminate all bacteria and parasites from an aquaculture facility, **disease management requires a holistic approach, which includes the management of water quality, hygiene, and feed, stocking densities, stress, predators, husbandry techniques and more.**
- If **mortalities are detected**, the behaviours of the remaining stock must be monitored carefully. If large numbers die, the first step is to **check the physical and chemical characteristics of the water and thereafter the possibility of disease**. **Orderly and daily notes** must be kept of the numbers of dead organisms, cause of death and the behavioural patterns of the population as a whole.

- If production animals are **injured or diseased** to a point that causes excessive suffering, **humane euthanasia should be performed.**
- Any **dead organisms** must be removed and disposed of in a manner that **minimizes** the spread of diseases.
- **The equipment** used to remove mortalities must be **cleaned and sanitized.**
- Where large scale mortality occurs, **samples** should be sent to an i**ndependent veterinarian for assessment of the causative agents.**

4.6. Grading, Moving and Harvesting

Aquaculture organisms are regularly graded for uniformity in size, growth monitoring and the prevention of cannibalism. As with stocking and harvesting, this requires a degree of handling, which must be done in a manner that causes the least possible stress or injury and which eliminates the potential of escape.

Proposed Good practices for the management of these aspects include:

a) **No live organisms** may be transported to or from aquaculture facilities without a **transport permit** from the applicable authorities.
b) **Grading and moving should be preceded by a period of starving to aid in stress reduction**. **Metabolites and faecal matter also have the potential of fouling the water in which organisms are moved**.
c) Where possible, **grading and moving** should be done in **water and at lower temperatures** to reduce **metabolic rates and stress.**
d) **Grading, moving and harvesting equipment and techniques** should not cause **unnecessary injury and stress** and should be adequate to **prevent escape.**
e) **Harvesting and killing** must be done by the most humane method possible and with equipment that does not cause unnecessary injury and stress. Animals must be rendered unconscious (not immobilised or sedated) immediately before slaughter by means of **acceptable food-grade anaesthetic** or an **appropriate electrical or mechanical stunning device**.

4.7. Postproduction Processing and Marketing

This EMP is not intended to provide a detailed framework for postproduction, processing and marketing matters. However, as these aspects are related to aquaculture production, certain environmental management concepts have been included. Much of the handling and processing of aquaculture products are guided by national and international codes of practice, laws, health standards and quality control procedures that depend on the nature of the product, the level of processing, market requirements and needs of the consumers.

Proposed Good practices for the management of these aspects include:

- Where applicable, **depuration or purging** could be used to remove pathogens, chemical or treatment residues and taints from aquaculture products.

- Aquaculture products should be **handled with care to prevent deterioration of quality**. Phytosanitary responsibility must be maintained throughout the harvest and marketing chain and potential contact with microbiological contaminants should be eliminated.
- The **harvest cycle, processing and marketing chain** should be kept as **short as possible** and end products should be **chilled or frozen** as soon after processing as possible.
- Where applicable, **processing should be done in a chilled environment and under roof**.
- Employees involved in processing should be **trained for the task** and be fully briefed on the phyto-sanitary risks associated with personal hygiene.
- A high degree of **phyto-sanitary and hygienic cleanliness** should be maintained in any processing area or plant.
- **Wastewater from processing activities should be strained, filtered and disposed of via a capable sewerage system** or another legally sanctioned route of discharge.
- Where practically possible, all **processing waste** should be **ensiled by grinding and lowering the pH so that a stable liquid is formed which can be incorporated into fertilisers or animal feeds**. Where this is not possible, the burying or incineration of waste material may be employed, provided that these actions are legally sanctioned and not detrimental to the environment.
- Where applicable and appropriate, the use of **management systems and standards such as Hazard Analysis and Critical Control Point (HACCP)**, the Namibian Standards / South African National Standards (SANS) and the International Standards Organisation (ISO) can contribute greatly to postproduction phyto-sanitary and other matters.
- **Certain markets require traceability of products**, in which case the Mubiza aquaculture operator is required to **record and provide details** of the origin of **stocks and feeds** and of the manner in which the products were **farmed**. **Such traceability protocols are becoming increasingly important in globalized aquaculture (piggery, etc).**

4.8. Keeping of Production Records

Comprehensive records are a cornerstone to the viability of any operation and apart from their submission to the applicable authorities (where required), it is an important component of good practice. Such records will ensure that matters are dealt with in an orderly and logical fashion, which could prevent unnecessary environmental impacts.

Proposed Good practices for the management of record keeping include:

a) **Farm records** should be **written or electronically logged** in a **logical and tidy manner**. Record should be **safely kept and accessible for daily management and reference**.

b) Where possible, **farm records should be supported by authorizations, permits, photographs, water quality analysis reports, disease or diagnostic reports, incident reports, MSDS's and other information that may be of assistance.**

c) As a **guideline,** farm records should include the following:

- Dates of all entries.
- Identification of the person who made the entries.
- Climatic and water quality data.
- Water quality analysis records.
- Copies of all applicable permits, authorizations and protocols.

- A copy of the environmental and other appropriate management plans.
- Detailed and up to date stock registers of the farm.
- Production sampling records.
- A detailed feed program together with records of the feed stocks.
- A mortality record.
- Health records and diagnostic reports.
- Chemical and treatment application records.
- Chemical registers indicating stocks, MSDS's, purchase and expiry dates.
- A complaints register.
- A daily diary of significant events, incidents, feed response, etc.

5. THE SOCIAL ENVIRONMENT

The potential positive social impacts of Integrated Farming System include:

- The creation of employment.
- The creation of local business opportunities for entrepreneurs.
- The development of previously absent aquaculture skills in surrounding communities.
- The creation of food security.
- The supply of local fish products to the tourism trade.
- The sustainable use of natural resources for livelihood creation.

The potential negative social impacts of aquaculture development include:

- The potential conflict around shared resources, mainly water resources.
- The potential conflict with other land users such as tourism, mining etc.
- The competition in local markets.

5.1. Employee Facilities and Employment Conditions

The conditions under which employees work are part of the environmental footprint of any IFS activity.

Proposed Good practices for the management of employment include:

a) Provision must be made for clean and accessible ablution facilities for both sexes.
b) Provision must be made for clean drinking water for all employees.
c) An area should be provided where employees may **store personal goods and belongings.** This area must be **safe, dry and provide adequate privacy and protection from inclement weather** for people and their belongings.
d) **Protective gear** must be provided for certain tasks and for handling of chemicals.
e) Aquaculture facilities should carry **first aid equipment and at least one employee should be trained in first aid provision.** Relevant emergency service contact numbers should be clearly displayed at all facilities.

f) **Basic legal employment conditions** (i.e. for working hours, minimum wages, etc.) **must be followed** to ensure the maintenance of employment rights.

g) Employees must be provided with **opportunities for training and furtherance of skills**. For responsible aquaculture, basic training in the following aspects would also be advantageous:

- o Environmental awareness.
- o Feeding and feed management.
- o Water quality management and monitoring.
- o Sustainable aquaculture husbandry and welfare.
- o Biosecurity and disease management.
- o Aquaculture ecology.
- o First aid and fire safety.

h) All employees should be sensitized to their responsibilities in terms of environmental protection and management through dedicated training sessions.

5.2. Communities and Neighbors

IFS activities can influence surrounding communities at various levels. It is important to manage these interactions in such a manner that the communities become allies rather than display any resentment.

Proposed Good practices for the management of surrounding communities include:

a) When aquaculture facilities are planned the surrounding communities must be **informed** and they should be provided with an **opportunity to voice concerns or support.**

b) Once **established**, **communities must be informed of the on-going aquaculture activities adjacent to the areas in which they live and work.**

c) Whenever possible, **new employees should be sourced from the surrounding communities in preference to importing personnel from further afield.**

d) Where possible, **outside contractors should be sourced from local communities.**

e) **Efforts** should be made to **encourage aquaculture and environmental awareness by allowing and facilitating visits by schools and other community groups**.

f) Where practically possible, **discounted aquaculture products or by-products should be made available to local communities.**

5.3. Dealing with Complaints

As with any development, aquaculture facilities will be subject to complaints at some stage. Some of these may be caused by a lack of understanding, but others may be of importance. Nevertheless, complaints must be dealt with appropriately to ensure due consideration to the complainant and to ensure public and environmental safety.

Proposed Good practices for the handling of complaints include:

a) All complaints must be **recorded in a well-kept complaints register** with details of the nature of the compliant, the person or organisation that lodged the complaint, the date and the name of the responsible person dealing with the complaint.
b) Complaints must be **fully investigated** and the o**utcomes and actions documented, implemented, monitored and communicated to the complainants**.

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6. AUDITING, DECOMMISSION AND OTHER

6.1. Auditing and Review

Internal auditing of aquaculture activities through monitoring and adaptive management should be supported by periodic independent or external audits to determine the level of compliance with any specified standard, good practice or environmental management programme. Such audits can be enforced as a condition of any authorisation and in particular as a condition of an environmental authorisation.

The aim of an audit is primarily to:

a) Check the degree to which a facility meets a set of predetermined standards.
b) Check that proper records are kept.
c) Determine the effectiveness of specifications in the predetermined standards.
d) Aid in logical communication and feedback between aquaculture proponents and the applicable authorities.
e) Recommend changes and updates to the predetermined standards.
f) Good practices for conducting audits include:
g) It is advisable that at least one person should be tasked to take responsibility for internal monitoring and auditing and that the remaining employees are made aware of the requirements, standards and procedures.
h) Internal auditing can be done by means of a checklist based exercise that is completed at set intervals.
i) Internal audit results should be orderly stored and communicated to all employees, so that corrective actions may be taken.
j) When external auditors are appointed it is advisable that they have knowledge and experience in environmental auditing, environmental management and in aquaculture.
k) The results of any external audits should be communicated to any authorities that may have stipulated a requirement for such an audit. Copying audit results to other key authorities or key interested or affected parties is good practice.
l) All audits should inform changes to an environmental management programme. In this regard an audit should be used to identify aspects in an environmental management programme that may not be applicable, that may be impractical, outdated or that are not adequately addressed. These aspects should be amended.

6.2. Decommissioning

IFS projects are terminated from time to time for a number of reasons.

This section deals with the best practices that can be taken in the event of project termination:

a) As many IFS projects are subject to specific statutory authorisations, the applicable authorities must be informed when activities are terminated. In addition to this, the onus remains on the proponent to determine whether any of the decommission activities in themselves trigger the requirement for an environmental authorisation
b) At decommissioning, all aquaculture organisms must be removed responsibly (e.g. by sales, donations or humane killing). This eliminates the risk for redistribution into areas where they are not ecologically compatible.
c) Any insecure or unsafe infrastructure should be demolished at decommissioning. Alternatively, the responsibility for all infrastructures must be handed over to the landowner or appropriate third party. Rubble, including supply piping, fencing and cabling from any demolition activities must be appropriately disposed of before the area is stabilised and vegetated.
d) Where infrastructure has been removed, the receptiveness of the soil for revegetation should be enhanced by means of ripping, topsoil application or the use of fertilisers and compost. Quick growing, indigenous plant species that provide stability should be established.
e) To ensure that decommissioning and rehabilitation is acceptable, an external audit should be conducted, the results of which should be copied to the applicable authorities.

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7. ENVIRONMENTAL MANAGEMENT TOOLS

A number of environmental management tools can be used towards achieving best practices in aquaculture.

These tools include:

a) The EIA process itself. This can be supported by environmental risk and various other assessment methods.
b) **Geographic information systems** such as **biodiversity and ecosystem maps**, including maps of MEFT's, provincial spatial biodiversity plans, biodiversity sector plans for municipalities indicating critical biodiversity areas and ecological support areas and maps of threatened ecosystems.
c) Environmental **method statements, checklists, registers, audits and audit results, incident and complaints registers, site diaries, photographic records** etc.
d) **Environmental education of employees**.
e) **Contingency plans** that contain details of the actions to be taken in addressing environmental emergencies and the people responsible for these actions. These could include contingencies for aspects such as **water pollution, disease, escape or fire and more.**

f) One of the most important environmental management tools is the **EMPr**. In this regard, implementation and compliance with the EMPr becomes a condition of authorization and is therefore legally binding. Much of the environmental management and good practice content of this Report / EMP can be used to formulate and compile a **project specific EMPr**. the content of an EMPr must include:

- Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified, including environmental impacts or objectives in respect of:
  - Planning and design.
  - Pre-construction and construction activities.
  - Operation or undertaking of the activity.
  - Rehabilitation of the environment.
  - Closure and decommissioning where relevant.
- A detailed description of the aspects of the activity that are covered by the EMPr.
- An identification of the persons who will be responsible for the implementation of the management and mitigation measures contained in the EMPr.
- Proposed mechanisms for monitoring compliance with and performance assessment against the EMPr and reporting thereon.
- As far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures.
- A description of the manner in which it intends to:
  - Modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation.
  - Remedy the cause of pollution or degradation and migration of pollutants.
  - Comply with any prescribed environmental management standards or practices.
  - Comply with any applicable legal provisions regarding closure, where applicable.
  - Comply with any legal provisions regarding financial provisions for rehabilitation, where applicable.
- Time periods within which the measures contemplated in the EMPr must be implemented.
- The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking the operations.
- An environmental awareness plan describing the manner in which:
  - The applicant intends to inform his or her employees of any environmental risk which may result from their work.
  - Risks must be dealt with in order to avoid pollution or the degradation of the environment.
  - Where appropriate, **closure plans, including closure objectives**.

8. CONCLUSION

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The primary objective of this EIA and accompanied / embedded EMP for the proposed Integrated Animal and Crop Farming (Integrated Farming System) development at Mubiza Village Farm, some 30km east of the town of Katima Mlilo in the Zambezi Region of Namibia, revolves around equipping the proposed Mubiza Village Farm and other stakeholders with the required approach to deal with environmental management matters, so that potential environmental impacts can be reduced.

Following the principles in this EIA Report and EMP will result in the development of environmentally sustainable project and ultimately an environmentally responsible aquaculture project at Mubiza Village in Katima Mlilo in the Zambezi Region of Namibia.

As such, it is advisable that the **Environmental Clearance Certificate / Authorization** be approved to enable the development of the project, which will directly contribute towards the national development.