ENVIRONMENTAL IMPACT ASSESSMENT STUDY

THE CONSTRUCTION AND OPERATION OF THE PROPOSED FRESHWATER AQUACULTURE AND HORTICULTURE PROJECT AT OMAYANGA VILLAGE, OSHANA REGION, NAMIBIA

SCOPING REPORT

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PROJECT DESCRIPTION

Freshwater Aquaculture and Horticulture
Omayanga Village, Oshana Region
Application No.: 240411003198

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LIST OF ACRONYMS AND ABBREVIATION

BID	Background Information Document
CDC	Constituency Development Committee
CLB	Communal Land Board
DO	Dissolved Oxygen
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EISR	Environmental Impact Scoping Report
EMA	Environmental Management Act
EMP	Environmental Management Plan
g	Gram
GRN	Government Republic of Namibia
Ha	Hectare
IAC	Inland Aquaculture Centre
I&APs	Interested and Affected Parties
m^2	square metre
m^3	cubic metre
MAWLR	Ministry of Agriculture, Water and Land Reform
MEFT	Ministry of Environment, Forestry and Tourism
MHSS	Ministry of Health and Social Services
MFMR	Ministry of Fisheries and Marine Resources
mg/L	Milligram per Litre
MLIREC	The Ministry of Labour, Industrial Relations and Employment Creation
NHC	National Heritage Council of Namibia
NORED	Northern Regional Electricity Distributor
OSHACLB	Oshana Communal Land Board
PH	Potential of hydrogen or power of hydrogen
RAS	Recirculation Aquaculture System
RDCC	Regional Development Co-ordinating Committee
TA	Traditional Authority
VDC	Village Development Committee
PPE	Personal Protective Equipment

STRUCTURE OF THIS REPORT

CHAPTER 1: INTRODUCTION

This chapter provides an overview of the proposed projects including the background information to the projects, the location of the developments, the associated land ownership and description of the properties on which the projects are to be undertaken.

CHAPTER 2: NEED AND DESIRABILITY

The motivation for the proposed aquaponics development is provided within this chapter.

CHAPTER 3: PROJECT DESCRIPTION

The description of the technical details of the proposed developments as well as activities are provided in this chapter. The associated bulk infrastructure requirements are also explained.

CHAPTER 4: LEGAL AND POLICY FRAMEWORK

This chapter identifies all the legislation and guidelines that have been considered in the preparation of this scoping report.

CHAPTER 5: DESCRIPTION OF THE ENVIRONMENT

The chapter provides a brief overview of the biophysical and socio-economic characteristics of the site and its environs that may be affected by the proposed development.

CHAPTER 6: IMPACT ASSESSMENT METHODOLOGY AND ANALYSIS OF ALTERNATIVES

The methodology of the EIA process that will be followed, including the Public Participation Process and evaluation of reasonable and practical alternatives are outlined here.

CHAPTER 7: POTENTIAL IMPACTS AND POSSIBLE MITIGATION MEASURES

This chapter outlines the potential impacts that will be associated with the aquaculture and horticulture projects as well as possible mitigation measures that will be related to impacts.

CHAPTER 8: IDENTIFICATION AND RATING OF THE ENVIRONMENTAL IMPACTS

This chapter provides a description of the methodology used in identifying and rating/ranking the potential environmental impacts and for the final scoping report.

CHAPTER 9: RECOMMENDATIONS AND CONCLUSIONS

This chapter provides a brief summary of the proposed development and outlines recommendations for the proposed way forward.

CHAPTER 10: LIST OF REFERENCES

List of all materials cited.

APPENDICES

The appendices contain all supporting documents and supplementary information.

THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

Armstrong Lukubwe has been appointed by Green Village, as the independent Environmental Assessment Practitioner (EAP) to apply for an Environmental Clearance Certificate (ECC) for the proposed freshwater aquaculture and horticulture developments within the Omayanga village of the Okatana Constituency in Oshana region of Namibia.

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Project Team

The project team consists of qualified and experienced personnel whose trade are in natural resources field (Table 1). Full curricula vitae for the project team are provided in Appendix G.

Table 1: Profile of Project Team

Mr Armstrong Sinvula Lukubwe **(Project Leader)**	Mr Armstrong has extensive knowledge and experience in a wide variety of areas with particular focus on environmental management and protection; integrated land management; fisheries and aquatic resources; sustainable agriculture; project management, and stakeholders' management. He has expertise in conducting environmental and social assessments, including knowledge of the legislation that have relevance to the proposed projects. He holds a Master's degree of Integrated Land Management from the Namibia University of Science and Technology (NUST). He is also a member of Environmental Assessment Professionals Association of Namibia (EAPAN).
Ms Agnes Shekupe Shivute **(Project Assistant)**	Ms Agnes Shivute is a highly motivated, creative, and innovative individual with an interest on environmental aspects. Her qualification is BSc in Integrated Environmental Science (Hons) from the University of Namibia. She has been involved in numerous projects in regard to environmental impact assessments (EIA).

EXECUTIVE SUMMARY

Project description

Green Village herein referred to as the proponent plans for the establishment of freshwater aquaculture and horticulture projects on a 10.2 ha of land at Omayanga village, Okatana constituency of the Oshana region. The proposed aquaculture development will include the establishment of greenhouse type tunnel system where Three-spotted tilapia (*Oreochromis andersonii)* will be cultured in tank culture system on land area measuring 1368 m^2. The aquaculture development will be farmed in combination with other farming operations which are vegetables and related fruit crops on a land area of 0.5 ha along with broiler chickens in an integrated farming system. This setup entails increasing the productivity of water, land, soil and associated resources while contributing to increased food production. The goal is to raise tilapia to harvestable size quickly, economically, and in good health maximizing aquaculture production by way of synergic interactions with other farming systems on the same piece of land for optimal yield.

Environmental requirements

Environmental Impact Assessment study was carried out as per the provisions of the Environmental Management Act (Act No. 7 of 2007) and EIA Regulations (Government Notice No: 30, 2012), since the establishment of agriculture and aquaculture developments, as listed activities, cannot be undertaken without prior consent from Interested and Affected Parties (I&AP) as well as obtaining the Environmental Clearance Certificate (ECC). Therefore, in order to achieve these objectives, an Independent Environmental Assessment Practitioner (EAP) had been appointed by Green Village to facilitate the Environmental Impact Assessment (EIA) process in obtaining ECC for the construction and operation of the proposed developments.

Need for the project

The proposed projects were specifically considered suitable as a key area of investment since the Namibian government through the various institutions and key players consider the development of agricultural and fisheries sectors as one of the important growth areas for socio-economic development; sustainable rural livelihoods, and environmental sustainability.

Estimated production output

Fish production target of around 14 tons with an average table/market size of 300 kg per breeding season will be produced. Tomatoes of 6.6 tons; 5.4 tons of 1269 cabbage pieces per season, with an average of 4.5 kg per head; 1.2 tons of green peppers will be realised.

Public participation Process

The study also sought public opinion or views through consultation and public participation exercise which was done through public meetings and stakeholders' engagement. I&APs, the general public, key stakeholders, adjacent landowners and government authorities at local level, where notified of the proposed development through various means.

Potential impacts

Both adverse and beneficial impacts were identified for various project phases which include: negatives - potential user conflicts over land and other communal resources; habitat degradation; potential contamination of surface water and groundwater; increase in noise and vibration levels; dust generation; storm water and erosion; generation of waste and effluent; health risks e.g., outbreak and spread of diseases, use and handling of chemicals and hazardous substances. Positive - creation of employment opportunities; ensured food and nutrition security; learning hub for integrated farming system, and optimal use of land.

Conclusion

From the analysis, the proposed freshwater aquaculture and horticulture developments will not pose any serious environmental impacts as it is observed and established that most of the highlighted negative impacts on the natural and social environment are rated low and short term with no significant effect. Even so, developing adequate measures of minimising and mitigating the environmental impacts of the proposed projects is key since aquaculture and horticulture activities have the potential to both enhance or undermine social-economic development and environmental sustainability.

Recommendation.

These projects are recommendable and should be approved by the Environmental Commissioner for the issuance of Environmental Clearance Certificate in compliance with the Environmental Management Act of 2007, and EIA Regulations (GRN Notice No: 30, 2012).

CHAPTER 1: INTRODUCTION

1.1 Projects background

Green Village herein referred to as the proponent plans for the establishment of a vibrant commercial projects employing environmentally friendly and pioneering agri-food technologies based on a sustainable and integrated farming system targeting three enterprises which are freshwater aquaculture, vegetable farming and poultry rearing which will be farmed on 10.2 hectares of land area located at Omayanga village, Okatana constituency of the Oshana region.

Overall, the proposed projects were carefully and specifically considered suitable as potential area of investment because of its strategic importance to the national objectives and priorities since GRN through various key players consider the development of freshwater aquaculture and horticulture projects as one of its important growth areas for socio-economic development and sustainable livelihoods. The proposed developments are aimed at waste recycling, water conservation, energy-efficient systems, optimal use of land and other associated resources while contributing to increased food production and the promotion of healthy living; generating income; creating employment for the local communities, and particularly fish farming, which has the potential to reduce fishing pressure on river systems.

Aquaculture is the farming of fish, shellfish, aquatic plants, and other aquatic organisms in ponds, tanks, net enclosures, cages, or raceways. It is one of the fastest growing food production sectors and significant renewable resources that many countries in the world have for food and nutrition security, sustainable livelihoods and economic growth. The expansion in aquaculture all over the world is now not just about having more ponds but more intensive and efficient systems of aquaculture production that promise higher yields and greater profit margins with due consideration in environmental sustainability.

Horticulture is the branch of plant agriculture dealing with garden crops, generally fruits, vegetables, flowers, or ornamental plants. With the horticulture development, Green Village aims at increasing the local production and supply of fruit and vegetables to the community of Oshana region, similarly reduce the overreliance on imported horticulture fresh produce. Horticulture plays an important role in socio-economic development, and also in addressing dietary and nutrition inequities of the local community by promoting high-quality diets.

1.2 Rationale for the EIA

Environmental Impact Assessment (EIA) is a process of identifying, predicting, evaluating and mitigating the potential effects of a proposed development or policy on the natural and social environment. EIAs are undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent authority. EIA should therefore have a holistic view in ensuring the rational approach to development, the operation of enterprises and sustainable exploitation of available resources and meeting livelihood needs that guarantees their viability and sustainability. If not appropriately regulated, this can also cause reverse impacts.

For sustainable development to occur, environmental issues should be given proper priority among the development challenges. As an invaluable tool for sustainable development in Namibia that contributes to overcoming these challenges, EIA addresses responsible and equitable use of the environment resources and fostering the commitment for environmental protection. This can be achieved through careful planning and the establishment of appropriate management systems, which should become an essential component of the development process to ensure that minimum damage is caused to the environment.

EIA is neither antidevelopment nor does it stop actions which impact the environment as it is generally perceived as 'an expensive permit investors need to acquire to satisfy government requirements' rather than as an investment to guarantee the viability and sustainability of an enterprise that includes safeguards for both the investor and other users in the society. EIA is therefore precautionary in nature as it only requires that those impacts be considered. Most development activities impact the environment hence a 'no impact' interpretation of EIA could lead to no development. But a minimum impact interpretation of EIA will lead to better development. If environmental impacts are ignored, the project may not be sustainable in the long-run, in which case the money invested in it will have been wasted.

It should also be noted that, the requirements and implementation of EIAs varies depending on the applications. e.g., listed activities which carry the most risk (large scale, most intensive production or culture method, location in sensitive area, introduction of alien species or incompatible forms of land use), are usually liable to undertake a full in-depth EIA. However, some developments would rather rely on alternative environmental management procedures especially those classified as small-scale projects, and in many cases, are traditional activities.

1.3 Environmental requirements and compliance to regulations

Green Village (the applicant) has appointed an Independent Environmental Assessment Practitioner (EAP) to facilitate the Environmental Impact Assessment (EIA) process in obtaining the Environmental Clearance Certificate (ECC) for the construction and operation of the proposed developments of freshwater aquaculture and horticulture. This is required as per the provisions of the Environmental Management Act (Act No. 7 of 2007), and EIA Regulations (GRN Notice No: 30, 2012), as well as the development of an Environmental Management Plan (EMP) for listed activities that may not be undertaken without an ECC.

1.4 Project location

The property and proposed projects under reference will be established at Omayanga village, Okatana constituency of the Oshana region in Namibia, and it is situated along the Okatana-Ongwediva road, and also accessed via the same road (Okatana-Ongwediva road). GPS Coordinates: 17.745697 S; 15.724750 E.

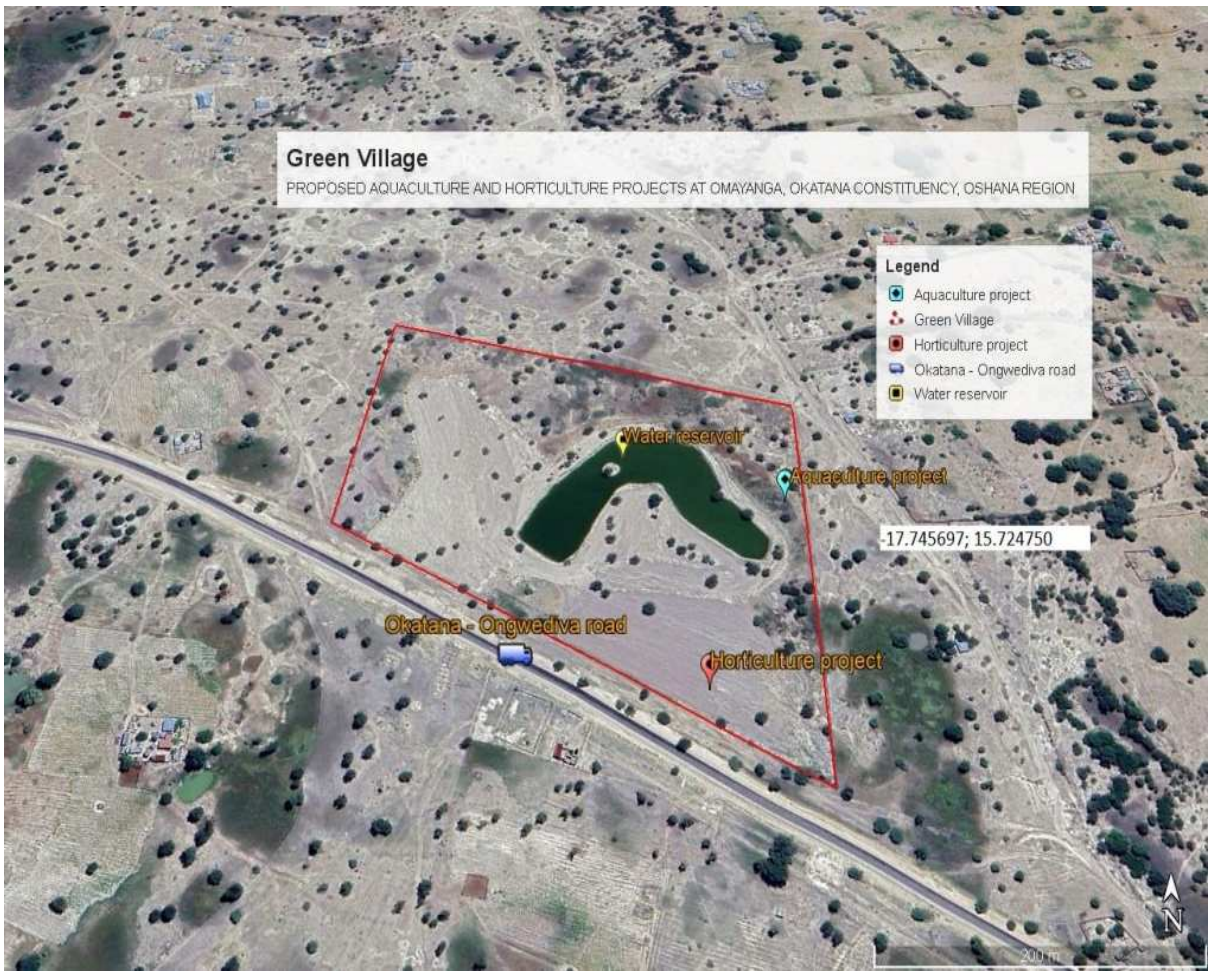

Figure 1: Location of Green Village

1.5 Site selection

Site selection ensures that projects or developments are located in a specific location, which has attributes that enable the necessary production with the least possible adverse impact on the environment and society. Following analysis of the regulatory framework, environmental factors, feasibility study, availability and suitability of the area, the designated site for Green Village was the most appropriate site that is available and was found suitable for this type of developments and project infrastructures establishment, particularly considering the topographic appraisal, land use, determination of approximate elevations and flood risks, and an analysis of drainage characteristics. The regional climate patterns which include precipitation, temperature, sunlight intensity and humidity are favourable for fish and horticultural production. The plot was previously undeveloped and uninhabited as it fell within the Oshanas. The project site is also located near the dugout/excavation dam which serves as reservoir for water supply to various projects at Green Village premises.

1.6 Land ownership

The property under reference (Green Village) is registered under Mr Linus Ndilinondje Amulungu, and the proposed aquaculture and horticulture developments will be established on sections of the allocated land measuring 10.2 hectares in extent which was granted under the customary land rights in Namibia, certificate no: OSHACLB-CLR-016143 (copy of allotment certificate attached). The portion of land is under the traditional authority of Uukwanyama.

1.7 Current land use

The land area in which the proposed development is located in a commonage zone of communal land of multiple land uses which is largely comprised and characterised of low-lying flat area, open and unimproved degraded grassland with few tree species, undergrowth, shrubs, and brush (Figure 17). This also include cultivated land for subsistence; communal grazing land; underutilized, low-density residential area and other communal land enterprises. The community mainly depend on agriculture for subsistence farming i.e., crop cultivation, pig farming, fish farming, poultry rearing, small and large stocks, orchards and vegetable gardens. Therefore, land uses for these particular developments will not conflict with the surrounding land use activities since the proponent is going to engage in projects similar to what is already existing in the neighbourhood.

CHAPTER 2: NEED AND DESIRABILITY

2.1 The goals and objectives of the projects

- The primary objective of the proposed projects is to sustainably develop a vibrant commercial aquaculture and horticulture projects with modern and pioneering agri-food technologies which will enhance food production in an environmentally sustainable manner; generate income and create employment.
- The goal is to raise tilapia to harvestable size quickly, economically, and in good health.
- To maximize aquaculture production by way of synergic interactions with other farming systems on the same piece of land for optimal yield.
- To have a controlled tomato cultivation system that ensures year-round production and the utilization of organic farming methods to produce premium-quality tomatoes.

2.2 The benefits of the projects will be:

- To improve the nutritional status, diet and ensured food security to the community of Okatana by providing source of fish protein through consumption of local fish.
- Capture fisheries or catching fish from the wild can't always fulfil the consumer's demand. In such cases, Green Village will produce grow-out tilapia fish in order to meet the challenges and demands of the domestic fish market.
- The projects will provide employment opportunities to members of the community, particularly those from Okatana constituency. Currently, Green Village employs 5 permanents workers with the possibility of employing more once the projects are in full operation. This offers significant economic benefits.
- The projects will increase local production and supply of fruit and vegetables to the community, and also reduce the overreliance on imported horticulture fresh produce.
- Apart from contributing to national food security and economic development, the project is committed to community engagement, skills transfer and development and mentorship programmes for smallholder farmers who intend to engage in Agri-entrepreneurship and sustainable food value chains in order to maximize the entrepreneurial potential of the horticulture and aquaculture sectors.
- Unlike capture fisheries, aquaculture does not rely on depleting the wild fish as it helps preserve natural ecosystems by reducing fishing pressure on the river systems.

2.3 EIA study objectives for the proposed projects are:

- To identify potential environmental, economic, social and health impacts that may be associated with the proposed projects.
- To gather views and opinions of the general public, key stakeholders and neighbours on the potential impacts of the proposed projects.
- To evaluate environmental and social concerns, sustainability issues and developing mitigation measures and environmental management programmes which will minimise any possible environmental impacts.

2.4 Justification and need for the projects

Aquaculture can be a very productive use of resources, with the amount of food produced per hectare is considerably higher than with arable farming or livestock rearing. Although low in production quantity, fish have a high unit value in terms of nutritional value. Since aquaculture does not require a large space for production, this project represents an excellent opportunity to develop fish farming with other farming enterprises for waste recycling, water conservation and energy-efficient systems and directly benefits from the output/harvest.

As fisheries resources are becoming increasingly vulnerable through over-utilisation and ecological degradation, fish farming is becoming increasingly necessary to maintain supplies to a growing market. This also has been developed in response to a decline in wild fish stocks in Namibia's river systems and an increase in demand for fish in Northern Namibia due to consumers recognising its nutritional value, affordability and good taste.

Moreover, the long-term forecast for the demand for food remains positive, and the demand for fish is expected to continue to rise in the coming decades, driven by population growth, growing cost of buying and consuming red meat, as well as diet-related health inequalities.

Further, to achieve the global fish consumption rate of 21.4 kg per capita, Namibia needs to increase its national consumption rate which is standing at 11.5 kg per capita, and this represents the national deficit in terms of per capita fish consumption. This deficit validates the influence for aquaculture to contribute towards meeting the target. These goals are to be achieved through deliberate policies and plans that are aimed at spurring economic growth, social development and environmental management. This is also contained in various national and regional strategic frameworks on food production.

CHAPTER 3: PROJECT DESCRIPTION

3.1 Production System: Freshwater Aquaculture

The proposed aquaculture production system or method of fish farming for this project is Recirculation Aquaculture System (RAS) or Closed Recirculating Systems (CRS) which is considered and also deemed the most appropriate for high stocking density of fish farming as it also allows for a wide variety of fingerlings to be cultured in an economical manner. By definition it is the culture of aquatic animals and plants under controlled or semi-controlled conditions. This approach uses large plastic tanks that are placed inside high tunnel greenhouse. The water in the plastic tanks is circulated. It is a technology of farming aquatic organisms by reusing the water in production based on the use of mechanical and biological filters as illustrated in Fig 7 below. RAS also minimizes water usage, disease occurrence, acts as a water treatment system, improves feed conversion, and shortens the production cycle.

Overall, RAS is a far better option, with minimal environmental impacts due to its low effluents production. It is a good alternative of tilapia production to pond or cage culture if sufficient water or land is not available and the economics are favourable for water sustainability. This ensures that it can produce very high yields on small parcels of land.

Tilapia grow well at high densities in the confinement of tanks when good water quality is maintained. This is accomplished by aeration and frequent or continuous exchange of water to renew dissolved oxygen (DO) supplies and remove wastes in recirculating system because water will be filtered and recycled back in the system.

Recirculating aquaculture systems have become more economically viable because of advancements in modern technologies that accomplish the required unit processes: solids removal, biological nitrification, oxygenation, and dissolved gas management which also facilitate less new water input to conserve water and minimize wastage in an economically sustainable manner which is also good for the environment in terms of environmental management.

On the other hand, the filtration technology of recirculating systems in tank culture system can be fairly complex and expensive and requires constant and close attention because it relies on continuous aeration or water pumping is at risk of mechanical or electrical failure, therefore, backup systems are essential.

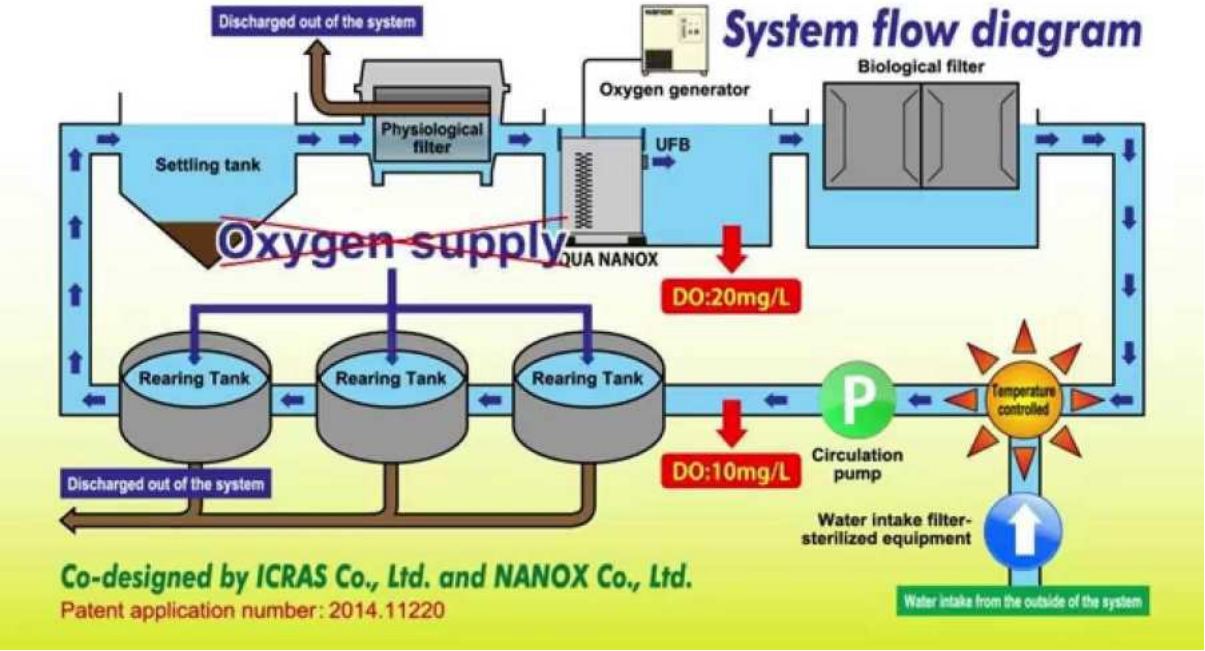

Figure 2: Infrastructure overview - Schematic example of recirculating system

Figure 3: Example of the proposed layout and design of facility within a high tunnel greenhouse

Recirculating systems generally recycle 90 to 99 percent of the culture water daily, and this also requires a clarifier i.e., settling tank to remove solid waste or particulates which is mainly comprised of faeces and uneaten feed, and biofilters to remove toxic waste products such as ammonia and nitrite that are produced by the fish.

3.1.1 Fish species and selection: Three spotted tilapia (Oreochromis andersonii)

The fish species of interest to be cultured which are an indigenous species and also hold the greatest potential and the most suitable fish to culture, well-suited to the local climate based on the distribution indicators in the northern part of Namibia are the Three-spotted tilapia (Oreochromis andersonii). These species are populous because of their health benefits and market demand. They have also increased in popularity due to their high protein, large size and growth capabilities as well as the adaptability to the northern part of Namibia's warm tropical like environment. The project will include a state-of-the-art recirculating system in a greenhouse utilizing environmentally friendly and sustainable practices in ensuring optimal water quality and efficient production through the incorporation of advanced aquaculture technologies for optimal yield.

It takes a life cycle of about six (6) to eight (8) months to get to maturity/table size of about 300-400g when fed adequately and environmental conditions are right. The fish cycle starts from getting the fingerlings of about 5g in size from the market into the tanks, and then feeding them with the various feeds until they are due for harvest and then taken to the market for sale. Fish production target of about 14 tons with an average table/market size of 300 kg per breeding season will be produced. The estimated batch of around 75 000 fingerlings will be stocked using about 48 tanks on 1368 m^2 of land in a greenhouse. This desired species is known to have a high spawning rate, high fertilization rate, and high viability of larvae and is resilient towards fighting off diseases and parasites. They are able to eat many types of foods (commercial e.g., floating or sinking pellets, mainly cereal-based diet such as maize, mahangu, sorghum, soy oil seed cake, soybeans, cotton seed, barley; and natural feed e.g., microalgae, zooplankton, phytoplankton), and don't eat other fish.

Figure 4: Tilapia fingerlings

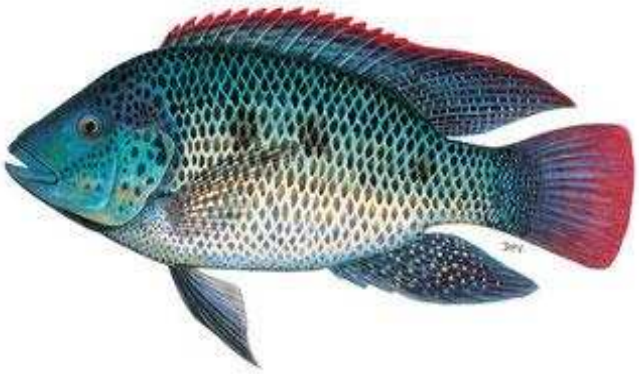

Figure 5: Three spotted tilapia (Oreochromis andersonii)

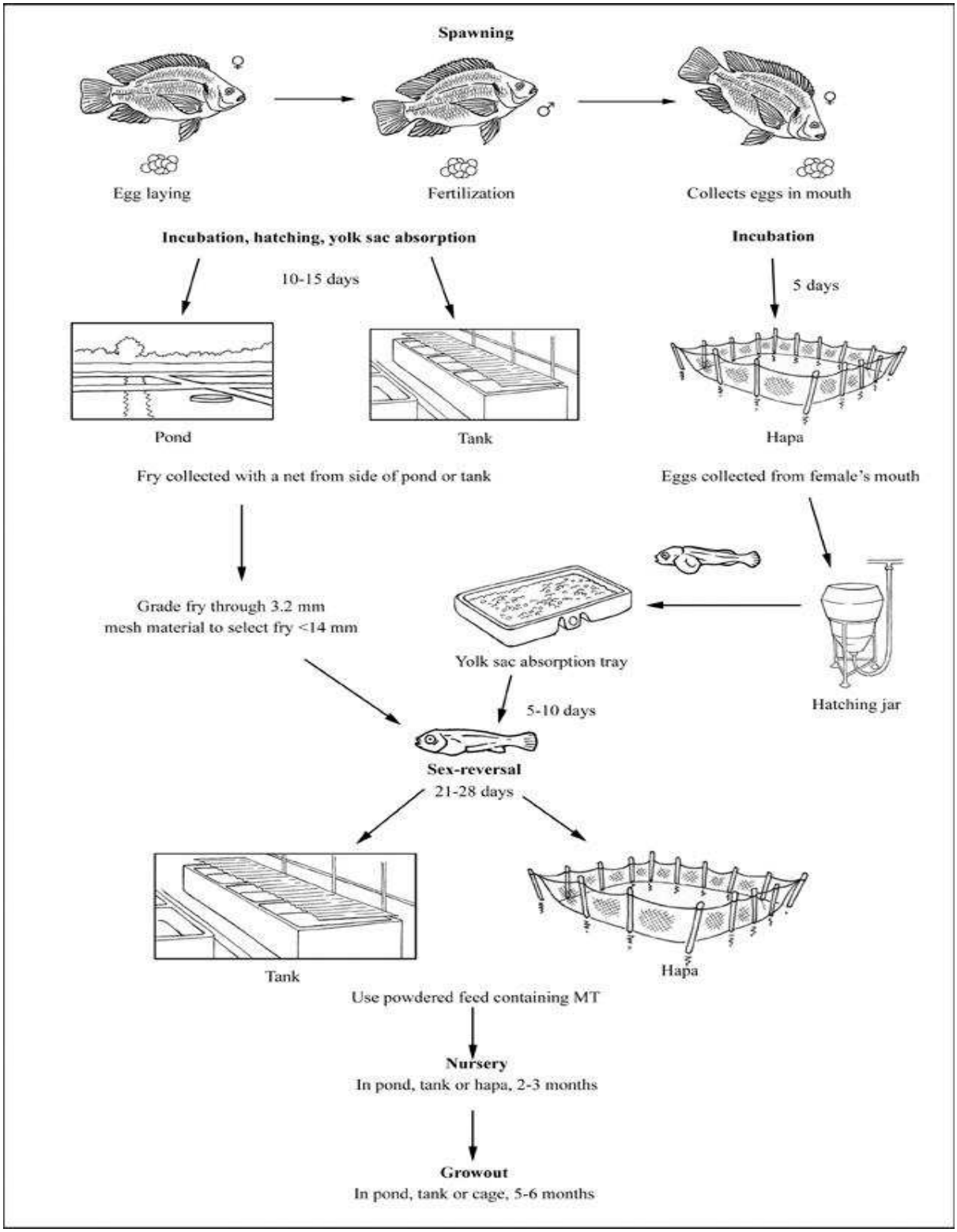

Figure 6: Production cycle of Oreochromis andersonii

Once the male has fertilized the eggs, the female collects the eggs by holding them in her mouth. In the mouth, the Tilapia eggs carry out their incubation process until the yolk sac is absorbed. If the conditions are right, one female tilapia will spawn between 4 weeks to 4 months, depending on the species. Even if the survival rates are very low, just one female will typically produce about 200-1000 eggs per spawn, and she'll spawn every 4-5 weeks if conditions are decent enough in the tank.

Figure 7: Example of growbeds with biofilters and aeration system

Plastic-media biofilters are now being commonly used because they are lightweight and easy to clean. These consist of self-supporting stacks of honeycombed modules, columns or tanks containing loosely packed rings that floats at the water surface and rotates, alternately exposing the media to water and air.

3.1.2 Production and supply of fingerlings

The value chain of fingerlings production is very crucial since fingerlings are the main inputs in fish production. During introduction, Green Village will either stock complete quality fingerlings which will only be available in all MFMR centres around the country of which in the central northern part, the supply centres are Ongwediva IAC in Oshana region, and Onavivi IAC and Epalela Fish Farm in Omusati region. Otherwise, stock male and female brood fish to begin breeding. Within 10 to 20 days after stocking brood fish, newly-hatched fry can be captured at regular intervals to ensures uniformity in size among the fry, and these are transferred to a nursery unit. Alternatively, this is accomplished by capturing each brood fish by hand and its mouth is held open under water to remove any fry, sac fry, or eggs that it maybe incubating (extraction), and these fries are moved to the nursery tanks while the sac fry and eggs are placed in hatchery jars. The fingerlings will initially be conditioned in tanks to monitor their performance and check for mortalities and to ensure that only those with good qualities are stocked after grading them before delivering them to the grow-out facility. Water parameters like Dissolved Oxygen (DO), PH and Temperature will be checked daily using a water checker and results recorded. Others like salinity will be measured seasonally. Tasks include testing, sorting, weighing, and several maintenance jobs up to harvesting stage.

3.1.3 Fish feed production

Since tilapia have limited access to natural foods in tanks, they must be fed a complete diet containing protein, carbohydrates, vitamins and minerals. Various feeds are used by fish farmers in Namibia, ranging from mash or powdered feed for fries; crumbles/juvenile pellets for fingerlings, and sinking and extruded floating feeds for adult fish. A small quantity of feed is also manufactured at the government facility i.e., fish feed plant under MFMR at Onavivi IAC in Omusati region.

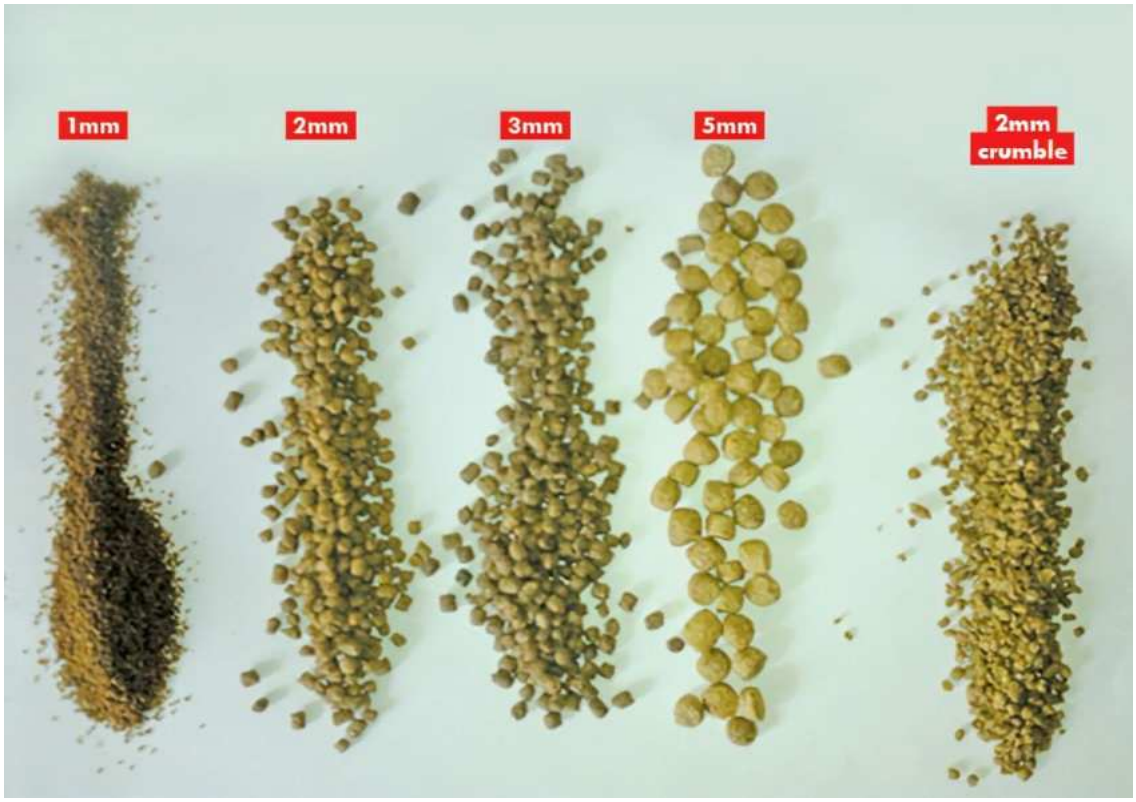

Figure 8: High protein dry feed for tilapia species: 1 - 5mm fish feeds

A variety of fish feed are readily available in the market. They come in many different shapes and sizes e.g., mash/ powdered feed, flour for fry; various sized crumbles or pellets for fingerlings, and pellets (floating or sinking) for adults and broodstock. Others include sticks, tablets, granules, dough or ball form. However, not all fish feed may be suitable for every fish species. It is therefore important to recognize the details about fish feed formulation, feed types, feeding pattern, feed conversion, and feed must be able to provide all of the required nutrients.

3.2 Production System: Horticulture - Vegetable and Fruit Production

Horticulture is the branch of plant agriculture dealing with garden crops, generally fruits, vegetables, flowers, or ornamental plants. Horticulture production plays an important role in socio-economic development as it alleviates unemployment by creating jobs to the communities especially many youths who can hardly find jobs. It is also playing an important role in addressing diet-related health inequalities by promoting high-quality diets.

3.2.1 Description of the project goals. The goal of the garden crops project is to provide ecologically clean vegetables and fruits to the surrounding communities while raising a reasonable income for the project especially during off season. The proposed project will be designed as a small to medium size horticultural growing which will include a greenhouse-based tomato cultivation system on an area of land measuring 0.2 hectares and fruits farming unit, spreading over a land area of 0.3 hectares. Vegetables and fruits proposed to be grown under this category will be a mix of farm fresh vegetables, such as, tomatoes, cabbage - gloria variety, hot and green pepper, and will be cultivated using drip irrigation system for water conservation. The cultivation will also include about 180 trees of Mango, Orange and Lemon.

3.2.2 Production factors for consideration: For horticultural growing, the following should be given proper attention: **(i)** ***climate*** since these crops thrive at temperatures of 23°C - 25°C. Green village has a temperate climate, with hot summers and mild to cold winters. This means that a wide variety of vegetables, including both cool weather and warm weather vegetables can be planted. The next thing to consider is the **(ii)** ***soil***. The site has rich soils, which are ideal for growing vegetables. However, some additions of organic inputs such as green manure to the soil to improve its fertility and water retention will be done. The waste from the fish will also serve as nutrients to the crops and this is minimizing the possible impacts of waste accumulation. The other thing to consider is **(iii)** ***water*** of which will be supplied using drip irrigation system for water conservation. Aquaculture and horticulture will be complimentary with each other in the sense that water from the aquaculture will be recycled to irrigate the horticultural growing. The next attention when planting a vegetable garden is the amount of **(iv)** ***sunlight*** the garden receives. The site receives a lot of sunlight, which is perfect for growing vegetables. The other important consideration is the protection from the **(v)** ***pests and diseases*** by using pesticides/sprays of chemicals, and trimming as well as the greenhouse.

Tomatoes and green pepper seeds will be planted in seedling trays first prior to being transferred to the growbeds (at two-leaf stage), as this has yielded greater success. The pepper and tomato seeds for each node will require 4 seedling trays per meter using 200 seeds per tray. Therefore a 16-tray nursery area has been allocated to each node for the propagation of these seeds to be planted in that node. Production period will be 16 weeks per batch grown.

3.2.3 Environmental sustainability

The project is likely to: Encourage integrated plant nutrition systems by combining mineral fertilizers with organic inputs such as farm yard or green manure. Increase the efficiency of organic fertilizer use while limiting environmental pollution. Limit chemical fertilizer applications to maximum effective rates taking into account the predominant cropping system, soil conditions, and other intensification factors by promoting the use of biological nitrogen fixation or other processes that might reduce fertilizer requirements. Protect areas or water bodies and other sources of freshwater from possible contamination of applications.

3.2.4 Production process of tomato cultivation

The following production flow is based on the production of tomatoes which is the primary crop. However, this can also be applied to other vegetable crops:

- Sowing of seeds in a separate plot of land for nursery.
- Preparation of seed beds in the field for cultivation of vegetables.
- Using organic fertilizer in the soil to maintain its fertility.
- Transplantation of nursery in the soil or sowing of seeds directly in the soil.
- Maintaining level of moisture in the soil through irrigation.
- Protection from the pests, diseases and other wild growths by using pesticides/sprays of chemicals, and trimming.
- Using fertilizer of different varieties for the smooth growth of plantation.
- Picking/harvesting at various times as per nature/requirement of the plantation.
- Grading of crop on the basis of quality and other standards.
- Application of post harvesting technology for picking/plucking, packing and storing the vegetables in order to fetch the maximum price.
- Transportation to the sale points in local or export markets.

Figure 9: Greenhouse-based tomato cultivation system

Figure 10: Tomato harvest at Green Village

Figure 11: Cabbage & green peppers at Green Village

Figure 12: Fruit related crops at Green Village

It is estimated that the production output of tomatoes of 6.6 tons per season will be realised; 5.4 tons of 1269 cabbage pieces per season with an average of 4.5 kg per head will harvested, and 1.2 tons of green peppers.

3.3 Service Infrastructures and Facilities

3.3.1 Water Supply and Water Quality Requirements: Water from NamWater line which is already installed on site will be used during construction and operation phases. Additional water supply for the projects will be tapped or abstracted from the excavation dam (dugout) that is located at the site through water supply pipeline (Figure 13 & 14). The water would then be treated, placed in settling tanks and filtered before being pumped to the facility. The water supplied to the aquaculture facility will require regular testing. The most critical water quality parameters to monitor are dissolved oxygen, temperature, pH and ammonia, nitrate and nitrite. Therefore, a water quality monitoring programme will need to be established.

Table 2: Water Quality Tolerance for Tilapia Species

Species	Temp °C	Dissolved Oxygen mg/L	pH	Alkalinity mg/L	Ammonia %	Nitrite mg/L
Tilapia	28-30	3-10	6-8	50-250	0-0.03	0-0.6

Figure 13: Excavation dam (dugout) on site

Figure 14: Overhead water storage tanks at the site

3.3.2 Electrical system: Connection to NORED's electricity grid will be used in the operations of the projects. Plans of using renewable resource (solar energy) are also underway.

3.3.3 Sewerage / Waste Water and Storm Water Management: The proposed developments will be provided with facilities for drainage of storm water into the drainage channels and out into the natural drainage channel/system. Waste water and sewage generated from each compartment of the facility units will be channelled and discharged into the sewer line. It will also include compartments for filter system and wastewater treatment or removal.

3.3.4 Solid Waste Management: Green Village will provide facilities for handling solid waste generated within the facility. These will include dust bins/skips for temporarily holding waste within the premises before final disposal at the designated dumping site in the area. Some waste will be composited accordingly, and some will be palletized or re-cycled depending on the national waste management strategy to be adopted in line with the Environmental Management Act of 2007 and its Regulations.

3.3.5 Buildings and facilities: These developments are also expected to include facilities for brood stock, hatchery, grow out, slaughtering or processing, and small support facilities such as workplace, laboratory, workshop, guard house, storerooms, cold storage, feed stores and ablution facilities. The Greenhouses will have adequate natural ventilation through provision of permanent vents, adequate natural and artificial light, floor, piped water and other amenities.

3.3.6 Security: A guardhouse will be established for safety and security which will be manned by security personnel.

3.3.7 Perimeter Fence: The project area is fenced off to limit unauthorised entry of public access and animals. Access to the area is strictly controlled through a locked gate to prevent access to the facility (Figure 15).

Figure 15: Perimeter fence with lockable gate

Figure 16: Perimeter fence (rear view)

CHAPTER 4: LEGAL AND POLICY FRAMEWORK

4.1 Policy, Legal and Legislative Framework and Guidelines

Table 3: Policy, Legal and Legislative Framework and Guidelines Referenced to the Proposed Projects

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
The Constitution of the Republic of Namibia, 1990.	– Article 95 (l) of the constitution of Namibia provides a legal and institutional framework for managing common property resources, maintenance of ecosystems, biological diversity and Namibia's essential ecological processes as well as human right issues to guide the Government in making laws which can govern all national resources of the country.	– GRN (all government ministries, public and private sector). – Organizations and Agencies. – General public.	– Greater recognition of customary rights under Article 66 of the Constitution. – For the general public to freely fulfill and engage in activities, investment and development that are aimed at spurring sustainable economic, social and environmental development. – It is the fundamental right of every citizen to freedom of speech and access to information in decision making process especially for adequate and appropriate consultation and public participation with all interested and affected parties in development.
Namibia's Vision 2030.	– Long-term vision and strategy to transform Namibia to a globally competitive and industrialized country in term of development.	– GRN (all government ministries, public and private sector). – Organizations and Agencies. – General public.	– In order for Vision 2030 objectives to be realized, Namibia has developed a series of successive NDP's, including deliberate policies and plans that are aimed at guiding the country in the attainment of long-term developmental objectives.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
NDPs.	– Defines medium-term and long-term national sustainable development objectives to the agricultural and aquaculture sector in Namibia.	– Organizations, Ministries, Agencies (O/M/As) – Public and private sector – General public.	– Identifies the importance of agriculture and aquaculture as a food security and economic empowerment strategy. – All plans have to promote the sustainable economic, social and environmental development including utilisation of natural resources and the protection of ecosystems.
Namibia's Aquaculture Policy, 2001.	– The policy provides the guiding principles, objectives and strategies for responsible and sustainable aquaculture development and establishes the legislative, administrative and institutional arrangements to achieve socio-economic benefits and environmental sustainability for the sector.	– MFMR – Food and Agricultural Organisation (FAO).	– The policy obligates GRN to promote and regulate responsible and sustainable development and management of aquaculture. – Provides for the maintenance of genetic diversity and integrity of Namibia's ecosystems. – Promotes responsible aquaculture production practices for participants in the sector e.g., to carefully consider the impact of any activity, project or development on the environment i.e., aquaculture activities. – Provides food safety and food quality guidelines for fisheries and aquaculture products. – Development of master plan for aquaculture, creation of enabling environment for aquaculture investment, development of infrastructure and support services. – Identifies the challenges and opportunities for aquaculture development including monitoring and evaluation of the sector.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
Aquaculture Act 2002 (Act no.18 of 2002).	– The Act provides legal framework to regulate and control aquaculture activities for sustainable development of aquaculture resources. – The Act also gives provision to the foundation for licensing and regulating aquaculture establishments, implementing management and control measures, aquaculture development zones and law enforcement stipulations.	– MFMR – FAO	– Section 11 of the Act under licensing provisions states: *"Aquaculture to be conducted only with a licence''. A person may not engage in aquaculture -* *(a) without a licence issued by the Minister in terms of section 13.* Section 25 (1) of the Act under: *Management and control measures: Report of disease or harmful organism, states: "Any licensee or other person engaged in aquaculture shall immediately report to the PS or an inspector the presence of any disease or harmful organism in an aquaculture facility''.* – The Act further provides for *water quality monitoring; introduction and transfer of aquatic organisms; import and export of live aquatic organisms; handling and marketing of aquaculture products including fish feed; offences and penalties; fish culture practices and for inspecting fisheries and aquaculture products* to ensure they meet accepted food safety and food quality standards. – Determine whether the applicant is required to submit an EIA of the proposed aquaculture project. Where an EIA is required under the Act, the Minister of Fisheries may not issue a licence unless satisfied that an environmental clearance for the project has been issued in accordance with EMA.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
National Aquaculture Strategic Plan 2020 - 2030.	– The NASP provides strategic guidance for the sector's planning and development including guidance on the regulatory framework, business climate, public acceptability and strategies to ensure training, research, marketing and infrastructure development.	– MFMR	– Strategy and development objectives. – Promotes best practices in aquaculture. – Outlines the vision, mission, strategic objectives, challenges, opportunities, and various interventions that MFMR will undertake to drive the agricultural sector. – Promotes enhancement of access to affordable and quality inputs including seed, feed, fertiliser, and genetic resources.
Namibian (Freshwater) Aquaculture Masterplan (2023-2027)	– This provides a roadmap in the creation of enabling environment for aquaculture investment, development of infrastructure and support services including inputs such as seed and feed, capacity building and training, and development of centres of excellence for research, training and demonstration.	– MFMR	– Identifies importance of community participation in aquaculture, capture fisheries resource management, value addition and marketing. – Identifies need to develop and invest in aquaculture facilities and infrastructures at household and institutional level. – Addressing identified challenges and considerations for promoting freshwater aquaculture development.
Aquaculture Licensing Regulations (2003)	– The regulations provide a framework for aquaculture license applications, maintenance of records and reports; health management for aquaculture facilities; disease outbreak within Namibian waters and measures for protecting the aquatic environment.	– MFMR	Provides for the establishment of regulations and schedules for: – Licensing provisions; records and reports; health management in aquaculture facilities; control of disease outbreaks within Namibian waters and aquaculture facilities; protection of the aquatic environment e.g., release and escape of aquaculture products, discharge of waste and introduction and transfer of aquatic organisms; offences and penalties. – The control of aquaculture inputs & outputs.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
Aquaculture Import and Export Regulations (2010).	– Regulations relates to the control of fisheries and aquaculture products, and fish feed to ensure they meet accepted food safety and food quality standards.	– MFMR	– Provides food safety and food quality guidelines for fisheries and aquaculture products. – Record keeping and batch identification. – Minimum monitoring requirements for the internal control system. – Conditions for export and import of fish, fishery products and fish feed.
Namibia's Blue Economy Policy (2019).	– The policy provides for a need to reorient the ocean and inland water activities for sustainable economic development for all Namibians.	– MFMR	– Systematic assessment and coordination in terms of the natural and other resources and the economic development potential of the region including land and other resource utilisation pattern, alternatives for land use and adopt the best land-use options.
Environmental Management Act (Act No. 7 of 2007).	– The Environmental Management Act (2007) provides the legal and institutional framework for sustainable management and use of the environment and natural resources. There shall be prior environmental assessment of projects and proposals that may significantly affect the environment or use of natural resources.	– MEFT – MFMR – IAPs	– The Environment Management Act seeks to ensure that the environmental consequences of development projects and policies are considered, understood, and incorporated into the planning process. – Establishing principles for decision-making, public participation and consultation on matters affecting the environment and ensuring that all activities, such as agricultural and aquaculture activities are undertaken with an Environmental Clearance Certificate (ECC) including EMPr to safeguard the environment & its people. – The Act contains a schedule of listed activities for which an ECC must be acquired for before the project may go ahead, unless exemption is obtained from the Minister.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
EIA Regulations (Government Notice No: 30, 2012)	– Provide guidelines and administrative procedures for conducting EIAs in Namibia according to the Environmental Management Act, 2007 (EMA).	– MEFT – MFMR	Provides guidelines for conducting EIA and subsequent approvals of ECC for freshwater fish farming and horticultural activities: – EIA process and screening of activities. – Public consultation process. – Format of an EIA study report. – EIA study and approval process. – Appeals. – Environmental monitoring and audit processes. – Fines.
Pollution Control and Waste Management Bill of 1999.	– Prevention and regulation of air, water and land pollutants. – Establishment of an appropriate framework for integrated pollution prevention and control.	– MEFT – MHSS – MFMR	– Regulation of noise, dust and odour, as well as an establishment of a system of waste planning and management. – No person shall cause or permit the discharge of pollutants or waste into any water or watercourse. – Under the aquaculture Act, section 11 (a), before making a decision on aquaculture application, the Minister may consider whether the granting of a licence will create a risk of pollution or adversely affect the environment by looking at the annual quantity and composition of effluent to be discharged from the aquaculture facility.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
National Solid Waste Management Strategy, 2018.	– To strengthen the institutional, and legal framework for solid waste management. – To install a widespread culture of waste minimisation and to expand recycling systems. – To implement formalised solid waste collection and management systems in all populated areas, including under the administration of RCs.	– MEFT – MFMR – MHSS	Controlling, monitoring and preventing waste at the project site through: – Waste prevention and minimization. – Waste recycling and re-use through the use of clean technologies. – Waste treatment e.g., sewage sludge can be treated and used as commercial fertilizer/compost for gardening. – Waste disposal - e.g., composting of garden refuse.
The Communal Land Reform Act (No. 5 of 2002).	– The Act provides for the establishment of communal land boards (CLBs), and places communal land under the administration of the CLBs and traditional authorities (TAs).	– MAWLR – CLBs – TAs – RDCC – CDCs – VDC	– *Chapter IV of the Communal Land Reform Act, 2002 (Act No. 5, 2002):* under Allocation of rights in respect of communal land makes provision for various forms of land rights: customary land grants; leasehold; licences, certificates or permits; and State ownership for the use of communal land primarily for residential, farming, business purposes, including tourism activities e.g., lodges. – Customary land rights for farming and residential will have to be allocated by a chief or traditional authority (TA), but must be ratified by the land board, which will then register the grant. It is based on these premise that ownership or the customary land right for Green Village was allocated.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
Traditional Authority Act (No. 25 of 2000).	– The Act indicates that traditional authorities shall ensure that the members of their traditional community use the natural resources at their disposal on a sustainable basis and in a manner that conserves the environment and maintains the ecosystems, for the benefit of all Namibians.	– TAs (Uukwanyama) – Oshana Communal Land Board (CLB)	– Under this act, TAs control access to land in communal areas, give recommendations on land issues in areas of their jurisdiction and consider customary land rights application for any farming land and residential land or any leasehold applications for business, before the land board grants final approval. – TAs also resolve social conflicts within their communities regarding land & social issues.
The Regional Councils Amendment Act of 2002 (Act No. 12 of 2002).	In terms of the Act, regional councils are given powers to develop and manage plans regarding the following: – The physical, social and economic characteristics of the region. – The natural and the economic development potential of the region e.g., infrastructure in the region such as water, energy, communication networks and transport systems. – The general land utilisation pattern.	– Oshana Regional Council (RDCC; CDC; VDC) – Oshana Communal Land Board (CLB)	– Responsible for socio-economic development planning and for the administration of settlement areas and communities in areas outside the municipalities, towns and villages. – Coordination in terms of the natural and other resources and the economic development potential of the region including land utilisation pattern and allocation.
The National Agricultural Policy of 1995	– The Act focuses on the need to increase agricultural productivity and ensure food security, create employment opportunities and alleviate poverty and improve the living standards of the people, especially in rural areas.	– MAWLR	– Identifies the importance of agriculture and aquaculture as a food security strategy. – The framework envisage that agriculture and aquaculture become a thriving industry that will contribute to the social and economic benefits of the Namibian people.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
The Water Resources Management Act (No. 24 of 2004)	– The act ensures that Namibia's water resources are managed, protected, conserved and used in a sustainable and responsible manner in addressing the increasing challenges posed by the demand and supply of the resource.	– MAWLR – NamWater	– Provides guidelines for the use of water; and provides requirements and procedures for water use permits. – The Act allows any person to use water for personal domestic use without seeking a license or permit. Extraction of water for any other use requires a license, including extraction to sell or otherwise provide to others for their domestic use. – An application for a licence under this act may be issued as a combined licence to abstract and use water and to discharge effluent. – Prevention of water pollution. – To promote sustainable and efficient use of water for production purposes for attainment of national cultural and socio-economic development aspirations.
Labour Act, 6 of 1992: Regulations for the Health and Safety of Employees at Work.	– The Act under the Ministry of Labour, Industrial Relations and Employment Creation (MLIREC), provides for the safety, health and welfare of workers.	– MLIREC	– The importance of the Act lies in its regulations which will be relevant to the proposed activities at Green Village. These will include: Health and safety procedures, general conditions of welfare and facilities, protective equipments, physical hazards, first aid and emergency arrangements etc. – The Act also requires that employers must ensure that their activities do not expose non-employees to health hazards.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
Public and Environmental Health Act, 2015	To provide a framework for a structured uniform public and environmental health system in Namibia. These include: – Promote public health and wellbeing. – Prevent injuries, diseases and disabilities. – Protect individuals and communities from public health risks. – Encourage community participation in order to create a healthy environment. – Provide for early detection of diseases and public health risks.	– MHSS	– The use of aquafeeds, chemical fertilizers, pesticides, herbicides, growth hormones, antibiotics etc. in horticulture and aquaculture production shall be consonant with the discharge requirements stipulated by relevant legislation and the health requirements of the relevant Acts. – Farm effluents entering inland aquatic and terrestrial environments shall be monitored and controlled through treating and safely disposing of waste at the village. – Choose the active ingredient that degrades the quickest in soil and water. – Whenever possible, use an active ingredient that is only effective against the primary pest.
Nature Conservation Ordinance, 1975 (No. 4 of 1975).	– This is the act that contains regulations related to wildlife and park management issues in Namibia. This ensures the protection and management of protected areas, the management of wildlife and the conservation of biological diversity.	– MEFT	– Identifies the need for integrated ecosystem management plan. This ensures for wildlife management, conservation of biodiversity, and that communities should co-exist with wildlife. Capture or injuries to wildlife should not be allowed. Any sighting, discovery or findings of wildlife should be reported to MEFT.
Revised National Policy on Human-Wildlife Conflict Management, 2018-2027.	– The policy is aimed at providing a framework for addressing human-wildlife conflict efficiently and effectively in order to promote both biodiversity conservation as well as human development.	– MEFT	– To develop a standardized monitoring system for human-wildlife conflict management. – To establish best practice mitigation measures for human-wildlife conflict management with regard to damages caused by wildlife. – To develop innovative mechanisms to

			reduce the level of human-wildlife conflict. – To provide clarity on the question of compensation regarding damages (crop, vegetation, livestock, property and loss of human life and injuries) caused by wildlife.
Legislation	**Description**	**Organisation/Stakeholder**	**Role in Aquaculture and/or Horticulture**
Soil Conservation Act, 76 of 1969.	– The Act makes provision for the prevention, combating and control of soil erosion and the protection, improvement and conservation of soil, vegetation and water supply sources and resources.	– MAWLR	– The project should prevent soil erosion, pollution, ecological degradation and contamination during construction and operation. – Unpaved roads around the facilities should not contribute to erosion. – Create and maintain soil traps and embankments. – Landscaping after completion of construction. Plant more tress and have small gardens around facilities.
The Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947).	– The legislation governs the registration, importation, sale, and use of agricultural products to ensure their safety and efficacy.	– MAWLR	– Provides guidelines on the safe use of agricultural chemicals e.g., pesticides, fertilizers, herbicides etc. These include proper registration, labeling, packaging, and usage to comply with safety standards in horticulture production, and this must be consonant with the requirements stipulated under this Act for the public health and environmental requirements. – Whenever possible, use an active ingredient that is only effective against the primary pest. – Choose the active ingredient that degrades the quickest in soil and water.

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
Plant Quarantine Act 7 of 2008.	– Regulations relating to issuing of import permits, examination of imported plants, diseases or Insects, and lodging of appeals.	– MAWLR	– To provide for the preventing, monitoring, controlling and eradication of plant pests. – To facilitate the movement of plants, plant products and other regulated articles within and into or out of Namibia. – To provide for the inspections, treatments and certification of the phytosanitary standards of plants and plant products exported from Namibia.
Animal Health Act, 2011 (Act 1 of 2011).	– This provides for the prevention, detection, management and control of animal diseases. – To provide for the maintenance and improvement of animal health.	– MAWLR – MFMR	– Provides guidelines for management of fish disease outbreaks and the use of veterinary supplements/medical medicines. – *Section 7 (1) of the Act regulates the importation of animals, animal products and restricted material for entry into Namibia through permitting system in order to control the spread of animal diseases. These also include live freshwater aquatic organisms.* – *Section 15 (1); (a) and (b) of the Act states that ''An owner of an animal who knows or has reason to suspect that the animal is infected with a disease must - take all reasonable steps to isolate the infected animal; to prevent the spread of the disease and appropriate treatment. Further, the owner must immediately notify a veterinary official of that incidence or suspected incidence.* – *The Act under Section 18 (1) and (2), gives the Chief Veterinarian to declare, any place or area to be a quarantine area on account of the presence or suspected presence in that place or area of a disease specified in the notice.*

Legislation	Description	Organisation/Stakeholder	Role in Aquaculture and/or Horticulture
National Heritage Act, 27 of 2004.	– Namibia's movable and immovable cultural and natural heritage, including its biodiversity, shall be protected and respected for the benefit of current and future generations. – Extends the protection of archaeological/ historical sites to private and communal land and defines permit procedures regarding activities at such sites. – Enables the proclamation of national monuments and protects archaeological sites.	– National Heritage Council of Namibia (NHC). – Ministry of Education, Arts and Culture. – National Museum of Namibia.	– Adequate consideration for the location of identified sensitive heritage sites and paleontological findings should be preserved, recorded, reported and handled in a proper manner. – Should any person discover archaeological or paleontological objects or material (e.g., artefacts, human remains etc.) in the course of development, work must stop immediately for investigation and must report immediately to the relevant authorities responsible for heritage resources or alternatively to local authority offices, police, TAs, which must notify such heritage resources to authority.
Hazardous Substances Ordinance, 14 of 1974, and its amendments.	– Control of toxic substances (including manufacture, use, disposal, import and export). – Provides for the prevention of dumping of hazardous matter that may be detrimental to the environment.	– MHSS – MEFT – MLIREC	– Appropriate storage and handling of hazardous substances is required for the operation and day to day site activities. – All hazardous materials used at the site should be disposed of according to the health and safety regulations.
National Policy on Climate Change, 2011.	– Aims to strengthen national capacities to reduce climate change risk and build resilience for any climate change shocks, the guiding principles to climate change that are effective, efficient and practical, as well as identifies priority action areas for adaptation and mitigation.	– MEFT – MFMR – RC	– The environmental management framework is applicable to aquaculture which is viewed as a sector that holds mitigation potential as a response to climate change for riverine and coastal communities.

Table 4: Roles and responsibilities of stakeholders in the management of Green Village

Organisation/stakeholder	Jurisdiction and relevance to the proposed project
Ministry of Fisheries and Marine Resources (MFMR)	<u>Regulates and Promotes Aquaculture:</u> – Provides enabling environment for aquaculture development and investment. – Provide technical assistance and extension services including agro-inputs such as seed and feed as well as support services across the industry value chain. – Health management and control of aquaculture disease outbreaks within Namibian waters and aquaculture facilities. – Capacity building and training, and development of centres of excellence for research, training and demonstration. – Licensing provisions and permitting system. – Monitoring and evaluation of fish farming projects.
Ministry of Environment, Forestry and Tourism (MEFT)	<u>Responsible for Environmental Management:</u> – Granting of Environmental Clearance Certificate under EMA. – Waste management. – Environmental monitoring and audit. – Gives technical support in sustainable management and use of the environment and natural resources.
Ministry of Agriculture, Water and Land Reform (MAWLR)	<u>Responsible for the Development, Promotion and Management of Agriculture, Water, Land, Soil and Forestry Resources:</u> – Agricultural production and technical support for food security. – Administration and management of communal land. – Conserves soil and water resources, maintains biodiversity, and forests. – Provision of veterinary services, extension and training. – Provides guidelines for management of fish disease outbreaks. – Regulates, controls and provides guidelines for the use of chemicals i.e., fertilizers, pesticides and herbicides in agricultural production.
Ministry of Health and Social Services (MHSS)	<u>Regulating air quality and hazardous substances:</u> – Dust emissions – Regulating air quality & hazardous substances.

Organisation/stakeholder	Jurisdiction and relevance to the proposed project
Oshana Communal Land Board	Management and Administration of Communal Land: – The Regional Communal Land Board grants, record, and cancel land rights in consultation with the traditional authorities e.g., chiefs, headmen. – Responsible for allocation of leases within communal areas. – Deals with land administration within communal areas.
Traditional Authority - TAs	Management and Administration of Traditional Matters and Communal Land: – Obligation to advise, manage conflict and ensure observation of customary law to assist GRN with development of land-use plans and ensure that communities are using natural resources in a sustainable fashion.
Oshana Regional Council	Plans and Coordinates Regional Development: – Responsible for socio-economic development and administration of areas and communities in areas outside the municipalities, towns and villages in Oshana region. – Coordinates the use of the natural and other resources and the economic development potential of the region including land utilisation pattern and allocation.
Local and Regional Development structures (e.g., VDC, CDC and RDCC)	Planning, Development and Reporting Back: – Responsible for development planning and coordination at village, constituency and at regional levels.
Ministry of Labour (MLIREC)	Health and Safety of Workers: – Workers' health and safety issues. – Worker's welfares. – Labour issues.
Ministry of Education, Arts and Culture together with the National Heritage Council of Namibia (NHC).	Protects and Regulates Cultural, Heritage, Historic, and Paleontological Resources: – Protects Namibia's movable and immovable cultural and natural heritage, including its biodiversity. – Responsible for historic preservation. – Protection and regulations of archaeological, and historical sites, paleontological objects or material in private and communal land and defines permit procedures regarding activities at such sites.

Organisation/stakeholder	Jurisdiction and relevance to the proposed project
Residents of the Village, Constituency, Region.	– Participating in the planning and decision-making processes and matters affecting their inhabited land and their environment according to the consolidative and bottom-up approach of land use planning and ensuring that all activities, such as land use planning, resources utilisation and allocation, agricultural and aquaculture activities are carefully considered to safeguard their environment.
Green Village	Responsible for representing the interests and vision of the project and serve as a voice on economic, social and environmental aspects: These are: – To sustainably manage the project, to negotiate business deals and joint ventures, make sure that planned activities are implemented, control finances, monitor and evaluate activities, hold meetings and many other activities as stipulated in their business plan.
NGOs	– Provide technical assistance and support across the industry value chain. – Provide capacity building on aquaculture and horticulture. – Provide inputs to policies related to agriculture and aquaculture sectors.
Commercial Banks and Funders	– Provide credit facilities/financial assistance.
Private Sector	– Supply agro-inputs to farmers and services across the industry value chain.
Donors and Stewardship Groups	– May provide funds and technical assistance.

CHAPTER 5: DESCRIPTION OF THE ENVIRONMENT

5.1 Description of the environment and baseline information of the study area

Green Village is located at Omayanga Village within the Okatana constituency in the Oshana Region. The village is under the Oukwanyama traditional authority and characterized as a rural setting in a communal area where rain fed subsistence farming is the main activity.

5.2 Biological Environment

Omayanga village has domesticated animals where farmers own livestock such as cattle, goats, sheep, donkeys, chickens, pigs. The vegetation cover consists of trees species, bushes (mainly Acacia species) and open grassland: (Acacia erioloba), mopane (Colophospermum mopane), the bird plum (Berchemia discolor), marula (Sclerocarya birrea), and jackal berry (Diospyros messipiliformis) tree. Although they are not listed as endangered or vulnerable, these trees species are classified as protected species.

Figure 17: Overview of vegetation type

5.3 Climatic conditions

The trends of farming are naturally synced with the climatic conditions where rainfall ranges from 400mm to 500mm. The rain fed agricultural activities depends on this rainfall which clarifies when there's minimal harvest accounted for by low rainfall. Temperatures can be as high as above 40°C in summer and as low as below 0 °C in winter however the majority of the time during any year sunshine is visible. Wind flows are on its peak during mid-year.

5.4 Topography and landscape

The name 'Oshana' is in the Oshiwambo language and translates to an open plain. This nature explains the flooding occurring within this region and Omayanga village is not an exception. The region forms part of the Cuvelai route where water flows to the Etosha pan in the Etosha National Park. Floods come with an opportunity for fishing where the tilapia and catfish are the most common fish within the flood plains.

5.5 Socio economic environment

The overall population of Okatana Constituency is recorded to be 19974 according to the latest 2023 census by the Namibia Statistics Agency. Every household is involved in subsistence farming, pearl millet which is locally known as Mahangu is the staple crop and main crop produced. Owed to the rural setting, economic activities in most of the villages are neutral and limited. The usual business activities being ownership of cuca shops where alcohol, traditional brews, snacks and relish are being sold. In addition, on a monthly basis some local entrepreneurs take the opportunity to sell at pension collecting points. These entrepreneurs sell products ranging from clothes, value added products from indigenous flora within their community such as marula oil, marula juice, bird plum fruits and traditional brews. Farmers also sell crop harvests which include; pearl millet, bambara nuts, maize, cow peas or sorghum.

Employment opportunities within the village ranges from housekeeping and weeding in crop fields during the rainy season. Young men also have a chance of securing livestock herding job opportunities or casual tenders of making bricks or fencing among other activities. This project not only comes with employment opportunities but also with fish supply to local people who previously had to get to town to source this type of fish.

CHAPTER 6: IMPACT ASSESSMENT METHODOLOGY AND ANALYSIS OF ALTERNATIVES

6.1 Environmental Screening

This is usually the first stage at which applications are filtered by the environmental authority (MEFT-DEA) and a decision is determined: if EIA, or what level of EIA is required; or if no EIA is required. Environmental screening was carried out to determine whether an EIA study is necessary for these projects and at what level of evaluation as per the requirements of the Environmental Management Act, 2007. Under screening, most countries apply thresholds which may include area, production level, intensity, technology, or species. For example:

- The applications which carry the most risk (large scale, the most intensive culture methods or location in a sensitive area) are usually liable to undertake a full in-depth EIA. In some cases, EIA is triggered by specific characteristics, such as introduction of alien species.
- Medium scale enterprises may have to undergo a limited assessment before being given environmental approval.
- Smaller projects, developments, enterprises are usually exempted unless otherwise.

6.2 Environmental Scoping

The process consists of a desktop review, site visits, on-site analysis, public participation process, submission of the application form and the scoping reports (draft and final report). The use of risk assessment as well as standard rating scales at this stage is required to quantifying the identified possible impacts, especially those that might have the highest risk or environmental impacts of great concern. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects. This included the assessment of the proposed projects in respect of but not limited to:

- **Project Background:** this gives the brief history of the proposed project site and area, project description, the parties involved and justification of the projects in terms of demand, relevant policy and legislation, identification of any associated project, or any planned projects within that specific area which may compete for the same resources, description of current land use of the project area, layout, project size and production.

- **The proposed project objectives:** both in the short and long run, and how they are linked to the overall objectives.
- **Present environmental conditions:** description of the project site, ecological zoning as well as the state of the environment and its surroundings e.g., identification and prediction of the magnitude of eventual impacts that are undertaken against an environmental baseline.
- **Identification of environmental impacts:** the report distinguishes between significant positive and negative impacts, direct and indirect impacts, low and high impacts, immediate and long-term impacts, localised or impacts on the national scale, the likelihood of these impacts occurring and those which are unavoidable and/or irreversible.
- **Analysis of the alternatives to the proposed projects:** this involved description of alternatives and identifying alternatives that would achieve the same objectives. Alternatives were compared in terms of project locations; suitability under local conditions; potential environmental impacts; capital and operating costs; consideration of project design or technology and production systems; social acceptability; land uses, and government policies and monitoring requirements.
- **Community participation and stakeholder consultations:** these were undertaken to determine how the projects will affect the local people / various stakeholders.
- **Cost- Benefit Analysis (CBA):** socio-economic evaluations were conducted to evaluate the economics of the project and establish its viability in terms of the expected environmental concerns and measures, and how the information gathered were evaluated to give optimum results.
- **Development of Environmental Management Programmes (EMPr):** to mitigate negative impacts, recommending feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels.
- **Development of a Monitoring Plan:** this is used in monitoring the implementation of the mitigation measures and the impacts of the project during construction and operational phases, including an estimate of capital and operational costs, responsible institutions or persons, monitoring mechanism, performance indicators and make necessary recommendations pertaining to the proposed development.

6.3 Desktop Study

The desktop review involved the analysis and interpretation of background information for the project area as well as the details of the activities applied for, socio-economic evaluations, the type of assessment which will be required, architectural drawings, legal and institutional frameworks, and biophysical environment and ecological properties of the study area. The desktop review also identified if the projects required any additional licences in terms of water use, waste management, aquaculture licence, land use or any other requirements.

6.4 Site Visits

Field visits to the proposed prospecting sites were meant for physical observations and inspections, on-site analysis as well as understand existing land use in the neighbourhood of the project sites in order to gather information on the state of environment. Baseline social and ecological data was collected at a screening level.

6.5 Public Participation Process

Public Participation is a legal requirement throughout the EIA process. Investors or developers are required to conduct public consultation throughout the scoping and EIA phase. Formal EIA documents are required to be made available for public review and comment by the proponent, these include the project brief, terms of reference and plan of study, scoping report, and the decision of the Environmental Commissioner. The method of public notifications and consultations that were used include:

- Site notice(s).
- Radio adverts/announcements.
- Letter of notification and information to identified I&APs.
- Background Information Document (BID) distribution.
- Public meeting at Omayanga village.
- Authority and stakeholder engagement.

The study also sought public opinion or views through consultation and public participation exercises which was done through public meeting and stakeholders' engagement. The general public, key stakeholders, adjacent landowner(s) and government authorities at local level, where notified of the proposed development through various means. The means by which I&APs were notified are described in full in Appendix D.

6.6 I&AP and Stakeholder Notifications

According to regulation 21 (2) of the EIA regulations under section 36 (2) of the EMA, 2007 in relation to public consultation process: *The person conducting a public consultation process must give notice to all potential interested and affected parties of the application which is subjected to public consultation by* -

(a) *fixing a notice board at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates is or is to be undertaken;*

To this effect, 5 site notices were dispatched/placed as follow: 1 was dispatched/placed at the property boundary of Green Village. Others were placed at the meeting place at Omayanga and offices of MFMR situated in Ongwediva; Agriculture office situated in Okatana constituency just right next to the Regional Councillor's Office, and the Okatana Regional Constituency Council Office.

(b) *giving written notice to – (i) the owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site; (ii) the local authority council, regional council and traditional authority, as the case may be, in which the site or alternative site is situated; (ii) any other organ of state having jurisdiction in respect of any aspect of the activity; and,*

Letters of notification and Background Information Documents (BIDs) were distributed and/or sent out via email/hand delivered on 7th June 2024 to all the main stakeholders and/or identified I&AP. Contact details of all stakeholders identified I&AP are available in Appendix D which contains the name, contact detail and address.

The local headman of Omayanga village under the jurisdiction of the Uukwanyama Traditional Authority, Mr Wenzelaus Huumbwa Mbwale; and the Regional Councillor of Okatana Constituency, Hon. Edmund Iishuwa were contacted telephonically through their administrative staffs in order to obtain and confirm contact details and the preferred methods and forms of communication for these engagements and consultations. Similarly, all I&APs were notified of the submission of the application to the competent authority, all proofs are included in the draft scoping report. A public meeting was held on 22 June 2024 at the meeting place located in Omayanga village, not far away from the proposed developments.

(c) *advertising the application once a week for two consecutive weeks in at least two newspapers circulated widely in Namibia.*

6.7 Newspaper Advertisements *(Radio Adverts/Announcements)*

In order to invite the public and capture large audiences in the area for the public meeting that was held on 22 July 2024 at Omayanga, as well as notifying the general public of the proposed development and of the availability of the draft scoping report for public review, radio announcements through the local language *(Oshiwambo)* at NBC Kati FM as a more preferred method of communication was favoured to newspaper advertisements especially for rural community. The announcement was also done by the village headman, Mr Wenzelaus Mbware Huumbwa as customary to community meetings in rural areas. This was opted because: (1). The proposed developments are located in communal (rural) area and newspapers are not well circulated in the area; (2). Most newspapers are in the official language *(English),* and many people in the area prefer the local language *(Oshiwambo)* to comprehend the message better*;* (3). Radio messages through nbc radio in the local language is more popular and preferred method of communication especially for the elderly people.

Figure 18: Public meeting at Omayanga village

Figure 19: CDC meeting at Okatana Constituency as chaired by Hon. Iishuwa.

6.8 Issues Raised by I&APs

Comments and issues raised during the public meeting held on the 22 June 2024 and that of the CDC meeting at Okatana constituency held on the 4th of July 2024 are included in the meeting minutes which can be found in Appendix D. The comments, questions and responses of all I&AP received have also been included in Appendix D.

6.9 Draft Scoping Report (DSR)

The information gathered through the initial public participation process phase, as well as the information from the site visit and from the client with regard to the history of the proposed project site, project description, details of activities, justification of the projects in terms of demand, relevant policy and legislation, identification of environmental impacts and associated mitigation measures, socio-economic evaluations was integrated into the draft report. The draft EIA report and EMPr will be made available for public review for a period of thirty (30) calendar days. Registered I&APs will be informed of the release of the draft report by email and other forms of communication. A hard copy of the report will made available in a publicly accessible place, and it will also be available on request.

6.10 Final Scoping Report (FSR)

Any comments, issues and concerns raised by I&APs and the authorities during the review period of the scoping phase will be included in the final scoping report. The FSR will be submitted to the office of the Environmental Commissioner for review and make a decision on the issuance of an Environmental Clearance Certificate (ECC).

6.11 Environmental Management Programme (EMPr)

The EIA report includes a detailed EMPr, which is submitted as a separate report, for the proposed projects. The EMPr contains suggested measures to manage and mitigate impacts identified during the EIA process, for both the construction and operational phase of the development. These measures are informed by the findings of the EIA report. It is therefore necessary to avoid land use, construction and operational conflicts for the projects through the implementation of the Environmental Management Programmes (EMPr). The measures presented in the EMPr are aimed at enhancing the potential benefits and minimizing the potential negative impacts of the project. The EMPr specify responsibilities for the implementation and monitoring of the project as well as the periodicity of the audits to be carried out.

6.12 Submission of Application Form

An application for EIA on form 1 is submitted to the office of the Environmental Commissioner under MEFT for review and decision making.

6.13 Assumptions and Limitations

This report is based on the information available at the time of compiling the report and, as a result, is subject to the following assumptions and limitations:

- The report is based on the project description and the conceptual site layouts of the proposed aquaculture and horticulture development provided by the applicant. These layouts are likely to undergo a number of changes before being considered to be final.
- Even with a final project description and an unchanged environmental context, the prediction of impacts and effects on resources and receptors may be uncertain.
- Descriptions of the natural and social environments of the study area are based on limited fieldwork, available desktop literature and on-site analysis.
- A project description based on the final design of the aquaculture and horticulture facilities, and the associated detailed activities is dependent on the outcome of the current projected output and not the potential future expansions.
- Even though Green Village is gonna operate as an integrated farming system, EIA is only conducted for fish farming and horticulture projects.
- It should be emphasised that information, as presented in this report, only has reference to the study area as indicated on the project maps. Therefore, this information cannot be applied to any other area without a detailed investigation being undertaken.

6.14 Analysis of Alternatives

Core to an environmental authorisation process is the assessment or evaluation and consideration of reasonable and practical alternatives. According to the Environmental Management Act No. 7 of 2007 and its Regulations (2012), alternatives must be considered during the EIA process. Consideration should be given to alternative sites or locations; layout, project design or technology alternatives to be used by the project; suitability under local conditions; potential environmental impacts; capital and operating costs; social acceptability; consideration of different production systems, different species and aspects such as alternative feeds with a view to identifying those which can mitigate some of the potential impact; local community participation; government policies and monitoring requirements; land uses and various social and political influences will play a part in some of these decisions, and as a consequence, the most feasible site based on the above will be considered.

6.14.1 The No Action Alternative No-Go Alternative

The No Action Alternative in respect to the proposed project implies that the status quo is maintained i.e., no construction or development activity to take place. This option is most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. However, from the socio-economic and partly environmental perspective, this option is ruled out due to the economic benefits i.e., provision of jobs for skilled and non-skilled workers, improved food and nutrition security, the generation of income by the developer and GRN as well as the insignificance anticipated environmental impacts resulting from construction and operation of the projects. The existing land use does provide limited employment opportunities to local residents in this regard. Should the proposed development not proceed, the land will remain underutilized with no additional job creation and no contribution to economic development within the region.

6.14.2 Site Alternative

There are no alternative sites for the proposed development (i.e., the project proponent doesn't have an alternative site or land elsewhere as it was the only area of land identified and available to him that was allocated under the customary land rights.

6.14.3 Land-use Alternative

The land area in which the proposed development is located in a commonage zone of communal land of multiple land uses which is largely comprised and characterised of cultivated land, communal grazing land, underutilized and undeveloped land classified as degraded unimproved grasslands, undergrowth, and few trees, bushes and brush and low-density residential area and other communal land enterprises. The community mainly depend on agriculture for subsistence farming i.e., pig farming, fish farming, poultry, crop farming, small and large stocks, orchards and vegetable gardens. Therefore, land uses for this particular development will not conflict with the surrounding land use activities since the proponent is going to engage in projects similar to what is already existing in the neighbourhood.

CHAPTER 7: POTENTIAL IMPACTS AND POSSIBLE MITIGATION MEASURES

Challenges emerge and evolve as the industry develops and matures, and those at the forefront of the solutions to these challenges are developing ways of minimising and mitigating the environmental impacts of the industry since aquaculture has the potential to both enhance and undermine ecosystem services and environmental sustainability.

7.1 NEGATIVE ENVIRONMENTAL IMPACTS OF CONSTRUCTION ACTIVITIES

7.1.2 Potential user conflict over land ownership and other natural resources:

The main potential social issues for considerations are due to the conflicts over use of land, water and other natural resources. Any establishments or construction that takes place without formal permission (land rights or lease agreement) would likely cause tension within the communities. To avoid user conflict, when selecting sites, proponent should consider the neighbouring land users and how their activities could potentially affect their livelihoods. Acquisition of land and other communal resources must be done according to the correct procedures i.e., as per the Communal Land Reform Act and Traditional Authority Act. Communication channels for complaints should be established, so that should a member of the public have a concern it will be dealt with by the appropriate authority.

7.1.3 Habitat degradation and ecological disturbance

Habitat degradation and ecological disturbance through vegetation clearing and clearing of land could result in erosion and sedimentation. Excavate only areas or physical sites to be affected by the buildings. Discarding of excess excavated materials should be done to sites that are designated as disposal sites for general waste. Generally, the designated area for Green Village is not so rich in biological diversity as not many faunas and floras are prevalent in the area. Nonetheless, natural features such as trees and other natural vegetation should be protected when found in proximity to aquaculture and horticulture facilities.

7.1.4 Security breach

The integrity of the aquaculture and horticulture facilities against unauthorised access by humans and animals can have serious environmental, social and economic and health risks.

- Access to the farm must be controlled for safety, security and biosecurity reasons, and to prevent uncontrolled movement of individuals and vehicles that may cause environmental degradation.

- Prohibition of entry by unauthorised persons must be displayed on all the gates including the main gate.
- Perimeter fences/boundaries must be created to disallow free access of unauthorised persons to the facilities including access to the water reservoir/excavated dam on site.

7.1.5 Excessive water use

The construction activities of the two projects and other associated facilities will require large quantities of water. Excessive water use may negatively impact on the water source and its sustainability. Ensure that water is used efficiently at the site by sensitising construction staff to avoid irresponsible water usage. Taps must be closed when not in use, while taps and pipes must be maintained to prevent leakage and waste. Adopt the use of the 3rs i.e., reduce, re-use, re-cycle. 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.

7.1.6 Health and safety of workers on site

Construction activities will expose construction workers to risks of accidents and injuries. The contractor and proponent should be committed to adherence to the occupational health and safety rules and regulations for the Health and Safety of Employees at Work (Labour Act, 6 of 1992). Appropriate personal protective equipments (PPE) such as hand gloves, boots, helmets etc as well as ensuring a healthy environment in terms of wellbeing for construction workers by providing sanitary and ablution facilities should be provided by the contractor. This should also include the provision of the first aid kits, emergence response plan, education and proper instruction on the use of tools and equipments as per specifications. An appropriate number of fire extinguishers must be available at aquaculture facilities.

7.1.7 Solid waste generation

Large amounts of solid waste will be generated during construction of the projects. These wastes can be a nuisance to the environment, humans and animals through injuries from broken bottles or iron/metals cuttings, ingestion of plastics bags by animals, entanglements of birds and other mammals, blocking drainage systems, odour, diseases, etc. Green Village should take steps to minimize the generation of such waste and to ensure proper disposal

procedures; provide facilities for handling solid waste generated within the facility e.g., dust bins or skips for temporarily holding waste within the premises before final disposal at the designated dumping site in the area; composite or re-cycle some wastes accordingly depending on the national waste management strategy to be adopted in line with the Environmental Management Act of 2007 and its Regulations.

7.1.8 Increase in noise and vibration levels

During the construction phase, construction activities could result in an increase in unbearable and ambient noise levels and vibration onsite and the surrounding properties due to the increase in movement of heavy vehicles and machineries (generators and concrete mixers) used for various construction works. Ensure the use of earmuffs by workers; sensitize truck drivers and machinery/tool operators to switch off vehicles/engines/machineries not in use. Works that generate high noise and vibration levels should be confined between 08:00 to 17:00 (local time). The contractor should also ensure that the surrounding or adjacent communities are informed about the planned activities.

7.1.9 Increase in air pollution in the form of dust and emissions

Dust generated by constant movement of construction vehicles and other construction activities, such as land clearing, excavation as well as emissions from auxiliary equipments will negatively impact air quality especially during dry, windy conditions which can lead to several environmental impacts and other health issues. Dust generation and emissions during construction should be minimized through strict enforcement as well as limiting unnecessary traffic within the project site. The site's driveways and other areas should regularly be sprinkled with water to reduce amount of dust generated. Roads must be maintained in a stable, dust free condition watering or grading where necessary.

7.1.10 Traffic flow during construction

Traffic flow within construction site and on the road adjacent to the site may increase during construction phase from trucks transporting building materials. This could lead to possible obstruction and congestion along Okatana - Ongwediva road, and may present a safety risk in terms of accidents and injuries to the local community. The flow of vehicles/traffic should be controlled by erecting traffic/construction/warning signages around construction site.

7.1.11 Hazardous substances

Inappropriate storage and handling of hazardous substances required for the day-to-day site activities could lead to the contamination of surface and groundwater. Therefore, appropriate storage and handling of these hazardous substances should be done in a proper manner with proper supervision. All hazardous materials used at the site should be disposed of accordingly.

7.1.12 Loss of cultural, heritage and archaeological resources

During construction, there should be adequate consideration for the location of identified sensitive heritage sites and archaeological resources. Where possible, avoidance of these sensitive areas is a first priority. All historical buildings, archaeological materials, graves and burial grounds, catchments, breeding sites should not be disturbed in any manner. Should archaeological heritage remains be uncovered during construction, works must stop immediately for investigation to take place. These must also be reported to the NHC.

7.1.13 Facility, materials and bulk infrastructure

The non-removal and disposal of all facility and bulk infrastructure on site may result in the disturbance to the surrounding terrestrial and aquatic environments. Site clean-up should be done by ensuring that all structures, equipments, materials, waste and facilities used during construction are removed upon completion the project.

7.1.14 Erosion management

Inadequate provision for the management of erosion could lead to erosion of the study area. Where vegetation is removed, this should be done in a proper manner to prevent unnecessary destabilisation and erosion. Where appropriate, landscaping with environmentally compatible plants suitable vegetation cover may also be used to prevent erosion. This can be accomplished with good vegetation cover, brush packing, sand bagging, retaining walls etc.

7.1.15 Visual aesthetic impact

The overall visual quality of the project area, the loss of existing valued aesthetic features and the introduction of contrasting features may not be appealing to some. The proponent must create visual compatibility features to maintain or promote a consistent character with the proposed project's visual relationship with existing and planned land uses in the project area.

7.2 POSITIVE ENVIRONMENTAL IMPACTS OF CONSTRUCTION ACTIVITIES

7.2.1 Creation of employment opportunities

During construction phase, short-term job opportunities will be created as construction workers. This will be a significant development as it will accord the youths an opportunity to be employed by Green Village as most of these youths are unable to secure employment and thus remain unemployed. Impartial and unbiased recruitment criteria as well as equal employment opportunities should be created for both male and female applicants. Local residents especially those around Omayanga/Okatana should be given preference for employment/piece jobs at the project.

7.2.2 Provision of market for supply of building materials

The project will require supply of large quantities of building materials, most of which will be sourced locally (Ongwediva and Oshakati). This provides ready market and fair opportunities for building supplies such as hardware shops and individuals with such materials.

7.2.3 Increased business opportunities

High number of construction workers of various components of the project will provide market leading to business opportunities for local informal traders or small-scale traders such as food vendors. Such opportunities and permission should be accorded to food vendors from Okatana/Omayanga who are interested to sell their food items around the construction site.

7.2.4 Optimal use of land

The selected site for this project enhances the optimal use of this particular portion of land which otherwise would be idle considering that this portion of land was previously undeveloped and uninhabited and part of it falls within the Oshanas/flood channel.

7.2.5 Revenue to Government.

Value Added Tax (VAT) on construction materials and tools to be purchased among others will be sources of revenue for the government and its institutions.

7.3 NEGATIVE ENVIRONMENTAL IMPACTS OF OPERATIONAL ACTIVITIES

7.3.1 Legal and policy compliance

During the operational phase, failure to adhere to existing legislation, policies, regulations, permits, authorisations and legal obligations could result in undue disturbance to the natural environment, lack of institutional support for the project and overall project failure. Therefore, these laws should be followed to enhance social cohesion between the project, community and stakeholders, institutional support for the project, overall project successes and protection and sustainability to the natural environment.

7.3.2 FISH FEEDING

7.3.2.1 Uneaten feed and faeces.

Uneaten feed and faeces are the two most prominent waste streams in tank-based aquaculture. Therefore, regular cleaning and monitoring of the quality of the water must be carefully done in order to avoid water quality deterioration due to fish farm waste (e.g., faeces and feed).

7.3.2.2 Fish feed quality and feed wastage

Only high-quality aquaculture feeds must be purchased from recognised feed producers; Information on the nutrient makeup and primary ingredients should be available to the farmers. This should also include the shelf life; feed storage areas must be lockable, well ventilated, dry and free of vermin that can damage, contaminate and consume feeds; feed must be stored on pallets and used on a ‘first-in-first-out’ basis; the calculation of suitable daily feeding rate, feeding allowance, feeding frequency and the FCR must be recorded and determined to prevent overfeeding; water quality monitoring programme should be implemented daily; water quality monitoring results must be correlated to feeding rates and production biomass once a month so that the necessary adjustments can be made ;factors such as feed position (floating or sinking) and feeding times of day must be considered when attempting to minimise feed wastage and the associated water pollution; feeding staff must be trained in feed application, as the detection in feeding behaviour is important. If fish are not actively feeding it may be necessary to suspend or delay feeding.

7.3.2.3 Potential fish escapees

Genetically distinct escapees may interbreed or even out-compete wild stocks, resulting in overall reductions on genetic diversity with resultant reductions in the fitness of wild populations. Install suitable strainers or screens on all piping, and in and outflow points in the facility to minimize the escape of fries, juveniles and broodstock. The moving of fish (stocking, sampling and grading) must be done in a manner, which prevents escape. Adequate steps must be taken to prevent the escape of production organisms, especially from the hatchery environment where individual organisms may be very small. Make thorough inspection for holes, leakages, tears and breakages of all culture tanks before they are deployed so as to avoid possible escapees from the tanks. When stocking aquaculture organisms, care must be taken to prevent secondary species from being accidentally introduced with the target species.

7.3.3 Bird entanglement in nets and predator related fish fatalities.

Employ bird-friendly net designs around greenhouses that minimize the risk of entanglement. Shade cloth or bird netting must be of such a mesh size, structure and of rigid material so that injury of any birds and other animals is prevented. It must also be clearly visible by birds approaching the facility. Install deterrents to prevent birds and other animals from accessing aquaculture and horticulture facilities.

7.3.4 Theft and vandalism

Theft, poaching and vandalism can be a key concern at the farm. This can be mitigated by fencing, patrolling, and guarding the premises 24hrs with either security guards or CCTV. Form neighbourhood watch which will be working together with NamPol and other security companies.

7.3.5 Use and handling of chemicals

Various chemicals, medicinal substances or treatments (including hormones, growth promoters, antibiotics, chemical fertilisers, disinfectants etc.) are used in aquaculture or horticulture production. These chemicals are often directly toxic to non-target organisms and may remain active in the environment for extended periods. Some antifoulants contain trace metals that can elevate environmental concentrations and can bioaccumulate in susceptible

organisms. If no special care is taken in their applications, these chemicals could pose environmental threats such as toxic contamination, damage to the ecology, cause water pollution. Chemical uses are also a significant factor which influences safety, consumer acceptance and the marketability of products. Due to these concerns, fish farming and horticulture industries are moving away from the use of antibiotics, mineral fertilisers and organophosphates and numerous other potentially hazardous chemicals.

- The use of chemicals must be responsible and in accordance with the prescribed application methods. Complete chemical testing of the water is required since cultured aquatic organisms have some very specific requirements. Chemical analysis of major elements and heavy metals for potential water sources should be performed.
- Depending on the land usage patterns, pesticide/herbicide/fungicide as well as screening of the prospective sources of freshwater should be conducted and protected from possible contamination of these applications. Operators must ensure that no downstream environmental pollution emanate from such chemical use.
- Increase the efficiency of organic fertilizer use while promoting the use of biological nitrogen fixation or other processes that might reduce fertilizer requirements. Encourage integrated plant nutrition systems by using organic inputs such as farm yard or green manure and waste from aquaculture systems.
- Only recognised and registered chemicals may be used as treatments, medicines, herbicides, insecticides, pesticides and for other purposes. Bait type pesticides should be used with care to prevent poisoning of non-target species.
- Chemicals must be stored in a dry, well ventilated, secure and lockable area.
- 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 recognised disposal site for these materials and according to the directions provided in the datasheet.

7.3.6 Outbreak and spread of diseases

Diseases bring risks to production and market access due to fish deaths and public health risks. For example, Streptococcus bacteria in tilapia populations can potentially affect humans. This needs to be considered by farmers when entering the industry. Even though Tilapias are resilient towards fighting off diseases and parasites, practice good animal

husbandry and biosecurity protocols must be followed as fish disease spread due to poor farm management strategies. Maintain suitable environmental conditions, select healthy fish, provide a nutritious diet, limit stress and vaccinate if really necessary. 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. Site manager should monitor the health status of fish as part of the daily operational activities. This includes water quality monitoring and the monitoring of the production conditions. 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; treatment of diseases must be done by recognised methods and under the guidance of recognised aquaculture pathologists, vet or fisheries biologist/technician/animal health technician. All treatments must be recorded. Diagnosis of the cause of largescale mortalities must be done as soon after such an incident as possible.

7.3.7 Mortalities

Mortalities in aquaculture are due to diseases, parasites, poor handling and stress, poor water quality, water temperatures etc. All mortalities must be recorded and the behaviour of the remainder of the fish be monitored. If uncontrolled mass mortalities occur, it must be reported immediately to the relevant authorities and these are: MFMR, MAWLR, headmen.

7.3.8 Consumer related risks, Quality assurance and Ethical concerns

One of the greatest risks, not only to the individual farmer and his trader, but to the industry as a whole, is if the health of a consumer is compromised. Any risks to public health could cause closure of the producer's farm and a stringent examination of all neighbouring farms. Consumer faith in the production firm could also be lost. To satisfy ethical concerns and to pre-empt potential damage to the fisheries industry, Green Village must ensure the biosecurity protocols on all farming activities as well as value chain (upstream and downstream) from ‘farm to fork’, including correct handling of fish and horticultural activities. Product quality should be monitored by the competent authority in order to promote a generic quality image for Namibia especially farmed aquatic organisms. Hygiene and appropriate storage of fish and vegetables must be emphasised. Health risks and symptoms should also be communicated immediately.

7.3.9 Tank structure failure and loss of fish stock

The tank anchor lines must be regularly (once a month) inspected to ensure the stable positioning and anchoring of the tank system at all times. Tank platforms must be kept in good order (clean, tidy and free of unnecessary equipment etc.). No chemicals may be used in the cleaning of the tanks unless approval is obtained from the relevant authorities.

7.3.10 Fish handling

Fish must not get stressed. If you handle the fish, take great care so that you upset them as little as possible. Extreme stress can be the direct cause of fish death. Damage to their skin (rubbing off the scales and the protective slime layer), means pathogens can enter the fish more easily.

7.3.11 Quality fingerlings

Poor quality fingerlings may die or even fail to grow and this would result in a loss of investment. So only good quality fingerlings from reputable suppliers i.e., MFMR's Inland Aquaculture Centres will be used.

7.3.12 Poor management

Poor farm management measures could result in the pollution and risks to indigenous fish health due to the introduction of disease, parasites and new genetic strains. Site-specific high-level Standard Operating Procedures (SOPs) that are in-line with international best management practices must be maintained for the management of fish genetics, hatchery and fingerling production, fish feed, fish health, biosecurity and the general environment.

7.3.13 Import and export permits

No live organisms or freshwater fish may be transported to or from any aquaculture facilities without a transport permit from the applicable authority. No aquaculture organisms may be imported into the aquaculture production facility from unrecognised sources, and all imported ova and fingerlings need to be certified disease free by the supplier. Unless specifically authorised, broodstock or organisms for farming may not be collected from the wild. Import and export permit must be obtained from the relevant authority i.e., MFMR, MAWLR or NamRa depending on the application.

7.3.14 Water use

The domestic activities during the operation phase of the project will involve the use of large quantities of water for irrigation and for aquaculture. Excessive water use may negatively impact on the water source and its sustainability. The proponent shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water usage. Employ water serving measures such as aquaculture recirculation system. Provision of increased water storage capacity of tanks. Use of the 3rs - reduce, re-use, re-cycle. Provide roof gutters to collect and direct roof water to garden/trees around the site. Aquaculture production systems should be structurally sound and not leak unnecessarily. 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.

7.3.15 Solid waste generation

Aquaculture produces large amount of various waste streams during operational phase of the project. These wastes can be a nuisance to the environment, humans and animals through injuries from broken bottles, ingestion of plastics bags by animals, entanglements of birds and other mammals, blocking drainage systems etc. Provide facilities for handling solid waste generated within the facility. These will include dust bins/skips for temporarily holding waste within the premises before final disposal at the designated dumping site in the area. Composite or re-cycle some wastes accordingly. Additionally, ensure waste materials are disposed or channelled to the approved sites. The disposal of contaminated or diseased and dead fish must comply with public health and veterinary procedures.

7.3.16 Liquid waste generation and management

As aquaculture waste originates mainly from waste feed. Other include sewerage and non-production related waste water, production related waste or effluent water, post production and processing waste. Inadequate treatment and disposal of effluent waste generated from the aquaculture facility itself may result in surface and groundwater pollution to the surrounding environment. Further, even though waste and effluent generation in aquaculture is not that much, accumulation of it may harbour bacterial and fungal infection due to poor water quality in tanks. The most profitable use of the sludge generated by aquaculture operations is as fertiliser or composite manure for agriculture. Therefore, it is important to

treat waste which can later be re-used for agriculture. Regular inspection, cleaning and maintenance of the waste disposal systems is important. Farm effluents entering inland aquatic environments shall be monitored and controlled through regulations within water legislation. Provision must be made for the responsible management and treatment of sewerage.

7.3.17 Stormwater impacts

Inappropriate routing of stormwater will lead to erosion and sedimentation. Provide roof gutters to collect and direct roof water to drains or otherwise to horticultural establishments on site. Design storm water drainage channels. Do regular inspection and maintenance of the waste disposal systems during the operation phase. Connect drainage channels to sewer system. Provide adequate storm water drainage system.

7.3.18 Noise pollution and vibration

Noise generation by aquaculture activities is generally minimal. Works that generate high noise and vibration levels should be confined between 08:00 to 17:00 (local time). The contractor should also ensure that the surrounding or adjacent communities are informed about the planned activities. Ensure the use of earmuffs by workers.

7.3.19 Traffic during operations

Increased flow of vehicular traffic/visitors may present a safety risk to the local community. Provide adequate parking facilities within the project site including proper signages and designing the site entrance to ease traffic that may occur when cars are entering/leaving the site.

7.3.20 Onsite sanitation and ablutions

Inadequate provision and management of ablutions for workers and clients/visitors may result in filthy conditions and runoff transferring infections and contaminants into the surrounding environment. Adequate and accessible sanitary and ablution facilities for both sexes with clean running water for workers and visitors alike should be provided.

7.3.21 Health and safety of workers

Some operational activities including dust feeding, fish handling, general works, application of chemicals etc may expose workers to chemicals and risks of injuries. Adherence to the

occupational health and safety rules and regulations must be maintained. Appropriate personal protective equipments (PPE) as well as ensuring a safe and healthy environment by providing sanitary and ablution facilities should be provided. This should also include the provision of the well-equipped first aid kits on site, emergence response plan, education and proper instruction on the use of tools and equipments as per specifications as well as proper building supervision. An appropriate number of fire extinguishers and firefighting equipment must be available at aquaculture facilities. Contact numbers for the nearest firefighting and emergency services must be clearly displayed in an accessible area. Employees must be provided with opportunities for training and furtherance of skills.

7.3.22 Electrical system

The project will also use electricity supplied by the already existing electricity main grid of Northern Regional Electricity Distributor (NORED) which will be used in all phases of the project. Future plans of using renewable resource (solar energy) are underway.

7.3.23 Energy consumption

During operation, the facility will use a lot of electrical energy mainly for running the recirculation system, filters, aerators, pumping water from reservoirs into the facilities etc including lighting, running of refrigeration systems etc. Therefore, excessive electricity consumption should be controlled and reduced where possible. Use of natural sunlight to light facilities should be encouraged. Install renewable energy resource (solar energy).

7.3.24 Dust generation and emissions

The project may generate significant quantities of dust at the site and its surrounding by vehicular movements. Ensure strict enforcement of onsite speed controls as well as limiting unnecessary traffic within the project site. To reduce dust emissions, the site’s driveways should be regularly sprinkled with water to reduce amount of dust generated by the regular works and vehicles movement. Have paved roads and walkway system.

7.3.25 Hazardous substances

Inappropriate storage and handling of hazardous substances required for the operation and day to day site activities could lead to the contamination of surface and groundwater. Appropriate storage and handling of hazardous substances should be done in a proper manner with supervision. All hazardous materials used at the site should be disposed of according to the health and safety regulations. If water has been contaminated with hazardous chemicals, it may not be released into the environment.

7.3.26 Loss of cultural, heritage and archaeological resources

Inadequate consideration for the location of identified sensitive heritage sites and archaeological findings could result in the damage or destruction by operational activities. Adequate consideration for the location of identified sensitive heritage sites and palaeontological findings should be preserved, recorded and reported. If any of these materials are uncovered (e.g., artefacts, human remains or historical materials etc.), work should stop immediately for investigation to take place should be reported to the NHC.

7.3.27 Soil erosion

Inadequate provision for the management of erosion could lead to erosion of the study area and surrounding areas. Unpaved roads around the facilities should not contribute to erosion. Create and maintain soil traps and embankments. Landscaping after completion of construction. Plant more tress and have small gardens around facilities. Roads or paths must be maintained in a stable, dust free condition by compaction, watering, grading and asphalt coverage where necessary.

7.3.28 Floods

Flooding is a major disturbance that impacts aquatic ecosystems and the ecosystem services that they provide. Extreme flooding events can cause loss of life and significant destruction to property and infrastructure. The area is not susceptible to floods as the site was filled with gravel (in some areas) to the elevated height. Embarkments must also be put around the facility to block water from passing through the facility during flood and rainy season. Design storm water drainage channels and provide adequate storm water drainage system.

7.3.29 Extreme weather events

Extreme weather events can have detrimental effects on aquaculture operations. Green Village should have access to climate change information and implement specific farm management measures for coping with the associated stresses. The aquaculture value chain, including fish distribution, need to implement climate change adaptation measures.

7.3.30 Invasion of Alien vegetation species

The removal of existing natural vegetation creates 'open' habitats which favours the establishment of undesirable vegetation in areas that are typically very difficult to eradicate and could pose a threat to surrounding ecosystems especially acacia species. Have an effective Alien Vegetation Management Plan. Do not disturb/remove existing natural vegetation that creates 'open' habitats which favours the establishment of undesirable vegetation in areas that are typically very difficult to eradicate and could pose a threat to surrounding ecosystems especially acacia species.

7.3.31 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). Such records will ensure that matters are dealt with in an orderly and logical fashion, which could prevent unnecessary environmental impacts. Good practices for the management of record keeping include: 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. Where possible, farm records should be supported by authorisations, permits, photographs, water quality analysis reports, disease or diagnostic reports, incident reports, and other information that may be of assistance. 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, authorisations 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; mortality record; health records and diagnostic reports; chemical and treatment application records; chemical registers indicating stocks; purchase and expiry dates; complaints register and daily diary of significant events, incidents, feed response, etc.

7.3.32 Dealing with complaints

As with any development, aquaculture and horticulture 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. Good practices for the handling of complaints include:

- All complaints must be recorded in 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.
- Complaints must be fully investigated and the outcomes and actions documented, implemented, monitored and communicated to the complainants.

7.4 POSITIVE ENVIRONMENTAL IMPACTS OF OPERATIONAL ACTIVITIES

7.4.1 Individual Investment

Economically, the project will be an investment to the proponent. The proposed project once complete can also be used as a collateral asset. The investment can also act as a knowledge hub for integrated farming in the promotion of aquaculture in the area.

7.4.2 Employment opportunities

The proposed development will create employment opportunities during the lifespan of the development. Some people will be employed by the project as caretakers, general workers, artisans, cleaners, security personnel and technicians. Impartial and unbiased recruitment criteria as well as equal employment opportunities should be created for both male and female applicants including those living with disabilities. Locals especially those around Omayanga/Okatana should be given preference for employment/piece jobs at the project.

7.4.3 Improved food security and nutrition

Food security, nutritional status and diet will be ensured to the community of Okatana constituency by providing cheap source of fish protein through consumption of local fish and fish products especially those who cannot afford to buy meat.

7.4.4 Visual impacts

The permanency/long-term placement of the facility structures and activities on site may impact positively on the aesthetic appearance or facelift of the project area.

7.4.5 Revenue to local, regional and national governments

Through payment of relevant taxes, rates and fees to the government and the local authority, the housing project will contribute towards the national and local revenue earnings.

7.4.6 Added value and integrated farming

The project will provide opportunity for added value and integration of fish farming into the other farm enterprises in order to create additional income and improve its water management (fish-crop-livestock integration). The intention is to integrate the aquaculture project with the vegetable production by recycling water from the greenhouse/fish tanks and use it for watering the small-scale garden project. Pond sediments will be used to fertilise the vegetable gardens and orchards, thereby reducing cost of manuring of vegetables.

7.5 DECOMMISSIONING

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. If such a stage is reached, the proponent needs to remove all materials resulting from the demolition from the site.

- Upon decommissioning the project, rehabilitation of the project site should be carried out to restore the site to acceptable status. Ensure that all structures, equipment, materials, waste and facilities used for operation purposes are removed from the site upon decommissioning the project. Site clean-up should also be done, and there will be opportunities for recyclable and reusable materials that can still be re-used for other purposes. The site should be well landscaped by flattening the mounds of soil. Backfill surface openings if practical. Plant more indigenous trees and flowers around the facilities. Fence and signpost unsafe areas until natural stabilization occurs. Where vegetation is removed or when undertaking any earthworks or following the exposure of any soils, this should be done in a proper manner to prevent unnecessary destabilisation and erosion, and a suitable vegetation cover or environmentally compatible plants may also be established or used to prevent erosion.

CHAPTER 8: IDENTIFICATION AND RATING/RANKING OF THE ENVIRONMENTAL IMPACTS

8.1 Impacts Identification Matrix

To ensure a direct comparison between various impacts, standard rating scales have been defined for assessing and quantifying the identified possible impacts (direct, in-direct as well as cumulative impacts). This is necessary since impacts have a number of parameters (negative or positive) that need to be assessed and will be related to activities to be carried out during the scoping phase of the EIA process, which can also be categorized into: impacts on the biophysical environment; socio-environmental; health and safety impacts; sociocultural context, and socio-economic impacts. These criteria and rating scales for assessment have been developed in accordance with the requirement outlined in Appendix 2 of the EIA Regulations 2012 and Procedures and Guidelines for Environmental Impact Assessment (EIA).

The impacts should also be assessed in terms of the following aspects:

- **Nature of the impact**

This is an appraisal of the type of effect the construction, operation and maintenance of a development would have on the affected environment. This description should include what is to be affected and how.

- **Extent of the impact**

The spatial scale defines the physical extent of the impact on whether the impact will be: local extending only as far as the development site area; or limited to the site and its immediate surroundings; or will have an impact on the region, or will have an impact on a national scale or across international borders.

- **Duration of the impact**

This defines the significance of the impact at various time scales, as an indication of the duration of the impact i.e., short term (0-1 year), medium term (1-10 years), long terms (10 years) or permanent.

- **Intensity**

Intensity is used in order to objectively evaluate the degree of change an impact is likely to have on the receptor or how severe or destructive a number of negative impacts might be on the issue under consideration, or how beneficial a number of positive impacts might be on the issue under consideration and should be qualified as low, medium or high.

- **Probability of occurrence**

This is the likelihood of impacts taking place as a result of project actions arising from the various alternatives. Most impacts would occur, but other impacts are not as likely to occur and may or may not result from the proposed development and alternatives. This is described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will definitely occur irrespective of any anticipation).

- **Reversibility and Mitigation**

The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. Both the practical feasibility of the measure, the potential cost and effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Table 5: Evaluation criteria for rating impacts

Effect	**Extent**	
	Localised	The proposed development site
	Study area	The site and its immediate surrounding
	Regional	Village / constituency / regional level
	National	National and transboundary / international level
	Duration	
	Temporary	Very short-term impacts, on the order of hours to weeks
	Short term	1 year or less
	Medium term	Between 1-10 years
	Long term	More than 10 years
	Intensity	
	Low	An impact is minor when a resource / receptor is affected, but the intensity of the impact is small enough to remain within the limits of applicable standards or negligible change which is barely noticeable
	Medium	An impact is moderate when its intensity remains within the standards or when moderate change or disturbance caused to receptors is reversible over the medium term
	High	A major impact is when the acceptable or allowable standards limits may be exceeded or when large degree of modification may affect a large proportion of receptors
	Type	
	Direct	The impacts resulting from direct interaction between the project and resource / receiver
	Indirect	Impacts resulting from direct interaction between the project and its environment, due to interactions occurring thereafter
	Induced	Impacts from other follow-up activities to the project
	Probability	
	Unlikely	The likelihood of these impacts occurring is slight (low probability) <25%
	May occur	The likelihood of these impacts occurring is possible (high probability) 25%-75%
	Definite	The likelihood is that this impact will definitely occur >75%
Mitigation	**Mitigation**	
	Easily achievable	The impact can be easily, effectively and cost effectively mitigated
	Achievable	The impact can be effectively mitigated without much difficulty or cost
	Difficult	The impact could be mitigated but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs
	Very difficult	The impact could be mitigated but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly

When assessing the significance of impacts, the following variables should be taken into consideration:

- **Cumulative impact**

Consideration must be given to the extent of any accumulative impact that may occur due to the proposed development. Such impacts will be either positive or negative, and will be graded as being of negligible, low, medium or high impact.

- **Significance**

The significance criteria are used to determine the overall significance of an activity. The overall significance is either negative or positive and will be classified as low, moderate or high (Table 6).

- **No significance:** The impacts do not influence the proposed development and/or environment in any way.

Table 6: Description of issues level significance ratings

Significance Rate	Description
NO SIGNIFICANCE	- The impacts do not influence the proposed development and/or environment in any way.
BENEFICIAL	An impact that will result in a positive effect on the social and/or natural environment and is considered to bring about positive change to a receptor.
LOW	- The impacts are acceptable and mitigation, whilst desirable, is not essential as the impacts will have a minor influence on the proposed development and/or environment. - Impacts on the issue by themselves are insufficient, even in combination with other low impacts, to prevent the development being approved. - For impacts ranked as 'LOW' significance, no investigations or alternatives will be considered.
MODERATE	- The impacts on this issue are, by themselves, insufficient to prevent the implementation of the project and will have a moderate influence on the proposed development and/or environment, but could in conjunction with other issues with moderate impacts, prevent its implementation. - Impacts on this issue will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment. - For issues identified as having a negative impact of 'MODERATE' significance, it would be standard practice to investigate alternate activities and/or mitigation measures and modification in the project design.
HIGH	- The impacts on this issue are serious, and if not mitigated, they may prevent the implementation of the project as they will have a major influence on the proposed development and/or environment. - Impacts on this particular issue would be considered by the affected community as constituting a major and long-term change to the natural and/or social environment, and will result in severe effects. - Negative issues that are ranked as being of 'HIGH' significance will need to be investigated further to determine how the impacts can be minimised, or what alternative activities or mitigation measures can be implemented.

Table 7: Environmental Impact Identification Matrix: Construction

Aspects	Potential Impacts	Extent	Duration	Intensity	Type	Probability	Mitigation	Significance
Biophysical environment	Land uses and user conflicts	Study area	Medium	Low	Direct	Low <25%	Achievable	Low
	Habitat degradation	Localised	Long	Low	Direct	High 25%-75%	Difficult	Low
	Land use change	Localised	Permanent	Medium	Direct	Definite >75%	Difficult	High
	Increase in water use	Localised	Short	Low	Direct	Low <25%	Achievable	Low
	Solid waste generation	Localised	Short	Low	Direct	Low <25%	Achievable	Low
	Soil erosion	Localised	Short	Low	Direct	Low <25%	Achievable	Low
Health and safety impacts	Occupational health risks	Localised	Short	Medium	Direct	Low <25%	Achievable	Low
	Air pollution	Study area	Short	Medium	Direct	High 25%-75%	Achievable	Moderate
	Hazardous substances	Localised	Short	Low	Direct	Low <25%	Difficult	Moderate
	Traffic flow	Study area	Short	Medium	Direct	Low <25%	Achievable	Moderate
Socio-economic impacts	Noise and vibration	Study area	Short	Medium	Direct	High 25%-75%	Achievable	Moderate
	Archaeological resources	Study area	No effect	No effect	Direct	Low <25%	Achievable	No Significance
	Visual aesthetic impact	Study area	Medium	Medium	Direct	High 25%-75%	Achievable	Low
	Employment opportunities	Regional	Medium	High	Direct	High 25%-75%	Achievable	Beneficial
	Business opportunities	Regional	Medium	Medium	Direct	High 25%-75%	Achievable	Beneficial
	Optimal use of land	Regional	Medium	Low	Direct	Low <25%	Achievable	Beneficial
	Revenue generation	National	Medium	Low	Direct	Low <25%	Achievable	Beneficial

Table 8: Environmental Impact Identification Matrix: Operation

Aspects	Potential Impacts	Extent	Duration	Intensity	Type	Probability	Mitigation	Significance
	Land uses and user conflicts	Study area	Medium	Low	Direct	Low <25%	Achievable	Low
Biophysical environment	Increase in water use	Localised	Short	Low	Direct	Low <25%	Achievable	Moderate
	Solid waste	Localised	Short	Low	Direct	High 25%-75%	Achievable	Low
	Liquid waste and effluent	Localised	Short	Low	Direct	High 25%-75%	Achievable	Low
	Floods and stormwater impacts	Localised	Short	Low	Direct	High 25%-75%	Achievable	Low
	Soil erosion	Localised	Short	Low	Direct	Low <25%	Achievable	Low
	Surface & groundwater pollution	Study area	Medium	Medium	Direct	Low <25%	Difficult	Moderate
	Alien vegetation species	Study area	Medium	Low	Direct	Low <25%	Difficult	Low
	Fish escapees	Regional	Short	Medium	Direct	Low <25%	Achievable	Low
	Bird entanglement	Localised	Short	Low	Direct	Low <25%	Achievable	Low
Health and safety impacts	Outbreak and spread of diseases	Regional	Medium	Medium	Direct	High 25%-75%	Difficult	Moderate
	Occupational health risks	Localised	Short	Medium	Direct	Low <25%	Achievable	Moderate
	Air pollution	Study area	Short	Low	Direct	Low <25%	Achievable	Low
	Hazardous substances	Study area	Medium	Medium	Direct	High 25%-75%	Difficult	Moderate
Socio-economic impacts	Consumer related risks	Regional	Short	Low	Direct	Low <25%	Achievable	Low
	Security breach	Localised	Short	Low	Direct	Low <25%	Achievable	Low
	Theft and vandalism	Localised	Short	Low	Direct	Low <25%	Achievable	Low
	Noise and vibration	Study area	Short	Low	Direct	Low <25%	Achievable	Low
	Traffic flow	Study area	Short	Low	Direct	Low <25%	Achievable	Moderate
	Individual investment	Regional	Long	High	Direct	Definite >75%	Achievable	Beneficial
	Employment opportunities	Regional	Medium	High	Direct	Definite >75%	Achievable	Beneficial
	Improved food & nutrition security	National	Medium	Medium	Direct	Definite >75%	Achievable	Beneficial
	Revenue generation	National	Medium	Medium	Direct	Definite >75%	Achievable	Beneficial
	Keeping of production records	Localised	Short	Low	Indirect	Low <25%	Easily achievable	Moderate

8.2 ENVIRONMENTAL MANAGEMENT PROGRAMME FOR PROPOSED FRESHWATER AQUACULTURE AND HORTICULTURE FARMING ACTIVITIES

Environmental Management Programmes (EMPr) for freshwater aquaculture and horticulture development is aimed at providing a logical framework during all phases of the project lifespan within which identified negative environmental impacts can be managed, mitigated, monitored and evaluated within the set environmental management standards as articulated in the Environmental Management Act (Act No. 7 of 2007), and EIA Regulations (Government Notice No: 30, 2012).

In addition, the EMPr provides a clear indication of the responsibilities and specific actions that must be undertaken for environmental management requirements and monitoring measures, performance indicators, compliance auditing and inspection programmes by each of the responsible institutions or persons involved in the construction, operational and decommissioning phases of the proposed developments of aquaculture and horticulture.

Further, it is recommended that environmental best practices and standard operating procedures in freshwater aquaculture and horticulture should include the environmental contingency plans that may need to be formulated in conjunction with an EMPr. These plans include: waste management plan; emergency response plan; workers health and safety plan; disease, parasite and pest management plan, and general farm management plan.

The development of the EMPr contain details on the tasks and actions to be taken in addressing environmental emergencies, the performance criteria for such actions, the responsible persons, reporting procedures and post-contingency review mechanisms. The plans must be communicated to all employees, the applicable local and regional government authorities, and emergency services. In order to maintain an acceptable level of preparedness, the plans should be put to practical testing and regularly updated.

The detailed EMPr will be submitted as a separate report, for the proposed projects. This will specify responsibilities for the implementation and monitoring of the project as well as the periodicity of the audits to be carried out including an estimate of capital and operational costs pertaining to the proposed development. Regular monitoring should be undertaken by the farmer, qualified technical service providers or appropriate institutions.

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusion

As per the analysis, results from EIA study show that the proposed freshwater aquaculture and horticulture developments will not have significant impacts on the natural and social environment, and therefore do not pose any serious environmental impacts as it is observed and established that most of the highlighted negative impacts on the environment are rated low and short term with no significant effect. Nonetheless, adequate mitigation measures have been proposed to address any of the negative impacts arising from the projects through the Implementation of an EMP which will assist in dealing with environmental issues during the project cycle. There are also guidelines for addressing environmental health and safety mitigation measures as part of the Labour Act, 6 of 1992: Regulations for the Health and Safety of Employees at Work, and the Public and Environmental Health Act, 2015.

Additionally, the social and economic rating for these projects is highly positive and will benefit the residents of Omayanga village through increased local production and supply of tilapia and horticulture fresh produce to the community of Oshana region for improved food and nutrition security, sustainable livelihoods and economic growth.

The projects proponent has also proposed to adhere to implementation of the environmental management plan as per the provisions of the Environmental Management Act (Act No. 7 of 2007), and EIA Regulations (GRN Notice No: 30, 2012), Aquaculture Act 2002 (Act no.18 of 2002), as also advised by technical experts, stakeholders and community members. They are obtaining all necessary permits and licenses from the relevant authorities and have qualified and adequate personnel to carry out activities as per the project's objectives.

9.2 Recommendations

This project is recommendable for approval by the Environmental Commissioner and for the issuance of an Environmental Clearance Certificate in compliance with the Environmental Management Act (Act No. 7 of 2007), and EIA Regulations (GRN Notice No: 30, 2012). The freshwater aquaculture project should also be licenced by obtaining the aquaculture licence through the competent authority i.e., MFMR in adherence to the implementation of the Aquaculture Act 2002 (Act no.18 of 2002) and Aquaculture Licensing Regulations, 2003.

10. List of References

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11. APPENDICES

A. Proof of payment and application form for ECC
B. Site Map and Location of the Project
C. Customary land rights certificate for the proponent
D. Proof of consultations and minutes of stakeholders' meetings
E. Site assessment report from MFMR
F. Letter of support from MFMR
G. Consent letter from the Headman
H. Personal profile/CV