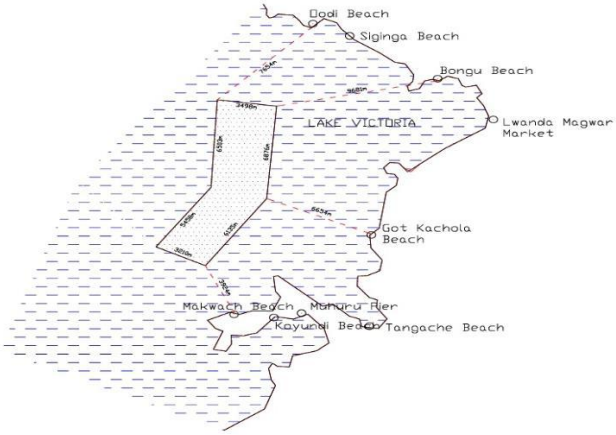
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

FOR

THE PROPOSED EXPANSION OF VICTORY FARM'S COMMERCIAL, SUSTAINABLE AND SOCIALLY RESPONSIBLE TILAPIA CAGE SYSTEM WITH AN ESTIMATED PRODUCTION CAPACITY OF 30,000 METRIC TONS PER ANNUM IN NEW 390 ACRES CONCESSION BLOCK WITHIN LAKE VICTORIA, NYATIKE WEST & NYATIKE SOUTH SUB-COUNTIES IN MIGORI COUNTY



GPS Points: Attached in the Annexes

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This EIA Report is submitted to the National Environment Management Authority (NEMA) in accordance with the requirements of EMCA, CAP 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003

OCTOBER 2025

CERTIFICATION

Certification by Lead Expert

We hereby certify that this Environmental and Social Impact Assessment for the Victory Farms Ltd expansion of sustainable cage aquaculture in **Nyatike West & Nyatike South Sub-Counties in Migori County** has been done under our supervision and that the EIA criteria, methodology and content reporting conform to the requirements of the Environmental Management and Coordination Act, 1999-Revised 2015 and legal notice No. 101 of June 2003 (Environmental Impact Assessment and Audit Regulations).

Signed: **Date____8th Dec. 2025_____**

Kevin Musiega (NEMA 1682)

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Certification by Proponent

We, **Victory Farms Ltd** hereby confirm that the contents of this Environmental Impact Assessment (ESIA) report are true to the best of our knowledge, and we will implement the Environmental Management Plan (EMP) proposed in this report and undertake to implement further mitigation measures as NEMA may direct in relation to the findings of this EIA and future inspections by the Authority.

Signed for and on behalf of**: Victory Farms Ltd**

Name: Michael Ouya .....Signature: .....

Position: Sr. Partnerships & Development Manager .....Date: 9th December 2025

ACRONYMS AND ABBREVIATIONS

BMU	Beach Management Unit
CPP	Consultation and Public Participation
DITTO	Same as Above
EA	Environmental Audit
EHS	Environment, Occupational Health and Safety
EIA	Environmental Impact Assessment
EIA/EA	Environmental Impact Assessment/Environmental Audit Regulations, 2003
EMCA	Environmental Management and Coordination Act, 1999
EMP	Environmental Management Plan
EMS	Environmental Management System
ERP	Emergency Response Plans
HDPE	High Density Polyethylene
ISO	International Standards Organizations
IAP	Interested and Affected Parties
KPLC	Kenya Power and Lighting Company
LR	Land Registration
LVFO	Lake Victoria Fisheries Organization
NEAP	National Environmental Action Plan
NEC	National Environment Council
NEMA	National Environment Management Authority
NET	National Environmental Tribunal
NETF	National Environmental Trust Fund
PAPs	Project Affected Persons
PPE	Personnel Protective Equipment
PSP	Private Sector Participation
TOR	Terms of Reference
SEM	Sustainable Environmental Management
VF	Victory Farms Limited

EXECUTIVE SUMMARY

Introduction

Cage aquaculture is the practice of growing fish in existing water resources while enclosed in a net cage that permits free passage of water. It is an established and profitable system in many countries and is considered one of the key interventions to increase fish supply in the face of declining wild fish stocks. Globally, cage aquaculture is hugely varied ranging from subsistence level holding of a few kilos of fish in small nets to salmon farms producing more than 5,000 Tons per year. In Asia, more than 50 species are reared in various forms of cage aquaculture. While the financial success of cage aquaculture has been demonstrated in Asia, Europe, North America and Latin America over the years, it is picking up in Africa and further growth is expected. This is despite cage aquaculture being introduced in several African countries in the 1970s[1].

The production of farmed fish in Sub-Saharan Africa has expanded more than sixteen-fold, mostly due to the expansion of tilapia cage aquaculture. Notable examples of rapid spread of cage aquaculture in Sub-Saharan Africa include Lake Victoria in Kenya and Uganda, Lake Volta in Ghana, Lake Kariba in Zimbabwe and Lake Malawi in Malawi. Despite the region's enormous fish market and the practice's proven potential, cage fish farming has not been widely practiced in East Africa though it has shown potential to be more productive than pond culture. Cage aquaculture was pioneered in Kenya by the Lake Basin Development Authority (LBDA) in 1988 with first trials around Dunga Beach. Dominion Group of Companies successfully harvested fish from cages at its Yala wetland farm in 2005. Between 2008 and 2013, "BOMOSA," an EU-sponsored project, conducted trials on cage aquaculture in small water bodies within the Lake Victoria Basin. Cage aquaculture techniques have grown in popularity on the beaches of Obenge and Dunga in Siaya and Kisumu counties respectively, through efforts of the Fisheries Cooperative Society and Beach Management Units (BMUs[2]).

Despite initial setbacks, the cage aquaculture strategy was eventually adopted in 2010 at Dunga Beach in Kisumu County through collaborative work between Kenya Marine and Fisheries Research Institute (KMFRI) and the Dunga BMU. Cage aquaculture has evolved in recent years as a new source of income and livelihoods in Lake Victoria, in addition to protecting endangered wild fish species. Since then, the practice has expanded across Lake Victoria's five riparian counties: Busia, Siaya, Kisumu, Homabay, and Migori. Notably, between 2016 and 2022, the total number of cages in the Kenyan section of Lake Victoria rose from 1663 to more than 5242[3]. This expansion has resulted in ecological concerns on cage aquaculture sustainability in Lake Victoria. It's against this background that, the proponent here in referred as **Victory**

[1] Lake Victoria Fisheries Organization (2016). Draft guidelines for establishment and operation of cage fish farming in East African Community.

2Aura, C. M., Musa, S., Yongo, E., Okechi, J. K., Njiru, J. M., Ogari, Z. & Oucho, J. A. (2018). Integration of mapping and socio-economic status of cage culture: Towards balancing lake- use and culture fisheries in Lake Victoria, Kenya. Aquaculture Research, 49(1), 532-545

[3] KMFRI-ABDP-CAGES (2022). Sustainable community-based cage aquaculture in Lake Victoria, Kenya. Kenya Marine and Fisheries Research Institute (KMFRI) Aquaculture Business Development Programme (ABDP), Kenya Fisheries Service (KeFS) and State Department for Fisheries, Aquaculture and the Blue Economy (SDFA & BE) for Cage Aquaculture technical report funded by the International Fund for Agricultural Development (IFAD).

Farms Limited has proposed to expand its commercial Sustainable Tilapia Cage System Farming in new proposed concession blocks within Lake Victoria waters in **Nyatike West and Nyatike South Sub-Counties in Migori County**.

Project Objectives

Kenya has vast fish resources (in marine, inland capture and aquaculture) the exploitation of which is providing a wide variety of benefits to the country in terms of revenue, employment and general contribution to socio economic growth and development. However, the capture fisheries of the country have generally demonstrated oscillations in total catch with a general tendency of declining catches in recent years. Therefore, the proposed project is expected to boost fish production levels in a sustainable manner.

Requirement for EIA

This Environmental Assessment Project Report study was undertaken pursuant to the requirements stipulated by the National Environmental Management Authority (NEMA) under the Environmental Management and Coordination Act (2015) that requires all proposed development projects listed under Schedule II of the EMCA, to undergo an Environmental Impact Assessment Study to determine the potential adverse impacts of a project and thereby devising appropriate mitigation measures. The proposed expansion of Tilapia cage culture system project is among developments that require the critical and strategic assessment as stipulated in the Environmental Management and coordination (amendment) Act, 2015 and Environmental Impact Assessment and audit regulation (2003).

Project Location

The project comprises a concession block that stretches as follows:

1. Lake Victoria waters in Kadem – Nyatike South Sub County in Migori County, comprising Got Kachola, Ongoro, Matoso and Lidha Beaches;

2. Lake Victoria waters in Karungu – Nyatike West Sub County in Migori County, comprising Aluru Island, Okiro, Oodi Beaches.

The project site is georeferenced by GPS as below:

MIGORI POTENTIAL PRODUCTION ZONE

0°51'28.31"S	34° 3'1.87"E
0°51'44.42"S	34° 4'52.91"E
0°55'26.97"S	34° 4'33.72"E
0°58'7.13"S	34° 2'40.81"E
0°57'20.93"S	34° 1'5.68"E
0°55'2.58"S	34° 2'47.17"E

Relevant Policies and Regulatory Frameworks

Project related national policies and regulatory frameworks reviewed and analysed include: -

- Sessional Paper No. 10 of 2014 on National Environment Policy, 2014;
- Kenya Fisheries Policy 2023,
- National Aquaculture Policy, 2011,
- National Water Policy, 2021,
- National Aquaculture Strategy and Development Plan, 2010,
- Kenya Vision, 2030

Legislative and Regulatory Framework

- Environmental Management and Coordination Act Cap 387 and other subsidiary regulations,
- Fisheries Management and Development Act No 35, 2016,
- Water Act 2016,
- Physical and Land Planning Act, 2019,
- Public Health Act, Cap 242 Revised edition 2012,
- Occupational Health and Safety Act, 2007,
- Lake Basin Development Authority Act, cap 442
- The Sustainable Waste Management Act, 2022
- The Climate Change Act, 2016

Methodology

A detailed analysis of beneficial and adverse impacts of various components of the project on the physical, biological, and human (*social, cultural, and economic*) environments was conducted based on analysis of project interaction with the baseline conditions. **Appropriate mitigation measures** were then identified **to prevent, minimize, mitigate, or compensate for adverse environmental and social impacts**. Consequently, **enhancement measures for positive impacts were developed to improve project environmental and social performance**. In addition, the roles, and responsibilities in the implementation of the mitigation measures were clearly defined, costs of implementing such measures as well as the costs for environmental and social capacity building for effective implementation of mitigations measures by the respective agencies. The sources of such financial resources will be clearly outlined in the mitigation plan.

A mixed methods approach was used in the study to address all pertinent environmental and safety aspects of the project on the biophysical and socio-economic aspects. The following data collection methods were used:

- **Remote Sensing and GIS Analysis** – Remote sensing was undertaken and ground-truthing done by the consultant at the time of the site visit. Remote sensing was based on available satellite imagery of the project area.
- **Desk Reviews**–A literature review was undertaken based on the findings of the reconnaissance process, which involved reviewing legislation, policies, the County Integrated Development Plan (CIDP), (Technical Design Documents), and previous EIAs studies carried out in the project area to determine the baseline conditions and establish the legal, institutional, and biophysical/socio-economic environmental setting of the project area. The desk-based study also included the development of fieldwork tools and fieldwork schedules as well as the approach to stakeholder engagement.
- **Site Visits** – A site investigation was undertaken during which detailed Environmental and Social Baseline data was gathered and collected.
    - **Stakeholder Engagement**–Various stakeholders were engaged (Proponent, Beach Management Units amongst other opinion leaders), and data was collected through: Focus group discussion and KIIs.

      Stakeholder engagement ensures that the views and concerns of diverse stakeholders (including the community) are incorporated as early as possible into the project development (i.e., at the planning, implementation, and operational phases), to minimize any potential or unexpected opposition to the proposed development. It also helps incorporate the views of key stakeholders into the design process.

      The main objective of the stakeholder engagement process is to inform stakeholders and the public about the proposed project and its likely effects, while incorporating their inputs, views, and concerns into project planning.
    - **Questionnaires administration**– people living within a radius of 4 kilometer of the proposed project area;
    - **Photography** – was used to record the salient features and baseline conditions at the proposed project site and surroundings. These included checklists, matrices, and observations.

Summary of the Project Impacts

Positive Impacts

Impact	Narrative
Employment, skills transfer and human resource capacity development	Implementation of this project will involve the use of both skilled, semi-skilled and unskilled labour. Different expertise will be required for the project. Provision of employment will contribute (directly and

	indirectly) to raising the socioeconomic well-being of the people living and working around the project.
Impact on human nutrition on local and national level	The supply of fish will contribute to filling the country's need for proteins, a commodity which is not only inadequate now but whose production is on the decline.
Diversifying community livelihoods	Beneficiary businessmen and middlemen will have an alternative livelihood thus offering cushion against shortcomings of the current agricultural activities in the area

Negative Impacts

Component/Activity	**Mitigation/Management**
Water quality impacts because of feed wastage.	• Only high-quality aquaculture feeds must be purchased from recognized feed producers; Information on the nutrient makeup, primary ingredients and production techniques, e.g. extrusion, should be available, • Feeding rates must be correlated to water quality sampling to allow detection and alteration of over-feeding. This will be done by the water quality monitoring programme to be implemented; • Correct feed pellet size must be used to ensure low levels of feed wastage.
Chemical spills and incorrect application of chemicals	• The handler must wear appropriate Personal Protective Equipment (PPE); • Dosages, application methods and resultant outcome must be known and recorded in a treatment register; • Expired chemicals must be disposed of at a suitable hazardous waste disposal site; • The advice of a recognized fish pathologists or aquaculturists must be sought where the application of chemicals is uncertain;
Fish mortalities	• All mortalities must be recorded and the associated behavior of the remainder of the organisms monitored, e.g. loss of appetite; • A database must be kept of the numbers of dead organisms and the behavioral patterns of the population.
Endangering predators	• No traps may be used to injure any predators of aquaculture organisms. Traps may only be set if these predators can be caught live (without injury) for translocation to alternative areas. This may only be done under the supervision of recognized organizations or authorities i.e. KWS;

Component/Activity	**Mitigation/Management**
	• Ensure no poisons is left out for aquaculture predators; • Ensure no animals that prey on the aquaculture species is shot • The main aquaculture predators and their control methods include cover netting for birds (Kingfishers, Fish Eagles, Herons, Storks and others) and fencing
Health and safety compliance at the cage site	• All involved personnel need to have adequate floatation safety gear and need to be fully trained in health and safety codes related to water borne activities; and • Skippers need to be licensed
Disease from processed fish waste	• The waste generated in the primary processing of the harvested fish (heads, gills and intestines) and the mortalities experienced from production must be ensiled to produce a stable and odor free high protein supplement for animal feeds or fertilizer. This waste must be milled and chopped and then stabilized by means of adding organic or mineral acids. The mineral or organic acids decrease the pH, which inhibits the growth of bacteria, and hence enables long term storage of the raw material.

Project Cost

The project cost is approximated at KES 750,077,009.00 (Kenya Shillings Seven Fifty Million, Seventy-Seven Thousand and Nine only. The Cost is summarized and **attached in the appendix.**

Conclusion:

The environmental impact assessment process has identified and assessed a range of potential impacts to the bio-physical and socio-economic environments. Where impacts have been identified, mitigation and enhancement measures for those impacts have been outlined in this EIA CPR. Most of the identified negative impacts are either of moderate or minor significance, even prior to the application of appropriate mitigation/management measures. With proper implementation of the proposed recommended mitigation/management measures, the significance of the potential or likely residual impacts looks set to be reduced to a minor or negligible level. The project will bring into productive use a high potential resource, the lake that has hitherto been underutilized. The project will boost fish production and improve incomes in the project area. The experts recommend to the authority that the project be approved.

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1 INTRODUCTION AND BACKGROUND

1.1 Background

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[4] Lake Victoria Fisheries Organization (2016). Draft guidelines for establishment and operation of cage fish farming in East African Community.

5Aura, C. M., Musa, S., Yongo, E., Okechi, J. K., Njiru, J. M., Ogari, Z. & Oucho, J. A. (2018). Integration of mapping and socio-economic status of cage culture: Towards balancing lake- use and culture fisheries in Lake Victoria, Kenya. Aquaculture Research, 49(1), 532-545

[6] KMFRI-ABDP-CAGES (2022). Sustainable community-based cage aquaculture in Lake Victoria, Kenya. Kenya Marine and Fisheries Research Institute (KMFRI) Aquaculture Business Development Programme (ABDP), Kenya Fisheries Service (KeFS) and State Department for Fisheries, Aquaculture and the Blue Economy (SDFA & BE) for Cage Aquaculture technical report funded by the International Fund for Agricultural Development (IFAD).

1.2 Background and Rational of the EIA

There has been a remarkable and refreshing interest in environmental issues in the recent past with the publication of the 1987 Report of the World Commission on Environment and Development (the Brundtland Report titled, "Our Common Future"). This is particularly so due to the increasing realization that man's unsustainable production and consumption patterns are largely responsible for the unprecedented rate of environmental degradation that is threatening mankind. Some of the negative consequences of mankind's irresponsible interaction with the environment include climate change, desertification, loss of biological diversity, pollution of air, water, and land/soil; diminishing indigenous forest cover and loss of natural habitats; among others. The concern for environment made evident the necessity for the planning authorities to count on sound information about possible environmental consequences of development actions[7].

Environmental Impact Assessment (EIA) can be broadly defined as the systematic identification and evaluation of the potential impacts (effects) of proposed projects, plans, programmes, or legislative actions relative to the physical-chemical, biological, cultural, and socioeconomic components of the total environment. EIA systematically examines both beneficial and adverse consequences of the project and ensures that these effects are considered during project design. EIA is both a decision-making process and a document that provides a systematic, reproducible, and interdisciplinary evaluation of the potential effects of a proposed action and its practical alternative on the physical, biological, cultural, and socioeconomic attributes of a particular locality[8]. An EIA aims to predict environmental, social, and economic impacts at an early stage in project planning and design, find ways to reduce adverse impacts, shape project to suit local environment and recommend suitable options to decision makers.

The purpose is to ensure that important environmental resources are recognized early in the planning process and protected through proper planning and decision-making. As a decision-making tool, EIA provides a means for all stakeholders in an action to be heard and to participate in the process of selection of alternatives and mitigation of adverse impacts. EIA gives decision makers more alternative courses of action that may better achieve several instead of just one set of goals.

1.3 Proposed Project Objectives

The proposed project will involve the expansion of the existing Victory Farms Sustainable Tilapia Cage Production to approximately 30,000 MT per annum through HDPE cage system in the new concession areas in Nyatike South and Nyatike West Sub Counties in Migori County. The proposed project was subjected to a comprehensive project assessment and the report prepared in accordance with the *Environmental Management and Coordination Act (EMCA) Cap 387 of 1999 (amended 2015) and Environmental (Impact Assessment) and Audit regulations of 2019* which categorizes

[7] Singh et al., 2007. In: Environmental bioremediation technologies, Singh, S. N.; Tripahti, R. D. (Eds) Springer, 223-258

[8] Wamukoya, G. M, and Ludeki, J., 2003. Environmental Impact Assessment in Kenya. Understanding Environmental Impact Assessment Process. CREEL Publications No 3. Nairobi.

the proposed project as medium risk and can be approved by National Environmental Management Authority (NEMA) though preparation of a full study project report.

1.4 Terms of Reference for the EIA

- A critical look into project objectives.
- Assessment of the proposed location of the project.
- A concise description of the baseline information, national environmental policy, legislative and regulatory framework, and any other relevant information related to the project.
- Evaluation of the technology, procedures and processes to be used, procedures and processes to be used in the implementation of the project.
- Evaluation of the materials to be used in the construction and implementation of the proposed project and their extended sources.
- Description, evaluation and analysis of the foreseeable potential environmental effects of the proposed project broadly classified into physical, ecological/biological and socio-economic aspects (direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated)
- Evaluation of waste management.
- Evaluation and analysis of alternatives including the proposed project, no project alternative, project site, design and technologies.
- An Environmental Management Plan (EMP), proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment.
- Propose measures to prevent health and safety hazards and to ensure security in the working environment for the employees and the management in case of emergencies. This encompasses prevention and management of foreseeable accidents and during both the construction and operational phases.
- Such other matters as NEMA may require.

1.5 Objectives and Scope of the Project Report.

The ESIA of the proposed developments was conducted to:

- Determine the Impacts the proposed project may have on the biophysical Environment.
- Assist decision makers arrive at a decision whether to grant or deny a license for the proposed project.
- Propose cost-effective mitigation measures for the significant negative impacts of the proposed project on the environment.
- Coming up with an Environmental Management Plan (EMP) to address environmental and social impacts of the proposed project to the affected population during construction, operational and decommissioning phases of the project.

1.5.1 Reporting

This report is an output of the whole EIA project report including public consultation. The proponent will have to submit:

i. A soft copy of this full study EIA Report alongside complementary specialized reports to the National Environment Management authority:
   a. Baseline Air Quality Measurement Report
   b. Baseline Noise Assessment Measurement Report
   c. NEMA Approved Terms of Reference (TOR)
   d. Letter of No Objection - Migori County Department of Agriculture, Livestock, Fisheries & Blue Economy
   e. Potential GPS Coordinates for the Proposed Migori Concession Block

ii. The following specialized assessment reports
   a. A detailed climate change risk and vulnerability assessment to inform the appropriate adaptation and mitigation measures to climate proof the project in line with provisions of Climate Change Act, 2016
   b. A detailed baseline environmental and social conditions on waste management, noise and excessive vibrations, air quality, water quality, geotechnical and existing land use character within the proposed project site
   c. Limnology of the Project area, analysis of the laboratory analysis of the sampled lake water and sediments
   d. Biosafety/biosecurity plan of the proponent

All the materials and workmanship used in the execution of the work shall be of the best quality and description. Any material condemned by the planners shall be removed from the site at the contractor's cost.

Environmental concerns need to be part of the planning and development process and not an afterthought. It is therefore advisable to avoid land use conflicts with the surrounding area through the implementation of the EMP.

1.5.2 Study Team

Table 1 Study Team

	Name	**Role**
1.	Kevin Musiega	Lead EIA Expert / Team leader
2.	Ruth Muhonja	Aquaculture expert and Associate Expert
3.	Edward Adino	Chemical Analyst and a Lead Expert
4.	Juliana Akinyi	Socio-Economist Expert
5.	Wycliff Oloo	GIS expert and a Planner
6.	John Ambuya	Lead Expert and Green Business Enthusiast
7.	James Orage	Lead Expert

2 ENVIRONMENTAL LEGISLATIVE AND REGULATORY FRAMWORK

2.1 Brief Overview

Applicable national statutes and regulations on environmental conservation and management suggest that the operation of the tilapia cage project must have a legal duty and social responsibilities to ensure that the operation of the sub-project does not compromise the status of the natural resources in the area, health and safety of the surrounding community. This position enhances the importance of this ESIA study to check on the compliance level of the sub-project. The key national laws that govern the management and conservation of environmental resources in the country have been discussed briefly below.

2.2 Policy Framework

2.2.1 The Constitution of Kenya, 2010

Article 42 of the Constitution states that every person has the right to a clean and healthy environment, which includes the right:

1. To have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69;
2. To have obligations relating to the environment fulfilled under Article 70. Article 69(2) states that every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources. Article 70 (1) states that if a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.

2.2.2 The Sessional Paper No. 10 of 2014 on National Environment Policy, 2014

Contained in Sessional Paper No. 10 of 2014, the Environment Policy aims at integrating environmental aspects into national development plans. Its broad objectives include, among others, optimal and sustainable use of natural resources and integrated environmental management. It's also meant to harmonize environmental management and development goals to ensure sustainability. It provides guidelines and strategies for government action regarding environment and development.

2.2.3 Kenya Fisheries Policy 2023

The policy aims to sustainably maximize utilization of the fisheries and aquaculture resources for socio-economic development. The Policy acknowledges the low adoption of aquaculture technologies including; Recirculating Aquaculture Systems, cage culture, aquaponics, aquaparks, breeding and feed formulation, particularly among the small-scale fish farmers and inadequate platforms for dissemination of research information and weak linkages between aquaculture research and management.

The proposed project is anticipated to contribute towards the policy objectives by promoting and upscaling sustainable aquaculture technologies.

2.2.4 National Aquaculture Policy, 2011

The Policy highlights the fact that the government recognizes the contribution aquaculture makes to food security and income generation to millions, poverty reduction and economic development in the country. It sets out the aquaculture sector's primary goal of ensuring for increased, sustainable and safe fish production and utilization in a sound environment.

The Policy's overall objective is to enhance the aquaculture sub-sector's contribution to wealth creation, increased employment for all especially for youth and women, food security and income generation through effective private, public and community partnerships. It aims at promoting the development of small scale, medium scale and large-scale aquaculture enterprises; achieving self-sufficiency in fish and ensuring that the domestic market is always adequately supplied; ensuring that gender issues, HIV/AIDs and other lifestyle diseases and cross cutting issues in aquaculture are addressed through establishment of social development programmes in aquaculture in collaboration with relevant stakeholders and partners.

It underlines in its strategies, the need to zone aquaculture resources by identifying, mapping and regulating zones of aquaculture practices in terms of species, systems, climatic and ecological diversities, and promoting the establishment of aquaculture parks (aquaparks) as well. It has strategies in place to promote marketing of aquaculture products through development of physical infrastructure and information systems; encouraging the maintenance of disease-free zones, biosecurity, fish safety and quality assurance management systems; promoting aquaculture produce value addition; and finally, promoting participation of the relevant stakeholders in aquaculture development.

2.2.5 The Kenya National Fisheries Policy, 2020

The policy is designed to improve the management and development of the fisheries sector in Kenya. The policy provides guidance on sustainable management of fisheries resources, enhancement of fish production, and promotion of socio-economic development in the fishing communities. The policy emphasizes the need for effective governance, stakeholder participation, and the use of modern technologies to improve the efficiency and profitability of the sector. It also aims to enhance the value chain of the fisheries sector, improve market access, and promote trade and export opportunities for Kenyan fish products. The policy also recognizes the role of women and youth in the fisheries sector and seeks to empower them through capacity building and access to financing.

The proposed project is aligned to the vision and mission of this policy.

2.2.6 National Water Policy, 2021

The overall goal of the policy is to guide the achievement of sustainable management, development, and use of water resources in the country. The overall objective of the policy is to provide a framework that is dynamic, innovative, and effective for re-engineering the water sector. It was developed to address missing gaps in water resources management. Finally, the policy geared towards and to builds on the successes, challenges, and lessons learnt from the previous policies of 1999, 2012, and the provisions of the Kenya Vision 2030 on water conservation and management.

The proponent will abide by the provisions of the Policy.

2.2.7 National Aquaculture Strategy and Development Plan, 2010 – 2015

Under the banner of filling the fish supply gap for food security, income and healthy living, the National Aquaculture Strategy proposes means and methods of addressing critical issues relating to aquaculture development vis-à-vis input supply (e.g., production and delivery of feeds and seeds as well as the availability of farm credit) and access to extension support and markets within the context of prevailing macro and micro-economic, social and cultural conditions involving a wide range of partners in the public and private sectors. These four critical issues entail the need for institutional reforms such as fostering public and private sector partnerships; strengthening the regulatory framework for aquaculture;) developing an enabling environment for expansion of the sector; and developing requisite human resource.

The strategy is in line with Vision 2030, the long-term national development blueprint that aims to transform the country into an industrialized middle-income economy providing high quality life for its entire citizenry by the year 2030 as well as programmes already put forward by the Ministry of Fisheries Development. This, it attains through its primary objectives which, among others, is to increase fish production through expanded aquaculture resource base and ensure for the availability of quality and adequate feeds by facilitating feed distribution networks.

2.2.8 Sessional Paper No 4 of 1981 on National Food Policy

The rapid expansion of the population and a shortage of un-exploitable arable land in the main high potential areas are beginning to expose a potentially dangerous imbalance in the relationship between the national supply of and demand for food.

In these circumstances, there is a clear need for a national food policy which will set guidelines for decision-making on all major issues related to food production and distribution. The overall objective of this policy is to maintain a position of broad self-sufficiency in the main foodstuffs to enable the nation to be fed without using scarce foreign exchange on food imports; achieve a calculated degree of security of food supply for each area of the country; ensure that these foodstuffs are distributed in such a manner that every member of the population has a nutritionally adequate diet.

2.2.9 The Kenya Vision 2030

One of the aims of the vision is to raise incomes in agriculture, livestock and fisheries even as industrial production and the service sector expand. This will be done by processing and thereby adding value to her products before they reach the market. She will do so in a manner that enables her producers to compete with the best in other parts of the world. This will be accomplished through an innovative, commercially oriented and modern agriculture, livestock and fisheries sector. These interventions are expected to generate an additional KSh.80-90 billion increase in GDP, mainly through better yields in key crops, increased smallholder specialization in the cash crop sector (2-3crops per plot), utilization of a million hectares of currently uncultivated land, and new cultivation of up to 1.2 million hectares of newly opened lands. Specific strategies will involve the following:

1. transforming key institutions in agriculture and livestock to promote household and private sector agricultural growth; and

2. Increasing productivity of crops and livestock. Kenya will also introduce new land use policies through:
    a. Better utilization of high and medium potential lands by her farmers;
    b. Preparation of new land for cultivation by strategically developing more irrigable areas in arid and semi-arid lands for both crops and livestock; and
    c. By improving market access for small holders through better marketing.

The proposed fish cage culture project is in line with the country's aspirations of increasing agricultural productivity.

2.3 Legislative and Regulatory Framework

2.3.1 Environmental Management and Coordination Act (EMCA, Cap 387)

The Environmental Management and Coordination Act (EMCA), Cap 387, is the framework law on environmental management and conservation. The National Environment Management Authority (NEMA) was established as the principal instrument of government charged with the implementation of all policies relating to the environment, and to exercise general supervision and coordination over all matters relating to the environment. In consultation with the lead agencies, NEMA is empowered to develop regulations, prescribe measures and standards, and issue guidelines for the management and conservation of natural resources and the environment. The Act provides for environmental protection through:

- Environmental impact assessment;
- Environmental audit and monitoring; and
- Environmental restoration orders, conservation orders, and easements.

Part VI under Section 58 of the Act directs that any proponent for any project listed on the Second Schedule of the Act should undertake and submit to NEMA an Environment Impact Assessment (unless exempted by NEMA), who in turn issues a license as may be appropriate.

The proponent has contracted Lakers Consultancy Ltd to undertake the EIA and prepare the report for submission to NEMA. The proponent shall obtain an EIA license before the commencement of works.

Table 2: EMCA Subsidiary Legislations Requirements

Relevant Regulations	Narratives
The Environmental (Impact Assessment and Audit) Regulations, 2003	These regulations outline the procedures and guidelines for carrying out environmental impact assessments and audits. The regulation requires that the EIA/EA be conducted by a registered lead or firm of experts in accordance with the terms of reference developed during the scoping exercise. These regulations have been amended by the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019. The amendment list projects into Low, Medium, and High Risk. For the low -risk projects, an environmental impact assessment Summary Project Report (SPR) is prepared while for medium-risk projects Comprehensive Project Report (CPR) must be prepared. For the

Relevant Regulations	Narratives
	high-risk projects, a full study report (FSR) is prepared and submitted to NEMA. ***The environmental consultant shall undertake an EIA study in accordance with the general environmental impact assessment guidelines provided for in Part III of the regulations***.
EMCA (Water Quality) Regulations, 2006	Described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006, these regulations apply to drinking water, water used for industrial purposes, agricultural purposes, recreational purposes fisheries and wildlife and any other purposes. The Regulations outline various water quality standards in relation to use and discharge. Regulation 24 of these regulations prohibit discharge or apply any poison, toxic, noxious or obstructing matter, radioactive wastes, or other pollutants or permit any person to dump or discharge any such matter into water meant for fisheries, wildlife, recreational purposes or any other uses unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards set out in the Third Schedule to these Regulations.
EMCA (Air Quality) Regulations, 2014	The objective of the Regulations is to provide for prevention, control, and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources such as mobile sources (e.g., motor vehicles) and stationary sources (e.g., industries) as outlined in the Environmental Management and Coordination Act, 1999. It also covers any other air pollution source as may be determined by the Cabinet Secretary in consultation with the Authority. Emission limits for various areas and facilities have been set. The regulations provide the procedure for designating controlled areas, and the objectives of air quality management plans for these areas. ***Fish processing is prone to foul smell and therefore, the proponent will ensure no foul smell emanates from the proposed activities.***
Environmental Management and Coordination (Wetlands, Riverbanks, Lake Shores and Sea Shore Management) Regulations (2009)	These Regulations make provision for the management, conservation and sustainable use of wetlands and wetland resources and the sustainable utilization and conservation of (resources on) riverbanks, lake shores, and the seashore. ***Permit to be obtained for activities set out in section 42 of EMCA;***

Relevant Regulations	Narratives
	No person shall carry out any of the activities stipulated in that section without a permit issued by the relevant lead agency and an EIA license issued by NEMA; and Projects having a significant impact on a wetland, riverbank, lake shore or the seashore also require an EIA.
The Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations (2006)	The Act states that no person shall engage in any activity that may have an adverse impact on any ecosystem, lead to the introduction of any exotic species, or lead to unsustainable use of natural resources, without an EIA License. Relevance: the proponent shall abide by the provision of this regulation.

2.3.2 The Fisheries Management and Development Act No. 35 of 2016

The main aim of the Act is to promote conservation, management and development of fisheries and other aquatic resources to enhance the livelihood of the communities dependent on fishing. This is to be achieved through establishment of Kenya Fisheries Service. The act also highlights the functions of the two levels of governance of significance to this sub-project component is the function of National government to develop mariculture related infrastructure and resource mobilization for conservation management of the fisheries development. And the function of the county government is to spearhead the development of mariculture at county level.

The proponent has obtained approvals from the County Governments of Homabay and Migori.

Regulations under Fisheries Management and Development Act

Table 3 Regulations under Fisheries Management and Development Act

Regulation	Narrative
Fisheries (Beach Management Units) Regulations, Legal Notice no. 55 of 2024.	These Regulations, made under section 37 of the Fisheries Management and Development Act, provide for establishing beach management units for a designated fish landing station, in order to: strengthen the management of fish landing stations, fishery resources and the aquatic environment; support the sustainable development of the fisheries sector; improve planning and resource management, good governance, democratic participation and self-reliance; ensure production of safe and quality fish and fishery products; build

Regulation	Narrative
	capacity of the members for the effective co-management of fisheries; reduce or resolve conflicts in the fisheries sector.
Fisheries Management and Development (Aquaculture) Regulations, Legal Notice no. 62 of 2024.	These Regulations, made under provisions of section 74 (1) and (2) of the Fisheries Management and Development Act, apply to any person engaged in any aquaculture activity, the sustainable-use, protection, conservation and management and development of inland, coastal and marine, lake and river basin aquaculture operations, occurring on private, public or community land. The objectives of these Regulations are: promoting the integration of wise-use of aquaculture resources and operations in the local, county, and national management; strengthening participatory conservation of aquaculture resources in Kenya; ensuring the protection of the diversity of aquaculture habitats, flora and fauna; promoting awareness creation, education, research, indigenous knowledge and partnerships with other relevant institutions in the management of aquaculture systems; maintaining an up-to-date inventory and database of aquaculture operations; protecting aquaculture operations on land, in river basins, lakes and coastal zones from pollution including siltation, agricultural and infrastructural developments, overexploitation, alien and invasive species, and other activities likely to degrade such ecosystems.

2.3.3 Occupational Safety and Health Act (OSHA), 2007

The Acts aim to ensure the safety, health, and welfare of persons at work and non-workers as well as cushion workers against loss of income or livelihood due to occupational accidents or diseases. The Act shall be applied for the safety of workers and the public to be ensured during project implementation, operation, and decommissioning phases. The site shall be registered under the Act as a workplace at all phases of the project before commencement of any activities.

2.3.4 Public Health Act, Cap 242 (Revised edition 2012)

The Act addresses matter of sanitation, hygiene, pollution, and general environmental health and safety, which are directly related to cases of pollution and contamination of water sources, be it ground or surface. The management of wastewater or any effluent that shall be generated should be managed in a way that shall not cause any public nuisance.

2.3.5 The Water Act (2016)

The new Water Act (2016) of the Laws of Kenya seeks to make better provision for the conservation, control of pollution; apportionment and use of the water resources in Kenya, and for purposes they are incidental thereto and connected therewith. The Act vests ownership and control of water in government subject to any rights of user. Under this provision the responsibility

to regulate access, use and control of water resources is vested in the Water Resources Authority (WRA).

Part 2, Section 18 provides for national monitoring and information systems on water resources. The Water Act protects water bodies and sources from pollution and controls their use by the project. It ensures that the projected required amount of water that can be provided by the existing water system and that the project designer will work to conserve the available water both during construction and operation phases.

2.3.6 The Physical and Land Planning Act, 2019

The Act provides for planning and controlling for physical development in the country in general. The Act read together with the county government Act 2012 will assist in synchronizing the national, local, and project physical planning, controlling for any possible conflicts.

The project shall be approved by the relevant County departments after meeting the requirements of the Act.

2.3.7 Land Titles Act Cap 282

Section 10(1) of the Act states that there shall be appointed and attached to the Land Registration Court, a qualified surveyor who, with such assistants as may be necessary, shall survey land, make a plan or plans thereof and define and mark the boundaries of any areas therein, as when and where directed by the Recorder of Titles, either before, during or after the termination of any question concerning land or any interest connected therewith, and every area so defined and marked shall be further marked with a number of other distinctive symbol to be shown upon the plan or plans for the purposes of complete identification and registration thereof, as is herein-after prescribed.

Section 27 further provides that every certificate of title shall set out a description of the immovable property therein referred to, with figures and references necessary to identify it on the plan or map of the area, in which it is situated, and a correct statement of the right, title or interest of the person to whom it is issued. Sub section 4 requires that there shall be attached to every certificate of ownership, a plan of the land, the subject of the certificate, and the plan shall be signed by the Recorder of Titles and the Director of Surveys or such officer as the Director of Surveys may appoint.

2.3.8 County Governments Act, 2012

The Act empowers county governments to protect the environment and natural resources with a view to establishing a durable and sustainable system of development. In addition, the county governments are responsible for development planning and control including the county spatial plans. The proponent will work in liaison with Homabay and Migori County Governments to ensure compliance with land use requirements within the counties.

2.3.9 The Agriculture Act, Cap 318

The Agriculture Act Cap 318 of the Laws of Kenya seeks to promote and maintain a stable and sustainable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land

management and good husbandry. This Act primarily guides and regulates farming practices especially in relation to the proximity of farming within the riparian section. The Act specifies that no agricultural activity is allowed and or permitted within the riparian area of a wetland, river or Lake. The Agriculture Act is the principal land use statute covering, inter- alia, soil conservation, and agricultural land use in general.

2.3.10 The Penal Code, Cap. 63

Section 191 of the Penal Code makes it an offence for any person or institution that voluntarily corrupts, or foils water for public springs or reservoirs rendering it less fit for its ordinary use. Similarly, section 192 of the same act prohibits making or vitiating the atmosphere in any place to make it noxious to health of persons/institution in dwellings or business premises in the neighborhood or those passing along a public way.

2.3.11 Lake Basin Development Authority (LBDA) Act, Cap 442

The LBDA Act that established the Authority stipulates among others, that the Authority shall coordinate the abstraction and use of natural resources and set up an effective monitoring system; effect the protection and utilization of water and soils; ensure water and soil conservation measures are undertaken; identify and collect all data related to water uses and other resources for efficient forward planning; examine the hydro-geological and ecological effects of development and evaluate how they affect economic activities of the persons dependent on river and lake water development; Consider all aspects of development of the area and their effects on lake inflows and outflows; and monitor the operation and provide technical reports on the operations of any agreement or other arrangements between Kenya and other states on the use of the waters of the Nile and Lake Victoria.

2.3.12 HIV/AIDS Prevention and Control Act, 2006

This is an Act of Parliament providing measures for the prevention, management, and control of HIV and AIDS, to provide for the protection and promotion of public health, and for the appropriate treatment, counseling, support, and care of persons infected or at risk of HIV and AIDS infection, and for connected purposes**.**

Requirements of the Act will ensure that the proponent together with Homabay and Migori County public health department provide VCT services for employees and locals where appropriate and promote public awareness. This will go a long way in ensuring stigmatization of HIV and AIDS is reduced as well as managed during the operation period.

2.4 International Conventions

The United Nations and other international institutions have drafted several international treaties and conventions aimed at enhancing social economic development, environmental sustainability and promoting fundamental human rights. Due to their ecological and economic significance to the Kenyan Nation, the Government of Kenya has found it befitting to be signatory to various global conventions on conservation of wetlands and biodiversity. The Kenyan fish caging sector has experienced significant growth in recent years, especially in Lake Victoria and other inland water bodies. This expansion must be aligned with international environmental standards and

conventions to ensure sustainability, conservation of biodiversity, and minimal disruption to local ecosystems. The following international conventions are particularly relevant to fish caging in Kenya:

- The Convention on Conservation of Wetlands, or the Ramsar Convention (1971);
- The Convention on Conservation of Biological Diversity (Nairobi, 1992);
- The Convention on the Conservation of Migratory Species and Wildlife (Bonn 1979); and
- The Conservation of Important Bird Areas, (IBAs) of these, the following are the most relevant for the project under review.

2.4.1 The Convention on Wetlands of International Importance (Ramsar Convention, 1971)

Kenya is a signatory to the Ramsar Convention and has designated several wetlands of international importance, including parts of Lake Victoria.

Wetlands provide critical breeding, feeding, and nursery habitats for many fish species, and support biodiversity essential to ecosystem health.

Fish cages, if poorly sited or managed, can degrade wetland quality through nutrient loading, eutrophication, and habitat alteration.

Implications for Fish Caging:

Site selection for cages must avoid sensitive wetland zones or Ramsar-designated areas.

Environmental Impact Assessments (EIAs) should evaluate risks to wetland functions and biodiversity.

Projects must promote wise use of wetlands, aligning with Ramsar's core principles.

2.4.2 Convention on Biological Diversity (CBD, Nairobi, 1992)

The convention was made in Nairobi in 1992, of which Kenya is a signatory. The approach of conservation of biodiversity is basically broad. The CBD emphasizes conservation of biodiversity, sustainable use of biological resources, and fair sharing of benefits.

Parties to the convention are required to adopt, national strategies, plans and programmes for the conservation and sustainable use of biological diversity into their relevant sectoral and cross-sectoral plans, programmes and policies. The cage aquaculture project should ensure the rare and endangered species in the project area and its environs are conserved

Fish caging can affect aquatic biodiversity by introducing invasive species, altering trophic dynamics, and impacting native fish stocks.

Implications for Fish Caging:

Operators must implement biodiversity-sensitive aquaculture practices (e.g., native species, disease control, pollution management).

Integration of biodiversity considerations into fish farming policies and planning is necessary.

Local communities should benefit fairly from fish caging operations, consistent with CBD objectives on access and benefit-sharing.

2.4.3 Convention on the Conservation of Migratory Species of Wild Animals (CMS, Bonn, 1979)

The convention on migratory species (CMS) was adopted to conserve migratory species of wild animals given that migratory species are seen as international resources. Such species may be terrestrial or marine. The conventions agreement on the conservation of African-Eurasian Migratory water birds is specific on the need to protect the feeding, breeding and wintering habitats, the main ones being wetlands and open water bodies. Many fish and aquatic birds in Kenya are migratory and depend on healthy freshwater ecosystems throughout their life cycles.

Caging operations could interfere with migration routes, spawning grounds, or feeding areas.

Implications for Fish Caging:

Impact assessments should consider migratory species, including potential barriers created by cages and water quality degradation.

Seasonal variations in species movement must guide cage placement and operation schedules.

Conservation of critical habitats must be a key part of aquaculture development plans.

2.4.4 Conservation of Important Bird Areas (IBAs)

Kenya has several IBAs, many of which are adjacent to or within fish caging zones such as Lake Victoria and Lake Naivasha. The Lake Victoria region has five out of the sixty sites that have been identified as an IBA of Kenya. Nature Kenya, Birdlife international and Global Environment Facility (GEF) have identified the sites. The Important Bird Areas Program is a worldwide initiative working for the conservation of biological diversity and sustainability of human use of natural resources. IBAs often overlap with wetlands, making them doubly sensitive to aquaculture activities.

The project is expected to recognize these sites and protect them where they occur in the project area or its environs.

Implications for Fish Caging:

Cage installations should avoid disrupting key bird nesting, roosting, or feeding areas.

Activities that increase water turbidity or fish kill events may negatively impact bird populations and must be controlled.

EIAs should incorporate avifauna assessments and consult with bird conservation organizations like Nature Kenya.

2.4.5 EAC Protocol on Environment and Natural Resources (2010)

This Protocol was established by the **East African Community (EAC)** to promote sustainable environmental management across member states, including Kenya.

Specific to the management of floods and flood-related disasters such as sedimentation, the protocol in article 112 (c) of the management of the environment take necessary disaster preparedness, management, protection and mitigation measures especially for the control of natural and manmade disasters. These include oil spills, biohazards, floods, earthquakes, marine accidents, and drought and bush fires. For purposes of paragraph 1 of this Article, the Partner

States undertake to: (e) adopt environmentally sound management techniques for the control of land degradation, such as soil erosion, desertification and forest encroachment. These directly relate to sound management of land practices that reduce incidents of soil erosion that leads to flooding and sedimentation.

Implications for Fish Caging:

The Protocol emphasizes **sustainable use of natural resources**, including **aquatic ecosystems**.

Fish cage culture directly interacts with **lake ecosystems** (e.g., Lake Victoria), and the Protocol guides how such activities should be conducted to avoid **pollution**, **eutrophication**, or **biodiversity loss**.

Fish cages may lead to **accumulation of fish waste**, uneaten feed, and use of **chemicals or antibiotics**. The Protocol requires proper waste management and control of pollutants to safeguard **water quality**.

Development of large-scale fish cage farms would necessitate an SEA or Environmental Impact Assessment (EIA), which the Protocol mandates for projects that may affect the environment.

Since Kenya shares water bodies (e.g., Lake Victoria) with Uganda and Tanzania, the Protocol promotes **regional coordination** in managing transboundary ecosystems. This is crucial for preventing **cross-border environmental degradation** from fish farming activities.

2.4.6 ILO Convention No. 184 on Safety and Health in Agriculture (2001)

This convention sets global standards for occupational health and safety in the **agriculture sector**, which includes **aquaculture** such as fish cage culture. Kenya has not ratified this convention, but it remains **normatively influential**.

Implications for Fish Caging:

Fish cage culture involves physical labor in potentially hazardous aquatic environments (e.g., drowning risks, equipment injuries, exposure to waterborne diseases). The Convention sets standards for protective gear, training, and first aid availability.

Many fish cage operations involve vulnerable groups. The Convention emphasizes safe working conditions and protection for young and female workers, aligning with Kenya's labor and gender equality frameworks.

If chemicals (like disinfectants or treatments for fish diseases) are used, the Convention requires safe handling, labeling, and training—to avoid health risks to workers.

Encourages member states to ensure social security and health insurance for agricultural workers. For Kenya's emerging aquaculture sector, this pushes for better worker rights and formalization of employment.

2.5 Institutional Framework

2.5.1 NEMA

NEMA is the National body charged with coordinating matters of implementation of policy issues relating to the environment. This body was established under the EMCA, Cap 387. Other

departments that deal with environmental issues include the Kenya Forests Service (KFS), Kenya Wildlife Services (KWS), County Governments of Homabay and Migori, among others.

2.5.2 National Environmental Council (NEC)

The NEC was set up under the EMCA 1999 and is responsible for policy formulation and directions; sets national goals and objectives and determines policies and priorities for the protection of the environment; promotes cooperation among public departments, local authorities, private sector, NGOs and such other organizations engaged in environmental protection programs among other functions assigned under EMCA 1999. This Council is appointed by the Minister.

2.5.3 National Environment Complaints Committee (NECC)

The NECC[9] investigates allegations and complaints of suspected cases of environmental degradation. The Committee also prepares and submits to the NEC periodic reports of its activities.

Members of the public can register or appeal to this committee regarding any aspects of the project that violates the law and its licenses.

2.5.4 National Environmental Action Plan (NEAP) Committee

The NEAP is responsible for the development of a 5-year Environmental Action Plan among other things.

2.5.5 Standards and Enforcement Review Committee (SERC)

The SERC is a technical committee that is responsible for the environmental standards formulation, methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures.

2.5.6 National Environmental Tribunal (NET)

NET[10] reviews administrative decisions made by NEMA relating to issuance, revocation or denial of license and conditions of license. It also provides legal opinion to NEMA on complex matters where the Authority seeks such advice. In addition, the Tribunal has powers to change or give an order and direction regarding environmental issues in dispute.

2.5.7 The East African Community (EAC)

The EAC is a regional forum that brings together Kenya, Tanzania, Uganda, Rwanda, Burundi, Democratic Republic of Congo (DRC), Somalia and South Sudan into an economic block. There are also plans to turn EAC into a regional political body. The EAC together with the donors are in the forefront of promoting sustainable development of the Lake Victoria Basin.

2.5.8 Lake Victoria Fisheries Organization (LVFO)

This is one of the projects of the EAC that is specifically responsible for promoting proper management and optimum utilization of the fishery resources of the Lake Victoria. Its establishment was achieved through the funding of the LVEMP courtesy of the three East African

[9] https://www.necc.go.ke
[10] https://www.judiciary.go.ke/the-national-environment-tribunal/

countries, the FAO, the European Union (EU), World Bank/GEF. It has the responsibility of enhancing partnership and collaboration with institutions and stakeholders for the betterment of Lake Victoria's ecosystem for sustainable fisheries resource utilization and socioeconomic development of the riparian communities.

2.5.9 Lake Victoria Environment Management Project (LVEMP)

This is a Global Environmental Facility (GEF) funded project whose second phase is currently underway. The first phase was completed in 2004 with a total funding to the tune of USD 75,636,000, of which the three East African states contributed 10%. Specific objectives of LVEMP Phase I were to maximize the sustainable benefits to the riparian communities from using resources within the basin to generate food, employment and income; to supply safe water and sustain a disease free environment; to conserve biodiversity and genetic resources for the benefit of the riparian communities; to harmonize national and regional management programs in order to achieve to the maximum extent possible the reversal of environmental degradation; and to promote regional co-operation.

2.5.10 The Lake Victoria Fisheries Research Project (LVFRP)

This was established in 1997 courtesy of the funding from the European Union. The principal aim of the Project was to assist the LVFO in establishing a framework for the rational management of Lake Victoria's fisheries. The specific objectives of the project were to carry out stock assessment, to train fisheries researchers, to rehabilitate and construct research vessels, to equip the research institutes and to investigate socio-economic issues related to the Lake and its fisheries.

2.5.11 The Nile Basin Initiative (NBI)

This initiative, funded by donors (e.g., World Bank, Norway and Sweden) comprises ten countries which make up the Nile River Basin, namely, Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. Its aim is to promote the exploitation of the development potential of the Nile River in a way that focuses on gaining mutual benefits from developments rather than on defending rights.

3 PROJECT DESCRIPTION AND IMPLEMENTATION

Victory Farms Limited has proposed a commercial, sustainable and socially responsible tilapia cage system with an estimated production of 30,000 metric Tons per annum in new 390 Acres concession block within Lake Victoria's Nyatike West (Kadem) & Nyatike South (Karungu) Sub-Counties in Migori County.

The entire proposed farming project will incorporate environmental guidelines as well as health and safety measures.

3.1 Construction Inputs and Activities

Table 4 Construction Inputs and Activities

The project inputs	• **Construction raw materials –** The construction of HDPE cages will include round HDPE pipes, nets, strings and fasteners. All these will be to the approved standards and shall be obtained from licensed dealers and especially those that have complied with the environmental management guidelines and policies; and • **Labour** – Construction labor force of both skilled and non-skilled workers who will require services such as water supply, washing and sanitation facilities
Construction activities	Construction activities will entail: • Procurement of construction materials from approved dealers; • Appropriate storage of the construction materials; • Site preparation i.e. demarcation; • Construction of the HDPE fish cages; and • Disposal of the resulting waste materials.

3.2 Project Description

The proposed project will be implemented in offshore waters of the block as follows:

1. West Kadem waters in Nyatike South Sub County in Migori County – comprising Got Kachola, Ongoro, Matoso and Lidha Beaches;

2. Karungu, Nyatike West Sub County in Migori County – comprising Aluru Island, Okiro, Oodi Beaches.

The proponent has an existing and largest sustainable tilapia cage farm in East and Central Africa. The expansion of the tilapia fish cage system will help in meeting the current national tilapia fish demand and generate income both to the proponent and residents of Migori county. The proposed new concession block is targeted to produce approximately **30,000 Metric Tons per year**.

3.2.1 Cage Design (High Density Polyethylene- HDPE Cages)

The design of fish cages is determined by several factors. In designing a cage, it is important to ensure that the fish and the people who use the cage are safe as mentioned above. The parts of a floating cage unit should be designed and constructed in a manner that provides suitable anchorage, buoyancy, strength and stability. When deciding on the adequacy of these features it is necessary to consider the likely loads imposed by vehicles, equipment, fish food, etc., and the effect of waves and wind. Continued safety of the installation will depend on regular routine inspection combined with maintenance inspection, normally at least once a year and immediately after storms (HSE, 1997). Lack of proper maintenance can lead to serious losses of fish, property or human life.

The proponent will use floating surface cages in the project. The proponent will make use of modern HDPE cages that are plastic in nature and more durable. They will be 30m diameter and 10m depth given the lake bottom depth of over 30 m. Thus, the difference between cage bottom and lakebed is 20m, making oxygen circulation optimum for juvenile tilapia fingerlings.

Figure 1 Project location

Plate 1 Sample HDPE Cage Design

4 BASELINE INFORMATION

4.1 Position and Size

Kenya has faced a steady decline in capture fish production in the recent years. The government of Kenya has realized this trend and implemented Economic Stimulus Program (ESP) for small scale farmers in the country which increased fish production by around 22,000 Tones and created a good business climate for aquaculture. There have been progressive policy milestones to support aquaculture production since the implementation of the ESP program. Given that Lake Victoria's Fishery accounted for 86,394 MT in 2022, which was an 8% decrease in catch compared to 94,349 MT recorded in the year 2021, it is obvious that the decrease was attributed to increasing overfishing and illegal fishing practices and even declining wild stocks. Thus, the proponent, Victory Farms Ltd, proposes to invest in an expansion of its tilapia cage system production into West Kadem and West Karungu regions in Migori County.

4.1.1 Overview of the project site - Nyatike South and Nyatike West (Migori)

The study area is the Kenyan section of Lake Victoria in Nyatike South and Nyatike West Sub Counties in Migori as listed below:

1. West Kadem waters in Nyatike South Sub County in Migori County – comprising Got Kachola, Ongoro, Matoso and Lidha Beaches;
2. Karungu, Nyatike West Sub County in Migori County – comprising Aluru Island, Okiro, Oodi Beaches.

Administratively, Aluru Island, Okiro, Oodi Beaches are within Gunga Sub-Location, West Karungu Location, Kachieng Ward, Nyatike West Sub-County within Migori County. Also, Got Kachola, Ongoro, Matoso and Lidha Beaches are located in Winam Sub Location, West Kadm Location, Got Kachola Division (ward), Nyatike South Sub County within Migori County.

Migori County is geographically located between latitudes 0°24' South and 1°04' South, and longitudes 34°00' East and 34°50' East, occupying a total land area of approximately 2,586 km². The county is situated in south-western Kenya, within the Lake Victoria Basin. It shares administrative boundaries with Homabay County to the north, Kisii and Nyamira counties to the north-east, Narok County to the east, the United Republic of Tanzania to the south, and Lake Victoria to the west.

The county's topography is diverse, ranging from low-lying plains along the Lake Victoria shoreline to undulating hills and highland areas toward the eastern and south-eastern parts of the county. Altitude levels range from approximately 1,134 metres above sea level along the shores of Lake Victoria to about 2,100 metres above sea level in the highland zones bordering Kisii and Narok counties. The lowland areas are characterized by gentle slopes and alluvial plains, while the upland areas consist of steep slopes, rolling hills, and dissected terrain, influencing land use patterns, drainage, and agricultural potential across the county.

4.2 Administrative, Political Units and population

Table 5 Area and population of the study area (Source: KNBS)

Sub-County	Land Area (km²)	Male Population	Female Population	Intersex	Total Population	Households	Average HH Size	Population Density (Persons/km²)
Awendo	255.3	56,348	60,939	3	117,290	27,033	4.3	459
Kuria East	187.6	46,969	49,894	9	96,862	17,363	5.6	516
Kuria West	395.7	101,090	107,417	6	208,513	39,781	5.2	527
Nyatike	676.9	83,989	92,164	9	176,162	40,257	4.4	260
Rongo	213.4	59,257	65,329	1	124,587	29,087	4.3	584
Suna East	205.1	58,977	63,694	3	122,674	27,302	4.4	598
Suna West	287.5	61,430	67,459	1	128,890	29,251	4.3	448
Uriri	392.1	68,127	73,318	3	141,448	30,094	4.7	361
TOTAL (Migori County)	**2,613.5**	**536,187**	**580,214**	**35**	**1,116,436**	**240,168**	**4.6**	427

According to the 2019 Kenya Population and Housing Census data above, Migori County covers a total land area of 2,613.5 km² and has a population of 1,116,436 people, with females (580,214) slightly outnumbering males (536,187), reflecting a common demographic trend in the region. Kuria West is the most populous sub-county with 208,513 people, while Kuria East has the smallest population at 96,862. Population density varies significantly across the county, from 260 persons per km² in the expansive Nyatike Sub-County to nearly 600 persons per km² in Suna East and Rongo, highlighting pressure on land in the more compact sub-counties and indicating potential challenges in land use planning and resource management.

Nyatike Sub-County, the largest in terms of land area at 676.9 km², accommodates 176,162 people, resulting in the lowest population density in the county. Its relatively sparse settlement pattern reflects an extensive rural landscape, proximity to Lake Victoria, and livelihoods dominated by fishing, agro-pastoralism, and rain-fed agriculture. The larger land area also affects service delivery, infrastructure provision, and access to social amenities due to longer distances between settlements. Household sizes across the county range from 4.3 to 5.6 persons, with Nyatike averaging 4.4, slightly below the county mean of 4.6. Overall, the data illustrates marked spatial and demographic contrasts, uneven settlement patterns, and diverse livelihood systems across Migori County, which are critical for planning and resource allocation.

Table 6 Distribution of population by sex, number of households, land area, density at the Division Level of the study area (Nyatike)

Name	Land Area km²	Population			Population Density	Number of Household
		Male	Female	Total		
Nyatike Sub County	**676.9**	**83,989**	**92,164**	**176,162**	**260**	**40,257**
Got Kachola Division	114.0	14,489	16,072	30,561	268	6,728
Kaler Division	101.5	9,933	10,900	20,833	205	4,377
Karungu Division	142.0	19,667	21,604	41,272	291	9,860
Muhuru Division	44.3	13,108	13,947	27,057	610	6,417
Nyatike Division	275	26,792	29,641	56,439	205	12,402

Source: KNBS census 2019

The table summarizes the demographic and spatial profile of Nyatike Sub-County and its divisions, showing clear variations in land area, population, density, and households. Nyatike Sub-County covers 676.9 km² with a total population of 176,162, where females slightly outnumber males. The average population density is 260 persons per km², reflecting moderate settlement pressure, and the sub-county has 40,257 households, indicating medium-sized household units.

Significant differences exist among the divisions. Nyatike Division is the largest in land area (275 km²) and has the highest population (56,439), yet its population density is relatively low, suggesting dispersed, predominantly rural settlement patterns. Karungu Division, though smaller, has a high population density of 291 persons per km² and a large number of households, pointing to more concentrated settlement and stronger economic or infrastructural influence.

Got Kachola and Kaler divisions exhibit moderate populations and densities, with Got Kachola being slightly more densely populated than Kaler, reflecting semi-rural characteristics. Muhuru Division is the smallest in land area but records the highest population density at 610 persons per km², indicating intense pressure on land and services, likely due to lakeshore activities and urbanization.

Overall, the population distribution in Nyatike Sub-County is uneven, with smaller divisions experiencing higher densities, creating important implications for planning and service delivery.

4.3 Physiographic and Natural Conditions

4.3.1 Physical and Topographic Features

Nyatike West Sub-County (Karungu) and Nyatike South Sub-County (Kadem) exhibits clear internal contrasts in physical environment and land-use patterns, despite both areas sharing a lakeside setting along Lake Victoria.

Nyatike West (Karungu) is dominated by lakeshore lowlands with generally flat to gently undulating terrain that slopes toward Lake Victoria. The area lies at relatively low elevations, averaging about 1,100–1,300 metres above sea level, and is characterized by black cotton soils. These soils are fertile and support crop farming, but they are also prone to waterlogging and seasonal flooding, particularly during heavy rains. Proximity to Lake Victoria strongly influences

livelihoods, with fishing, fish trade, and lakeside commerce playing a major economic role. Settlement patterns tend to be more concentrated, especially near the shoreline and market centres such as Karungu, resulting in relatively high population densities.

Nyatike South (Kadem), while also partly influenced by the lake, extends further inland and transitions more clearly into the upland plateau. The terrain here is more undulating, with better-drained soils compared to the lakeshore lowlands of Karungu. This supports a stronger agricultural base, particularly subsistence crop farming and livestock keeping. Settlements in Kadem are more dispersed, reflecting the availability of agricultural land and lower population density compared to Karungu.

In the broader context of Migori County, Nyatike West reflects a lowland, lake-oriented economy with higher settlement concentration, while Nyatike South represents a transitional zone between the lakeshore and upland plateau, with more land-based livelihoods. This internal contrast highlights the environmental diversity within Migori County and underscores the need for area-specific planning and development interventions.

Plate 2 Gwasi or (Usengere) Hills

4.4 Geological and Soil Characteristics of Nyatike West (Karungu) and Nyatike South (Kadem)

Nyatike West (Karungu) and Nyatike South (Kadem) lie within the Lake Victoria Basin and share a geological foundation largely shaped by Precambrian basement rocks overlain by younger lacustrine and alluvial deposits. These formations strongly influence soil development, land stability, and suitability for various land uses, which are critical considerations in Environmental Impact Assessments.

In Nyatike West (Karungu), the geology is dominated by recent alluvial and lacustrine sediments deposited along the shores of Lake Victoria. These deposits have given rise to extensive black cotton soils (Vertisols), which are clay-rich, highly expansive, and seasonally reactive. During wet periods, these soils become waterlogged due to poor drainage, while in dry seasons they shrink and crack extensively. Although inherently fertile, black cotton soils present challenges for

construction, road development, and drainage infrastructure. The low-lying geology also contributes to the formation of wetlands and marshy areas, which are environmentally sensitive and play a vital role in groundwater recharge, fisheries, and biodiversity conservation. Karungu is characterized by young, clayey, flood-prone soils with engineering limitations.

Nyatike South (Kadem) is underlain mainly by weathered basement rocks, including granites and gneisses, which form part of the upland plateau. Soils in this area are more varied and include loamy and sandy clay loams with moderate to good drainage. These soils are generally less expansive than those in Karungu and are better suited to agriculture and settlement. However, on sloping terrain, soil erosion can occur if land is poorly managed. Kadem has older, more stable geological formations with better-drained soils, supporting diversified land use.

4.5 Drainage Characteristics of Nyatike West (Karungu) and Nyatike South (Kadem)

Nyatike West (Karungu) and Nyatike South (Kadem) drainage characteristics are largely influenced by topography, geology, and proximity to the lake. These features are critical for understanding surface water flow, flood risks, wetland dynamics, and water resource management in the context of an Environmental Impact Assessment.

Nyatike West (Karungu) is characterized by a low-lying lakeshore drainage system that is directly influenced by Lake Victoria. The terrain slopes gently toward the lake, resulting in slow-moving surface runoff and poorly defined drainage channels. Numerous small seasonal streams and overland flow paths drain into the lake, particularly during the rainy seasons. Due to the flat topography and dominance of clay-rich black cotton soils, infiltration rates are low, leading to surface ponding and waterlogging in many areas. Wetlands, marshes, and floodplains are common along the shoreline and around river mouths, acting as natural buffers that regulate floods, trap sediments, and support aquatic biodiversity. However, during periods of intense rainfall or lake level rise, these lowlands are prone to localized flooding, which affects agriculture, settlements, and infrastructure. Human activities such as land reclamation, cultivation near riparian zones, and inadequate drainage structures further exacerbate flood risks. Karungu's drainage system is slow, lake-dominated, and flood-prone

Nyatike South (Kadem) exhibits a more developed drainage network influenced by its undulating upland topography. The area is drained by several seasonal streams and minor rivers that originate in the upland areas and flow toward Lake Victoria. These watercourses are generally better defined than those in Karungu, with higher flow velocities and improved natural drainage. Soils in Kadem allow relatively higher infiltration, reducing prolonged waterlogging. However, on sloping land, surface runoff can be rapid during heavy rains, increasing the risk of soil erosion and sediment transport into downstream water bodies. Kadem's drainage is more structured and slope-driven

Plate 3 Lake Victoria

4.6 Climate Characteristics of Nyatike West and Nyatike South Sub-Counties

Nyatike West and Nyatike South Sub-Counties experience a tropical climate that is moderately influenced by the lake. The climate is generally warm to hot throughout the year, with conditions varying slightly between the lakeshore lowlands of Nyatike West and the more inland areas of Nyatike South.

The area experiences a bimodal rainfall pattern, with long rains occurring from March to May and short rains from October to December. Annual rainfall averages between 600 mm and 1,000 mm, with Nyatike West receiving slightly higher rainfall due to its immediate proximity to Lake Victoria. However, rainfall is often erratic and unevenly distributed, with frequent dry spells that affect agricultural productivity. The flat terrain and clay-rich soils common in Nyatike West limit infiltration and effective water retention, leading to surface runoff during heavy rains and drought stress during dry periods.

Temperatures are generally high across both sub-counties, ranging from 22°C to 35°C, with higher daytime temperatures commonly experienced in Nyatike West due to lower elevation and exposure. Nyatike South, which extends further inland and into gently rising terrain, experiences marginally cooler conditions but remains predominantly hot and dry.

Humidity levels are moderate to high, particularly in Nyatike West near the lakeshore. The climate supports fishing, livestock keeping, and subsistence farming; however, increasing climate variability, prolonged dry spells, and unreliable rainfall pose significant challenges. These climatic conditions are critical considerations for water resource planning, agricultural sustainability, and climate resilience in EIA studies.

4.6.1 Wind Characteristics of Nyatike West and Nyatike South Sub-Counties

Nyatike West and Nyatike South Sub-Counties experience wind patterns that are largely influenced by their location within the Lake Victoria basin, local topography, and seasonal weather systems. Wind characteristics in the area are an important consideration for Environmental Impact

Assessment (EIA), particularly in relation to air quality, dispersion of emissions, erosion, and the design of infrastructure.

In Nyatike West, which lies directly along the shores of Lake Victoria, wind regimes are strongly influenced by lake–land breeze systems. During the daytime, cooler air from the lake moves inland, while at night, air flows from the land toward the lake. These diurnal wind patterns are generally moderate but can be locally strong, especially in open lakeshore areas and during storm events. Prevailing winds often blow from the southeast and east, particularly during the long and short rainy seasons. The open, flat terrain allows winds to travel with little obstruction, increasing their effect on wave action along the shoreline, dust transport during dry periods, and the dispersion of airborne pollutants.

In Nyatike South, wind speeds are generally lower and more variable due to slightly higher elevations, undulating terrain, and greater vegetation cover inland. While the area still experiences regional wind patterns similar to those of Nyatike West, the influence of the lake diminishes with distance. Winds are typically light to moderate and are more strongly felt during seasonal transitions and storm events. Vegetation and terrain features provide some natural wind breaks, reducing wind erosion and dust movement compared to the lakeshore zone.

Overall, Nyatike West experiences stronger and more consistent winds due to its lakeside exposure, while Nyatike South has relatively calmer and more variable wind conditions. These differences are relevant for assessing erosion risks, air dispersion, and the siting of facilities in EIA planning

4.6.2 Temperature Patterns of Nyatike West and Nyatike South Sub-Counties

Nyatike West and Nyatike South Sub-Counties in Migori County experience generally warm to hot tropical temperatures throughout the year, influenced by their low elevation, proximity to Lake Victoria, and regional climatic conditions. Temperature patterns are a key factor in environmental planning, agricultural productivity, and human comfort, making them important for Environmental Impact Assessment (EIA) studies.

In Nyatike West, the lakeshore zone near Karungu experiences slightly moderated temperatures due to the cooling effect of Lake Victoria. Daytime temperatures generally range between 22°C and 33°C, while nighttime temperatures are milder, typically between 18°C and 24°C. Seasonal variations are relatively small, but the hottest months usually occur just before the onset of the long rains, from January to March, when high solar radiation and reduced cloud cover increase temperatures. The lake's moderating influence reduces extreme heat, providing relatively stable conditions for fishing and lakeshore agriculture.

In Nyatike South (Kadem), which lies further inland and slightly away from the direct influence of the lake, temperatures are marginally higher and more variable. Daytime temperatures often range between 23°C and 35°C, with nighttime temperatures averaging 19°C to 25°C. The inland terrain and reduced vegetation cover contribute to faster heating during the day and more pronounced temperature fluctuations. The hottest period similarly occurs in the pre-rainy season months of January to March, while the cooler periods coincide with the long rains when cloud cover and precipitation reduce solar heating.

Nyatike West experiences slightly cooler and more stable temperatures due to lake influence, while Nyatike South experiences warmer, more variable conditions. These patterns have implications for agriculture, water demand, human comfort, and climate adaptation strategies (*Migori CIDP, 2023*).

4.7 Fauna and Flora of Nyatike West and Nyatike South Sub-Counties

Nyatike West (Karungu) and Nyatike South (Kadem) Sub-Counties exhibit diverse flora and fauna, shaped by variations in topography, soil type, and proximity to the lake. These biological resources are essential for ecological balance, livelihoods, and environmental assessments under EIA studies.

4.7.1 Flora:

Nyatike West, along the lakeshore, is characterized by wetland vegetation, riparian forests, and patches of swampy grasslands. Common plants include papyrus (Cyperus papyrus), reeds, water lilies, and other hydrophilic species that thrive in waterlogged soils. Scattered acacia and fig trees occur on slightly elevated areas, providing shade and habitat for birds and insects. The fertile clay soils support small-scale cultivation of crops such as maize, cassava, and sugarcane along well-drained sections, while wetlands remain largely uncultivated.

In Nyatike South, the flora transitions to upland and gently undulating terrain with more drained soils. Vegetation is dominated by savannah grasslands, scattered shrubs, and indigenous trees such as neem, acacia, and Ficus species. Agroforestry practices are common, with farmers planting fruit trees and timber species alongside staple crops. Natural vegetation is increasingly fragmented due to human settlement and agriculture, but pockets of native shrubs and woodlands remain, contributing to biodiversity and soil conservation.

4.7.2 Fauna:

Nyatike West supports a variety of aquatic and semi-aquatic species due to its proximity to Lake Victoria. Fish species, including Nile perch and tilapia, are abundant, supporting fishing livelihoods. Wetlands provide habitat for amphibians, reptiles, and water birds such as herons, kingfishers, and African jacanas. Small mammals like rodents and insectivores are common, while domestic livestock such as cattle, goats, and poultry are reared in settled areas.

In Nyatike South, fauna is more terrestrial, with small mammals, reptiles, and birds adapted to savannah and farmland habitats. Common species include hares, mongooses, guineafowl, doves, and weaver birds. Livestock farming is prominent, complementing subsistence agriculture. Human-wildlife interactions are moderate, with most wildlife concentrated in less-disturbed patches.

Nyatike West exhibits a lakeshore and wetland ecosystem rich in aquatic and riparian biodiversity, while Nyatike South supports upland savannah and farmland species. Both areas are ecologically significant and require careful management in development planning to maintain biodiversity and ecosystem services.

4.8 Economic Activities and Household Income in Nyatike West and Nyatike South Sub-Counties

Nyatike West (Karungu) and Nyatike South (Kadem) Sub-Counties support a range of economic activities, largely shaped by their geography, climate, and proximity to Lake Victoria. These

activities directly influence household income, livelihoods, and socio-economic development, making them critical considerations in Environmental Impact Assessment (EIA) studies.

Nyatike West (Karungu): The economy in Karungu is strongly linked to its lakeshore location. Fishing is the primary livelihood activity, with residents engaged in catching, processing, and trading fish such as Nile perch, tilapia, and dagaa. Fishing generates both direct income for fishers and indirect income through fish trading, boat services, and equipment supply. Small-scale agriculture complements fishing, with households cultivating crops such as maize, cassava, sweet potatoes, and vegetables on fertile but sometimes waterlogged black cotton soils. Livestock keeping, including goats, poultry, and cattle, provides supplementary income and food security. Small-scale trading, boat transport, and casual labor in the fisheries sector also contribute to household earnings. Household incomes vary widely, with fishing households generally earning higher but more variable incomes compared to those reliant on subsistence agriculture.

Nyatike South (Kadem): Kadem's economy is more diversified and primarily land-based. Subsistence farming dominates, with households growing maize, beans, cassava, groundnuts, and vegetables. Livestock rearing, particularly cattle, goats, and poultry, complements crop farming. Small-scale trade and casual labor provide additional income, while some households engage in fishing in rivers and smaller water bodies. Compared to Karungu, household incomes in Kadem are generally more stable but lower on average, as agricultural yields depend on seasonal rainfall and soil fertility.

Nyatike West relies heavily on lake-based economic activities with fluctuating incomes, while Nyatike South depends more on stable but low-yield agriculture. These areas are vulnerable to climate variability, market fluctuations, and environmental degradation, highlighting the need for sustainable livelihood interventions in development planning.

Table 7 Economic activities and Household Incomes of the study area

Sub-county	Main Economic Activities	Poverty Rate (≈)	Typical Household Income Sources	Notable Constraints / Opportunities
Nyatike	Fishing, artisanal gold mining, drought-tolerant cropping, livestock, petty trade	~38% (Migori overall)	Fish, gold earnings, crop sales, livestock, trade, remittances	Semi-aridity, informality in gold sector, infrastructure gaps

Plate 4 Fishing Boats birthed along Victoria shores

4.9 Environment Issues

4.9.1 Water Pollution

The pollution of Lake Victoria is a critical issue. The lake, being a huge system fed by rivers that originate from far-off areas, has elements of both on-site and off-site pollution:

- Agro chemicals/ fertilizer (non-point sources of pollution of the lake)
- Water hyacinth menace
- Direct draining of sewers into the lake
- Car washing in town (run-off to main sewer)
- Clothes washing and bathing in the lake
- Agro-based industrial water release on rivers

Proposed Mitigation Measures

- Proper management of sewage
- Ensure riparian reserves are protected
- Efforts to rid the lake of hyacinth urgently

4.9.2 Air Pollution

Air pollution within the area is minimal; however, there are notable problems and challenges which include;

- Dust during constructions
- Stench from fish mortality
- Burning of wastes such as polythene bags, tyres
- Smoking in public places
- Exhaust fumes from un-roadworthy automobiles

Opportunity for improvement

- Enforcement of laws for hoarding construction sites
- Watering during construction to reduce the dust levels
- Provision of incinerators
- Improve public awareness, especially on the advantages of environmental conservation
- Designating smoking zones within Homabay and Migori Counties.

4.10 Cross Cutting Socio-Economic Issues

4.10.1 Water

There's a lack of water storage facilities to keep water during after treatment. The residents consume water directly from the lake hence contributing to water borne diseases.

4.10.2 Sanitation

- Lack of toilets is a big problem in beach areas.
- Pit latrines collapse due to lose soils in the beach.

4.10.3 Solid waste

There is lack of waste management system in the beach.

4.10.4 Poverty

Poverty in the project catchment is exemplified through the following factors:

- Lack of food security
- Poor housing conditions
- Mushrooming of slums and squatter settlements
- Increased insecurity
- Dwindling health standards, high under-5 mortality rates, low life expectancy and high prevalence of HIV-AIDS
- Inequitable resource distribution

5 METHODOLOGY OF THE STUDY

The EIA experts used site surveys and perused documents relevant to the EIA to come up with data and information regarding the proposed development and expected effects on the water and land resources and socio-cultural environment.

5.1 Methodology Outline

The general steps followed during the assessment were as follows: -

- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of EMCA, Cap 387
- Environmental scoping that provided the key environmental issues
- Desktop studies and interviews
- Stakeholders' engagement and distribution of questionnaires
- Physical inspection of the site and surrounding areas
- Reporting

5.2 Site Surveys

It was important that the Environment Experts carry out a detailed study of the proposed site. Observation enabled the expert to determine what environment factors were most likely to be impacted.

5.2.1 Interviews and Focused Group Discussion

To determine the part of the extent of the proposed project, the expert consulted in depth with the proponent, to determine, size, and objectives of the proposed project. Proponent elucidated his vision for the project and dialogued with the environment expert who advised concerning application of all relevant laws and by-laws related to the project.

For the proposed project to see light at the end of the tunnel, the team of EIA expert sought the views of the professionals and government agencies as well as those of the individuals from different social classes in the community; using structured interviews and focused group discussion to further in depth understanding of the perception to the locals regarding the proposed project.

5.2.2 Perusal of Documents

The environment expert explained to the proponent the importance in acquiring the proper documents associated with the proposed projects. The environment expert perused the following documents:

- County Approvals
- Project layout designs
- State department of fisheries aquaculture guidelines
- The proponent development concept
- Biosafety and biosecurity plan.

5.2.3 Secondary Data

Various literatures were used in aiding the successful completion of the report. They include EMCA-Cap 387, The Physical Planning Act (Cap 286) Laws of Kenya, The Factories and Other

places of Work Act, The Public Health Act, Cap 242 and Environmental Management and Co-ordination (Waste Management) Regulations, 2006 Legal Notice No. 12. Fisheries Development Management Act, 2016, KNBS Census 2019, CIDP Homabay and Migori Counties.

5.3 Actual EIA Public Consultation

Public participation is enshrined in Kenyan constitution. It has also demonstrated that projects that go through this process will acquire high level of public acceptance and accrue benefits for a wider section of the society. Public consultation forms a useful component of gathering, understanding and establishing impacts of projects; determine community and individual preferences and selecting mitigations. Furthermore, it makes it possible to enhance project designs and ensure sustainability of projects.

5.3.1 Process of Public Consultation

The Consultant developed questionnaires for the proposed juvenile tilapia fish cage culture project to gather concerns from the community living in the project area and the entire community. Comments from the Beach Managements (BMU) Committee were sought and incorporated in the report. The study team also sought comments from key informants in the fisheries sector.

5.3.2 Objective of Public Consultation

The consultations with the relevant and affected persons were conducted with a view to: -

- Inform the community, stakeholders and relevant parties of the proposed fish cage culture project.
- Seek the views of the residents of Beach Management Units on the proposed project;
- To seek their opinions on any positive or negative impacts from the establishment of such a project;
- To find out if there are any issues that the project could negatively or positively impact on the lives of the residents and the public.
- Explain to the community and stakeholders the nature of the proposed project, its objectives and scope;
- Obtain suggestions from the public on possible ways that they feel potential negative impacts can be effectively mitigated.

There was a positive reaction over the proposed project with the residents giving no objection to its establishment. The residents could clearly see the benefits of the existing project and thus supported the establishment of a juvenile tilapia cage system.

5.3.3 Salient Issues

The respondents expressed several positive impacts they expect from the proposed project. There were also negative impacts that the respondents expected, and these have been adequately addressed in the Environmental Management Plan. The major issues raised include:

- Will interfere with water quality
- Will hamper free navigation
- May cause disease outbreak
- Pollution of the lake waters
- Injuries and accidents

- Involvement of the BMU in the project implementation
- Proper construction of the cages
- The proponent to limit the project to Tilapia species only
- Use certified fingerlings and feeds.
- Create a buffer zone for biosecurity
- Adopt advanced feeder technology
- Site project clear of navigation route
- Minimizing feed waste
- Keep proper sanitation at the cages
- Control use of chemical drugs
- Proper despoil of human wastes

5.3.4 Consultation & Public Participation (CPP)-analysis

The public interviewed welcomed the development and were optimistic that the project will create employment opportunities, boost food security at the beach as well as improving the incomes from sale of fish, stimulate the growth of national economy by boosting other sectors of business and lead to better standards of living. There was no major negative issue raised as far as the flood control project is concerned. The participation from the stakeholders, the public and neighbours were very successful, and the participants were very cooperative. Therefore, the project is commendable for approval by NEMA

5.3.5 Reporting and Documentation

A comprehensive EIA Study Report containing the findings has been compiled by the consultant in accordance with NEMA guidelines for consideration and approval by the authority.

5.3.6 Key Stakeholders Consulted

Table 7 Key Stakeholders Consulted

Name of Stake Holder	Organization
County Fisheries Department	County Governments of Migori
Lands Office	Nyatike South and West Sub Counties
Water Analyst	Water Resources Authority Lab
State Department of Fisheries	Kisumu Regional Office
Aquaculture Specialist	Part of the experts
Immediate Neighbors	Neighboring residents
Ministry of Interior and National Government Coordination	Chief, Sub-Chief and Nyumba kumi
Local Community	Local Fishing Community and Boat owners/ operators/ Transporters
Media Houses	Newspaper, Radio and Kenya Gazette outlets

5.3.7 Summarized Methods, Tools and Techniques for Stakeholder Engagement

Stakeholder Category	Engagement				
	Communication strategist	**Information Disclosure**	**Consultation**	**Participation**	**Negotiation and Partnership**
Beach management Units Leadership	General meeting, FGD and KIIs (Shared Minutes)		Informed and in-depth individually	BMU	Memorandum of understanding and agreements
All residents of the project area	General meeting, FGD and KIIs (Shared Minutes)	-	General meeting with questions and answers	Beach management units (BMU)	Group
Fishermen in the project area	Key informants' interviews (KIIs)		General meeting with questions and answers	Group	Group
Government Stakeholders	NEMA public consultation	Newspaper adverts	Meeting and letters	Lead agencies	Lead agencies
The general fishing community	Posters, general meetings, minutes, reports and flyers distributed through BMU offices, shops, and chief's baraza and office, websites and documents and reports at county information		Meeting	Representatives	County government

5.4 Feedback and Outcome of Public Consultation

Detailed analysis of administered questionnaires and outcome of public meetings and Barazas are annexed in the report.

6 PROJECT ALTERNATIVES

This Chapter analyses the proposed project alternatives in terms of culture sites, species, and culture systems, with and without floating cages, technology scale and waste management options.

6.1 Project Alternatives Considered

This section analyses the project alternatives in terms of site, technology scale and waste management options.

6.1.1 Relocation Option

Relocation option to a different site is an option available for the project implementation. At present the proponent has alternative sites but the current site is the best according to the surveys done. However, this means that he must look for another site and this will take more time and resources. The proponent already secured concession from relevant authorities.

6.1.2 No Project Option

The No Project option in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. This option will, however, involve several losses both to the proponent and the community. The No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

- The proponent will not benefit from the revenue expected from the project.
- The economic status of the Kenyans and the local people would remain unchanged.
- The local skills would remain underutilized.
- No recreational center and job opportunities will be created for thousands of Kenyans who will work and live in the proposed project.
- Increased urban and rural poverty and crime in Kenya.
- Discouragement for investors to produce this level of affordable facility to the public.

From the analysis above, it becomes apparent that the No Project Option is no alternative to the proponent, Local people, Kenyans, and the government of Kenya.

6.1.3 Analysis of Alternative Construction Materials and Technology

Cages for fish culture can be constructed from a variety of materials and in practically every shape and size. Cages can also be purchased from companies that sell aquaculture supplies, but it will be more economical if construction of cages can be done by oneself. The two most important things to remember are: Cages should be made of sturdy materials. The cage materials should be strong, durable, and nontoxic. The cage (mesh size) must be able to retain the fish yet allow maximum circulation of water through the cage. It is best to select the largest mesh possible that will retain your fish. Adequate water circulation brings oxygen into the cage while washing wastes away. The proponent will use HDPE cages.

6.1.4 Materials

Cage components consist of frame, nets, floats, weights and ropes.

Frame: The frame of the cage can be made from wood, plastic, fiberglass, PVC or metal. Frames made from metals and wood should be coated with a water-resistant paint.

Net materials: Net materials can be plastic coated, welded wire, solid plastic mesh or nylon netting. Mesh size of the net depends on the culture species, initial size of the seed, and the culture method. If we use 6 - 8-inch fingerlings as seed to culture most suitable mesh size is ½ inch and nets with 1/8, ¼ or 3/8-inch (0.5 – 1.0 mm) mesh sizes can be used for fry to fingerling rearing cages.

Floats: For the floating cages, flotation can be provided by waterproof foam rubber, Styrofoam, sealed PVC pipes, plastic bottles or barrels, sealed metallic barrels or any other suitable floating material. For small cages Styrofoam or foam rubber floats are commonly used and plastic or metal barrels are used for large cages.

Anchors: On the other hand, it should be anchored using stones or cement or metallic anchors. For fixed cages the cage should be fixed to the bottom using bamboo, PVC pipes or metallic pipes and nylon ropes to avoid drift. Materials used for cage construction should have following qualities:

- Be durable and strong, but lightweight
- Allow complete exchange of water volume every 30 to 60 seconds
- Allow free passage of fish wastes
- Not stress or injure fish
- Be resistant to fouling
- Be inexpensive and readily available

6.1.5 Wastewater management alternatives

The project is not expected to generate wastewater.

6.1.6 Cage culture site location

There is no water body in region with more suitable conditions for cage culture than Lake Victoria. Other sites along Lake Victoria exist, but do not have better water quality conditions than the zone selected for developing the fish farm. The site that proponent has earmarked is in most suitable location for cage culture and ponds in the area. Other zones are acceptable but with limitations on depth due to higher average turbidity. It is therefore recommended to develop the aquaculture farm by proponent in its current location

6.1.7 Cage Culture without Tilapia Species

Tilapia is the fish species of choice as it is the only proven fish species suitable for economical cage culture in Kenya. There is no alternative water body for culture of Tilapia in cages in the project area. Tilapia fish are widespread in the wild within the lake. Other fish species can also be reared in cages, but this alternative system has not been proven in the area and its economic

viability is still questionable. Using an alternative species on Lake Victoria has no environmental benefit.

6.1.8 The Proposed Development Option

Under the Proposed Development Option, the developer of the proposed project would be issued with an EIA License. In issuing the license, NEMA would approve the proponent's proposed development of the project, provided all environmental measures are complied with during the construction period and operational phases. This alternative consists of the applicant's final proposal with the inclusion of the NEMA regulations and procedures as stipulated in the environmental impacts to the maximum extent practicable.

7 PROJECT POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 Introduction

This Chapter provides the potential ecological effects associated with the proposed cage fish farming by Victory Farms Limited in Migori/ Homabay concession within Lake Victoria. The potential impacts were based on existing commercially farmed Tilapia.

7.2 Positive Impacts

Table 8 Positive Impacts

Impact	Narrative
Employment, skills transfer and human resource capacity development	Implementation of this project will involve the use of skilled, semi-skilled and unskilled labour. Different expertise will be required for the project. Provision of employment will contribute to raising the socioeconomic well-being of the people living and working around the project.
Impact on human nutrition on local and national level	The supply of fish will contribute to filling the country's need for proteins, a commodity which is not adequate now.
Diversifying community livelihoods	Beneficiary businessmen and middlemen will have an alternative livelihood thus offering cushion against shortcomings of the current agricultural activities in the area

7.3 Negative Impacts – Farm Design and Construction Phase

7.3.1 Disturbance of Benthic Habitat

Installation of the proposed development offshore cluster cages (quays) may result in some localized disturbance of the lakebed, including the movement and suspension of sediment and substrate materials within the water column. The destruction of habitats for the establishment of aquaculture farms will be negative if the habitat is considered ecologically or economically important. Such areas would include breeding, nesting, nursery and foraging areas for a range of species with emphasis on rare and endangered species and species of conservation importance. The establishment of cages will smother existing habitats.

Mitigation Measures

- Sensitive habitats such as bird nesting or fish breeding areas, must be identified prior to cage establishment and avoided,
- During the installation phase, due diligence should be observed including use of underwater cameras to avoid potentially sensitive benthic habitats and species, and
- The proponent will use floating surface cages in the project. The proponent will make use of modern HDPE cages that are plastic in nature and more durable. They will be 30m diameter and 10m depth given the lake bottom depth of over 30 m. Thus, the difference between cage bottom and lakebed is 20m, making oxygen circulation optimum for juvenile tilapia fingerlings

7.3.2 Deployment of Cage

During the process of cage deployment, the process could possibly impact on the benthic substrate as follows. Disturbance of fauna and flora (turbidity in the water column)

7.4 Negative Impacts – Farm Operation and Management Phase (Impacts)

7.4.1 Water Quality Deterioration

The concentration of fish in the cage's sites are likely to contribute to deteriorating physical parameters including turbidity, conductivity and pH. Effluent discharges are also likely to cause water pollution. At the cage localized high nutrient load is likely to take place due to un-utilized feed, fish excreta and build-up of organic material. The major pollutants are nitrates and phosphates whose quantities at certain thresholds become a threat to the water body as well as the fish.

Mitigation Measures

- Reducing any over-supply of nutrients in the diet.
- Improving the efficiency of feed utilization.
- Feed on response to avoid overfeeding.
- Increase feed use efficiency by using high-quality feed that contains desired nitrogen and phosphorus minerals and by assuring that fish consume most of the feed offered.
- Include periodic water quality assessments to ensure mitigation measures are effective.

7.4.2 Ecological Effects

Fish farming sometimes requires the addition of artificial diets in the form of fish feed pallets. Therefore, most ecological effects on the water column are related to the Tilapia farming waste products such as uneaten feed and excreted ammonia entering the Lake system and changing the concentrations of nutrients. Particulate wastes expelled into the water column are also expected to settle onto the seabed in proximity to the farm. The buildup of organic matter on the Lakebed primarily may cause physico-chemical and ecological impacts. The deposition of faeces and uneaten feed can lead to localized over-enrichment of the Lakebed below the cages due to its high organic content.

Mitigation Measures

- Ensure feeds selection are of high utilization rates to reduce the nutrient pollution from uneaten feed and excreta,
- Feed shall include balanced levels of amino-acids and other nutrients appropriate for age of the fish, high palatability to stimulate consumption and high stability to prevent rapid nutrient release,
- Medicated feeds shall be used only when necessary for the control of specific diseases,
- Feeding management shall be in conformity with carrying capacity, stocking density and size of the fish, and
- Good feeding practices shall be employed to ensure minimal feed wastage.

7.4.3 Habitat Modification or Exclusion

The presence of the proposed farm structures and their associated aquaculture activities can potentially exclude or modify how particular species of the Lake mammals use critical and sensitive habitats, including foraging or feeding areas, resting or nursery areas, and migration routes. Habitat modification may also lead to aggregations of scavenging or predatory organisms. These faunas tend to be displaced under highly enriched conditions and instead they often aggregate around the perimeter of the farm. However, the excess food and waste released from fish cages may be food for wild fish.

7.4.4 Fish Mortalities

Bacterial action and autolysis of dead fish results in the excretion of ammonia in lake waters. Live fish preying on dead fish could result in the spread of diseases if the dead body died of a disease. Mortality attracts fish predators e.g. birds at the cage. Another possible cause of diseases is the risk of people using water near the cage for domestic purposes and swimming.

Mitigation Measures

Conduct a daily routine of collecting mortalities and the cages will be placed away from water use points.

7.4.5 Attraction to Artificial Lighting

The use of submerged lighting to aid in caged fish maturation may attract marine mammals to the associated aggregations of wild fish.

7.4.6 Waste from fish feeds

The company has its own feeds factory. However, not all feeds will be consumed by the juvenile tilapia. Thus, some feeds may enrich the lake water by promoting algae bloom. The following practices shall be adopted to maintain water quality, improve efficiency of feeds and feed management and at the same time reduce the number of wastes discharged into the environment.

Mitigation

- Feeds shall be selected for their high utilization rates to reduce the nutrient pollution from uneaten feed and excreta.
- The proponent will employ a qualified expert to deal with issues of feed formulation that will ensure feed efficiency, low feed conversion ratios, maximum feed floatability
- Feed shall include balanced levels of amino-acids and other nutrients appropriate for age of the fish, high palatability to stimulate consumption and high stability to prevent rapid nutrient release.
- Feed shall be stored in cool and dry areas to prevent contamination.
- Feeding management shall be in conformity with carrying capacity, stocking density and size of the fish.
- Use species and system-specific feeds to maximize food conversion ratios (and minimize waste)
- Monitor fish feeding behavior and particulate matter deposition, adapt the feeding strategy to maximize feeding efficiency and minimize particulate matter fallout.

- Rotation of cages within a site (fallowing) to allow recovery of benthos.
- Undertake ongoing, detailed water quality and benthic monitoring, including baseline surveys at control and impact sites.

7.5 Impacts on Biodiversity

Most farmed species are genetically different from native species and there is always concern about genetic contamination from the release of farmed species into the wild. Domestic fish are bred for traits that may not be optimal for survival in the wild. If some escape into the wild, for example, if a storm or predator attack damages a cage, the viability of wild populations may be threatened by inter-breeding.

7.5.1 Impacts on Wild Fish

The impact of fish cage farming on wild fish populations can lead to an increase in biomass as a result of increased natural and waste feed. Wild fish may be attracted to the floating structures and escaped fish may impact wild fish biodiversity and result in the transmission of pathogens from farmed stocks to wild fish populations. Wild fish can become trapped inside the cage when small and grown with the cultured fish. Framed fish may escape from cages which may also lead to interbreeding with potential impacts on wild fish genetics (especially from genetically selected strains of cultured fish).

Mitigation Measures

- To avoid escape of farmed fish into the wild, the cages swill has series of net meshes and/or grills and screens and barriers on inlets and outlets of culture facility,
- Cages will be double netted with strong and appropriate nets. The nets will be appropriately sized to retain the stocked fish.
- Maintain genetic compatibility (similar levels of variation) between wild and cultured stock and ensure adequate genetic monitoring,
- Proponent will use Oreochromis niloticus, which is a species already present in the lake
- Reduce the number of escapees by maintain cage integrity through regular maintenance and replacement and training of staff.
- Develop and implement recovery procedures should escapes occur.
- The proponent shall collaborate local research institutions to stay updated on emerging diseases and best practices.

7.5.2 Disease and parasites

Potential disease and parasite transmission to wild stocks could have negative impacts throughout the natural distributional range of the species, the magnitude of the potential impact will be high as it could alter wider natural (ecosystem impacts) and social functions (fisheries), and the impact will be ongoing.

Mitigation

- Maintain strict bio-security measures within hatchery, holding tanks and fish cages.
- Ensure all fry undergoes a health examination prior to stocking in fish cages.

- Regularly inspect stock for disease and/parasites as part of a formalized stock health monitoring programme and take necessary action to eliminate pathogens using therapeutic chemicals or improved farm management. This will require focused research effort into the identification, pathology and treatment of diseases and parasites infecting farmed species, both within culture and wild stocks.
- Maintain comprehensive records of all pathogens and parasites detected as well as logs detailing the efficacy of treatments applied. These records should be made publicly available to facilitate rapid responses by other operators to future outbreaks.
- Locate cages stocked with different cohorts of the same species as far apart as possible.
- Treat adjacent cages simultaneously even if infections have not yet been detected.

7.5.3 Entanglement of other lake species

Physical interactions between Tilapia farms and Lake mammals can lead to an increased risk of entanglement in structures, nets, or non-biological wastes from farm production. The risk of entanglement also increases as some Lake mammals tend to be attracted to the farmed fish themselves or the associated aggregations of wild fish.

Mitigation

- Ensure all lines and nets are highly visible (use thick lines).
- Keep all lines and nets tight through regular inspections and maintenance.
- Ensure that mesh size nets do not exceed 16 cm stretched mesh, use square mesh.
- Establish a rapid response unit to deal with other species entanglements.

7.6 Social Risks

7.6.1 User Conflict

The main social issues relating to aquaculture and the intensification thereof are due to the conflicts over use of land, water and other natural resources (Boyd et al., 2008). Land rights and land ownership vary within Counties and communities, and within the case of Western Kenya many people are dependent on Lake Victoria for their livelihoods. Any intensification that takes place without formal permission (land ownership) or blocked the pathway to popular fishing sites would likely cause tension within the communities.

Farmers involved in the intensification must comply with regulated environmental standards and implement the recommended monitoring and management measures to ensure that their practices do not negatively impact on their neighbours' resources, and ultimately livelihoods. For example, the discharge of water and/or contamination of the domestic water supply would prove an issue to all users reliant on the resource especially if the quality of drinking water deteriorated. It is important that Victory Farm Limited (Proponent) establishes a communication channel for complaints (a grievance mechanism), so that should a member of the public, fishermen, have a concern are promptly addressed.

Mitigation

- Install navigational markers and lights.
- Include position of fish cages on navigational charts.

- Ongoing consultation with user groups, especially fishermen in Roo beach to keep them informed of the cage developments.
- The proponent shall hold regular stakeholder engagement sessions to proactively address concerns.

7.6.2 Occupational Health and Safety

As a general approach, health and safety management planning should include the adoption of a systematic and structured approach for prevention and control of physical, chemical, biological, and radiological health and safety hazards. Occupational health and safety hazards related to the daily operations of the aquaculture sector are physical hazards like drowning, effects from use of chemicals.

Mitigation

- Provide lifejackets and harnesses with safety clips that lock on to lines or fixed points;
- Ensure that workers/personnel are experienced swimmers;
- Train personnel in safety at the cages, including procedures for supervision of personnel;
- Always require that personnel wear lifejackets on exposed sites.
- Appropriate signage and warnings in potential risk areas shall be provided;
- Appropriate Personnel Protective Equipment (PPE) shall be provided to the workers where applicable;
- The Proponent shall develop and implement detailed and site-specific emergency response plans; and
- The Proponent shall endeavor to create health and safety awareness among residents.

7.6.3 Air Emissions

It is difficult to predict air emission impacts at this stage of the Victory farm planning stage. Fish feed mills are, however, known to generate dust. Auxiliary equipment such as diesel generators or boilers would also require investigation. A detailed Baseline Air Quality Measurement was conducted in the preliminary stages of the EIA phase of the programme. The objective was to assess and document the existing levels of key air pollutants in the area surrounding the proposed fish farm expansion.

The results of the baseline air quality assessment conducted for Victoria Farm Kenya's proposed expansion of fish farming operations in Lake Victoria indicate that all monitored pollutants are within the permissible limits set by the Environmental Management and Co-ordination (Air Quality) Regulations, 2014 (EMCA, 2014) as outlined in the table below. The fact that these pollutants are within regulated thresholds suggests that the current air quality poses no significant risk to the environment or public health in the vicinity of the proposed expansion site.

Table 9 Air quality test results

MUKUYU				
	Average Pollutant	Average in Standard units	TWA OEL -RL	Remarks
Carbon Monoxide (CO)	0.21 ppm	0.243 mg/m^3	4 mg/m^3**	Within Limit
Carbon Dioxide (CO_2)	278.38 ppm	278.377 ppm	9000 ppm**	Within Limit
Hydrocarbons (C_xH_y)	0.00 ppm	0.000 ppb	NP	Not Provided
Nitrogen Monoxide (NO)	1.97 ppb	0.175 ppm	NP	Not Provided
Nitrogen Oxides (NO_2)	1.99 ppb	0.175 ppm	0.2 ppm	Within Limit
Nitrogen Oxides (NO_x)	3.96 ppb	0.350 ppm	150 $\mu g/m^3$	Within Limit
Oxygen (O_2)	20.90 %	20.900 %	NP	Not Provided
Ozone (O_3)	0.24 ppb	0.096 ppm	0.12 ppm	Within Limit
Particulate Matter (PM_{10})	5.61 $\mu g/m^3$	2.303 $\mu g/m^3$	100 $\mu g/m^3$**	Within Limit
Particulate Matter ($PM_{2.5}$)	3.11 $\mu g/m^3$	3.106 $\mu g/m^3$	NP	Not Provided
Sulphur Dioxide (SO_2)	2.05 ppb	2.208 $\mu g/m^3$	80 $\mu g/m^3$**	Within Limit
Volatile Organic Compound (VOCs)	0.00 ppb	0.000 ppb	NP	Not Provided
Relative humidity (RH)	65.16 %			
Temperature	24.37 °C			
Wind direction	21.99 °			
Wind speed	1.40 kph			
Temperature and Pressure (STP), * the 24-hour limit may not be exceeded more than three times in one year; ** 24-hour limit may not be exceeded more than three times in one year micrograms/m3, *** Not to be exceeded more than once per year average concentration Emission limits are as stipulated under EMCA 2014; CO_2 limits are obtained from Occupational Safety and Health Act, of 2007				

Mitigation Measures

- The proponent is advised to stick to the provisions of EMCA (Air Quality) 2014 by conducting annual air quality assessment and filing the same with NEMA as part of the annual Environmental Audit.
- Monitor dust levels while conducting land-based aquaculture activities.
- If operating feed mill, ensure all emission controls are in place and maintained (dust collectors, exhaust fans, scrubbers etc.

8 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

8.1 Significance of an EMP

An Environmental Management and Monitoring Plan (EMP) provides a mechanism to address any negative environmental impacts of a proposed project and aims to promote benefits. The EMP provides a document that assists in detecting the development of any negative environmental issues through the monitoring of environmental parameters. The document defines the responsibilities and evaluates performance. As with the Victory farm, an EMP document needs to be designed for a specific project (in this case farm), as the monitoring requirements need to be tailored to the activities, the size of the farm and the location. All of these will in turn determine the frequency of sampling, methods and the details thereof (parameters and positions).

8.2 The objectives of the EMP:

- To militate against the possible degradation of the Lake Victoria ecosystem during the operation of the proposed cage aquaculture project by reducing negative impacts and enhancing positive effects.
- To ensure that the proposed project does not result in excessive enrichment of Lake Victoria thereby modifying the ecosystem integrity
- To outline mitigation measures, to manage environmental impacts associated with the project
- To ensure that the aquaculture project will comply with relevant environmental legislation of the country and other requirements throughout its operational phase
- To identify roles and responsibilities and the cost involved and
- To propose mechanisms for monitoring compliance

8.3 Water Quality Monitoring and Management

Best practice guidelines must be used for monitoring water bodies potentially impacted by the proposed cage farming. It is especially important to take samples of the fish farm sites to ensure that any impacts relating to feed and return effluents are identified. The water quality variables of concern (to be monitored) are as follows.

Table 10 Water quality variables to be monitored

Variables	Methods
Temperature (°C)	In situ using a temperature meter
Dissolved oxygen (mg/ℓ)	In situ using a dissolved oxygen meter
pH	In situ PH using a water pH tester
Turbidity (NTU)	Standard Methods in laboratory
Secchi (m) – Visibility	In situ using Secchi Disk
Nutrients (mg/ℓ, ortho-phosphates, total phosphates, nitrate, nitrite, ammonia)	Standard Methods in laboratory
Algal identification	Standard Methods in laboratory

Table 11: EMP for Construction Phase and operation of the proposed cage culture

Component/Activity	Component/Activity	Mitigation/Management	Responsibility	Monitoring Mechanism	Indicator/ Performance Criteria
Fish feeding	Water quality impacts because of feed wastage.	• Only high-quality aquaculture feeds must be purchased from recognized feed producers; Information on the nutrient makeup, primary ingredients and production techniques, e.g. extrusion, should be available, • Feeding rates must be correlated to water quality sampling to allow detection and alteration of over-feeding. This will be done by the water quality monitoring programme to be implemented; • Correct feed pellet size must be used to ensure low levels of feed wastage.		Water quality monitoring programme.	Water quality results which fall within the predetermined parameters
Chemical and Drug treatments	Chemical spills and incorrect application of chemicals	• The handler must wear appropriate Personal Protective Equipment (PPE); • Dosages, application methods and resultant outcome must be known and recorded in a treatment register;	Proponent/Accredited aquaculture pathologist	Specific inspection of the suitability of chemical stores (expiry dates, etc.) must be done once in three months and according to the relevant MSDSs	Chemical spills

Component/Activity	Component/Activity	Mitigation/Management	Responsibility	Monitoring Mechanism	Indicator/ Performance Criteria
		• Expired chemicals must be disposed of at a suitable hazardous waste disposal site; • The advice of a recognized fish pathologists or aquaculturists must be sought where the application of chemicals is uncertain;			
	Fish mortalities	• All mortalities must be recorded and the associated behavior of the remainder of the organisms monitored, e.g. loss of appetite; • A database must be kept of the numbers of dead organisms and the behavioral patterns of the population.	Proponent	• Conduct a daily routine of collecting mortalities on the farm. • All mortalities be transported to the the company's licensed organic waste site for composting. • Establish a Black Soldier Fly (BSF) Breeding facility at the waste licensed	Outbreak of disease Accumulation of predators

Component/Activity	Component/Activity	Mitigation/Management	Responsibility	Monitoring Mechanism	Indicator/ Performance Criteria
				site to produce animal feeds.	
	Endangering predators	• No traps may be used to injure any predators of aquaculture organisms. Traps may only be set if these predators can be caught live (without injury) for translocation to alternative areas. This may only be done under the supervision of recognized organizations or authorities i.e. KWS; • Ensure no poisons is left out for aquaculture predators; • Ensure no animals that prey on the aquaculture species is shot • The main aquaculture predators and their control methods include cover netting for birds (Kingfishers, Fish Eagles, Herons, Storks and others) and fencing	Proponent	Specific consideration and inspection of all fences, predator netting	Predator injury or death
	Health and safety compliance at the cage site	• All involved personnel need to have adequate floatation safety gear and need to be fully trained in health and safety	Proponent		Health and safety incidents

Component/Activity	Component/Activity	Mitigation/Management	Responsibility	Monitoring Mechanism	Indicator/ Performance Criteria
		codes related to water borne activities; and • Skippers need to be licensed			
	Disease from processed fish waste	• The waste generated in the primary processing of the harvested fish (heads, gills and intestines) and the mortalities experienced from production must be ensiled to produce a stable and odour free high protein supplement for animal feeds through breeding of Black Soldier Flies. • Excess waste should also be composted at the Company's licensed organic waste facility located at Kinyasaga.	Proponent	Audit	Disease free processing facilities which have been audited.

Table 12 Environmental Management Plan for Decommissioning

Expected Negative Impacts	**Mitigation Measures**	**Responsible**	**Cost**
Scrap materials	Waste generated will be characterized in compliance with standard waste management procedures Disposal locations will be selected by the licensed contractor	Site supervisor and Licensed Waste Disposal Contractor	100,000
Scrap materials and other debris	Equipment and structures that will not be used for other purposes should be removed and reused or sold to scrap material dealers	Project Manager and site supervisor	
Rehabilitation of Project Site			
Site water quality disturbed	Remove project materials and debris from the lake to restore the site to its original condition	Project Manager and site supervisor	400,000

9 CLIMATE RISK VULNERABILITY ASSESSMENT

This chapter details the climate profile of the Project area. Specifically, it looks at the impact of climate stressors on the Project and beyond. A climate stressor is a climate factor that can affect the functioning of a system. For example, rising temperatures and greater rainfall variability may affect agricultural productivity, with implications for food security. Climate stressors can also limit the potential success of development interventions.

9.1 Climate Change

Climate change has resulted in alterations in temperature and rainfall patterns worldwide. Although it is still very difficult to assess the consequences of these changes at a local level, it is evident that whatever the magnitude of the phenomenon, aquatic fauna will be affected.

9.2 Key Climate Policies

- Constitution of Kenya (2010)
- National Climate Change Response Strategy, NCCRS (2010)
- 2nd National Communication to the UNFCCC (2015)
- National Adaptation Plan, NAP (2015- 2030)
- Nationally Determined Contributions, NDC (2016)
- Green Economy Strategy and Implementation Plan, GESIP (2016-2030)
- National Climate Change Framework Policy (2016)
- Climate Change Act (2019)
- Homabay County Climate Change Policy 2021
- Homabay County Climate Change Action Plan (CCCAP) 2021-2026
- National Policy on Climate Finance (2016)
- Low Carbon Development Strategy espoused in Kenya's Second National Communication (2015).

9.2.1 General Circulation Model Projections for Kenya

According to a climate change study conducted for the United Nations Development Programme (UNDP) in 2010, an increase in mean annual temperature and an increase in annual rainfall is projected for Kenya as outlined in the sub sections below:

a) Temperature

The mean annual temperature is predicted to increase by 1.0 to 2.8°C by the end of 2060s, and by 1.3 to 4.5°C by the 2090s; All projections indicate increases in the frequency of days and nights that are considered 'hot' in current climate; and All projections indicate decreases in the frequency of days and nights that are considered 'cold' in current climate (McSweeney *et al.*, 2010).

b) Precipitation

The projections indicate an increase in annual rainfall in Kenya. The range spans changes of -1 to +48% by the 2090s; Projected increases in total rainfall are largest in the short rainfall season (-3 to +49 mm per month), but the proportional changes are largest in January-February (-7 to +89%); The models consistently project increases in the proportion of annual rainfall that falls in heavy

events. The increases range from 1 to 13% in annual rainfall by the 2090s; and the models consistently project increases in 1- and 5-day rainfall annual maxima by the 2090s of up to 25 mm in 1-day events, and 3 to 32 mm in 5-day events.

9.3 Climate Change Profile: Nyatike West and Nyatike South Sub Counties

9.3.1 Climate change and variability: historic and future trends

9.3.1.1 Historical Climate Trends

Over the past several decades, Nyatike West and South sub-counties have experienced notable changes in temperature and rainfall patterns. Historical records indicate a consistent rise in average temperatures across the Lake Victoria Basin, with Kenya's national mean temperature increasing by approximately 0.34 °C per decade since 199011. Between 1979 and 2010, parts of western Kenya, including areas adjacent to Lake Victoria, experienced increases in maximum temperatures by up to 3 °C and minimum temperatures by around 1.2 °C12.

In terms of rainfall, the region continues to experience a bimodal rainfall pattern, with the long rains (March–May) and the short rains (October–December). However, rainfall variability has increased, with the short rains intensifying and the long rains becoming shorter and less predictable13. The period from the 1980s to the early 2000s witnessed several severe droughts, particularly during La Niña years, while El Niño and Indian Ocean Dipole (IOD) events have been associated with intense rainfall and flooding (e.g., 1997–1998 and 2019–2020)1415.

Thunderstorm activity in the Lake Victoria basin has also intensified due to increased lake surface temperatures and convection16. This has led to more frequent localized flash floods, particularly in low-lying regions such as West Karungu and riverine areas in Nyatike.

9.3.1.2 Projected Future Climate Trends

Climate models project continued warming and greater climate variability across the region through the 21st century. Average temperatures are expected to rise by 0.5 °C to 3.5 °C by the year 2085, depending on emissions scenarios[17]. This warming is projected across all seasons, with greater increases in minimum temperatures during the dry season (June–August)[18].

Rainfall projections indicate an overall increase in total annual rainfall, particularly during the short rains (OND) and long rains (MAM), with estimates of +5% to +16% by mid- to late-century[19]. However,

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[11] IPCC (2021). *Sixth Assessment Report – Working Group I: Climate Change 2021: The Physical Science Basis*
[12] FEWS NET (2012). *Kenya: Climate Trends and Projections Summary*
[13] Liebmann, B. et al. (2014). "The observed relationship between rainfall variability in the Lake Victoria Basin and climate patterns." *Journal of Climate Studies*, 27(3), pp. 482–495
[14] Nicholson, S.E. (2017). "Climate and climatic variability of rainfall in Eastern Africa." Climate Dynamics, 49(9), pp. 2765–2781.
[15] Walker, N.D. & Wainwright, C.M. (2019). "Impact of El Niño and IOD on rainfall extremes in Kenya." International Journal of Climatology, 39(2), pp. 879–895
[16] Thiery, W. et al. (2016). "Lake Victoria's changing climate and its impact on thunderstorms and rainfall patterns." *Nature Communications*, 7, 12729
[17] Christensen, J.H. et al. (2013). "Climate phenomena and their relevance for future regional climate change." IPCC AR5 WG1 Chapter 14.
[18] Osima, S.E. et al. (2018). "Projected changes in climate over East Africa." Climate Services, 10, pp. 1–11.
[19] Gebrechorkos, S.H. et al. (2019). "Climate change trends in East Africa based on high-resolution datasets." Scientific Reports, 9, Article 5271.

the intensity of rainfall events is expected to rise sharply, with extreme indices (e.g., 5-day rainfall maximums, number of very wet days) projected to increase by 18% to 47% by 2100**,** especially around the Lake Victoria shoreline[20]**.**

The combination of warming, intense rainfall, and altered seasonality is likely to increase the frequency and severity of floods, droughts, and crop failure**.** In Nyatike's semi-arid zones will face heightened drought risks and water stress**,** threatening agriculture and water-dependent livelihoods[21][22].

9.3.2 Climate and Environmental Risks of the project catchment

Homabay County's strategic plan identifies population dynamics, environmental degradation, and climate change (amongst others) as key development challenges. Like all the communities around the Lake Victoria Basin (LVB), a large proportion of the catchment's residents depend on Lake Victoria to support agriculture, fisheries, livestock and other livelihoods. The adverse effects of climate change disproportionately affect marginalized and rural communities, especially women and youth, by reducing the productivity of agriculture and wetlands, the abundance of fish in Lake Victoria and its tributaries, and loss of other ecosystem functions.

Effects of climate change includes;

- Threat to freshwater ecosystems, due to pollution and proliferation of invasive species
- Deteriorating water quality and quantity, declining fish stocks and loss of biodiversity, and
- Increased climate change-induced migration

9.3.3 Effect of Climate Change on Aquaculture

Most fish are poikilothermic, meaning that their body temperatures vary with the ambient temperature. Any changes in habitat temperatures will therefore significantly affect their metabolism and, consequently, growth rate, total production, reproduction seasonality and possibly reproductive efficacy, and susceptibility to diseases and toxins (FAO, 2008).

Impacts on aquaculture could be positive or negative, arising from direct and indirect impacts on the natural resource's aquaculture requires, namely water, land, seed, feed and energy. As fisheries provide significant feed and fingerling inputs, the impacts of climate change on them will also, in turn, affect the productivity and profitability of aquaculture systems (FAO, 2008). Vulnerability of aquaculture-based communities will stem from their resource dependency and exposure to extreme weather events.

The predicted increase in heavy rainfall events may result in flooding which can cause physical damage to farm structures, and consequential loss of fish. In addition, floods can cause great changes to water quality such as siltation or the transportation of pesticide residues from nearby agricultural practices. Flood waters may introduce predators into a farm, or new pathogens, and may also provide an opportunity for fish to escape confinement. Severe storms over Lake Victoria could damage cages resulting in the release of fish stock into the natural environment. Depending

[20] Ntwali, D. et al. (2023). "Future rainfall and extreme event projections in the Lake Victoria Basin." Heliyon, 9(5), e14528.
[21] Okeyo, G.O. & Nsubuga, F.W. (2021). "Hydro-climatic variability and its implications in the Nyando and Kuja River Basins." African Journal of Environmental Science and Technology, 15(3), pp. 55–66.
[22] Government of Kenya (2020). Kenya Climate Smart Agriculture Strategy (2017–2026).

on the species and genetics of the fish farmed, this could have negative impacts on the wild fish stock.

Inland aquatic environments are critically dependent upon rainfall. Thus, any change in climate will have major consequences for the water balance that can cause an increase or reduction in aquatic habitats. In the case of drought, a decline in water resources will limit the carrying capacity of the ponds. Cages located in shallow waters could also be at risk. This could possibly drop the functioning of fish farm operations below profitable levels. The extraction of water for aquaculture during drought will exacerbate water shortages and could result in user conflict. Changes in temperature can also have significant impacts on the reproductive cycles of fish, including the speed at which they reach sexual maturity, the timing of spawning and the size of the eggs they lay. Ultimately, the success of a fish farm operation is highly dependent on temperature, water quality and quantity. It is therefore imperative that the fish farmers are well informed of the climate characteristics specific to their regions and associated risks, such as 100-year flood levels and drought (FAO, 1989).

9.3.4 Climate Change Management Measures

For most climate change-related impacts, improved management and better aquaculture practices would be the best and most immediate form of adaptation, such as the ecosystem approach to aquaculture (EAA) management (FAO, 2008). Genetic knowledge and management in aquaculture are not as developed as in other husbandries and provide both a major challenge and an opportunity. Genetics can be improved resulting in more efficient feeding and diet specificity, and for increasing species resistance to higher temperature, lower oxygen and pathogens. Climate change may increase pathogen risks and so biosecurity and prevention measures need to change accordingly. Early identification and detection mechanisms may need to be improved, and suitable treatment strategies and products developed (FAO, 2008).

Table 13 Climate change-related impacts and potential adaptation measures in aquaculture

Climatic change element	**Impacts on aquaculture or related function**	**Adaptive measures**
Warming	Raise temperature above optimal tolerance range of farmed species	• Selective breeding and genetic improvements for higher temperature tolerance.
	Increase in eutrophication- mortality of farmed stock	• Improve planning and siting to conform to climate change predictions; and • Establish regular monitoring and emergency procedures
	Increased virulence of dormant pathogens and expansion of new diseases	• Set up biosecurity measures; • Monitor to reduce health risks; • Improve treatments and management strategies; and • Make genetic improvements for higher resistance
Extreme weather events	Destruction of facilities; loss of stock; loss of business; mass scale escape with the potential to impact on biodiversity	• Improve siting and design to minimize damage, loss and mass escapes; • Encourage use of indigenous species to minimize impacts on biodiversity; and • Use non-reproducing stock in farming systems

10 LIMNOLOGY, LAKE SEDIMENT ANALYSIS AND BIOSECURITY/BIOSAFETY PLAN

This chapter details the limnology of the Project area, analysis of the laboratory analysis of the sampled lake sediment and biosafety/biosecurity plan of the proponent. The term Limnology is derived from Greek word; Limne means lake and logos means knowledge. Limnology is often regarded as a division of ecology or environmental science. It is however, defined as "the study of inland waters" (running and standing waters fresh and sometimes saline; natural or man-made). This includes the study of lakes, ponds, rivers, reservoirs, swamps, streams, wet lands, bogs, marshes etc. Hence, it is commonly defined as that branch of science which deals with biological productivity of inland waters and with all the causal influences which determine it (Welch, 1963). Biological productivity, as used in this definition, includes its qualitative and quantitative features and its actual and potential aspects.

10.1 Baseline Parameters of the project area

The proponent's sustainable and socially responsible expansion project is to be located in the waters of Lake Victoria in off shore concessions in Nyatike South and Nyatike West Sub Counties, Migori County. Lake Victoria is the largest lake in Africa (68,000 KM^2) with an average depth of 40M (130 Ft). The lake's shoreline is long (about 3,500 km) and convoluted, enclosing innumerable small, shallow bays and inlets, many of which include swamps and wetlands, which differ a great deal from each other and from the lake itself. The lake has a wide land catchment area, which is almost three times the size of the lake, and extends over the three East African countries together with Rwanda and Burundi. This is the area from which rivers carry water, nutrients, sediments and pollutants into the lake and is about 193,000 km2; of which the catchment area in Kenya covers 42,460 km2.

Lake Victoria has numerous wetlands on the edges of its shore as well as open beaches and islands. The coastline ranges from papyrus swamps to rocky and sandy beaches. The wetlands are important for fish breeding and growth; for filtering river waters; the wetlands plants are harvested for building materials by the riparian communities and are food for wildlife. The lake serves as an important reservoir for the region and for the larger Nile Basin. Because the lake is shallow (Fig. 2), its volume is substantially less than that of other African Great Lakes, which have much smaller surface areas. Its total volume is about 2,760 km3, only 15% of the volume of Lake Tanganyika, even though the latter has less than half its surface area. In the Winam Gulf of Lake Victoria, 8.1 billion m3 of water comes from rainfall over its surface and in-flowing rivers contribute 9.2 billion m3. The rivers, which originate from and enter the Lake in the Kenyan catchment contribute 38% of the total river discharge entering Lake Victoria from land catchment, however River Mara, which enters the lake in Tanzania and contributes about 5% is mainly from the Kenyan catchment, therefore total contribution of Kenyan catchment is estimated at about 42% of land catchment input. Consequently, activities in Kenya catchments potentially affect a substantial portion of the river discharge to the lake and especially in Winam Gulf. The table below indicates the discharges of several rivers that feed into Lake Victoria.

River discharges and their % contribution to Lake Victoria land catchment input.

River	Discharge, m^3s^{-1}	% Kenya basin	% Whole basin
Sio	11.4	3.5	1.5
Nzoia	115.3	35.0	14.8
Yala	37.6	11.4	4.8
Nyando	18.0	5.5	2.3
North Awach	3.7	1.1	0.5
Sondu-Miriu	5.9	1.8	0.8
South Awach	42.2	12.8	5.4
Kuja-Migori	58.0	17.6	7.5
Mara	37.5	11.4	4.8
Total, whole basin	778.3	100	42.4

Source: J .O. Okungu, et al

Studies on the water exchange between the Winam Gulf and the open lake have been undertaken under the water quality component. Measurements and modelling of the hydraulic conditions at the Rusinga channel has been a major objective to understand water fluxes and movements of water borne materials between the littoral and pelagic areas of the lake. The largest loss of Lake Victoria water (76%) is through evaporation from the lake surface the rest leaves the lake through the outflow into Victoria Nile at Jinja. The greatest input of water into the lake is from direct rainfall onto the lake surface (82%). Therefore, only about 18% of combined rainfall and river inflow water exits the lake at the Nile. The Nile provides critical water supplies for nations beyond the basin and so there is continuous interest internationally, as well as in the basin, in the quantity and quality of water leaving Lake Victoria (***Khisa, et al.,***)

The literature on limnology of the Kenyan waters of Lake Victoria is rather scanty. However, extensive measurements of water currents, temperature dissolved oxygen and winds on the Kenyan waters of the lake were done by Ochumba (1996). Hypolimnion temperatures as low as 23.5ºC observed in 1928 by Worthington (1930) in the 1950s (Fish 1957) and in 1960-61 (Talling, 1966) were not seen, suggesting a response of Lake Victoria to a possible warning trend in the climate of East Africa. Ochumba (1996) also reported that oxygen conditions have deteriorated since 1950. Hecky et al. (1994) concluded that low oxygen conditions are now more extensive and persistent than previous investigators had found. Aware of these immense benefits of Lake Victoria, the proponent has taken every measure to conduct baseline studies to determine physio-chemical conditions of the project site before implementing the project. Regular water quality assessment has been carried out. Zooplankton dynamics in Lake Victoria was outline by Bransrator et al (1996), who suggested that the composition of cladocerans, calanoid copepods and cyclopoid capepods in the modern community were largely unchanged from historical conditions although the proportions may have changed

The project site is located in the off shore areas of Four beaches (earlier mentioned) in Nyatike West and Nyatike South Sub Counties, Migori County. The shoreline is hilly, with rocky bays and well curved coast line. The water depth at the project site is approximately 28m.

10.2 Fisheries Resources in the project area

Since the 1970s total fish catches have increased by between four and five times after the introduction of exotic species such as the Nile Perch (Mbuta). However, catch per fishing effort has been dropping while effort has continued increasing, indicating that the maximum sustainable

yield is below the present level of exploitation. Furthermore, introduction of exotic species of fish has altered the food web structure of Lake Victoria, which has led to a dramatic decline in diversity of indigenous fish species. A number of original 300 species of fish are now extinct or facing depletion. Other factors which have affected the status of lake and riverine fisheries in the project area are: overfishing by use of small mesh nets and harvesting of brood stocks; destruction of fish habitats through river engineering; siltation due to deforestation, algal blooms due to nutrient enrichment, pollution, wetland conversion and development, fish pathogens and water hyacinth infestation. It is important to note that the project area is over 30 meters deep, thus the main fish species that can be found in the area is Nile perch. However, the proponent will culture Tilapia species within the HDPE cages while taking deliberate actions to avoid any escape of fingerlings to the lake.

10.3 Project Site Sediment Analysis

As mentioned previously, Lake Victoria receives waters of varying quality from several rivers, precipitation, recharge from groundwater; industrial and domestic waste treatment and disposal systems, urban and agricultural run-offs. These waters, rich in nutrients encourage biological activities within the lake that are a source of biogenic sediments. To a small extent, shoreline erosion is also responsible for the sediments found in the lake. The need to carry out sedimentation and sediment characteristics at the project site was to generate baseline information on bio-physical parameters of the project area sediments. This was important because of future monitoring of project/s impact on the lake sediment. The table below shows the results analysis of the sampled sediment in the project area:

Sediment Analysis Results

Date Received: 6/10/2025 **Date Analysis Started:** 6/11/2025
Date Analysis Completed: 6/13/2025 **Date Released** 6/24/2025

[2] PARAMETER	METHOD	RESULTS	[1]STANDARD (Max Limits)
Chemical			
Total Petroleum Hydrocarbons (TPH)			np
C5 - C12, mg/L	CSITP 033	0.0005	np
C12 - C28, mg/L	CSITP 033	0.0011	np
C28 - C44, mg/L	CSITP 033	0.0019	np

np - No standard reference for the parameter
BDL- Below Detection Level
To maintain the correct history ensure that the next sample sent from this Water Source is labelled: Lake Water
These results relate to the items sampled.
Sampling Method: CSL/QMS/STIRH/SP 20 - Test Item Receipt, Sampling, and Handling Procedure
History is 30 days

10.1 Biosafety/Biosecurity Plan

The proponent's biosecurity plan aims to prevent disease, improve fish welfare, and increase productivity and profitability. The biosecurity measures are designed to improving fish welfare and productivity to increase the efficiency of inputs and the sustainability of the system.

The objectives of the plan are to:

- better fish health and improved performance;
- mitigate the transmission and amplification of diseases between cages and concessions;

- allow for early disease detection so that impacts can be reduced;
- support claims of freedom from diseases that impact marketability and market access;
- facilitate translocation within and between production sites;
- reduce the risk of diseases from being introduced to the farm, spreading within the farm, or escaping from the farm;
- have emergency response protocols in place for serious disease outbreaks.

The biosecurity plan fulfills the legal requirement mandated by the Kenya Fisheries Service (KFS) and ensures that during project implementation, off-shore concessions are chosen and designed in line with the surrounding topography, assuring optimum water quality conditions for animal welfare. Cages are spaced in order to assure water quality within each cage, reduce the risk of disease transmission, and minimize environmental impacts. Biosecurity and Biosafety plan covers both lake based and land based aquaculture of the proponent. All broodstock shall be produced on the farm and maintained off-shore in cages. Upon maturation, broodstock will be moved to breeding ponds, allowing the tilapia to practice their natural breeding behaviours, including burrowing and mouth-breeding. Eggs shall be collected from the females' mouths and incubated in a hatchery building, where optimum water quality shall be assured through a recirculating aquaculture system (RAS).

10.1.1 Traceability

The proponent shall record for traceability at the cage level, such that each cage can be traced back to the broodstock group that produced those eggs. Groups of broodstock shall be kept separately in ponds, and eggs from that pond will be labelled and identified by the pond of origin and date of collection. This identifying information shall be retained with the fry and fingerlings upon transfer to the pond nursery, the cage nursery, and eventually the grow-out cage. Fish shall be delivered to each retail outlet and should be traced back to the cage using the harvest date and the cage number recorded in during processing. These records shall be retained for at least 10 years.

10.1.2 Disease checkpoints

Staff shall record observations for indications of disease at all lifecycle stages. Broodstock and fish at nursery and grow-out stages shall be observed for lesions, physical abnormalities, and irregular swimming and eating behaviours. Eggs and fry shall be observed for physical or other developmental abnormalities. Observations shall be reported to management and recorded. At all stages, mortalities shall be promptly removed from the environment and disposed of using biosecure disposal protocols. The daily number of mortalities shall be recorded for each cage and pond.

10.1.3 Annual Biosecurity Risk Assessment

The proponent shall conduct an annual biosecurity risk assessment. The resulting report shall be stored in the main office and is used to inform annual revisions to the biosecurity plan. Audit reports shall also be stored in the main office.

10.1.4 Location of Cage Farms

This cage farm proposes to exceed Kenya Fisheries Guidelines of 500 meters between cage farms to 5 Kilometers between cage farms to enhance biosecurity of its operation.

11 CONCLUSION AND RECOMMENDATIONS

11.1 Recommendations

From this EIA process, cage fish culture in Lake Victoria basin has the potential to be beneficial and has attracted the attention of fishers and other members of the community. The proposed fish cage culture project will provide employment and additional income to local fishers and increase the supply of fish protein. Its main effect will be to reduce pressure on native fish by diverting fishers from fishing of wild stocks to aquaculture and thus provide alternative livelihoods. However, like in other culture systems, there are several constraints which limit the practice of cage culture system. Lack of inexpensive and suitable fish feeds is a problem in cage culture especially because special diets that do not pollute the environment are necessary. Several measures are needed to expand and intensify cage culture in the Lake Victoria basin. Fish hatcheries should be established in or near the Lake Victoria basin to meet the increased demand for fingerlings from cage farms.

Although caged fish can grow to larger sizes than pond raised fish, they are likely to face stiffer competition from capture fisheries at the local market because they are still far smaller than many of the wild caught stocks. Therefore, it is necessary that market

strategies for caged fish are put in place, which include marketing caged fish distances away from the lake and value addition and processing leading to larger profits, covering all the fixed and variable costs, thus making cage culture a sustainable venture. As more fishers turn into farmers, it will be necessary for provision of more cage material, construction of cages and fish feed production. These could be motivating factors for industries to form to provide these services. Because fish feeds are still unavailable in most Kenyan markets, farmers could start production of their own feeds. The results of lake-based cage culture trials indicate a relatively high growth of fish on natural lake productivity. Thus, cage culture as is practiced in Kenya can be economically and environmentally sustainable with proper cage culture production and marketing

11.1.1 Specific Recommendations

From the detailed environmental and socio-economic analysis of this project, **the experts are of the opinion that this is a viable project, hence we recommend that NEMA approves it and issues an EIA license**; since the EIA process reveals that **this project does not have serious negative environmental impacts**, and for the impacts identified, **adequate mitigation measures have been spelt out in the EMP.**

We further recommend that **the proponent and contractors implement the recommendations in the environmental management plan and those in the health, safety and accident prevention action plan**. This is to ensure that the potentially affected environment is well managed and that accidents are prevented during project implementation.

The proponent needs to continue complying with the relevant legal and policy requirements about project implementation. NEMA and other relevant authorities need to continue raising public awareness of EIA requirements.

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    d) Legal Notice No. 121, Waste Management Regulations, 2006
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APPENDICES

Annex 1: Certificate of Incorporation

Annex 2: KRA PIN Certificate

Annex 3: Baseline Air Quality Measurement Report

Annex 4: Baseline Noise Assessment Measurement Report

Annex 5: Water Sample

Annex 6: Sediments Sample

Annex 7: NEMA Approved Terms of Reference (TOR)

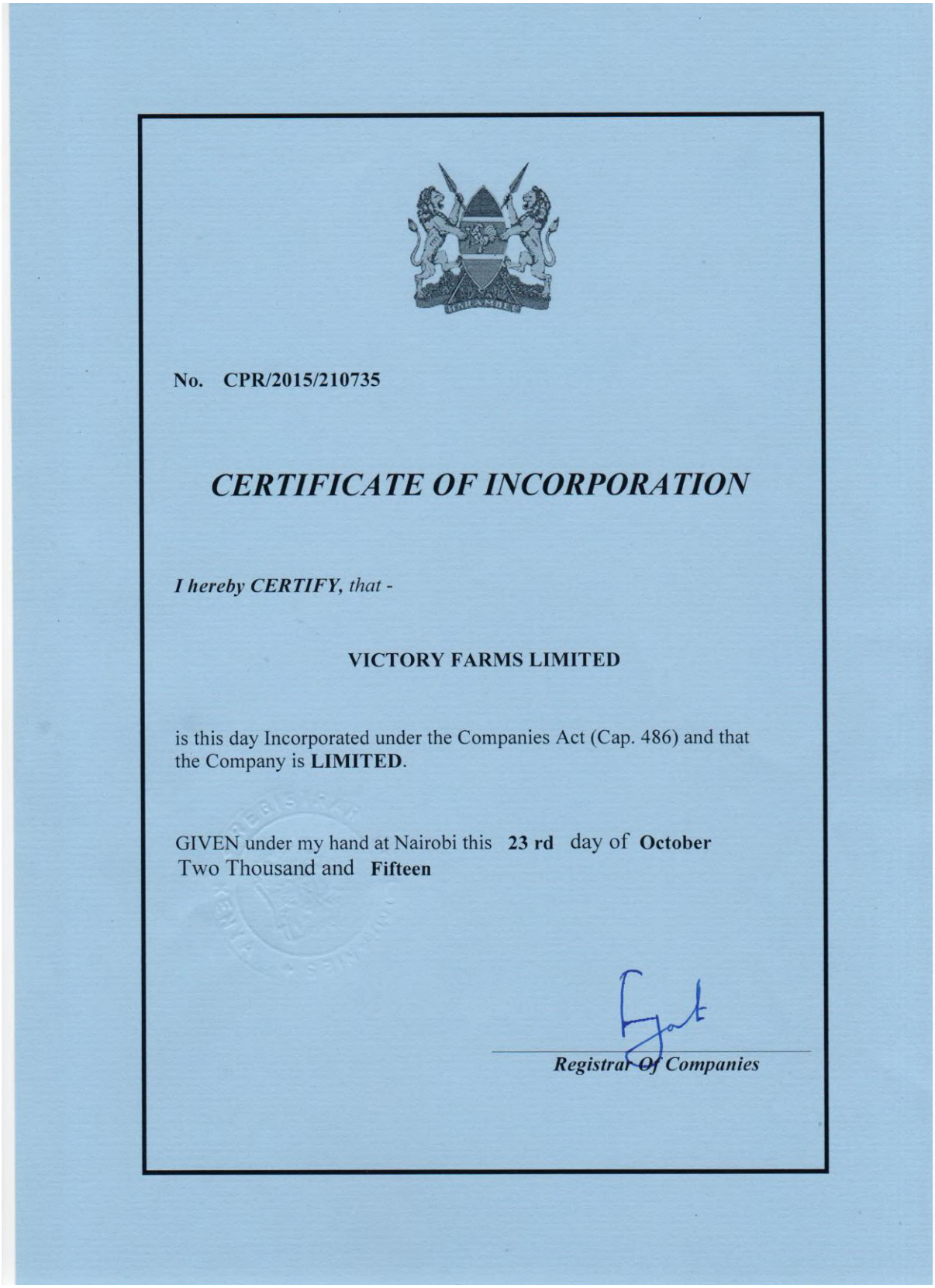
Annex 8: Letter of No Objection - Migori County Department of Agriculture, Livestock, Fisheries & Blue Economy

Annex 9: Potential GPS Coordinates for the Proposed Migori Concession Block

Annex 10: Biosafety/ Biosecurity plan of the proponent

Annex 11: Aquatic Monitoring Plan

Annex 1: Certificate of Incorporation



No. CPR/2015/210735

CERTIFICATE OF INCORPORATION

I hereby CERTIFY, *that -*

VICTORY FARMS LIMITED

is this day Incorporated under the Companies Act (Cap. 486) and that the Company is **LIMITED**.

GIVEN under my hand at Nairobi this **23 rd** day of **October** Two Thousand and **Fifteen**

Registrar Of Companies

Annex 2: KRA PIN Certificate

KENYA REVENUE AUTHORITY

www.kra.go.ke

PIN Certificate

For General Tax Questions
Contact KRA Call Centre
Tel: +254 (020) 4999 999
Cell: +254(0711)099 999
Email: callcentre@kra.go.ke

Certificate Date : 27/10/2015

Personal Identification Number

P051566466U

This is to certify that taxpayer shown herein has been registered with Kenya Revenue Authority

Taxpayer Information

Taxpayer Name	VICTORY FARMS LIMITED
Email Address	Joseph.Rehmann@victoryfarmskenya.com

Registered Address

L.R. Number :	**Building :** Williamson House
Street/Road : 4th Ngong Avenue	**City/Town :** Nairobi
County : Nairobi	**District :** Westlands District
Tax Area : Kilimani	**Station :** West of Nairobi
P. O. Box : 40111	**Postal Code :** 00100

Tax Obligation(s) Registration Details

Sr. No.	Tax Obligation(s)	Effective From Date	Effective Till Date	Status
1	Income Tax - Company	26/10/2015	N.A.	Active

The above PIN must appear on all your tax invoices and correspondences with Kenya Revenue Authority. Your accounting end month is December unless a change has been approved by the Commissioner-Domestic Taxes Department. The status of Tax Obligation(s) with 'Dormant' status will automatically change to 'Active' on date mentioned in "Effective Till Date" or any transaction done during the period. This certificate shall remain in force till further updated.

Disclaimer : This is a system generated certificate and does not require signature.

Annex 3: Baseline Air Quality Measurement Report

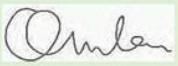
BASELINE AIR QUALITY MEASUREMENT REPORT FOR

VICTORY FARMS KENYA HOMABAY

JUNE 2025

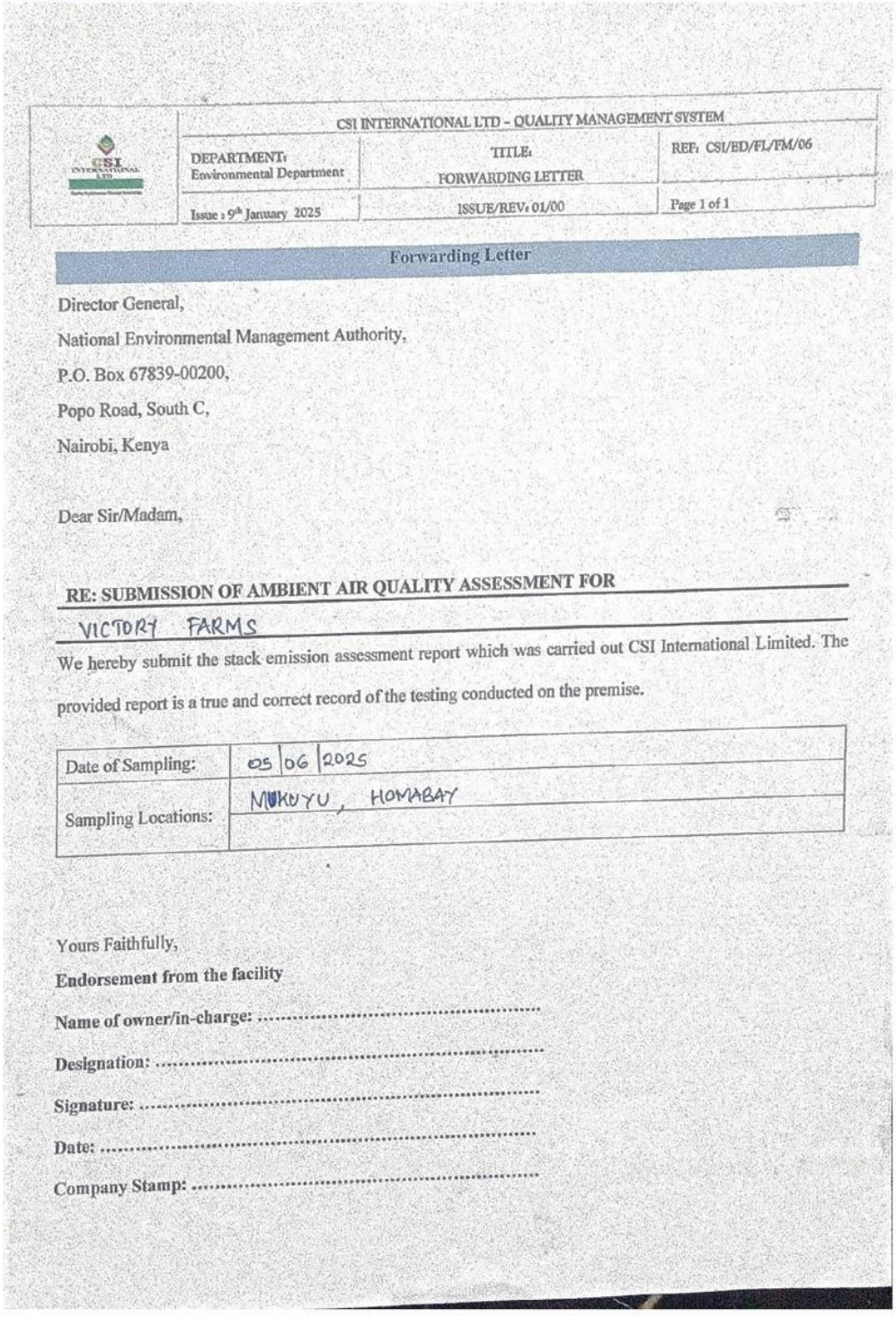
CSI INTERNATIONAL LIMITED
Howse & McGeorge Centre, Factory St, Off Bunyala Road, Building No. 10, Industrial Area
Address: P.O. Box 47846-00100, Nairobi, Kenya
TEL: +254 102 897 647
Email: info@csiinternationalke.co.ke
Website: http://www.csiinternationalke.co.ke

GENERAL INFORMATION	
CLIENT	VICTORY FARMS KENYA
CONTACT PERSON	NAME: KEVIN MUSIEGA
PROJECT TITLE	BASELINE AIR QUALITY MONITORING REPORT
PURPOSE OF MEASUREMENT	BASELINE AIR QUALITY MONITORING AND COMPLIANCE
DATE OF MONITORING	5TH JUNE 2025
BATCH NUMBER	25/0377
CSI REFERENCE NUMBER	CSI13900
REVISION STATUS	FINAL

DOCUMENT RELEASE INFORMATION				
REV.	DATE	PREPARED BY	REVIEWED BY	AUTHORIZED BY
1	25TH JUNE 2025	JERMAINE OMULAMI Air Quality Expert	GEORGE OINDO QA Manager	GEORGE OKOWA Laboratory Manager
				

This Baseline Ambient Air Quality Monitoring Report has been carried out to the best of our knowledge and ability and within the terms of the contract with the client and is limited to the exercise of reasonable care. This report is not intended to relieve the establishment from their contractual obligations. This report reflects our findings as at the time and place of intervention and is issued under the CSI International Limited terms and conditions of service.

Forwarding Letter



CSI INTERNATIONAL LTD – QUALITY MANAGEMENT SYSTEM		
DEPARTMENT: Environmental Department	TITLE: FORWARDING LETTER	REF: CSI/ED/FL/FM/06
Issue : 9th January 2025	ISSUE/REV: 01/00	Page 1 of 1

Forwarding Letter

Director General,

National Environmental Management Authority,

P.O. Box 67839-00200,

Popo Road, South C,

Nairobi, Kenya

Dear Sir/Madam,

RE: SUBMISSION OF AMBIENT AIR QUALITY ASSESSMENT FOR

VICTORY FARMS

We hereby submit the stack emission assessment report which was carried out CSI International Limited. The provided report is a true and correct record of the testing conducted on the premise.

Date of Sampling:	05/06/2025
Sampling Locations:	MUKUYU, HOMABAY

Yours Faithfully,

Endorsement from the facility

Name of owner/in-charge: .....

Designation: .....

Signature: .....

Date: .....

Company Stamp: .....

Executive Summary

CSI International conducted baseline air quality monitoring on 5 June 2025 at Victory Farms Kenya, a facility preparing to commence aquaculture farming in Mukuyu in Homabay. The objective of the assessment was to establish existing ambient air quality conditions prior to the start of operations, in line with environmental compliance requirements. The monitoring focused on key air pollutants as stipulated under the Environmental Management and Coordination (Air Quality) Regulations, 2014 (Legal Notice No. 34 of EMCA). Results shown in Table 1 below from the assessment indicated that all measured parameters were within the permissible limits set by the regulations, suggesting that the current air quality poses no immediate risk to the environment or public health. These findings provide a critical reference point for future impact assessments once the operations begin. The results represent the findings as at that particular time of assessment; hence, they are susceptible to deviation owing to prevailing conditions.

Table 1: Summary of results

Company	Victory Farm										
Purpose of Analysis	Baseline Assessment										
	Environmental Monitoring - Residential, Rural & Other area										
Sample Location	**CO**	**CO2**	**HC**	**NO**	**NO2**	**NO_X**	**O2**	**O3**	**PM10**	**PM2.5**	**SO2**
	ppm	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**	**mg/m3**	**mg/m3**	**ppm**
Mukuyu	0.24	155.51	0.00	0.17	0.18	0.35	20.90	0.10	2.30	3.11	2.21
Limit	**4.0**	**9000.0**	**NP**	**NP**	**0.2**	**150.0**	**NP**	**0.1**	**100.0**	**NP**	**80.0**

Legend: ppm: Parts per million.; mg/m3: milligrams per cubic metre; % - percentage concentration, ppb - parts per billion

Definition of Terms

Air Quality Standards: Legal thresholds set by regulatory bodies to limit the concentration of pollutants in the air to protect human health and the environment.

Ambient Air: The air surrounding us, which is the focus of air quality monitoring and assessments.

Baseline Data: Initial data collected to establish the current conditions of air quality in a particular area before any new development or changes take place.

Carbon Monoxide (CO): A colorless, odorless gas produced by burning fossil fuels. High levels of CO can be harmful to human health, preventing oxygen from entering the bloodstream.

Compliance: Adherence to air quality standards and regulations set by governmental and international bodies to ensure environmental and public health protection.

Emission Sources: Origins of pollutants released into the air, which can include industrial activities, motor vehicles, natural sources, and other anthropogenic activities.

Health Risk Assessment: The process of evaluating the potential health effects of exposure to air pollutants, based on concentration data and toxicity information.

Meteorological Data: Information about weather conditions such as wind speed, wind direction, temperature, humidity, and atmospheric pressure, which can affect the dispersion and concentration of pollutants.

Nitrogen Oxides (NOx): Gases produced from burning fuels, including nitric oxide (NO) and nitrogen dioxide (NO2), which can cause respiratory problems and contribute to the formation of smog and acid rain.

Ozone (O3): A gas that occurs both in the Earth's upper atmosphere and at ground level. Ground-level ozone is a major component of smog and can cause various health issues, including respiratory problems.

Particulate Matter (PM10, PM2.5): Tiny particles or droplets in the air that are 10 micrometers (PM10) or 2.5 micrometers (PM2.5) or smaller. PM2.5 is particularly harmful as it can penetrate deep into the lungs and even enter the bloodstream.

Pollutant Concentration: The amount of a particular pollutant present in a unit volume of air, typically expressed in micrograms per cubic meter ($\mu g/m^3$) or parts per million (ppm).

Sulfur Dioxide (SO2): A gas produced by volcanic eruptions and industrial processes, particularly the burning of coal and oil at power plants and refineries. SO2 can cause respiratory problems and contribute to the formation of acid rain.

Table of Content

1 Introduction

1.1 Background Information

Baseline air quality assessment is a comprehensive evaluation of the existing air quality in the proposed sites. The aim of the assessment is to provide a reference point for understanding the current environmental conditions and for the protection of human health, buildings, crops, vegetation, ecosystems, as well as for planning and other purposes. Baseline assessment include data collection, pollutant monitoring, meteorological data assessment and identification of pollution sources. The sources may include industrial activities, traffic, natural sources, and other contributors. The pollutants measured are compared with the national standard limits provided in the Environmental Management and Coordination (Air Quality Regulation), (EMCA) 2014.

In this study, the scope of the pollutants and meteorological conditions monitored include:

Table 2: Scope of study

Pollutant			
1.	Carbon Monoxide (CO), ppm	8.	Particulate Matter (PM_{10}) $\mu g/m^3$
2.	Carbon Dioxide (CO_2) , ppm	9.	Particulate Matter ($PM_{2.5}$), $\mu g/m^3$
3.	Hydrocarbons (C_xH_y) , ppm	10.	Sulphur Dioxide (SO_2), ppb
4.	Nitrogen Monoxide (NO), ppb	11.	Wind direction, Deg
5.	Nitrogen Oxides (NO_2), ppb	12.	Wind speed, kph
6.	Oxygen (O_2), %	13.	Temperature, deg. C
7.	Ozone (O_3), ppb	14.	Relative Humidity, %

1.2 Air Quality Legislations - The Environmental Management and Coordination (Air Quality Regulation), (EMCA) 2014

Ambient Air Quality Legislations are contained in the Environmental Management and Coordination (Air Quality Regulation), (EMCA) 2014. The objective of these Regulations is to provide for the prevention, control and abatement of air pollution to ensure clean and healthy ambient air. These Regulations shall apply to: -

i. All internal combustion engines
ii. All premises, places, processes, operations, or works to which the provisions of the Act and Regulations made thereunder apply
iii. Any other appliance or activity that the Cabinet Secretary May by order in the Gazette, specify

Under the regulation,

i. No person shall cause the ambient air quality levels specified in the First Schedule of these Regulations to be exceeded.
ii. A person, owner or operator of a facility listed under the Fourth Schedule shall ensure that measurement of emissions and occupational exposure levels are carried out in accordance with the methods of test set out in the Eleventh Schedule

iii. The Authority in consultation with the relevant lead agencies May carry out all measurements of ambient air quality levels in accordance with the methods of test set out in the Eleventh Schedule.

The national monitoring standards stipulated under the First Schedule in the Environmental Management & Coordination (Air Quality) Regulations, 2014 - Republic of Kenya. The standards are shown in

Table 3: Monitoring standards stipulated under EMCA 2014

Parameter	Units	Time weighted Average	Industrial area Residential	Rural & Other area	Controlled areas***
Carbon Monoxide (CO)	mg/m^3	1 hour	10	4	2
Carbon Dioxide (CO_2)***	ppm	8 hour	9000		
Hydrocarbons (C_xH_y)	ppb	Instant peak	700		
Nitrogen Oxides (NO_2)	$\mu g/m^3$	24 hour	100	0.1 ppm	
Nitrogen Oxides (NO_x)	$\mu g/m^3$	24 hour**	150	80	30
Ozone (O_3)	$\mu g/m^3$	1 hour	200		
Particulate Matter (PM_{10})	$\mu g/m^3$	24 hour**	150	100	75
Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	24 hour**	75		
Sulphur Dioxide (SO_2)	$\mu g/m^3$	24 hour**	125	80	30

KEY: $\mu g/m^3$ - microgram per cubic metre, mg/m^3 - milligram per cubic metre, ppm - parts per million, ppb - parts per billion, Values at Standard Temperature and Pressure (STP), * the 24-hour limit May not be exceeded more than three times in one year; ** 24-hour limit May not be exceeded more than three times in one year micrograms/m3, *** Not to be exceeded more than once per year average concentration, *** Occupational Safety and Health Act, of 2007), **** California Air Resource Board (CARB)

1.3 Clean Air (Unpolluted Air)

The concentration of what can be considered pure air is shown in Table 4 (Schnelle & Brown, 2001)

Table 4: Clean air (Unpolluted air)

Component	Concentration (Considered to be pure air)
Particulate Matter	10–20 $\mu g/m^3$
Sulphur Dioxide	0.001–0.01 ppm
Carbon Dioxide	300–330 ppm
Carbon Monoxide	1 ppm
Oxides Of Nitrogen	0.001–0.01 ppm
Total Hydrocarbons	
Total Oxidant	0.01 pm

1.4 Objectives of Monitoring

The monitoring was based on the following three objectives:

i To establish baseline ambient air quality conditions at Mukuyu in Homabay prior to the commencement of aquaculture farming.

ii To assess the levels of key air pollutants and compare against the limits set by the Environmental Management and Coordination (Air Quality) Regulations, 2014.

iii To provide a reference point for future monitoring and support regulatory compliance and environmental management during plant operations.

2 Sampling Details

2.1 General Source Information

Victory Farms Kenya, founded in 2015 and based on the shores of Lake Victoria in Homa Bay County, is one of East Africa's fastest-growing aquaculture companies. It operates a fully vertically integrated tilapia farming system, covering brood-stock, hatcheries, deep-water cage farming, cold-chain logistics, and retail distribution. Victory Farms uses large, floating HDPE cages and advanced data systems to maintain low spoilage rates and high productivity, producing over 7,000 tonnes of tilapia annually and targeting rapid growth. The company also prioritizes sustainability by aiming for carbon-neutral operations, integrating solar energy, sustainable feed, waste recycling, and community partnerships. Through these efforts, Victory Farms addresses the region's significant fish supply gap while promoting nutrition, economic development, and environmental stewardship.

2.2 Sources of Pollution in the Area

- Boat emissions: Diesel-powered fishing and transport boats operating on Lake Victoria emit nitrogen oxides (NOx), sulfur dioxide (SO_2), PM, and hydrocarbons.
- Open waste burning near homes can produce toxic air pollutants including dioxins and furans.
- Wind-driven pollutants from other parts of the lake or nearby towns (e.g., Kisumu or Mbita) may reach the region depending on meteorological conditions

2.3 Sampling Date and Location

Monitoring was carried out on 5th June 2025 for a dwell time of 60 minutes approximately 1 km into the lake (00° 48' 48" S 34° 04' 56" E) with the instrument being 100% online for the duration of monitoring. Monitoring was carried out at 2.0 m (approximated breathable height) height above nominal ground.

3 Method

3.1 Instrument (Haz-Scanner)

The Haz-Scanner is an Environmental Device Corporation instrument capable of measuring potentially harmful gases and particulates in addition to other existing environmental conditions. The portable HAZ-SCANNER™ system is portable and easily deployable as an ambient air quality monitor to measure and document critical U.S. EPA criteria pollutants including nitrogen oxides, Sulphur dioxide, ozone, carbon oxides, particulates, Temperature, Wind direction, and Wind speed. The HAZ-SCANNER instrument provides direct readings in real-time with data logging capabilities. Incorporating a dashboard, control panel, the instrument was powered on 20 minutes before collecting data. During the first 15 minutes of operation the HAZ-SCANNER system enters a warm up period. During the warm-up period the logging function is disabled. The system samples data every ten seconds before you begin logging data. This is useful in finding an optimum location for data collection. Figure 1 and Table 5 display the equipment used for sampling and analysis

Figure 1: Haz Scanner HIM 6000

Table 5: Equipment details

Instrument	Haz-Scanner
Model	HIM-6000
Manufacturer	Environmental Devices Corporation U.S.A
Serial Number	921265

3.2 Air Quality Sampling Procedure

- The Haz-Scanner was first powered on and allowed a warm up time of 15 minutes before data collection was done. During this period, the logging function is disabled.
- After warm-up, the date was set, the flow rate was set at 2.0 litres per minute (LPM) and the existing data cleared and instrument zeroed. The data log-in function was then activated.
- The system samples data every ten seconds before logging data.

3.3 Data Analysis

For various conversions, the following equations stipulated under the Eleventh Schedule in EMCA 2014 were used;

Ppm to mg/m³	$mg/m^3 = ppm\ x\ \frac{MW}{22.4}\ x\ \frac{273}{T(K)}\ x\ \frac{P}{101.3}$	Key: In the equations, MW is the molecular weight of the gas, T is the temperature at which the readings were taken in Kelvin and P is the pressure. The assumption made was that the readings were taken at atmospheric pressure, hence $\frac{P}{101.3}$=1
mg/m³ to ppm	$ppm\ = mg/m^3\ x\ \frac{22.4}{MW}\ x\ \frac{T(K)}{273}\ x\ \frac{101.3}{P}$	
Ppb to µg/m³	$\mu g/m^3 = \frac{ppb\ x\ 12.187\ x\ MW}{T(K)}$	
Ppm to ppb	$1\ ppm = 1000\ ppb$	
Conversion of time weighted average (TWA)	$C_{long} = C_{short}\left(\frac{t_{short}}{t_{long}}\right)^P$	C_{long} = the concentration for the longer averaging time C_{short} = the concentration for the shorter averaging time t_{short} = the shorter averaging time (in minutes) t_{long} = the longer averaging time (in minutes) p = the power law exponent, 0.28

Figure 2: Conversion equations

4 Results

The baseline air quality assessment conducted at Victory Farms Kenya involved the measurement of a range of critical air pollutants to establish the ambient environmental conditions prior to the start of production. The parameters measured included Carbon Monoxide (CO), Carbon Dioxide (CO_2), Hydrocarbons (CxHy), Nitrogen Monoxide (NO), Nitrogen Dioxide (NO_2), total Nitrogen Oxides (NO_x), Oxygen (O_2), Ozone (O_3), Particulate Matter (PM_{10} and $PM_{2.5}$), and Sulphur Dioxide (SO_2). Results from the monitoring exercise shown in Table 6 and Table 7 indicated that the concentrations of all the pollutants were within the permissible limits set by the Environmental Management and Coordination (Air Quality) Regulations, 2014. This suggests that the current air quality at the site does not pose any immediate risks to human health or the environment. The findings provide a clean and reliable baseline against which future monitoring. Furthermore, the results support the company's readiness for regulatory compliance and reinforce its commitment to sustainable and environmentally responsible development. It should be noted that values represent the findings as at that particular time of assessment; hence, they are susceptible to deviation owing to prevailing conditions.

Table 6: Summary of results

Company	Victory Farm										
Purpose of Analysis	Baseline Assessment										
	Environmental Monitoring - Residential, Rural & Other area										
Sample Location	**CO**	**CO2**	**HC**	**NO**	**NO2**	**NO_X**	**O2**	**O3**	**PM10**	**PM2.5**	**SO2**
	ppm	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**	**mg/m3**	**mg/m3**	**ppm**
Mukuyu	0.24	155.51	0.00	0.17	0.18	0.35	20.90	0.10	2.30	3.11	2.21
Limit	**4.0**	**9000.0**	**NP**	**NP**	**0.2**	**150.0**	**NP**	**0.1**	**100.0**	**NP**	**80.0**

Legend: ppm: Parts per million.; mg/m3 : milligrams per cubic metre; % - percentage concentration, ppb - parts per billion

Table 7: Ambient air quality result

MUKUYU				
	Average Pollutant	**Average in Standard units**	**TWA OEL -RL**	**Remarks**
Carbon Monoxide (CO)	0.21 ppm	0.243 mg/m^3	4 mg/m^3**	Within Limit
Carbon Dioxide (CO_2)	278.38 ppm	278.377 ppm	9000 ppm**	Within Limit
Hydrocarbons (C_xH_y)	0.00 ppm	0.000 ppb	NP	Not Provided
Nitrogen Monoxide (NO)	1.97 ppb	0.175 ppm	NP	Not Provided
Nitrogen Oxides (NO_2)	1.99 ppb	0.175 ppm	0.2 ppm	Within Limit
Nitrogen Oxides (NO_x)	3.96 ppb	0.350 ppm	150 $\mu g/m^3$	Within Limit
Oxygen (O_2)	20.90 %	20.900 %	NP	Not Provided
Ozone (O_3)	0.24 ppb	0.096 ppm	0.12 ppm	Within Limit
Particulate Matter (PM_{10})	5.61 $\mu g/m^3$	2.303 $\mu g/m^3$	100 $\mu g/m^3$**	Within Limit
Particulate Matter ($PM_{2.5}$)	3.11 $\mu g/m^3$	3.106 $\mu g/m^3$	NP	Not Provided
Sulphur Dioxide (SO_2)	2.05 ppb	2.208 $\mu g/m^3$	80 $\mu g/m^3$**	Within Limit
Volatile Organic Compound (VOCs)	0.00 ppb	0.000 ppb	NP	Not Provided
Relative humidity (RH)	65.16 %			
Temperature	24.37 °C			
Wind direction	21.99 °			
Wind speed	1.40 kph			

Temperature and Pressure (STP), * the 24-hour limit may not be exceeded more than three times in one year; ** 24-hour limit may not be exceeded more than three times in one year micrograms/m3, *** Not to be exceeded more than once per year average concentration

Emission limits are as stipulated under EMCA 2014; CO_2 limits are obtained from Occupational Safety and Health Act, of 2007

5 Conclusions and Recommendations

5.1 Conclusion

The baseline air quality monitoring conducted at Victory Farms in Mikuyu on 5 June 2025 successfully established the pre-operational ambient air quality status at the proposed site. The results demonstrated that all measured pollutants, including particulate matter (PM_{10}, $PM_{2.5}$), nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2) and ozone (O_3) were within the acceptable limits set by the Environmental Management and Coordination (Air Quality) Regulations, 2014. These findings indicate that the current air quality in the assessed area is acceptable and poses minimal risk to public health and the environment. The favorable results provide a solid foundation for planning future developments, ensuring that ongoing monitoring and management practices can maintain these air quality levels and address any potential increases in pollutant concentrations.

5.2 Recommendations

- Periodic review and assessment assessments of the pollutants should be adhered to as guided by the authorities in order to monitor the levels of pollutants after operations commence, hence, provide the management and regulatory body with necessary data for purposes of mitigation measures.
- Enhance emission control and adoption of green technology when operations begin
- Increasing public awareness about issues related to air quality and encourage community involvement through educational campaigns and public participation
- Development and maintenance of emergency response plan to address potential acute air pollution incidents, ensuring rapid and effective action to protect public health.

6 References

i. Environmental Management and Coordination (Air Quality) Regulations, 2014

ii. EH40/2005 Workplace exposure limits Reference EH40/2005 ISBN 9780717667031

iii. International standards Organization Air Quality - Particle size fraction definitions for health-rela sampling ISO standard 7708 1995.

iv. BS6069 Section 4.4:1993 (ISO 7935) - Stationary source emissions determination of m concentrations of persistent air pollutants (POP)

v. WHO Air Quality Guidelines in the International Finance Corporation (IFC), Global Update 2007

vi. Schnelle, J. . K. B., & Brown, C. A. (2001). *Air Pollution Control Technology Handbook* (F. Kre (ed.); 1st ed.). CRC Press. https://doi.org/10.1201/9781420036435

7 Appendix

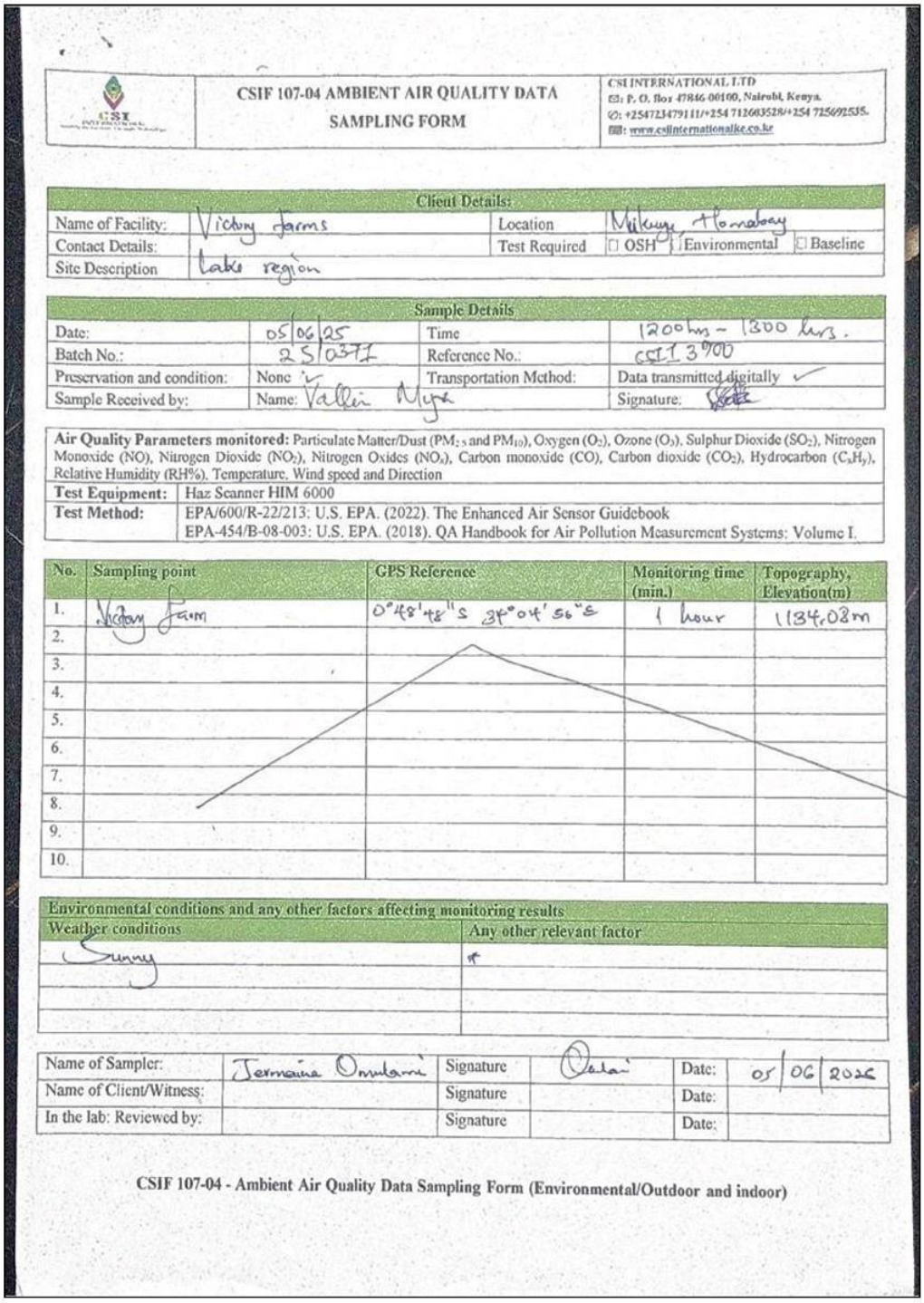
Appendix 1: Raw Data

AMBIENT AIR QUALITY ASSESSMENT

Client	Victory Farm			Measurement Point	Mukuyu
Start Date	06/05/2025	End Date	06/05/2025	Purpose	Environmental Monitoring - Residential, Rural & Other area
Start Time	11:55:21	End Time	12:50:56		

	CO	CO2	HC	NO	NO2	O2	O3	PM10	PM2.5	RH	SO2	TmpC	WDir	WSpM	VOC
	ppm	ppm	ppm	ppb	ppb	%	ppb	ug/m3	ug/m3	%	ppb	Deg. C	Deg.	kph	ppb
Ave	0.212	278.377	0.000	1.971	1.987	20.900	0.235	5.606	3.106	65.157	2.050	24.373	21.986	1.403	0.000
Max	0.496	283.330	0.000	2.935	2.743	20.900	3.100	6.985	3.955	65.290	2.099	24.693	22.231	1.907	0.000
Min	0.002	274.269	0.000	1.140	1.095	20.900	0.000	4.189	2.275	65.035	2.002	24.026	21.749	1.014	0.000
11:55:21	0.162	274.4	0.00	2.94	1.35	20.90	0.54	5.52	3.86	65.05	2.03	24.56	22.21	1.04	0.00
11:57:46	0.418	282.9	0.00	1.14	1.10	20.90	0.00	4.87	3.05	65.24	2.08	24.04	21.94	1.54	0.00
12:00:11	0.257	278.0	0.00	2.41	2.68	20.90	0.98	6.79	2.34	65.24	2.00	24.42	21.98	1.01	0.00
12:02:36	0.145	275.2	0.00	2.71	2.74	20.90	0.12	4.26	2.30	65.08	2.06	24.31	21.86	1.19	0.00
12:05:01	0.401	275.6	0.00	2.48	1.20	20.90	3.10	6.50	3.79	65.03	2.08	24.30	21.75	1.87	0.00
12:07:26	0.002	277.5	0.00	2.48	1.74	20.90	0.00	6.34	2.38	65.17	2.00	24.45	22.05	1.48	0.00
12:09:51	0.016	281.4	0.00	1.66	2.72	20.90	0.00	6.83	3.12	65.13	2.05	24.22	21.97	1.19	0.00
12:12:16	0.366	283.3	0.00	2.54	2.37	20.90	0.00	5.53	3.30	65.18	2.08	24.08	21.77	1.11	0.00
12:14:41	0.006	277.2	0.00	1.58	1.81	20.90	0.00	5.03	2.84	65.11	2.10	24.47	22.10	1.25	0.00
12:17:06	0.276	276.0	0.00	1.44	2.29	20.90	0.00	4.58	3.81	65.29	2.09	24.37	22.19	1.07	0.00
12:19:31	0.287	276.0	0.00	1.27	1.10	20.90	0.00	5.86	3.79	65.22	2.01	24.28	22.00	1.72	0.00
12:21:56	0.265	282.0	0.00	2.63	2.35	20.90	0.00	5.94	3.02	65.11	2.07	24.43	21.88	1.22	0.00
12:24:21	0.193	282.1	0.00	1.29	1.37	20.90	0.00	5.78	3.58	65.18	2.06	24.32	21.76	1.84	0.00
12:26:46	0.051	283.3	0.00	1.79	2.50	20.90	0.00	5.39	2.92	65.21	2.00	24.03	22.11	1.26	0.00
12:29:11	0.065	281.7	0.00	2.71	2.58	20.90	0.00	4.19	3.11	65.28	2.07	24.64	21.80	1.04	0.00
12:31:36	0.373	281.1	0.00	1.56	1.41	20.90	0.00	6.99	2.49	65.09	2.00	24.26	22.21	1.11	0.00
12:34:01	0.009	276.4	0.00	1.42	1.79	20.90	0.00	5.67	2.57	65.13	2.02	24.69	22.02	1.84	0.00
12:36:26	0.135	276.8	0.00	1.44	2.61	20.90	0.00	5.91	3.75	65.29	2.05	24.53	21.96	1.91	0.00
12:38:51	0.156	281.3	0.00	1.78	2.64	20.90	0.00	4.87	2.90	65.07	2.05	24.57	22.02	1.56	0.00
12:41:16	0.403	274.3	0.00	1.30	1.65	20.90	0.90	6.85	3.01	65.20	2.07	24.26	21.88	1.60	0.00
12:43:41	0.365	276.2	0.00	2.22	2.33	20.90	0.00	5.14	3.96	65.07	2.04	24.11	22.21	1.45	0.00
12:46:06	0.182	276.2	0.00	1.89	2.50	20.90	0.00	4.19	2.94	65.22	2.05	24.45	21.99	1.68	0.00
12:48:31	0.496	275.5	0.00	2.68	1.34	20.90	0.00	6.86	2.27	65.04	2.08	24.67	22.23	1.21	0.00
12:50:56	0.057	276.8	0.00	1.93	1.50	20.90	0.00	4.65	3.44	65.13	2.05	24.48	21.77	1.50	0.00

Appendix 2: Sampling forms



CSIF 107-04 AMBIENT AIR QUALITY DATA SAMPLING FORM

CSI INTERNATIONAL LTD
P. O. Box 47846-00100, Nairobi, Kenya.
+254723479111/+254 712603528/+254 725692535.
www.csiinternationalke.co.ke

Client Details:					
Name of Facility:	Victory farms	Location	Mikuyu Homabay		
Contact Details:		Test Required	☐ OSH	☐ Environmental	☐ Baseline
Site Description	Lake region				

Sample Details			
Date:	05/06/25	Time	1200hrs - 1300 hrs.
Batch No.:	25/037	Reference No.:	CSIT 3700
Preservation and condition:	None ✓	Transportation Method:	Data transmitted digitally ✓
Sample Received by:	Name: Valli Mya	Signature:	

Air Quality Parameters monitored: Particulate Matter/Dust ($PM_{2.5}$ and PM_{10}), Oxygen (O_2), Ozone (O_3), Sulphur Dioxide (SO_2), Nitrogen Monoxide (NO), Nitrogen Dioxide (NO_2), Nitrogen Oxides (NO_x), Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrocarbon (C_xH_y), Relative Humidity (RH%), Temperature, Wind speed and Direction

Test Equipment:	Haz Scanner HIM 6000
Test Method:	EPA/600/R-22/213: U.S. EPA. (2022). The Enhanced Air Sensor Guidebook EPA-454/B-08-003: U.S. EPA. (2018). QA Handbook for Air Pollution Measurement Systems: Volume I.

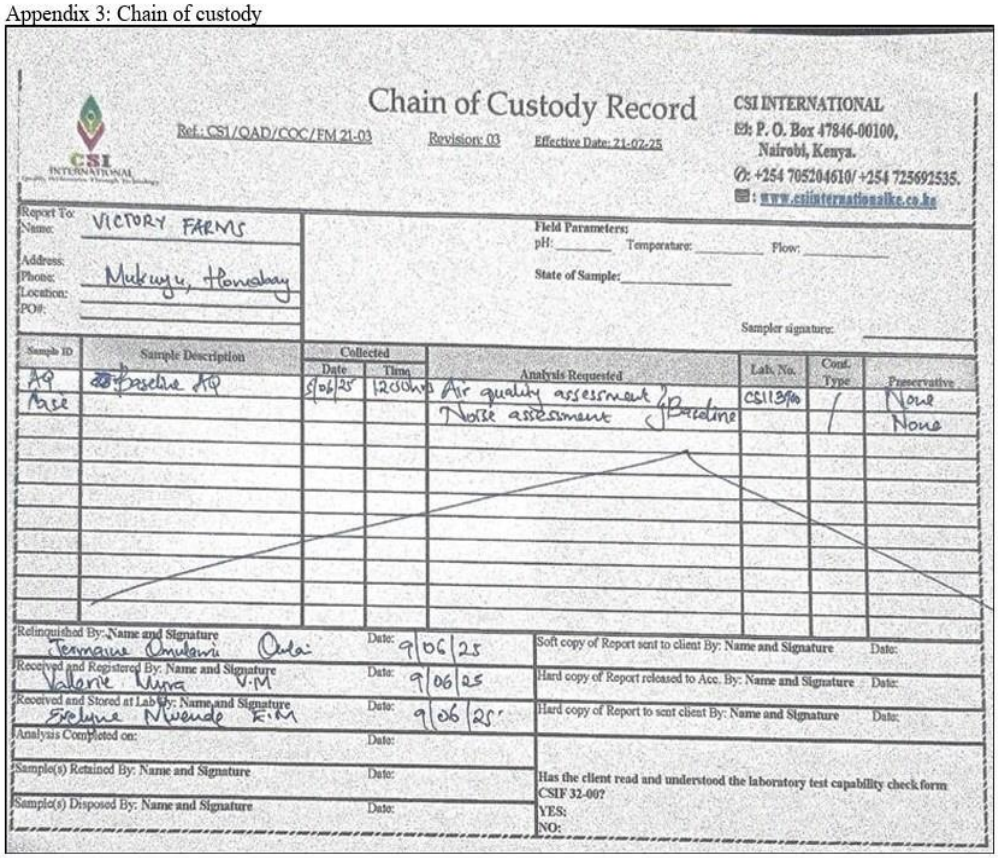
No.	Sampling point	GPS Reference	Monitoring time (min.)	Topography, Elevation(m)
1.	Victory Farm	0°48'48"S 34°04'56"E	1 hour	1134.08m
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Environmental conditions and any other factors affecting monitoring results	
Weather conditions	Any other relevant factor
Sunny	*

Name of Sampler:	Jermaine Omulami	Signature		Date:	05/06/2025
Name of Client/Witness:		Signature		Date:	
In the lab: Reviewed by:		Signature		Date:	

CSIF 107-04 - Ambient Air Quality Data Sampling Form (Environmental/Outdoor and indoor)

Appendix 3: Chain of custody



Chain of Custody Record

Ref.: CSI/QAD/COC/FM 21-03 Revision: 03 Effective Date: 21-02-25

CSI INTERNATIONAL
P. O. Box 47846-00100, Nairobi, Kenya.
+254 705204610/ +254 725691535.
www.csiinternationalke.co.ke

Report To: Name: VICTORY FARMS
Address:
Phone:
Location: Mukuyu, Honoday
PO#:

Field Parameters: pH: _____ Temperature: _____ Flow: _____
State of Sample: _____
Sampler signature: _____

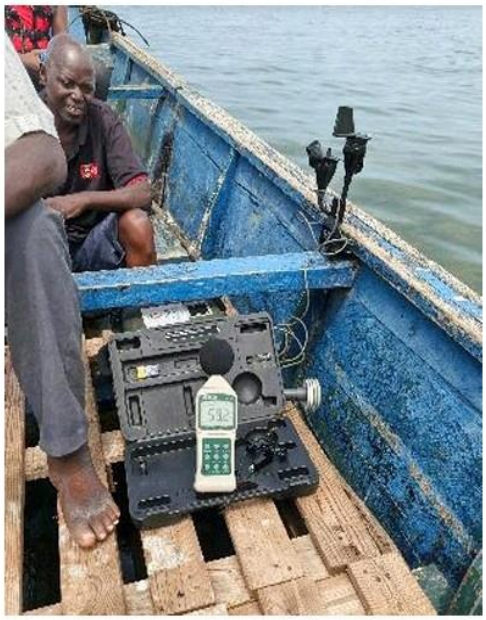
Sample ID	Sample Description	Collected Date	Collected Time	Analysis Requested	Lab. No.	Cont. Type	Preservative
AQ Base	Baseline AQ	5/06/25	1250hrs	Air quality assessment / Baseline Noise assessment / Baseline	CS1139/25	1	None None

Relinquished By: Name and Signature: Jermaine Omubanda Date: 9/06/25
Received and Registered By: Name and Signature: Valerie Nina V.M Date: 9/06/25
Received and Stored at Lab By: Name and Signature: Evelyne Mwende E.M Date: 9/06/25
Analysis Completed on: Date:
Sample(s) Retained By: Name and Signature Date:
Sample(s) Disposed By: Name and Signature Date:

Soft copy of Report sent to client By: Name and Signature Date:
Hard copy of Report released to Acc. By: Name and Signature Date:
Hard copy of Report to sent client By: Name and Signature Date:

Has the client read and understood the laboratory test capability check form CSIF 32-00?
YES:
NO:

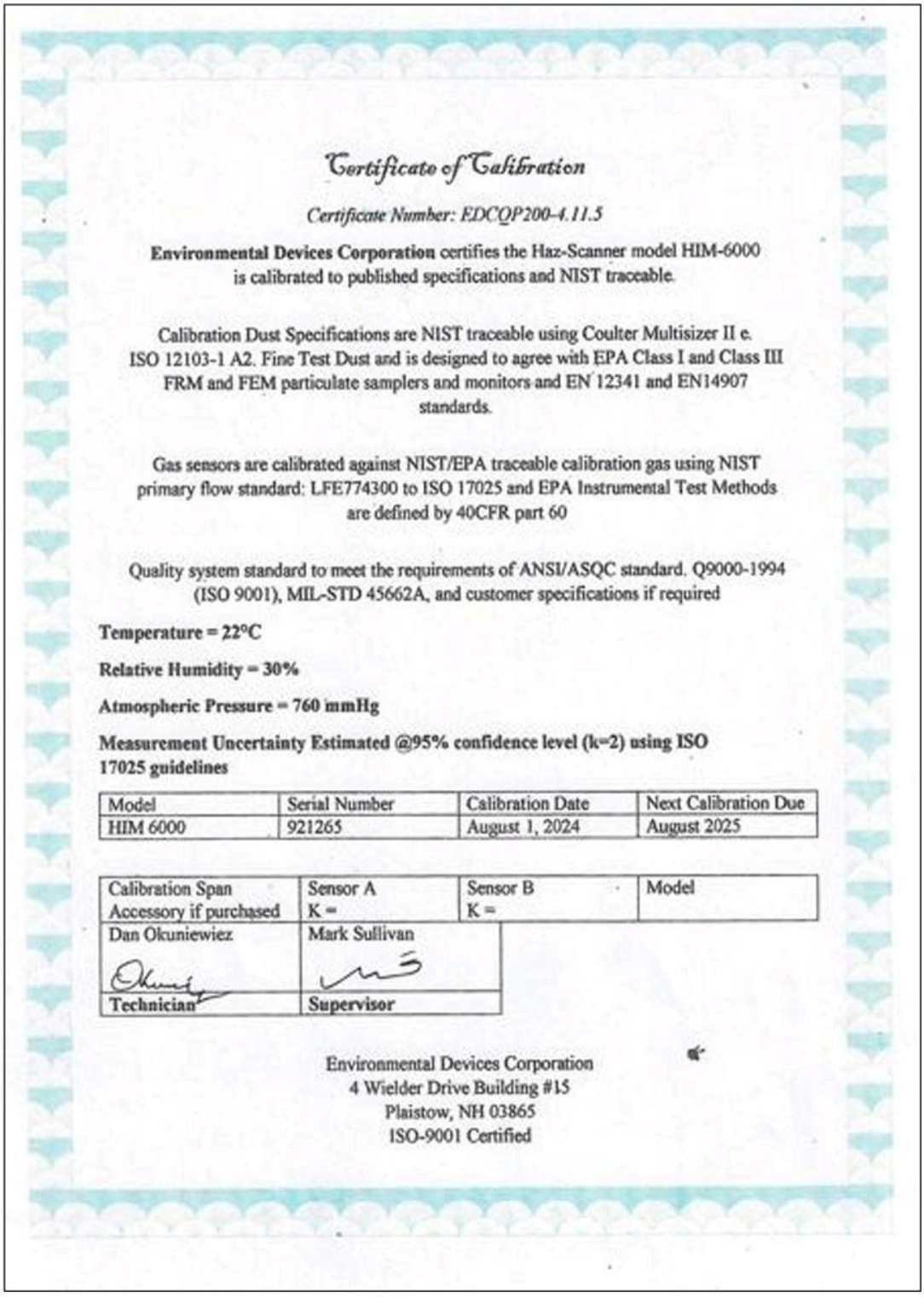
Appendix 4: Site pictures



Ongoing Assessment

Site

Appendix 5: Haz-Scanner calibration certificate



Certificate of Calibration

Certificate Number: EDCQP200-4.11.5

Environmental Devices Corporation certifies the Haz-Scanner model HIM-6000 is calibrated to published specifications and NIST traceable.

Calibration Dust Specifications are NIST traceable using Coulter Multisizer II e. ISO 12103-1 A2. Fine Test Dust and is designed to agree with EPA Class I and Class III FRM and FEM particulate samplers and monitors and EN 12341 and EN14907 standards.

Gas sensors are calibrated against NIST/EPA traceable calibration gas using NIST primary flow standard: LFE774300 to ISO 17025 and EPA Instrumental Test Methods are defined by 40CFR part 60

Quality system standard to meet the requirements of ANSI/ASQC standard. Q9000-1994 (ISO 9001), MIL-STD 45662A, and customer specifications if required

Temperature = 22°C

Relative Humidity = 30%

Atmospheric Pressure = 760 mmHg

Measurement Uncertainty Estimated @95% confidence level (k=2) using ISO 17025 guidelines

Model	Serial Number	Calibration Date	Next Calibration Due
HIM 6000	921265	August 1, 2024	August 2025

Calibration Span Accessory if purchased	Sensor A K =	Sensor B K =	Model
Dan Okuniewiez	Mark Sullivan		
Technician	**Supervisor**		

Environmental Devices Corporation
4 Wielder Drive Building #15
Plaistow, NH 03865
ISO-9001 Certified

Appendix 6: CSI Designation and Accreditation Certificates

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Telcom Wireless: 020-2183718, 020-2101370, 020-2103696
Mobile Line: 0724 253 398, 0723 363 010, 0735 013 046
Incident Line: 0786 101 100

P. O. Box 67839 - 00200
Popo Road, Nairobi, Kenya
Email: dgnema@nema.go.ke
Website: www.nema.go.ke

NEMA/21/2/VOL.III **13th March 2017**

CSI International
1st Floor, Quincy Mall
Langata
P.O. Box 47846-00100
NAIROBI.

RE: LABORATORY DESIGNATION BY NEMA.

Pursuant to your application for designation, your laboratory was inspected and evaluated based on ISO 17025 for laboratory competence to carry out tests and samplings.

Your laboratory qualified and has in principle, been designated to undertake **Drinking Water, Effluent, Air Quality, and soil Analysis** subject to the attached terms and conditions.

You will however await the due process of laboratory gazettement.

ZEPHANIAH OUMA
FOR: DIRECTOR GENERAL

Our Environment, Our Life, Our Responsibility

ISO 9001: 2008 Certified

Appendix 7: Project Participants and Titles

NAME	TITLE
Dr. Victor Shikuku	Head of Laboratory Services
Mr. Edwin Odongo	Environmental Section Head
Mr. Hannington Muhati	EIA/EA Expert
Ms. Gloria Masitsa	Application Chemist
Ms. Everlyne Mwende Mumo	Data Entry and Reporting Personnel
Mr. Jermaine Onyando Omulami	Air Quality Expert and Reporting Personnel

Annex 4: Baseline Noise Assessment Measurement Report

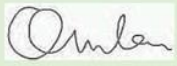
BASELINE NOISE ASSESSMENT MEASUREMENT REPORT

VICTORY FARMS KENYA
HOMABAY

JUNE 2025

CSI INTERNATIONAL LIMITED
Howse & McGeorge Centre, Factory St, Off Bunyala Road, Building No. 10, Industrial Area
Address: P.O. Box 47846-00100, Nairobi, Kenya
TEL: +254 102 897 647
Email: info@csiinternationalke.co.ke
Website: http://www.csiinternationalke.co.ke

GENERAL INFORMATION	
CLIENT	VICTORY FARMS KENYA
CONTACT PERSON	NAME: KEVIN MUSIEGA
PROJECT TITLE	BASELINE NOISE MONITORING REPORT
PURPOSE OF MEASUREMENT	BASELINE NOISE MONITORING AND COMPLIANCE
DATE OF MONITORING	5TH JUNE 2025
BATCH NUMBER	25/0377
CSI REFERENCE NUMBER	CSI13900
REVISION STATUS	FINAL

DOCUMENT RELEASE INFORMATION				
REV.	DATE	PREPARED BY	REVIEWED BY	AUTHORIZED BY
1	25TH JUNE 2025	JERMAINE OMULAMI Air Quality Expert	GEORGE OINDO QA Manager	GEORGE OKOWA Laboratory Manager
				

This Baseline Noise Monitoring Report has been carried out to the best of our knowledge and ability and within the terms of the contract with the client and is limited to the exercise of reasonable care. This report is not intended to relieve the Establishment from their contractual obligations. This report reflects our findings as at the time and place of intervention and is issued under the CSI International Limited terms and conditions of service

Executive Summary

CSI International carried out baseline noise assessment at the proposed site with strict adherence to the standard protocols. The aim of the exercise was to establish the current noise levels for future reference and comparison for the control and mitigation of noise pollution at the proposed area before operations begin. The survey was conducted under the provisions of Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. Results shown in Table 1 revealed that the noise levels at the assessed area were within the limits provided in the Noise and Excessive Vibration Pollution Control Regulations, 2009. This indicates that the current noise assessment in the area is acceptable and poses minimal risk to public health and the environment. The noise results submitted herein are as at the time of measurement and may vary based on the activities of the company.

Table 1: Summary of results (standard noise level meter)

Noise Assessment - Victory Farms										
Purpose:	Baseline Assessment			**Date of assessment**			**5/6/2025**			
Method:	ISO 1996			**Sample duration (min)**			**60**			
Instrument:	Extech Instruments 407750									
	Time and date			**Noise Levels, dB(A)**					**Standard limits, dB (A)**	
Sample Location	**Date**	**Start time**	**End time**	**L_{eq}**	**L_{50}**	**L_{90}**	**L_{max}**	**L_{min}**	**Limit**	**L_{peak} limit**
Mukuyu	06/05/2025	11:55:21	12:55:38	38.52	45.50	49.53	67.40	33.30	50	140
Legend: The monitoring standards used during assessment was the Factories and Other Places of Work (Noise Prevention and Control) Rules 2005 and The Environmental and Coordination (Noise Excessive Vibration Pollution) (Control) Regulations, 2009; The noise levels are in dB(A).										

Table of Content

Definition of Terms

Baseline noise assessment: the measurement of the existing ambient noise levels in an area, serving as a reference point for evaluating future noise impacts from new projects or developments.

dBA: The unit in decibels on the A scale for quiet sounds

Decibels: A dimensionless unit used in comparison of the magnitude of sound pressures or powers

Disturbance: Any act or instance of interrupting the rest, calm, attention or quiet of another person;

Impulsive noise: A noise consisting of one or more bursts of sound energy of a duration of less than one second;

Intermittent noise: A noise whose level suddenly drops to several times the level of the background noise;

L_{eq} (Equivalent Continuous Sound Level): The constant noise level that, over a specified period, would contain the same sound energy as the varying levels actually measured. It provides a single value that represents the average energy level of fluctuating noise.

L_{max} (Maximum Sound Level): The highest noise level recorded during the measurement period.

L_{min} (Minimum Sound Level): The lowest noise level recorded during the measurement period.

Noise Monitoring: The process of systematically measuring noise levels over a period to gather data on environmental noise.

Noise pollution: The release of uncontrolled noise that is likely to cause danger to human health, or damage to the environment;

Noise: Any unwanted and annoying sound that is intrinsically objectionable to human beings or which can have or is likely to have an adverse effect on human health or the environment;

Permissible noise levels: The levels of noise prescribed by regulation 6;

Sound Level Meter: An instrument used to measure sound pressure levels in decibels.

Sound: A fluctuation in pressure, particle displacement, or panicle velocity propagated in any medium, or the auditory sensation that may be produced;

1. Introduction

1.1 Background Information

Baseline noise assessment involves measuring and analyzing the existing ambient noise levels in a specific area over a period of time. This assessment establishes a reference point for understanding the current acoustic environment, which is crucial for evaluating the potential impact of future developments or projects. The data collected helps in planning, regulatory compliance, and mitigating noise pollution.

1.2 Noise Metrics in Occupational Health and Safety

Various noise metrics provide different perspectives on the noise environment and help in formulating effective control measures. The key metrics include L_{eq}, L_{50}, L_{90}, L_{max}, and L_{min}. Each of these plays a significant role in understanding and mitigating noise-related risks.

1.2.1 L_{eq} (Equivalent Continuous Sound Level)

L_{eq} represents the continuous equivalent sound level over a specified period. It is an energy-averaged measure that takes into account the varying levels of noise over time, providing a single value that represents the total sound energy exposure. L_{eq} is critical because it reflects the cumulative exposure of workers to noise, which is essential for assessing the risk of hearing loss and other health effects. Regulatory limits often specify maximum permissible L_{eq} levels over an 8-hour workday to prevent excessive noise exposure.

1.2.2 L_{50} (Median Noise Level)

L_{50} is the noise level that is exceeded 50% of the time during the measurement period. It is essentially the median noise level. L_{50} provides insight into the typical noise environment experienced by workers, highlighting the most common noise conditions rather than extreme values. This metric is useful for understanding the general noise climate in a workplace and identifying areas where workers may consistently experience significant noise levels.

1.2.3 L_{90} (Background Noise Level)

L_{90} is the noise level exceeded 90% of the time. It is often used to represent the background or ambient noise level in an environment. L_{90} is important because it helps to identify the baseline noise that workers are exposed to, excluding transient or sporadic noise events. High L_{90} levels can indicate a persistently noisy environment, which might require continuous control measures or the provision of hearing protection.

1.2.4 L_{max} (Maximum Noise Level)

L_{max} is the highest noise level recorded during the measurement period. It represents the peak noise exposure that workers might experience. L_{max} is significant because short-duration, high-intensity noise events can cause

immediate hearing damage or other adverse health effects. Regulatory standards often include peak noise level limits to protect workers from these potentially harmful noise spikes.

1.2.5 L_{min} (Minimum Noise Level)

L_{min} is the lowest noise level recorded during the measurement period. While less critical than other metrics, L_{min} can provide context about the variability and range of noise levels in a workplace. Understanding the minimum noise levels can help in assessing the overall noise environment and determining the effectiveness of noise control measures.

1.2.6 Significance of Noise Metrics in Occupational Health and Safety

Each of these metrics offers unique insights into the noise environment and helps in developing a comprehensive noise management strategy:

- Risk Assessment: L_{eq} and L_{max} are crucial for evaluating the risk of hearing loss and other health impacts, ensuring compliance with regulatory standards, and identifying areas where noise exposure exceeds safe limits.
- Noise Control: L_{50} and L_{90} help in designing and implementing noise control measures by providing information on typical and background noise levels. This assists in targeting persistent noise sources and improving the general noise climate.
- Protective Measures: Understanding L_{max} and L_{min} aids in selecting appropriate hearing protection devices and scheduling work activities to minimize exposure to harmful noise levels.

1.3 Objectives of Monitoring

The monitoring was based on the following three objectives:

i To quantify the baseline noise level of the proposed area

ii To compare the levels assessed with the recommended standard limits

iii To propose to the management about measures that should be undertaken to maintain the levels within permissible limits

2. Legal Guideline

2.1 The Environmental and Coordination (Noise Excessive Vibration Pollution) (Control) Regulations, 2009

The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 sets guidelines for managing and controlling noise pollution in Kenya. Key aspects to consider when conducting a noise assessment include:

- ✓ **General Prohibitions:** Noise that is loud, unreasonable, and affects public health, safety, or comfort is prohibited.
- ✓ **Permissible Noise Levels:** The regulations outline maximum allowable noise levels for different zones, such as silent zones, residential areas, and commercial areas. These levels vary between day and night, with stricter limits at night as summarised in Table 2.
- ✓ **Measurement and Control:** Noise levels must be measured by relevant lead agencies or other authorized personnel. The regulations empower authorities to issue guidelines on noise measurement techniques.
- ✓ **Licensing:** Activities that may emit noise or vibrations beyond permissible levels, such as construction, demolitions, and public events, require a license. The application must include details of the activity, noise control methods, and notification to affected communities.
- ✓ **Exemptions:** Certain activities, such as emergency responses and public safety alerts, are exempt from the regulations.
- ✓ **Enforcement:** Authorities can issue improvement notices, impose penalties, or order the closure of facilities that violate noise control regulations. Non-compliance can result in fines or imprisonment (Noise regulations).
- ✓ **Noise from workplaces:** The provisions of The Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005 shall apply mutatis mutandis to these Regulations.

Table 2: Environmental noise and vibration guidelines

Zone/Area	Day (dB(A))	Night (dB(A))	Noise Rating Level (NR)
Silent Zone	40	35	30 (Day), 25 (Night)
Places of Worship	40	35	30 (Day), 25 (Night)
Residential - Indoor	45	35	35 (Day), 25 (Night)
Residential - Outdoor	50	35	40 (Day), 25 (Night)
Mixed Residential (with some commercial/entertainment)	55	35	50 (Day), 25 (Night)
Commercial	60	35	55 (Day), 25 (Night)
Source: The Environmental and Coordination (Noise Excessive Vibration Pollution) (Control) Regulations, 2009			

2.2 The Factories and Other Places of Work (Noise Prevention and Control) Rules 2005

The monitoring standards used during assessment was the Factories and Other Places of Work (Noise Prevention and Control) Rules 2005 and The Environmental and Coordination (Noise Excessive Vibration Pollution) (Control) Regulations, 2009. According to the regulations:

- No worker shall be exposed to noise level in excess of the:
  - ✓ continuous equivalent of 90 dB (A) in 8-hour within any 24-hour duration.
  - ✓ 140 dB(A) peak sound level at any given time.
- Where noise is intermittent, noise exposure shall not exceed the sum of the partial noise exposure equivalent continuous sound level of 90dB (A) in 8-hour duration within any 24-hour duration.
- It shall be the duty of the occupier to ensure that noise transmitted from the workplace to the community shall not exceed 55 dB (A) during daytime and 45 dB (A) at night time

The recommended occupational exposure levels (OEL-RL) are summarised in Table 3.

Table 3: Recommended OEL exposure levels

Time Average	Maximum Permissible Level (dB)
24-hour duration	90
At any point	140
Workplace to Community - Day	55
Workplace to Community - Night	45
Residential – Outdoor*	50

Source: Factories and Other Places of Work (Noise Prevention and Control) Rules 2005.
*The limit is under The Environmental and Coordination (Noise Excessive Vibration Pollution) (Control) Regulations, 2009

3. Monitoring Details

3.1 General Source Information (Monitoring Location)

Victory Farms Kenya, founded in 2015 and based on the shores of Lake Victoria in Homa Bay County, is one of East Africa's fastest-growing aquaculture companies. It operates a fully vertically integrated tilapia farming system, covering brood-stock, hatcheries, deep-water cage farming, cold-chain logistics, and retail distribution. Victory Farms uses large, floating HDPE cages and advanced data systems to maintain low spoilage rates and high productivity, producing over 7,000 tonnes of tilapia annually and targeting rapid growth. The company also prioritizes sustainability by aiming for carbon-neutral operations, integrating solar energy, sustainable feed, waste recycling, and community partnerships. Through these efforts, Victory Farms addresses the region's significant fish supply gap while promoting nutrition, economic development, and environmental stewardship.

3.2 General Observations and Sources of Noise in the area

In the site, the noise sources identified included:

- Motorized fishing boats often use outboard engines, which are a primary source of persistent and impulsive noise
- Motorbikes ("boda bodas") create traffic-related noise, especially on access roads to farms or fish markets.
- Natural sounds (waves, wind, bird) contribute to the overall noise environment and may mask or be affected by anthropogenic noise.

3.3 Monitoring Location Details

Noise monitoring was carried out on 5th June 2025 with strict adherence to standard protocol. Monitoring was carried out for a dwell time of 60 minutes at each sampling point (00° 48' 48" S 34° 04' 56" E).

4. Methodology

4.1 Instrument

The Extech 407750 shown in Figure 1 is a versatile and reliable noise monitoring instrument designed for accurately measuring sound levels in various environments, making it ideal for both industrial and environmental noise assessments. It features a broad measurement range from 30 to 130 dB, ensuring it can handle a wide spectrum of noise levels. With an accuracy of ±1.5 dB and a resolution of 0.1 dB, the device provides precise and dependable data. The instrument offers A and C frequency weighting options, allowing it to mimic the human ear's response to different frequencies for general noise measurements and to evaluate peak sound levels and low-frequency noise.

Figure 1: Extech 407750 Instrument and SV-104 noise dosimeter

4.2 Sampling Procedure

4.2.1 Site selection

- The noise meter was positioned to capture the dominant noise source such as machinery or construction activity.
- The measurement sites are identified according to project needs or environmental regulations (e.g., residential, industrial, or urban zones) such as nearness to the receptor or noise source
- The measurement site was free from obstacles that could affect the readings (e.g., buildings, barriers, electric wires and poles, transformers).
- The position chosen should be such that there is lowest effect to the influence of background noise (e.g., distant traffic, wind, birds, or nearby human activity) unless you specifically aim to measure these sources.

- Areas with excessive wind, as wind noise can affect measurements, even when using a windscreen on the microphone were avoided.

4.2.2 Measurement Procedure

- Set the noise meter on a tripod at a height of 1.2 to 1.5 meters above the ground, away from reflective surfaces.
- Ensure the microphone is oriented towards the dominant noise source.
- Set the meter to A-weighting for environmental noise measurements (commonly used in environmental assessments).
- Allow the meter to record noise levels for a minimum of 10 minutes or longer, depending on the purpose of the measurement. Continuous measurements over a 24-hour period may be necessary for detailed environmental assessments.
- Record the results for all measured parameters (L_{eq}, L_{50}, L_{90}, L_{max}, L_{min}).

4.2.3 Data Analysis

Data was collected after every second in each location for a period of 30 minutes using the standard noise meter and throughout the shift using the noise dosimeter. Data collected was used to determine noise metrics including L_{eq}, L_{50}, L_{90}, L_{max}, and L_{min} shown in Table 4

Table 4: Data analysis equations

Noise Metric	Formula	Parameters
L_{eq} (Equivalent Continuous Sound Level)	$L_{eq} = 10x \log_{10}\left(\frac{1}{N}\sum_{I=1}^{N} 10^{\frac{L_i}{10}}\right)$	L_{eq}: The equivalent continuous sound level. **N**: The total number of sound level samples. L_i:The individual sound level samples in decibels (dB)
L_{50} (Median Noise Level)	The median is the middle score in the set	
L_{90} (Background Noise Level)	L90 is the sound level that is exceeded 90% of the time obtained after arranging data in ascending order	
L_{max} (Maximum Noise Level)	Maximum value over a range of dataset	
L_{min} (Minimum Noise Level)	Minimum value over a range of dataset	

5. Results

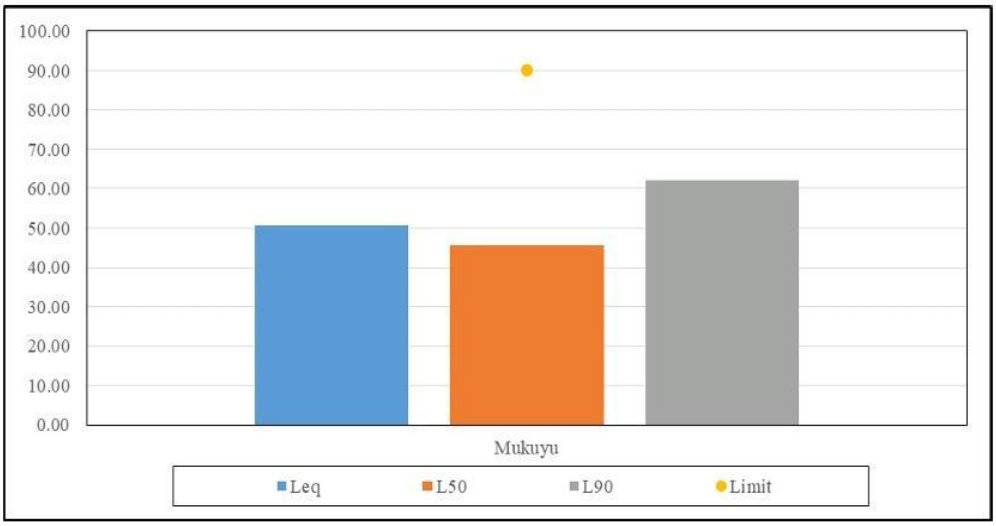
5.1 Results Summary and Discussion

The baseline noise levels were benchmarked against the Factories and Other Places of Work (Noise Prevention and Control) Rules 2005 and The Environmental and Coordination (Noise Excessive Vibration Pollution) (Control) Regulations, 2009. The summaries of results shown in Table 5 and Figure 2 below shows that the noise levels at the assessed area were within the limits provided in the Noise and Excessive Vibration Pollution Control Regulations, 2009. This indicates that the current noise assessment in the area is acceptable and poses minimal risk to public health and the environment. The noise results submitted herein are as at the time of measurement and may vary based on the activities of the company.

Table 5: Noise monitoring results (standard noise monitor)

Noise Assessment - Victory Farms										
Purpose:	Baseline Assessment			**Date of assessment**			**5/6/2025**			
Method:	ISO 1996			**Sample duration (min)**			**60**			
Instrument:	Extech Instruments 407750									
	Time and date			**Noise Levels, dB(A)**					**Standard limits, dB (A)**	
Sample Location	**Date**	**Start time**	**End time**	**L_{eq}**	**L_{50}**	**L_{90}**	**L_{max}**	**L_{min}**	**Limit**	**L_{peak} limit**
Mukuyu	06/05/2025	11:55:21	12:55:38	38.52	45.50	49.53	67.40	33.30	50	140
Legend: The monitoring standards used during assessment was the Factories and Other Places of Work (Noise Prevention and Control) Rules 2005 and The Environmental and Coordination (Noise Excessive Vibration Pollution) (Control) Regulations, 2009; The noise levels are in dB(A).										

Figure 2: Noise assessment graphical presentation



6. Conclusion and Recommendations

6.1 Conclusions

The baseline noise levels measured were within the limits stipulated under the Factories and Other Places of Work (Noise Prevention and Control) Rules 2005 and The Environmental and Coordination (Noise Excessive Vibration Pollution) (Control) Regulations, 2009. This indicates that the current noise assessment in the area is acceptable and poses minimal risk to public health and the environment. The noise results submitted herein are as at the time of measurement and may vary based on the activities of the company.

6.2 Recommendations

Based on the findings, it is recommended that the facility:

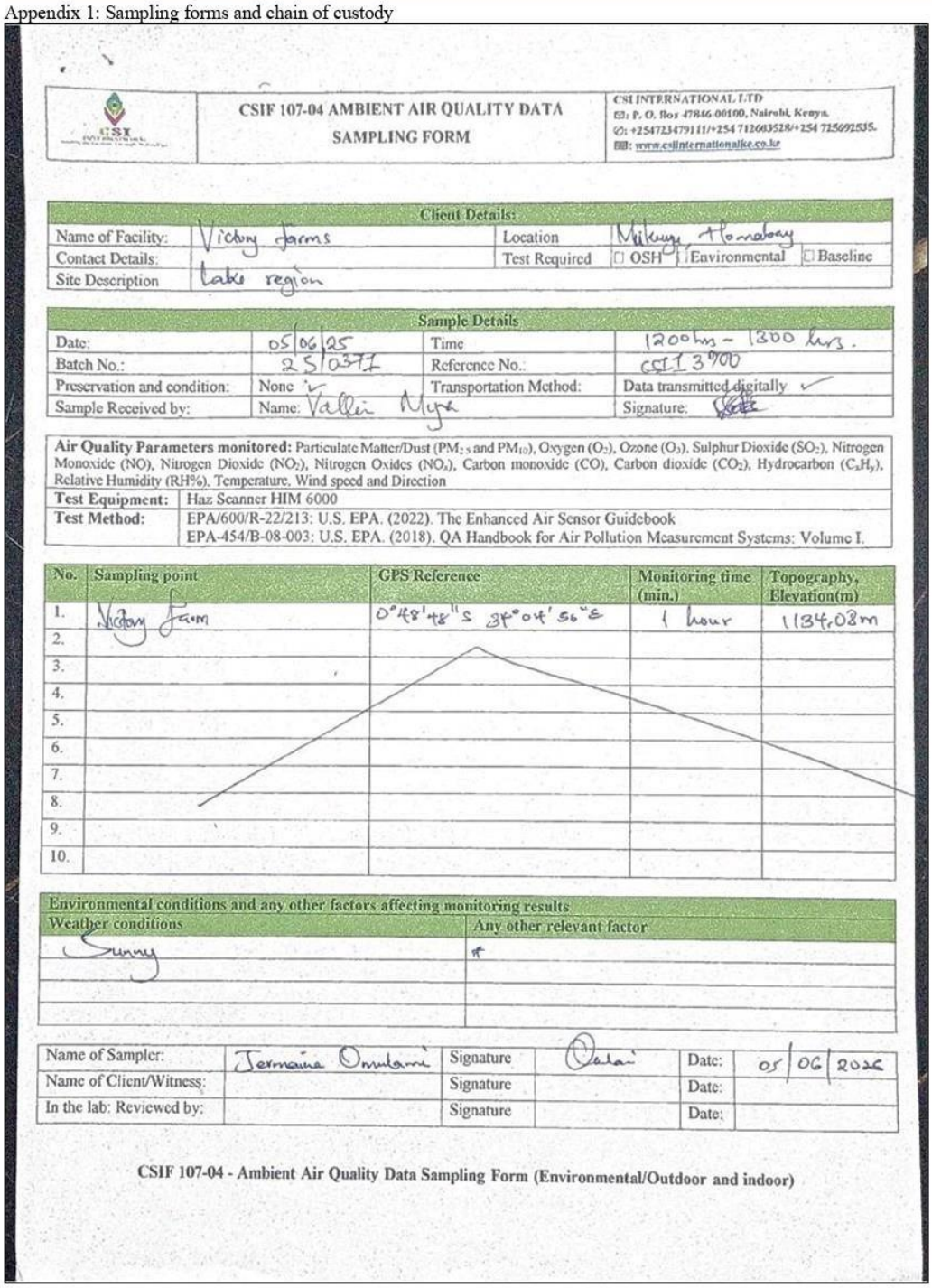
- **Implement a Noise Monitoring Program:** Regular and periodic monitoring of noise levels at various locations on-site to ensure they stay within regulatory limits and adjust mitigation measures as needed.
- **Training and Awareness:** Conduct regular training sessions for workers on the risks of noise exposure and the proper use of PPE to protect their hearing.
- **Community Engagement**: For the nearest homestead and other potentially affected areas, engage with the local community to provide timely information and install sound barriers to reduce noise impact.

7. References

1. The Factories and Other Places of Work (Noise Prevention and Control) Rules, (Legal Notice No. 24), 2005.
2. Environment Management and Coordination Act (Noise and Excessive Vibrations Pollution - Controls) Regulations, 2009.
3. Government of Kenya (2005). Occupational Safety and Health Act, 2007 Nairobi: Government Printer.
4. NIOSH (1998). Criteria for a Recommended Standard: Occupational Noise Exposure. Revised Criteria 1998. http://www.cdc.gov/niosh/98 –126.html. National Institute for Occupational Safety and Health, Cincinnati.

8. Appendixes

Appendix 1: Sampling forms and chain of custody



CSIF 107-04 AMBIENT AIR QUALITY DATA SAMPLING FORM

CSI INTERNATIONAL LTD
P. O. Box 47846-00100, Nairobi, Kenya.
+254723479111/+254 712603528/+254 725691535.
www.csiinternationalke.co.ke

Client Details:			
Name of Facility:	Victory farms	Location	Mikuyu, Homabay
Contact Details:		Test Required	☐ OSH ☐ Environmental ☐ Baseline
Site Description	lake region		

Sample Details			
Date:	05/06/25	Time	1200hrs - 1300 hrs.
Batch No.:	25/037	Reference No.:	CSI 3900
Preservation and condition:	None ✓	Transportation Method:	Data transmitted digitally ✓
Sample Received by:	Name: Valli Mya	Signature:	

Air Quality Parameters monitored: Particulate Matter/Dust ($PM_{2.5}$ and PM_{10}), Oxygen (O_2), Ozone (O_3), Sulphur Dioxide (SO_2), Nitrogen Monoxide (NO), Nitrogen Dioxide (NO_2), Nitrogen Oxides (NO_x), Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrocarbon (C_xH_y), Relative Humidity (RH%), Temperature, Wind speed and Direction

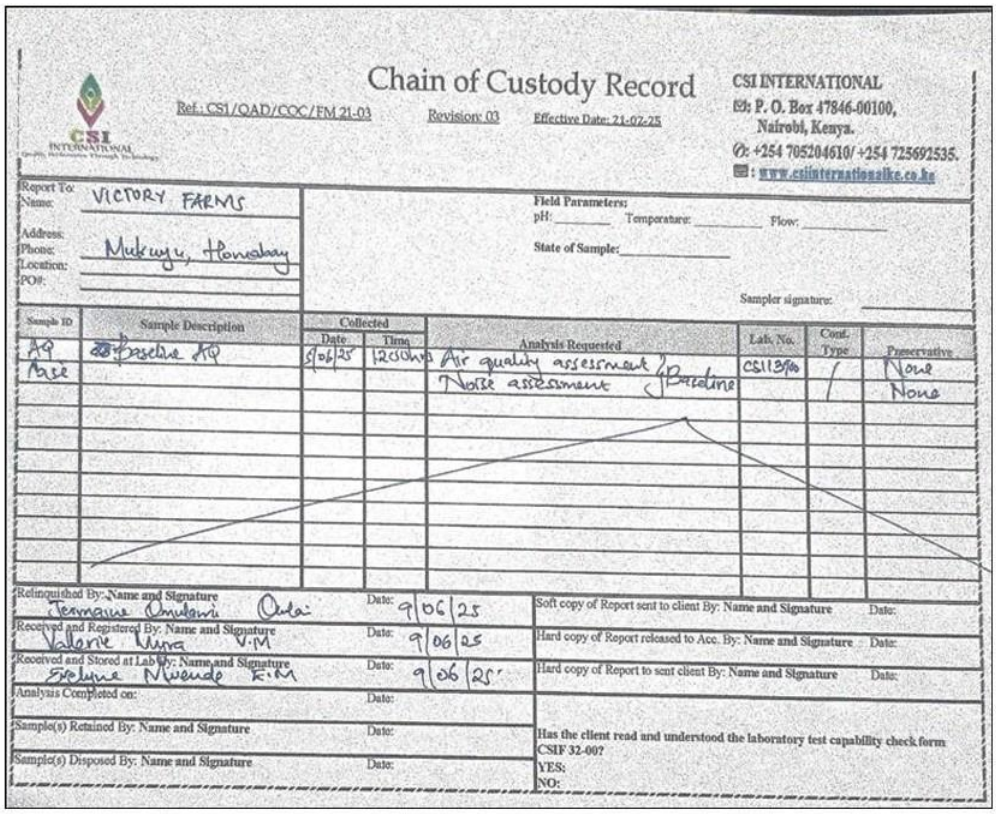
Test Equipment:	Haz Scanner HIM 6000
Test Method:	EPA/600/R-22/213: U.S. EPA. (2022). The Enhanced Air Sensor Guidebook EPA-454/B-08-003: U.S. EPA. (2018). QA Handbook for Air Pollution Measurement Systems: Volume I.

No.	Sampling point	GPS Reference	Monitoring time (min.)	Topography, Elevation(m)
1.	Victory Farm	0°48'48"S 34°04'56"E	1 hour	1134.08m
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Environmental conditions and any other factors affecting monitoring results	
Weather conditions	Any other relevant factor
Sunny	*

Name of Sampler:	Jermaine Omulami	Signature	Omulami	Date:	05/06/2025
Name of Client/Witness:		Signature		Date:	
In the lab: Reviewed by:		Signature		Date:	

CSIF 107-04 - Ambient Air Quality Data Sampling Form (Environmental/Outdoor and indoor)



Chain of Custody Record

CSI INTERNATIONAL

Ref.: CSI/QAD/COC/FM 21-03 Revision: 03 Effective Date: 21-07-25

CSI INTERNATIONAL
P. O. Box 47846-00100,
Nairobi, Kenya.
+254 705204610/ +254 725692535.
www.csiinternationalke.co.ke

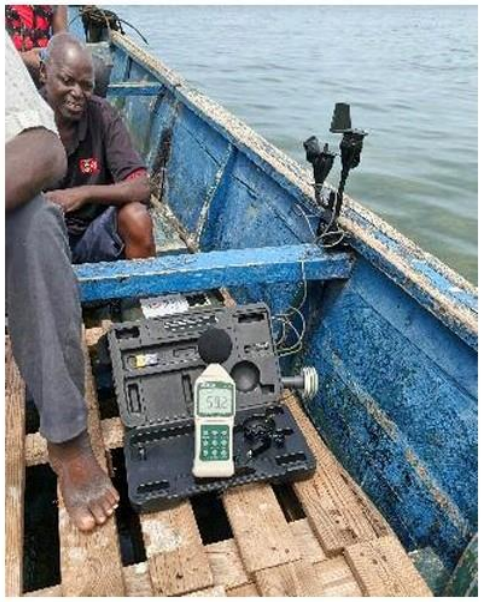
Report To:
Name: VICTORY FARMS
Address:
Phone:
Location: Mukuyu, Honoloy
PO#:

Field Parameters:
pH: _____ Temperature: _____ Flow: _____
State of Sample: _____
Sampler signature: _____

Sample ID	Sample Description	Collected Date	Collected Time	Analysis Requested	Lab. No.	Cont. Type	Preservative
AQ Base	Baseline AQ	5/06/25	12:50hrs	Air quality assessment / Baseline Noise assessment / Baseline	CS113/00	1	None None

Relinquished By: Name and Signature: Teemaine Omolo Ouda	Date: 9/06/25	Soft copy of Report sent to client By: Name and Signature	Date:
Received and Registered By: Name and Signature: Valorie Nina V.M	Date: 9/06/25	Hard copy of Report released to Acc. By: Name and Signature	Date:
Received and Stored at Lab By: Name and Signature: Solume Mwende K.M	Date: 9/06/25	Hard copy of Report to sent client By: Name and Signature	Date:
Analysis Completed on:	Date:		
Sample(s) Retained By: Name and Signature	Date:	Has the client read and understood the laboratory test capability check form CSIF 32-00? YES: NO:	
Sample(s) Disposed By: Name and Signature	Date:		

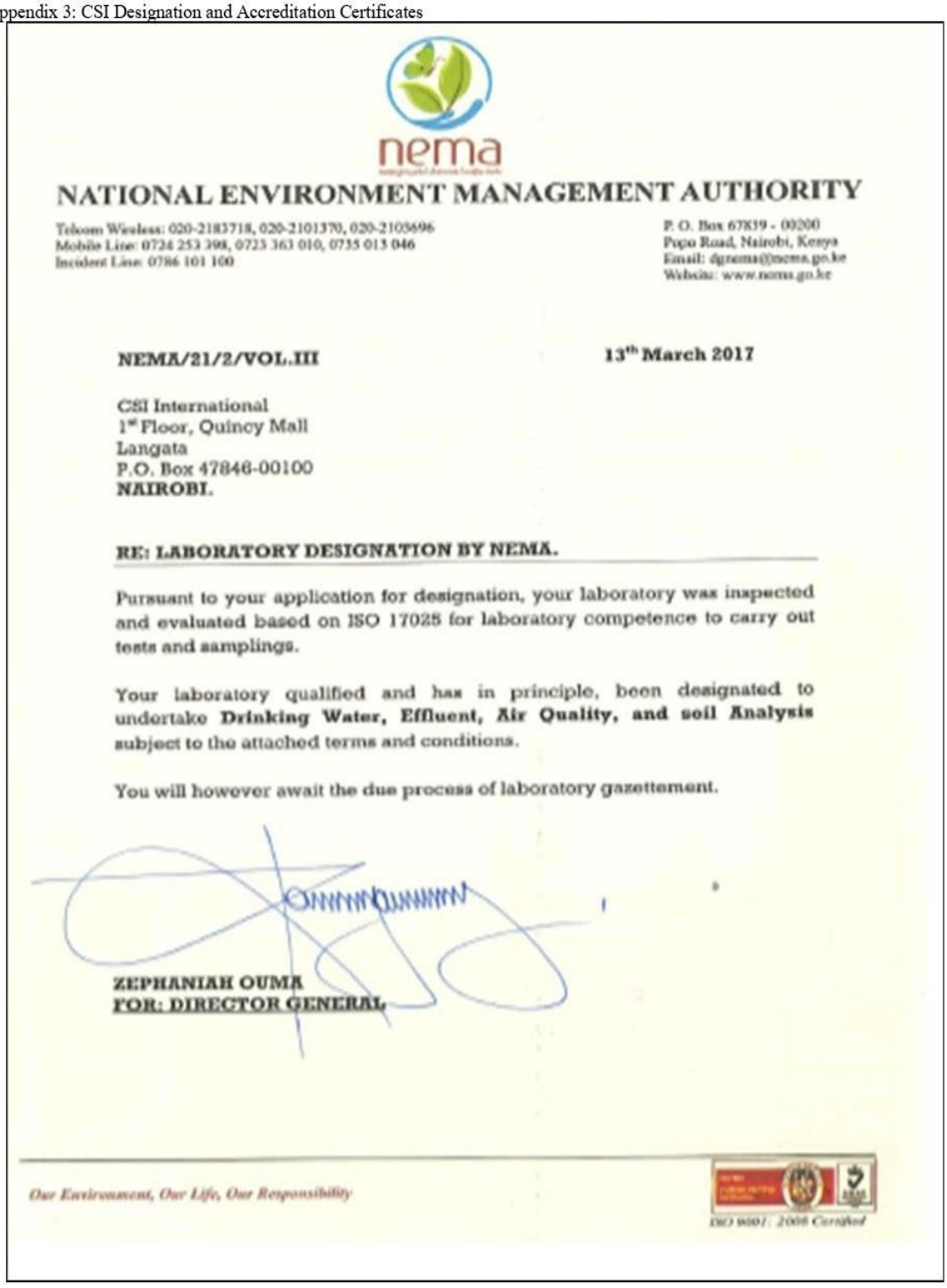
Appendix 2: Site Photos



Ongoing Assessment

Site

Appendix 3: CSI Designation and Accreditation Certificates



NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Telcom Wireless: 020-2183718, 020-2101370, 020-2103696
Mobile Line: 0724 253 398, 0723 363 010, 0735 013 046
Incident Line: 0786 101 100

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Website: www.nema.go.ke

NEMA/21/2/VOL.III **13th March 2017**

CSI International
1st Floor, Quincy Mall
Langata
P.O. Box 47846-00100
NAIROBI.

RE: LABORATORY DESIGNATION BY NEMA.

Pursuant to your application for designation, your laboratory was inspected and evaluated based on ISO 17025 for laboratory competence to carry out tests and samplings.

Your laboratory qualified and has in principle, been designated to undertake **Drinking Water, Effluent, Air Quality, and soil Analysis** subject to the attached terms and conditions.

You will however await the due process of laboratory gazettement.

ZEPHANIAH OUMA
FOR: DIRECTOR GENERAL

Our Environment, Our Life, Our Responsibility

ISO 9001: 2008 Certified

Appendix 4: Project Participants and Titles

NAME	TITLE
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Mr. Hannington Muhati	EIA/EA Expert
Ms. Gloria Masitsa	Application Chemist
Ms. Everlyne Mwende Mumo	Data Entry and Reporting Personnel
Mr. Jermaine Onyando Omulami	Air Quality Expert and Reporting Personnel

Annex 5: Water Sample

CSI INTERNATIONAL LTD
P.O. Box 47846-00100, Nairobi, Kenya.
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✆: +254 (0) 775 735 521/ +254 (0) 102 897 647
Toll Free: +254 (0) 800720879
www.csiinternationalke.co.ke

Serial Number: CCSI13899

CERTIFICATE OF ANALYSIS
CHEMICAL

Client:	**Victory Farms c/o Meshak Ouma**	**Sample Type:**	Water
Contact Details:	**0791738053**	**Sampled By:**	CSI International Ltd (J. Omulami)
Sample ID:	Lake Water		
Lab Batch No.:	25/0371	**Lab. Ref. No.:**	CSI13899
Date Received:	6/10/2025	**Date Analysis Started:**	6/11/2025
Date Analysis Completed:	6/13/2025	**Date Released**	6/24/2025

[2] PARAMETER	METHOD	RESULTS	[1]STANDARD (Max Limits)
Chemical			
Total Petroleum Hydrocarbons (TPH)			**np**
C5 - C12, mg/L	CSITP 033	0.0005	**np**
C12 - C28, mg/L	CSITP 033	0.0011	**np**
C28 - C44, mg/L	CSITP 033	0.0019	**np**

np - No standard reference for the parameter
BDL- Below Detection Level
To maintain the correct history ensure that the next sample sent from this Water Source is labelled: Lake Water
These results relate to the items sampled.
Sampling Method: CSI/QMS/STIRH/SP 20 - Test Item Receipt, Sampling, and Handling Procedure
History is 30 days

Chemistry Lab:

Masitsa

Gloria Masitsa
Chemical Analyst
6/24/2025

Authorised by:

Isaac Namachi
Quality Assuarance Manager
6/24/2025

Annex 6: Sediments Sample

CSI INTERNATIONAL LTD
P.O. Box 47846-00100, Nairobi, Kenya.
Howse & McGeorge Centre, 10 Factory Street,
Industrial Area, Nairobi
✆: +254 (0) 775 735 521/ +254 (0) 102 897 647
Toll Free: +254 (0) 800720879
: www.csiinternationalke.co.ke

Serial Number: CCSI13898

CERTIFICATE OF ANALYSIS
CHEMICAL

Client:	**Victory Farms c/o Meshak Ouma**	**Sample Type:**	Soil
Contact Details:	**0791738053**	**Sampled By:**	CSI International Ltd (J. Omulami)
Sample ID:	Sediment Sample		
Lab Batch No.:	25/0371	**Lab. Ref. No.:**	CSI13898
Date Received:	6/10/2025	**Date Analysis Started:**	6/11/2025
Date Analysis Completed:	6/13/2025	**Date Released**	6/24/2025

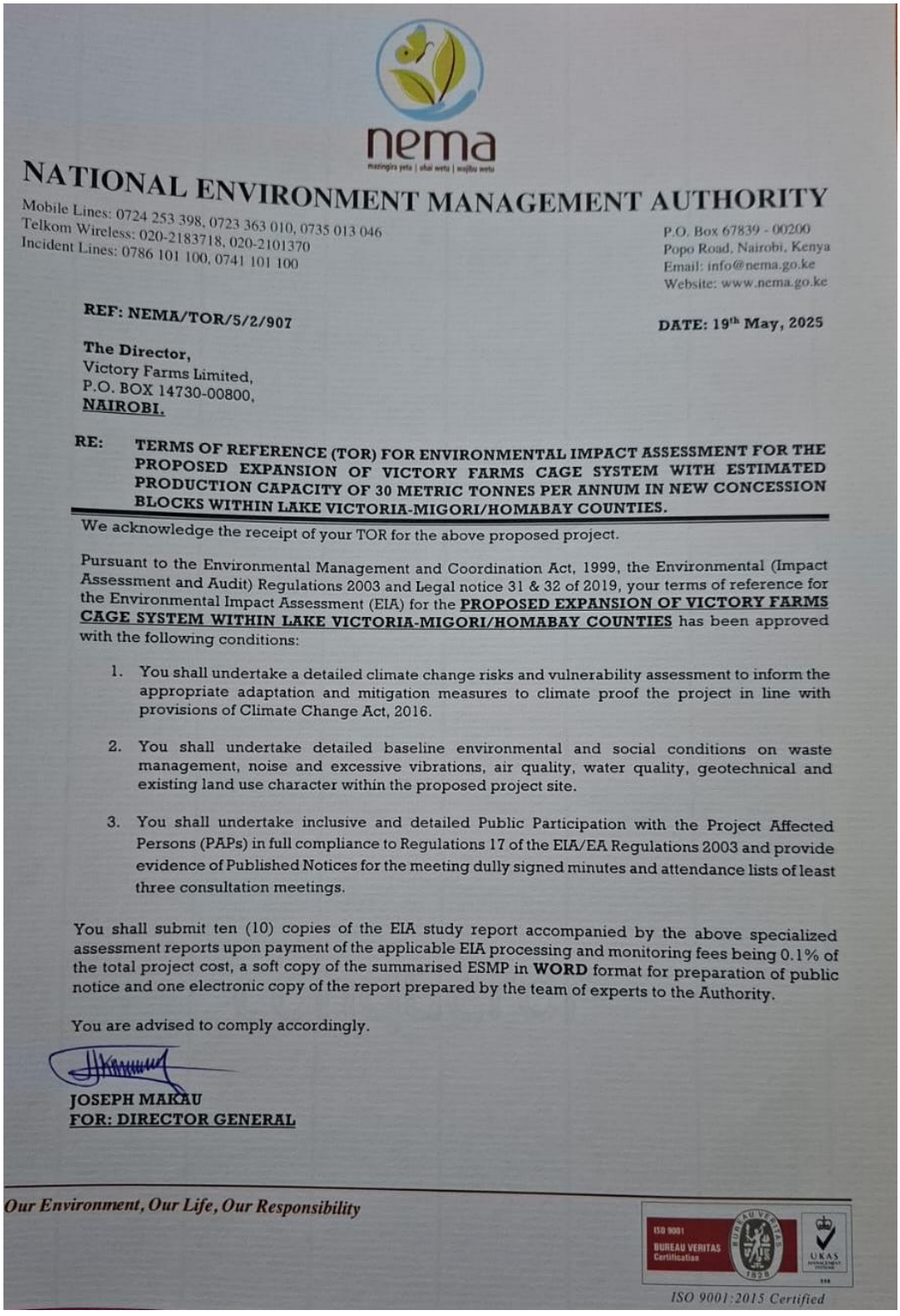
[2] PARAMETER	METHOD	RESULTS	[1]STANDARD (Max Limits)
Chemical			
Total Petroleum Hydrocarbons (TPH)			**np**
C5 - C12, mg/Kg	CSITP 033	0.0010	**np**
C12 - C28, mg/Kg	CSITP 033	0.0017	**np**
C28 - C44, mg/Kg	CSITP 033	0.0022	**np**

np - No standard reference for the parameter
BDL- Below Detection Level
To maintain the correct history ensure that the next sample sent from this Water Source is labelled: Sediment Sample
These results relate to the items sampled.
Sampling Method: CSI/QMS/STIRH/SP 20 - Test Item Receipt, Sampling, and Handling Procedure
History is 30 days

Chemistry Lab:
Masitsa
Gloria Masitsa
Chemical Analyst
6/24/2025

Authorised by:
Isaac Namachi
Quality Assuarance Manager
6/24/2025

Annex 7: NEMA Approved Terms of Reference (TOR)



nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Mobile Lines: 0724 253 398, 0723 363 010, 0735 013 046
Telkom Wireless: 020-2183718, 020-2101370
Incident Lines: 0786 101 100, 0741 101 100

P.O. Box 67839 - 00200
Popo Road, Nairobi, Kenya
Email: info@nema.go.ke
Website: www.nema.go.ke

REF: NEMA/TOR/5/2/907 **DATE: 19th May, 2025**

The Director,
Victory Farms Limited,
P.O. BOX 14730-00800,
NAIROBI.

RE: TERMS OF REFERENCE (TOR) FOR ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED EXPANSION OF VICTORY FARMS CAGE SYSTEM WITH ESTIMATED PRODUCTION CAPACITY OF 30 METRIC TONNES PER ANNUM IN NEW CONCESSION BLOCKS WITHIN LAKE VICTORIA-MIGORI/HOMABAY COUNTIES.

We acknowledge the receipt of your TOR for the above proposed project.

Pursuant to the Environmental Management and Coordination Act, 1999, the Environmental (Impact Assessment and Audit) Regulations 2003 and Legal notice 31 & 32 of 2019, your terms of reference for the Environmental Impact Assessment (EIA) for the **PROPOSED EXPANSION OF VICTORY FARMS CAGE SYSTEM WITHIN LAKE VICTORIA-MIGORI/HOMABAY COUNTIES** has been approved with the following conditions:

1. You shall undertake a detailed climate change risks and vulnerability assessment to inform the appropriate adaptation and mitigation measures to climate proof the project in line with provisions of Climate Change Act, 2016.

2. You shall undertake detailed baseline environmental and social conditions on waste management, noise and excessive vibrations, air quality, water quality, geotechnical and existing land use character within the proposed project site.

3. You shall undertake inclusive and detailed Public Participation with the Project Affected Persons (PAPs) in full compliance to Regulations 17 of the EIA/EA Regulations 2003 and provide evidence of Published Notices for the meeting dully signed minutes and attendance lists of least three consultation meetings.

You shall submit ten (10) copies of the EIA study report accompanied by the above specialized assessment reports upon payment of the applicable EIA processing and monitoring fees being 0.1% of the total project cost, a soft copy of the summarised ESMP in **WORD** format for preparation of public notice and one electronic copy of the report prepared by the team of experts to the Authority.

You are advised to comply accordingly.

JOSEPH MAKAU
FOR: DIRECTOR GENERAL

Our Environment, Our Life, Our Responsibility

ISO 9001 BUREAU VERITAS Certification

ISO 9001:2015 Certified

Annex 8: Letter of No Objection - Migori County Department of Agriculture, Livestock, Fisheries & Blue Economy

REPUBLIC OF KENYA
MIGORI COUNTY GOVERNMENT

CECM - Department of Agriculture, Livestock, Fisheries & Blue Economy

P O Box 210-40400
SUNA MIGORI

E-mail: MosendaLucas@migori.go.ke

Ref: MC/CECM/AGRIC/VOL.2/ (114)

Date: 8th May 2025

The Chief Development Officer
Victory Farm
(Attn. Caesar Asiyo)

RE: VICTORY FARM EXPANSION TO MIGORI

I refer to your letter dated 14th April 2025 on the reference subject.

This is to communicate the County Government's no objection to your endeavors and plan to expand into our county.

We however request that you keep us updated on these developments.

Further, we request for the following:-

(i) The exact coordinates of the areas that you have identified for the proposed developments to enable us better plan for other upcoming developments in and along the shores of Lake Victoria.
(ii) Our involvement in public participation by communities so that all stakeholders are informed of the developments proposed by Victory Farms.
(iii) A meeting to clarify on further details with respect to the projects, including any expected concessions from the County Government.

Wishing you all the best in your endeavors.

Kind regards.

CECM
AGRICULTURE, LIVESTOCK, FISHERIES
& BLUE ECONOMY
P.O. Box 84-40400,
SUNA-MIGORI

Lucas Mosenda
CECM – Agriculture, Livestock, Fisheries & Blue Economy
MIGORI COUNTY

Copy to: County Chief Officer – Fisheries & Blue Economy

Office if the County Executive Committee Member – Agriculture, Livestock, Fisheries & Blue Economy

Annex 9: Potential GPS Coordinates for the Proposed Migori Concession Block

MIGORI POTENTIAL PRODUCTION ZONE

0°51'28.31"S	34° 3'1.87"E
0°51'44.42"S	34° 4'52.91"E
0°55'26.97"S	34° 4'33.72"E
0°58'7.13"S	34° 2'40.81"E
0°57'20.93"S	34° 1'5.68"E
0°55'2.58"S	34° 2'47.17"E

Annex 10: Biosafety/ Biosecurity plan of the proponent

Victory Farms Biosecurity Plan

Version: V1, July 2025

Certification Page

This document serves as a biosecurity plan for Victory Farms production site, Migori County, Kenya. This document is dynamic, requiring annual review and updates as Victory Farms develops, expands, and improves its biosecurity practices.

Signed for and on behalf of**: Victory Farms Ltd**

Name: Michael Ouya ..... Signature: .....

Position: Sr. Partnerships & Development Manager ..... Date: 9th December 2025

Table of Contents

1. Introduction

Victory Farms' (VF) biosecurity plan aims to prevent disease, improve fish welfare, and increase productivity and profitability. Our biosecurity measures are designed to improving fish welfare and productivity to increase the efficiency of inputs and the sustainability of the system.

The objectives of VF's biosecurity plan are:

- better fish health and improved performance;
- mitigate the transmission and amplification of diseases between cages and concessions;
- allow for early disease detection so that impacts can be reduced;
- support claims of freedom from diseases that impact marketability and market access;
- facilitate translocation within and between production sites;
- reduce the risk of diseases from being introduced to the farm, spreading within the farm, or escaping from the farm;
- have emergency response protocols in place for serious disease outbreaks.

This documented biosecurity plan fulfills the legal requirement mandated by the Government of Kenya's Ministry of Fisheries, Agriculture, and Blue Economy.

2. Site Description

2.1. Site location

Victory Farms is located in Homa Bay county, Kenya. Its operations are based on the shores of Lake Victoria, southwest of Mbita Village, just outside the Winam gulf (Figure 1). The site consists of an on-shore production site and off-shore concessions in the lake. The coordinates of the off-shore concessions are shown in Table 1, and the coordinates of the on-shore production site are shown in Table 2 and Figure 2.

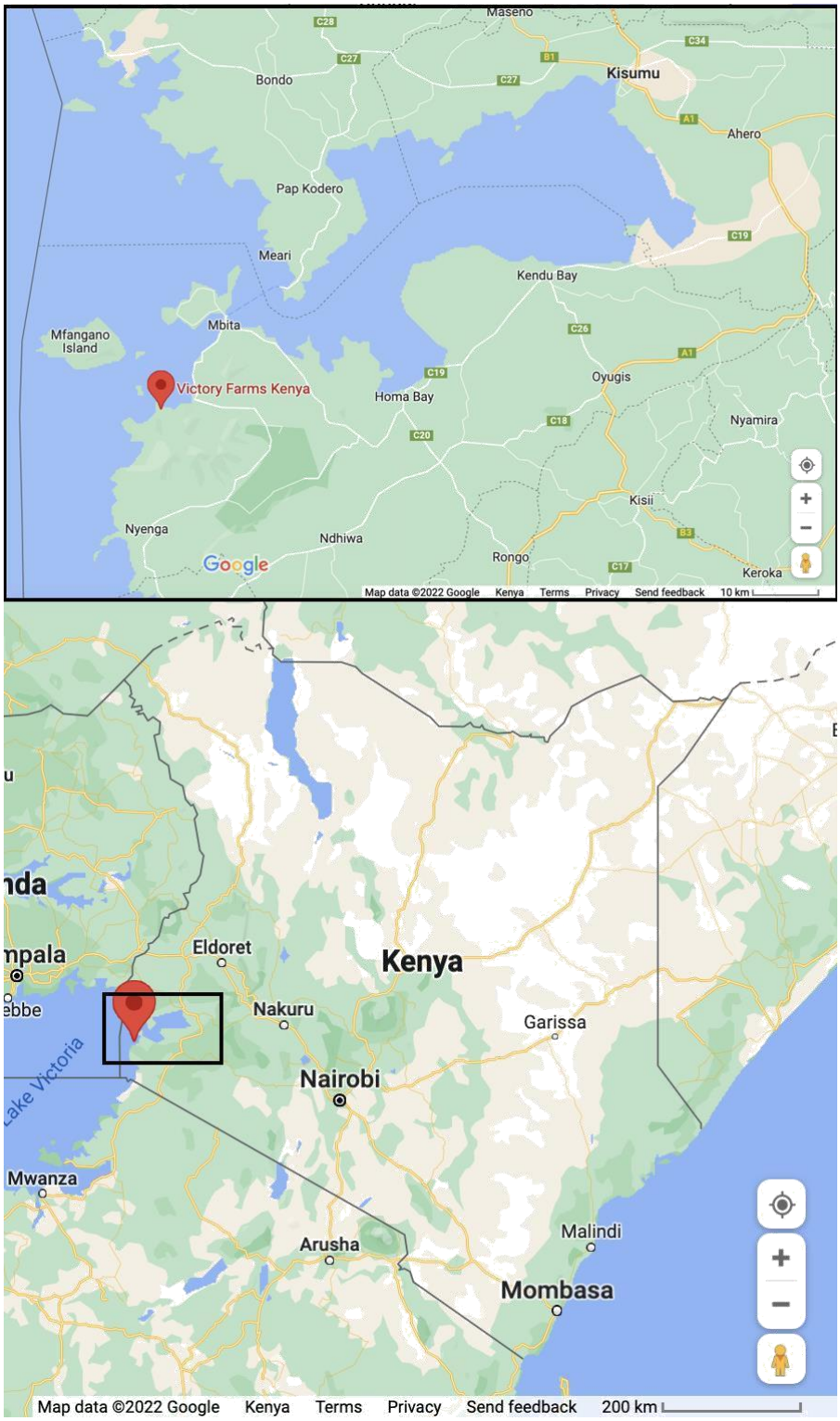
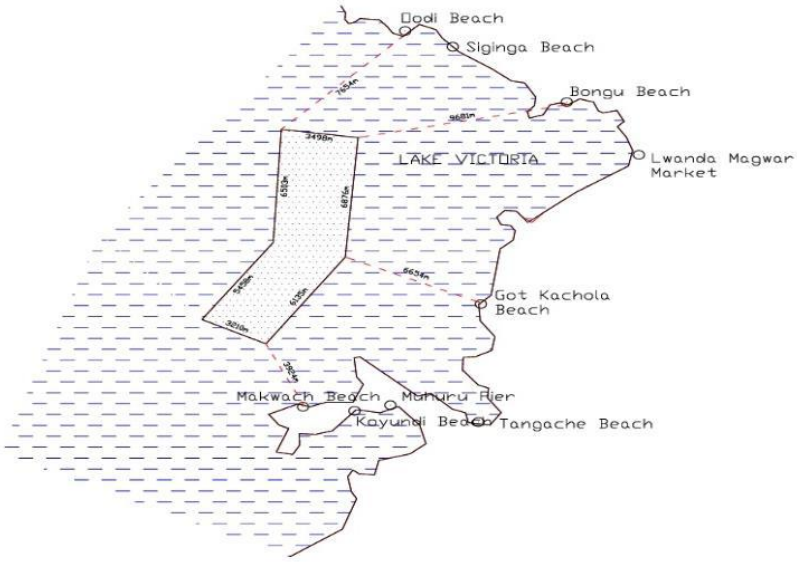


Figure 1 Location of Victory Farms production site, Kenya

Table 1 coordinates of the off-shore concessions

MIGORI POTENTIAL PRODUCTION ZONE	
0°51'28.31"S	34° 3'1.87"E
0°51'44.42"S	34° 4'52.91"E
0°55'26.97"S	34° 4'33.72"E
0°58'7.13"S	34° 2'40.81"E
0°57'20.93"S	34° 1'5.68"E
0°55'2.58"S	34° 2'47.17"E

Table 2 Migori Concession Coordinates of the on-shore production site (reference figure 2 for map)



2.2. Layout

VF is fully-integrated, covering the entire lifespan of the tilapia. Figure 3 shows the location of the on-shore production site and off-shore concessions. Off-shore concessions were chosen and designed in line with the surrounding topography, assuring optimum water quality conditions for animal welfare. Cages are spaced in order to assure water quality within each cage, reduce the risk of disease transmission, and minimize environmental impacts.

Figure 4 Site map, describing production layout. A & B ponds are for breeding and nursing, whereas settling ponds and 'W' ponds are for treatment of effluent water.

All broodstock are produced on the farm and maintained off-shore in cages. Upon maturation, broodstock are moved to breeding ponds, allowing the tilapia to practice their natural breeding behaviours, including burrowing and mouth-breeding. Eggs are collected from the females' mouths and incubated in a hatchery building, where optimum water quality is assured through a recirculating aquaculture system (RAS). Fry are returned to pond nurseries then transported to off-shore nursery cages (6m by 6m by 6m) for acclimatisation. Large fingerlings are then transferred to large circular grow-out cages (12m diameter x 6m). Upon harvesting, food fish are transported to the processing plant on shore. Fish are scaled, gutted, washed, frozen, and sorted by size grade. Refrigerated trucks transport frozen fish to various retail outlets across the country.

Feed is imported from reputable fish feed companies and stored in the warehouse. While the farm is solar-powered by day and uses the main electric grid at night, generators are on-standby in the case of intermittent power supply. The hatchery has its own generator to ensure water quality standards are not at risk.

Ponds are equipped with aerators which are automatically enabled in the case of low oxygen. Each pond has its own pump, which is used for water exchange. Water is sourced directly from the lake, with mesh covering the pipes to prevent predators or other wild animals from entering the ponds.

All people and vehicles enter and exit the farm through one main gate. This entrance/exit is marked in figure 4. Movement across the farm is depicted in figure 4, and movement across the lake is depicted in figure 5.

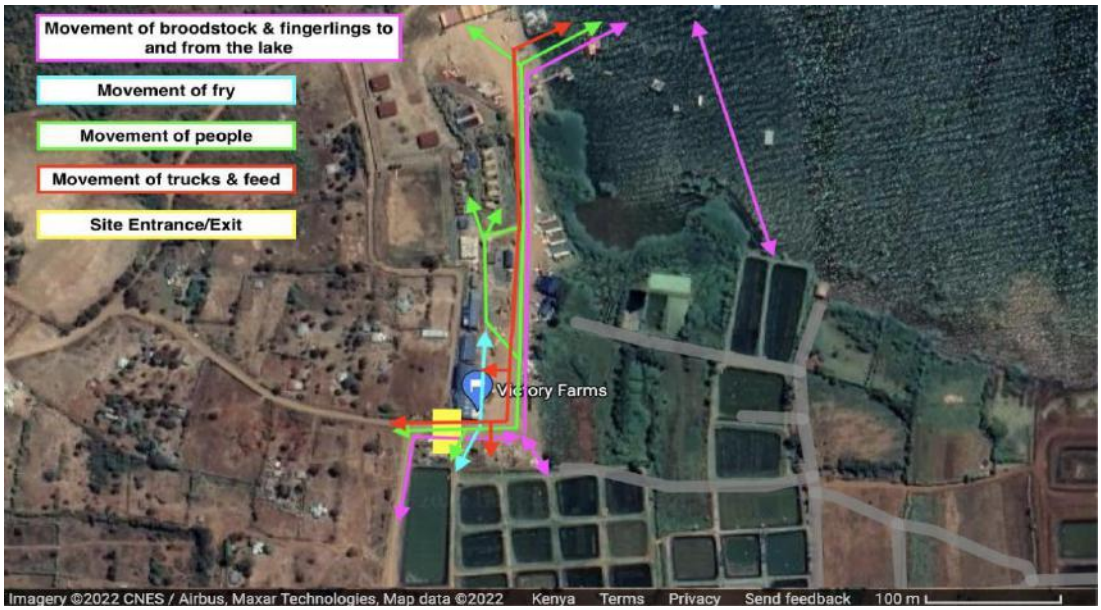


Figure 4: Entrance/ Exit and Movement across the lake

Figure 5 Movement of fish, people, trucks and feed through the on-shore production site.

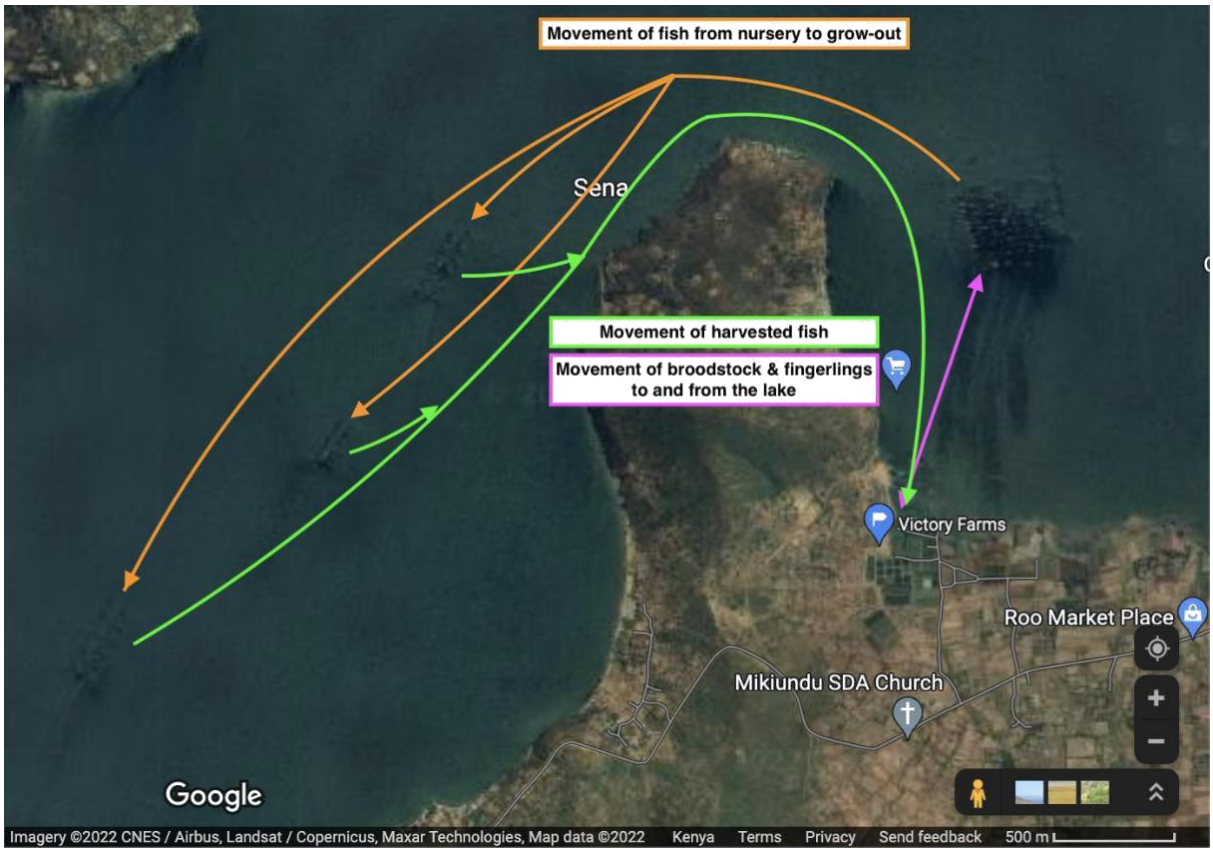


Figure 6 Movement of fish across the lake. Movement of feed and people follow the same routes as the movement of fish.

3. Record keeping

Objective: To record all information necessary to support good biosecurity practice in accordance with the farm biosecurity plan.

3.1.Traceability

VF has records for full traceability at the cage level, such that each cage can be traced back to the broodstock group that produced those eggs. Groups of broodstock are kept separately in ponds, and eggs from that pond are labelled and identified by the pond of origin and date of collection. This identifying information is retained with the fry and fingerlings upon transfer to the pond nursery, the cage nursery, and eventually the grow-out cage. Fish delivered to each retail outlet can be traced back to the cage using the harvest date and the cage number recorded in during processing. Records are retained for at least 10 years.

Currently, individual broodstock families are not traced; however, VF is planning on implementing a 'breeding programme' for enhanced broodstock management and genetic improvement. Under this programme, fish will be traceable back to individual families.

3.2.Disease checkpoints

Staff record observations for indications of disease at all lifecycle stages. Broodstock and fish at nursery and grow-out stages are observed for lesions, physical abnormalities, and irregular swimming and eating behaviours. Eggs and fry are observed for physical or other developmental abnormalities. Observations are reported to management and recorded.

At all stages, mortalities are promptly removed from the environment and disposed of using biosecure disposal protocols (as described later in this document). The daily number of mortalities is recorded for each cage and pond.

In processing, fish are observed for lesions or any indications of poor quality during the grading and sorting process. These fish are also disposed of using biosecure disposal protocols and their numbers recorded.

Veterinarians perform routine pathobiology (parasitology, virology, and bacteriology) sampling every 6 months. Results of the analysis are emailed to VF and filed. VF is currently designing and implementing an on-site laboratory for more frequent testing.

The biosecurity manager conducts an annual biosecurity risk assessment. The resulting report is stored in the main office and is used to inform annual revisions to the biosecurity plan. Audit reports are also stored in the main office.

All disease observations, disposals, pathobiology, risk assessments, biosecurity plan revisions, and audits are retained for at least 10 years.

3.3.Production details – Hatchery

All treatments (e.g., cleaning, hormone) and movements of fish in and out of the hatchery are recorded. All treatments are kept in the cool dry place and only accessible by management. Egg batches are identified by pond of origin and date. Each batch is weighed then distributed to individual incubators, which are labelled for traceability purposes. Egg batches are identified by pond of origin and date. Eggs are also sampled to determine average number and weight of eggs in each batch.

Upon total absorption of the yolk, fry are fed finely-ground commercial feed treated with hormone for monosex production; preparation of the hormone and feeding are documented and worker safety protocols are observed. Hourly water quality parameters are also recorded. For every transfer, the estimated number of fish, the total biomass, and the estimated average body

weight is recorded. Fry are fed six times per day in pre-determined quantities published in a feed record book. All water quality parameters are recorded.

Monthly cleaning of the RAS and hatchery systems are also recorded. Calibration and maintenance of water quality measurement tools is also recorded.

Treatment, feeding, water quality parameters, fish movement, and cleaning records are retained for at least 10 years. Calibration records are retained for at least one year.

3.4.Production details –Nursery and breeding ponds

All movements of fish in and out of the ponds are recorded, including date, managing staff member, number of fish and estimated biomass. Water quality parameters for ponds and transfer tanks are also recorded.

Pond preparation methods are also recorded, including lime, fertiliser and other treatments. Ponds are prepared using chlorine, lime, dried, and sun-exposed (weather-dependent) for 10-14 days prior to re-use (new ponds are only limed and sun-dried for 3 days). All ponds are treated between each cycle (approximately every three to four months for nursery ponds and every six to eight months for broodstock ponds).

All records are retained for at least 10 years.

3.5.Production details – Cage Nursery and Grow-out

In nursery and grow-out phases, stocking densities, growth rates, feed quantities, FCRs, grading treatments, and water quality parameters are monitored and recorded for each cage. Records are stored for at least 10 years. All cages are identified by permanent cage numbers. Water quality parameters are measured and recorded twice daily. In the event of abnormal water quality conditions, water quality parameters are measured more frequently.

Victory Farms does not use any prophylactic or other chemical or medicinal treatments once fish are in the lake.

Protocols for cage management are documented and available to relevant staff.

3.6.Staff and visitors

All people enter and exit the farm through one main gate. At this checkpoint, a visitor register includes the following records: name, date, entrance time, exit time, purpose of visit, and whether the person has visited another aquaculture facility in the previous 24 hours). Signing

the visitor book indicates that visitors agree to adhere to biosecurity protocols and directions of supervisory staff while on the farm. The visitor register is retained for at least 10 years.

Copies of SOPs are stored in the main office and made available to staff during biosecurity training and upon request. SOPs are also made available to relevant staff in each department for ease of referencing. SOPs are updated whenever management decides to make changes to the protocols. Old versions of the SOPs are stored digitally, but physical copies are destroyed to avoid confusion among staff when referencing the documents.

All staff are trained in biosecurity and worker safety protocols, and training records are stored in the main office for at least 10 years.

4. **Staff training**

Objective: To ensure all farm staff understand their responsibilities to maintain farm biosecurity.

All staff receive training upon induction. This training includes the following topics:

- An overview of the biosecurity plan and workers' responsibility regarding the plan;
- Understanding the major routes of disease transmission;
- SOPs and VF-specific husbandry practices, for the farm generally and specific to the employee's department, including:
    - Feeding and cleaning protocols;
    - Recognizing indicators of poor fish health (feeding, swimming patterns, appearance) and reporting it;
    - Fish handling techniques (counting, bagging, transporting); o Recognizing faulty or broken equipment and reporting it;
    - Pest management approaches specific to the employee's department;
- Worker safety (e.g., first aid kit locations, designated first aid responder/health officer, location of emergency phone numbers, equipment for fire or wild animals), for the farm generally and specific to the employee's department;
- Emergency procedures and contact information for reporting biosecurity threats or other issues;
- Staff benefits, including sick leave policies, time-off, salary payment schedules, among others;
- Soft skills, such as communication, responsibility, a sense of agency, among others;

Staff are required to pass an evaluation of knowledge (exam) at the end of the training to demonstrate adequate retention of topics. The human resources department maintains records on staff training, including name, date, topics covered, and test scores.

5. Property management

Objective: To provide effective control points to manage the risk of disease transmission onto, within and from the farm.

VF property has several features to ensure biosecurity of the farm. Wire perimeter fencing encloses the entire property (except for along the lakeshore) and is checked regularly for damages or holes. The farm has a main entrance/exit point to control and monitor the movement of people, trucks and equipment. At this checkpoint, all trucks and equipment are examined and vehicles must drive through a footbath to sanitise the wheels. Security staff register people entering and exiting. People entering the farm are required to wash their hands, pass through a footbath, and undergo a search for potential biosecurity risks (e.g., no fish are allowed to be brought onto the farm). VF has two additional entry and exit points: a gate at Bama and a gate by B2 to the southern ponds. Both gates are monitored by a security guard who records all movement through this gate in logs. People entering and exiting through these gates must pass through a footbath with saline solution and sanitise their hands.

Extra precautions are taken with movement from community ponds. Because VF is unable to ensure biosecurity in community ponds, all equipment and materials from the community ponds is disinfected upon return to VF.

A floating tube encloses beach concession, which is also designated as a wildlife protected area. This assures that only registered and approved aquatic vessels approach the shores or water inlet areas. Two ports are maintained for docking aquatic vessels to avoid damage to the vessels and shoreline corrosion. Mesh filters cover all inlet and outlet pipes to prevent predators or other wild animals from entering the pond and hatchery systems.

Cage concession perimeters are marked by buoys, and non-approved vessels are prohibited from entering this zone. This reduces the risk of damage to the cages and nets and supports better animal welfare. The Security's Lake Operations Unit patrols the cage concessions at all times to ensure compliance.

During production, nets and cages in the water are inspected by divers to prevent potential escapees. In the event that net fouling is observed, nets are exchanged. Net exchange is planned and executed according to SOPs. Nets are exchanged periodically before the fouling be

significant accumulated in the mesh, where the frequency depends on the mesh size and time in water. Done in order to prevent pathogens nest in the cages.

Between production cycles, nets, cages, transfer tanks, and other equipment are inspected for damages and cleaned in a designated cleaning area. The cleaning area is rinsed with salt water and allowed to dry completely daily. Transfer vehicles, trucks and boats are also inspected, maintained, and cleaned weekly or after transporting fish. . Jet washers are used in all instances. Boats are rinsed with lake-water offshore inside the concessions (for example, to rinse fish scales) then disinfected on-shore with saline solution away from all production areas and pathways of movement. Transfer vehicles and trucks are cleaned off-site by community car-wash businesses.

The processing plant, including its equipment, is disinfected at the end of each day of operation. Cleaning residues are deposited into drains that divert the water away from production areas to prevent cross-contamination of departments. Fish waste-products are appropriately sealed in containers and transported to disposal sites, where the waste is incinerated along with mortalities or other discarded fish.

Departments are separated by at least 10 meters and often also by physical obstructions to prevent transmission of disease through the farm. The hatchery is contained in a separate building, with two entrances/exits that have additional footbaths. The hatchery and processing plant are separated by a construction/welding building. The processing plant and pond area are separated by a feed storage warehouse. The cages are accessible by boat only.

The residents' personal vehicles have a designated parking lot in the residential area. These vehicles must drive through the farm to reach the parking lot, but are not allowed to park outside of the designated area. Personal vehicles must also drive through the footbath at the entrance checkpoint.

6. Protocols to address major transmission routes

6.1. People

Objective: To manage the risk of people transmitting pathogens onto, within and from the farm.

People must enter and exit the farm through the main entrance/exit gate, where security staff can record the movement and perform biosecurity checks. Vehicles and people must abide by

the disinfections processes: the main gate has footbaths for pedestrians and vehicles, and hand-washing stations.

Visitors to the farm are briefed on biosecurity measures and directed to the main office, where they are under constant supervision of a manager who can assure compliance with biosecurity protocols.

The hatchery and RAS facilities are restricted access areas, and only authorised staff are allowed to enter. The hatchery manager on duty must provide authorisation. No phones or camera equipment are allowed inside the hatchery or RAS facilities.

Only authorised staff are allowed in the processing unit. Visitors must be accompanied by an authorised member of staff. People entering the processing plant must go through a foot bath upon entry and exit and hair nets at all times.

Workers at the processing plant are required to clean their protective clothing (e.g., bibs and gumboots) at the end of each day. Protective clothing is stored on-site. Workers in the processing avoid entering other departmental areas without explicit direction from departmental managers. The processing plant has a designated changing area for staff, where protective clothing is also stored overnight. During training, employees are instructed not to enter the processing plant if they have any illness.

6.2. Animals

Objective: To manage the risk of animals transmitting pathogens onto, within and from the farm.

Hatchery

Prior to entering the hatchery building, eggs are treated in a solution of Potassium permanganate ($KMnO_4$ at 0.01 ppt) to prevent pathogen transmission into the hatchery from the ponds. Only eggs are treated; any swim-up fry are removed prior to this treatment for optimum animal welfare.

Feeding protocols are designed to optimise animal welfare and support healthy animals. Water quality parameters are taken hourly, including temperature, dissolved oxygen, pH, ammonia, nitrate and nitrite.

When fry are ready to be transferred to the nursery, technicians take another sample to determine average weight and number of fry. For every transfer, the estimated number of fish, the estimated total biomass, and the estimated average body weight is recorded.

The RAS system manages biosecurity and water quality within the hatchery (described in more detail in section 6.3). Water quality resulting from the RAS system is monitored closely and recorded hourly, including dissolved oxygen levels, temperature, pH, ammonia, nitrite and nitrate. Water, eggs and filter media samples are also examined in a microscope for parasites.

The hatchery system is cleaned monthly, or more frequently in the case that parasites or pathogens are detected. Protocols for hatchery management are documented and available to relevant staff.

Ponds

Pumps are used to fill the ponds with water directly from the lake; all pipes have a mesh filter to avoid predators and other aquatic animals from entering the pond system. Fertiliser is added to the water to stimulate green-water technology, which improves fish welfare and immunity. Hapas are installed to keep batches of fish separate, and labelled with identifying information for traceability purposes. Hapas are inspected daily for holes or damage to avoid escapees. Hapas are covered to prevent birds and other predators from feeding on the fish.

Water quality parameters are measured and recorded daily, including temperature, dissolved oxygen, and pH. Ammonia, nitrate, nitrite, phosphate and hardness are monitored and recorded twice per week. Aerators are available for use in the case of emergencies and overnight when dissolved oxygen levels are lower.

Should fish in a pond show sign of disease, water quality parameters are monitored and maintained more frequently. Fish showing signs of disease are isolated, all equipment is cleaned and disinfected with saline solution and/or permanganate where appropriate.

Broodstock were originally sourced from Jewlet (Kendu Bay) and Kamuthanga (Machakos). No new broodstock have been brought in since the original stocking in 2016-17. In the case that new broodstock might be brought into the farm, they will be required to reside in a designated quarantine pond away from the main nursery and broodstock ponds for at least 15 days.

Protocols for preparing and managing ponds are documented and available to relevant staff.

Cages

Water quality parameters of lake water are monitored and recorded daily at all input points. Fingerlings transferred from the pond nurseries to the cages are treated with a salt water bath to avoid disease transmission between the ponds and the cages. The grading machine is rinsed weekly with saline solution.

Sanitisation, including removal of mortalities or other floating items, is required prior to feeding. Feeding may not occur when mortalities are present due to the risk of fish feeding on mortalities. Feed rings are used to keep the floating feed inside the cage, preventing feed losses to the surrounding environment that can result in poor water quality. Dissolved oxygen is measured and recorded prior to feeding. In the case of low oxygen, feed is reduced and in extreme conditions stopped.

Fish are starved one day prior to any handling events to reduce stress. Fish that show any signs of stress or disease should not be handled. For bagging and grading, stocking densities and oxygen levels are closely monitored and handling is limited to less than 30 minutes. The grading has a pre-operational check (inspections for damages, cleaning, etc) prior to every grading session.

Nets are appropriately sized to prevent escapees and routinely inspected by divers to ensure integrity and prevent escapees. Feeding staff are expected to inspect and report any damages to the cage, nets, corner ropes, and anchors to their supervisor. Staff are trained in handling techniques to avoid escapees during handling and transfer. Buckets and nets are placed under common escape points during handling and transfers.

Should fish in a cage show signs of disease, feeding is reduced and all handling is avoided. The net is exchanged. The used net is cleaned and disinfected thoroughly, avoiding contact with other nets in the cleaning area and taking extra precautions to disinfect the cleaning area.

Mortalities are collected immediately with designated scoop nets and deposited in secure bags. Twice daily, these bags are sealed, collected by a designated boat, and deposited at a designated platform on-shore with sealed floor storage preventing any leaks back to the late. At the end of every day, these bags are transferred to the disposal site (8km inland) where they are buried. No mortalities are left on the property overnight to avoid attracting predators (e.g., wild dogs).

Harvested fish are placed in designated harvesting buckets and transferred directly to the processing plant. This route avoids the hatchery and the pond areas. Harvesting equipment is not used for any other purposes.

Protocols for managing cages are documented and available to relevant staff.

Farm property and feed storage

Scavengers (monitor lizards, birds, snakes, rodents in feed, etc) are prevented through appropriate physical barriers (e.g., fencing, mesh filters), rodent control, minimising exposed food items that might attract them (e.g., feed, mortalities), and removing suitable habitat (e.g., grass cutting). Feed is stored in locked containers and a warehouse to prevent contamination and scavenging.

The domesticated broodstock plan aims to enhance biosecurity by selecting for fish that have increased immunity to disease. Genetic selection will support a more robust fish population and reduce the risk of disease and, should disease outbreaks occur, its transmissions.

6.3. Water

Objective: To manage the risk of water transmitting disease onto, within and from the farm.

Hatchery

The hatchery uses a recirculating aquaculture system (RAS) to maintain optimum water quality for eggs and fry. The water is slightly saline (3ppt) to prevent freshwater parasites and other pathogens. Figure 7 shows a diagram of the VF hatchery RAS.

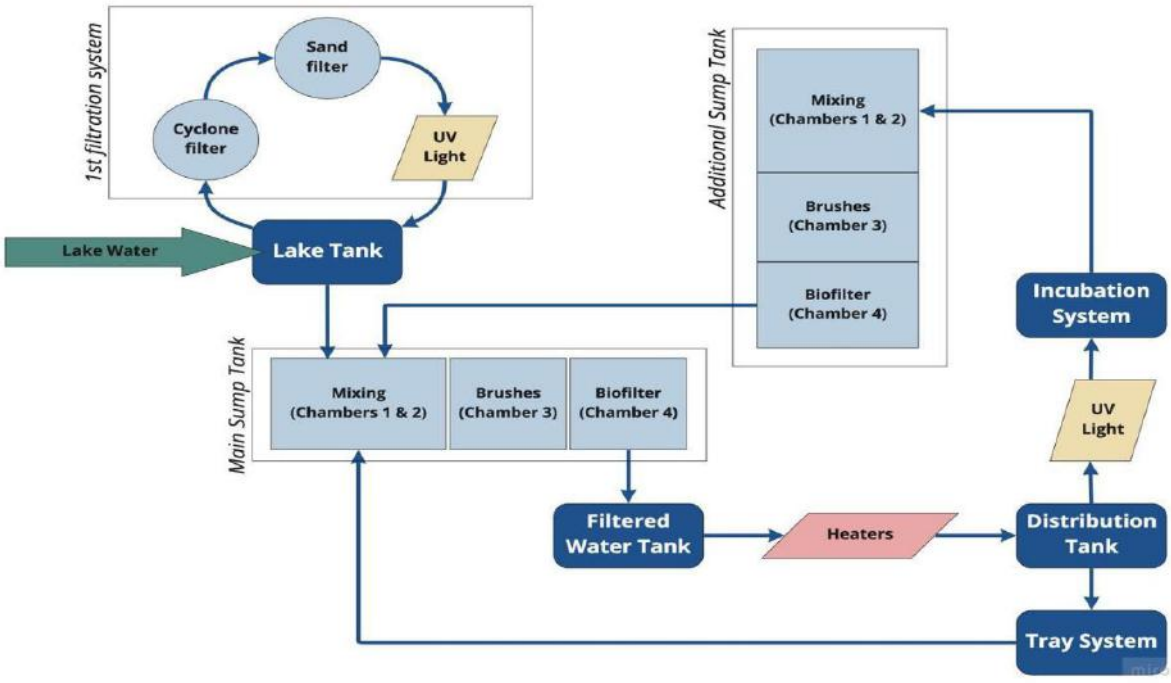


Figure 7 Diagram of the VF hatchery RAS

Water quality parameters in the hatchery must be measured and recorded hourly and in the same locations. Parameters must be measured in the pump tank, where filtered water is pumped, and directly in the incubators. Every week, water quality parameters must also be checked in the storage tanks and for incoming water from the lake. Water quality parameters include: dissolved oxygen, temperature, pH, ammonia, nitrate, and nitrites.

Water is examined daily under a microscope for parasites, including samples from the sumps, the lake, system tank, lake tank (inlet), and drains, among others. Samples are recorded, including name of the technician, the date, the sample location, and parasite counts.

Ponds

Ponds and piping are inspected for leakages prior to stocking. Water quality parameters of inlet water are sampled prior to pumping and once weekly. Pond water quality parameters are monitored daily, including dissolved oxygen, temperature, and pH readings. Ammonia, nitrate nitrites, phopshates & hardness are monitored twice per week.

In all ponds, water is 'flushed' (water enters as water exits) with a water pump to improve water quality. Ponds are flushed for at least two hours to improve water quality. For sex reversal ponds, at least third the water is flushed daily when oxygen and / or nitrogen readings are below optimum ranges. Broodstock ponds are flushed three days before and after egg collection. New ponds are flushed for one day prior to stocking.

Cages

Cages are located in open water, positioned for optimum water quality by considering factors like water depth, currents, and wind. Cages are spaced appropriately to maintain optimum water quality parameters in the cages. Water quality parameters are measured twice daily, including temperature, dissolved oxygen, and ph. Secchi readings are measured and recorded once per day.

Fish are only fed to satiation and excess feeding is avoided to maintain good water quality and low FCRs.

Processing

Water used at the processing plant for fish and equipment cleaning is freshwater and UV treated. Water is tested for pathogens every 2 months with a local registered laboratory. Wastewater is collected in drains, then transferred to the S-pumps through an underground 10-to-12-inch pipe.

Currently, the pipe is only cleaned when blocked due to reduced access. A new pipe is being constructed with manholes every 30m for improved access and monthly cleaning.

6.4. Feed

Objective: To manage the risk of feed transmitting disease onto and within the farm.

Feed is purchased from large international commercial feed companies with their own biosecurity plans and assurance. Feed is transported and stored in sealed bags that remain unopened until feed is ready for use in each department. Opened feed bags are not transported or shared between departments.

Feed is measured and distributed at designated times of day. Feed for immi?nent use is stored in a purpose-built warehouse and in shipping containers, which are sealed and locked during non-use. The containers and warehouse are regularly examined for evidence of rodents or other potential animal pathogen vectors. Regular inspections of container and warehouse integrity ensure that risks of exposure are quickly identified and solved.

No feed is made on-site. Feed for sex reversal is treated with hormone mixed in ethanol for application in the hatchery facilities. Hormone-treated feed is stored in the hatchery facilities away from other feed and its use is recorded.

6.5. Waste

Objective: To manage the risk of waste materials transmitting disease onto, within and from the farm.

All waste, including residential and processing waste, is current incinerated in a dug hole in a corner of the property, away from any fish production areas. Mortalities and other rejected harvested fish are also incinerated in this location. Waste is transported in sealed containers from the collection point to the disposal point. Waste containers are washed with saline solution and sun-dried after every use.

Water effluent is treated in four settlement ponds (30x10m) processing 60m3 per day of processing effluent with a 20-day residency time. Treated effluent water is discharged into the lake in accordance with legal requirements outlined by the National Environmental Management Authority (NEMA).

Wastewater from cleaning equipment is allowed to discharge into the soil. Chemical concentration in discharge water is maintained well within NEMA regulations. Wastewater from cleaning the processing plant is directed into drains that discharge wastewater away from the production site.

6.6. Equipment, vehicles and vessels

Objective: To manage the risk of equipment, vehicles or vessels transmitting disease onto, within or from the farm.

The hatchery uses a saline RAS to maintain water quality, which is cleaned monthly at various parasite harbouring points to control loads in the system. On a weekly basis, the cyclone filter, the sand filter, and the UV light systems are cleaned. Brushes are also cleaned on a weekly basis. Thirty percent of the biomedia in the biofilters are removed and cleaned weekly. All cleaning is conducted with pressure washers and chlorine, then rinsed with filtered water until it tests negative for chlorine (using paper chlorine test strips).

Hatchery equipment is cleaned between every use, using chlorine, permanganate, or saline solution. All equipment is cleaned with soap, dried and sun-exposed (when possible) between use.

Equipment from other departments is cleaned using saline solution only; if disease is detected, chlorine may also be used for cleaning. In ponds and cages, dirty hapas and nets are removed and cleaned immediately upon removal. Net handling is tracked by a net tagging system for traceability, in order to identify the status and life span of the net.

Equipment is not shared between departments. In cases of emergency, where limited equipment is available, equipment is cleaned with saline solution and sun-dried prior to being used in another department. Equipment for each department is stored within that department to prevent transmission or confusion. Protective clothing is rinsed at the end of each day and stored in designated areas within each department; protective clothing is not used in multiple departments.

Boats, canoes, and trucks are cleaned whenever residues or growths are observed. These are cleaned with saline solution only. All trucks and vehicles entering the farm must go through the security checkpoint, which includes driving through a footbath.

Equipment used for harvesting is different than that for transporting live fish or unintended mortalities. All harvesting and transportation equipment is washed with salt water and sun-dried between use.

Processing equipment is cleaned using soap and saline solution at the end of every operating day. Ice boxes and crates are cleaned between every use. The freezer room is defrosted and cleaned at least every three months. Protective gear is cleaned at the end of every operating day and stored in the processing department overnight. Equipment in the processing plant is made of easy-to-clean materials (e.g., stainless steel, plastic), and in white colour where possible for easier observations of hygiene standards. Crates are disinfected with soap, chlorine, then rinsed in freshwater.

7. Biosecurity plan monitoring and audit

Objective: To ensure the farm biosecurity plan continues to address biosecurity risks effectively and efficiently.

7.1.Annual Review

The biosecurity plan should be reviewed annually by the biosecurity and production unit management. Additional reviews should occur after major changes in farm operations, such as increased production, construction of new production units, changes to husbandry approaches or the occurrence of a biosecurity incident.

Reviews of the biosecurity plan should consider changes to:

- the site layout (e.g., entry/exit points, departments, cleaning stations, residential areas);
- transportation routes through the farm (e.g., of feed, fish, staff, or equipment);
- the number of species or number of animals brought onto the farm;
- the type, size, and quantity of equipment (e.g., trucks, boats, cages, nets, buildings);
- the source of feed (if live or alternative feeds have been introduced);
- waste management (water inlets/discharge from ponds, dead fish, guts/scales, waste from the residential area, bathrooms);
- SOPs of the various departments;

Unit managers and team leads are responsible for ensuring that biosecurity measures are implemented and enforced throughout their department.

7.2.Risk Assessment

Risk assessments should be conducted annually and will inform the revision of Victory Farms Biosecurity Plan. The risk assessment should assess the severity of risk across routes for disease transmission. The risk assessment should evaluate the risk of biosecurity problems at the farm-level and for each department. In addition, the risk assessment should aim to identify potential biosecurity hazards and a plan to address those hazards.

The following table can be used to identify and detail biosecurity hazards:

Table 1 Template for table detailing known hazards

Hazard	Description	Proposed Mitigation Strategy
[E.g., New disease agent detected in water column of the lake]	[organism species, endemic or exotic, morbidity, vectors]	[introduce novel feed additive to improve the immunity of the fish; monitor fish health for signs of infection]
Hazard 2		

Table 2. Staff & Visitors (e.g., veterinarians, investors)

Risk Concern	Low Risk	Moderate Risk	High Risk
Multiple farm visits per day	One farm, little or no animal contact.	Occasionally visits more than one farm per day. Minimal animal contact.	Visits many farms or auctions. Significant animal contact.
Protective clothing	Shoes are sanitised upon arrival and prior to leaving. Protective clothing is appropriate and cleaned between use.	Shoes are usually sanitised upon arrival and prior to leaving. Protective clothing is not always cleaned between use.	Protective clothing is not used, dirty, or inappropriate.
Protective outer clothing	Clothing and boots worn on home farm and not worn to different farms or animal events.	Clean clothing and disposable boots or sanitized boots.	Clothing or boots worn on home farm and also worn to different animal events.

Risk Concern	Low Risk	Moderate Risk	High Risk
Complacent use of dirty or defective materials	Cleans materials and supplies and stores them appropriately.	Cleans materials and supplies but leaves them in exposed areas.	Materials and supplies may be left exposed, untidy, and uncleaned.
Animal ownership	Does not own similar species at home.	Similar species but a different production type.	Owns and/or cares for a similar species and production type at home.
Contact with potentially infected animals	Minimal or no contact with potentially infected animals.	Contact with healthy animals and avoids contact with potentially infected animals.	May own or be exposed to many animals of unknown health status.
Work in animal contact areas	Does not work in areas with highly susceptible animals.	Minimal exposure to high-risk animals and only with protective clothing.	Works with highly susceptible animals. Little precautions.
Biosecurity knowledge and attitudes	Understands and promotes biosecurity measures.	Aware of biosecurity principles but is not an advocate.	Little appreciation for biosecurity and does not view it as an industry issue.
Foreign Travel	Does not travel out of Kenya.	Limited travel outside of Kenya without animal contact.	Travel to foreign countries with animal contact in those countries.
Foreign Visitors with previous contact with other animals	Have no contact with animals or feeds.	May be in animal or feed areas after adequate quarantine.	Are permitted in animal or feed contact areas without screening or quarantine.
Emergencies	Emergency SOPs are in place and staff are trained in emergency SOPs.	Emergency SOPs are in place, but staff is not trained.	Emergency SOPs are not in place.
Processing Plant	All staff have hair nets and masks on at all times.	Not all staff have hair nets and masks, or wear hair nets and masks intermittently.	No staff are wearing hair nets and masks.

Table 3. Animals

Risk Concern	Low Risk	Moderate Risk	High Risk
Purchased or imported broodstock carrying potential pathogens	Screening tests and quarantine for 30+ days upon arrival.	Minimal screening; quarantine for only 15-30 days.	No screening; no quarantine or <15 days.
Eggs	Eggs are treated with a cleaning solution before entering the hatchery.	Eggs are treated with a cleaning solution once inside the hatchery, or not always treated with a cleaning solution.	Eggs are not treated with a cleaning solution.
Immunisations	Timely, comprehensive plan coordinated with veterinarian.	Immunization based on show regulations but not necessarily part of total plan.	Haphazard immunization plan that is not coordinated nor professionally supervised.
Inbreeding or other genetic maladaptation	Broodstock families are tagged and tracked; a comprehensive breeding programme is in place to select for improved disease resilience.	Families are not tagged or traced, but males, females, and fish of different origins are kept in separate ponds and cage to prevent inbreeding.	Families are not tagged or traced; fish are allowed to breed freely without genetic control.
Animal transportation	Transports own animals only in containers specifically for that unit or department.	Transports animals in another's unit or departments containers that have been cleaned or sanitized.	Transports animals in unit or departments containers without sanitation.
Escapees	Escapees are rare; practices and equipment is in place and frequently maintained to prevent escapees.	Escapees are uncommon; practices and equipment to prevent escapees are in place,	Escapees are common; practices and equipment to prevent escapees are not in place.

Risk Concern	Low Risk	Moderate Risk	High Risk
		but are faulty or not always used.	
Processing waste (guts, scales)	Processing waste is contained within the processing plant; waste is transported in sealed containers, waste is disposed of and incinerated away from the production site.	Processing waste is contained within the processing plant; waste is transported in open containers; waste is buried away from the production site.	Processing waste is allowed to spill over the processing plant; waste is transported in open containers; waste is disposed of near other production departments.
Contact of public with animals	The public is unable to touch or feed the animals or affect their environment.	The public has limited access to touch or feed the animals. The public may be able to affect their environment.	The public has access to the animals and can affect their environment.
Predators	Protective equipment (e.g., bird netting, mesh filers on pipes) is used in all cages and ponds to prevent predators entering the culture area.	Protective equipment is used in some cages and ponds, or protective equipment is in place but damaged.	Protective equipment is not in place or too damaged to be effective.
Mortalities & sick fish	Mortalities and sick fish are removed immediately from production areas; no mortalities visible.	Mortalities and sick fish are not removed daily; some mortalities visible.	Mortalities and sick fish are not regularly removed; many mortalities are visible.
Traceability	Animals can be traced throughout the value-chain, from egg to sales point.	Animals are partially traceable, or traceable for only a portion of the value-chain.	Animals are not traceable.

Table 4. Water

Risk Concern	Low Risk	Moderate Risk	High Risk
Water quality	Parameters are well within optimum range.	Parameters are on the higher or lower ends of the optimum range.	Parameters are not in optimum range.
Water quality monitoring	Parameters are measured regularly and frequently.	Parameters are measured routinely but not frequently.	Measurements are sporadic.
Pathogens (hatchery)	RAS is functioning and cleaned regularly.	RAS is functioning, but is not cleaned regularly.	RAS is leaking or has dysfunctional sections and is not cleaned regularly.
Water inlet/outlet position	Waste water outlets are in separate watersheds from water inlets.	Waste water outlets are in the same watershed but at a distance from water inlets.	Waste water outlets are nearby water intake outlets.
Concession positions	Concessions are spaced appropriately and currents do not flow between them.	Some, but not all concessions are spaced appropriately; currents may partially flow between some concessions.	Concessions are too close; currents run between concessions.
Pipes and Pumps	Pipes and pumps are cleaned and inspected regularly.	Pipes and pumps are cleaned and inspected, but irregularly.	Pipes and pumps are not cleaned or inspected unless there is a problem.

Table 5. Feed

Risk Concern	Low Risk	Moderate Risk	High Risk
Scavengers	Feed is secured in containers and inaccessible to scavengers.	Feed is secured in containers, but damages to the containers may allow access for scavengers.	Scavengers are present or evidence of their access to feed is visible.

Risk Concern	Low Risk	Moderate Risk	High Risk
Fish Nutrition & Welfare	Purchased feed is from reputable commercial feedmills; OR feed produced on-site has appropriate formulations and ingredients for tilapia.	Feed is purchased from feed producers with questionable track records or with little knowledge of tilapia; feed produced on-site has appropriate formulations but its ingredients are inconsistent.	Feed is purchased from feed producers with poor track records and little knowledge of tilapia; feed produced on-site does not use appropriate formulations.
Feed Quality	Feed is of high and consistent quality	Feed is of inconsistent quality.	Feed is poor and inconsistent quality.
Feeding protocols	Feeding is to satiation and little surplus feed is visible.	Some overfeeding or wasted feed is visible; feed scavengers are occasionally present.	A lot of wasted feed is visible in and around the cages; feed scavengers are common.

Table 6. Waste

Risk Concern	Low Risk	Moderate Risk	High Risk
Disposal transportation	Waste is sealed and disposed of off-site daily.	Waste is not sealed and may remain on-site overnight.	Waste is not sealed and may be disposed of on-site.
Disposal	Waste is incinerated.	Waste is buried.	Waste is deposited in a land-fill.
Wastewater	Waste water is contained within the production department and/or disposed of away from other departments.	Wastewater is disposed of away from other departments but leakages or other exposures are possible.	Waste water can flow towards other departments.
Chemical use (hormones, chlorine, etc)	Chemicals are contained and labelled in appropriate containers and not allowed to enter the surrounding environment.	Chemical are contained, but inappropriately labelled or at risk of entering the surrounding environment.	Chemicals are poorly contained and enter the surrounding environment.

Table 7. Equipment

Risk Concern	Low Risk	Moderate Risk	High Risk
Equipment cleanliness	Equipment is cleaned between every use with saline or chemical solution.	Equipment is sometimes cleaned with saline or chemical solution, or equipment is only rinses with freshwater.	Equipment is not cleaned.
Sharing between departments or units	Equipment is not shared between units or departments.	Equipment is shared between units, but not between departments.	Equipment is often shared between departments.
Net conditions	Nets are checked for holes and fouling every 2 weeks or more frequently; fouled nets are exchanged and cleaned.	Nets are checked for holes and fouling monthly; fouled nets are sometimes exchanged.	Nets are not checked regularly; fouled nets are not exchanged.
RAS	RAS is functional and no parasites are detected.	RAS has some dysfunctional parts; parasites are detected occasionally.	RAS is dysfunctional and parasite observations are common.
Trucks, vehicles & vessels (TVV)	TVV are cleaned regularly off-site or away from production areas with saline solution.	TVV are not cleaned regularly, but are cleaned off-site or away from production areas with water.	TVV are not cleaned regularly, or are cleaned near production sites.
Parking areas	Vehicles are parked in designated parking areas.	Vehicles are parked in a designated parking area and in non-designated areas.	No designated parking area is available.
Footbaths	Footbaths are present and filled with clean and appropriate solution at the entry/exit of the farm, the hatchery department, and the processing department; all staff are observed to use the footbaths and sanitisation stations.	Footbaths are present but not maintained, or footbaths are not always present; use of footbath is inconsistent.	Footbaths are not present or not used.

Risk Concern	Low Risk	Moderate Risk	High Risk
Temperature Control (Processing)	The processing plant is temperature-controlled for safety & hygiene; fish are stored at optimum temperatures (<3degC) until shipped to sales points.	Processing plant is not temperature controlled, but fish are stored at optimum temperatures until shipped to sales points.	Fish are not kept at optimum temperatures; fish are not refrigerated/iced quickly after harvest.

8. Biosecurity plan

Table 8: Victory Farms Biosecurity Plan

Guidelines	Responsible Person	Frequency	Notes (eg location of record)
1. Record keeping			
1.1 Movement records should be maintained for all animals moved (a) onto the farm, (b) between production zones within the farm (hatchery to ponds, between ponds, pond to lake concession, between lake concessions), and (c) from the farm (processed fish).			
1.2 Health monitoring records should be kept of regular health screenings and should include details of any sickness, mortality, treatments, disease testing and relevant environmental information (e.g., water quality and benthic sampling).			
1.3 Biosecurity Training records should be kept to ensure all staff are aware of the biosecurity plan and their role in it.			
1.4 Visitor registry should be maintained for all people and vehicles entering and exiting the farm			
1.5 Annual risk assessments should be completed and reports should be stored.			
1.6 Standard Operating Procedures should be documented for each department and updated whenever protocols are improved.			
2. Staff training			
2.1 A designated staff member is responsible for overseeing farm biosecurity.			
2.2 All farm staff should understand disease risks to the farm, the role of the farm biosecurity plan in managing disease risks and their responsibilities for its implementation, including response protocols. Staff are aware of who to contact in the case biosecurity risks arise			
2.3 Staff should receive training on aspects of the farm biosecurity plan relevant to their work and have access to the farm biosecurity plan and supporting procedures.			
2.4 Staff should receive training on aspects of the farm biosecurity plan relevant to their work and where appropriate have access to the farm biosecurity plan and supporting procedures.			

Guidelines	Responsible Person	Frequency	Notes (eg location of record)
3. Property management			
3.1 The farm should have a secure perimeter fence or otherwise well-defined boundary, establishing a clearly defined biosecurity zone. Entrances to the farm restricts vehicle access and foot traffic and are kept should be locked unless manned by farm security. Lake concession boundaries are enforced by security patrols.			
3.2 All inputs to the farm (for example, animals, people, water, equipment and vehicles) and between zones within the farm should be assessed for potential biosecurity risks.			
3.3 All production units (cages, ponds, incubation trays and tubes) should have a unique and permanent identifier to facilitate good record keeping.			
3.4 All production units should have appropriate features to prevent entry of wild animals and escape of farmed animals.			
3.5 All cleaning points (for nets, boats, buckets, cages) should be regularly washed with saline solution and be sun-dried.			
3.6 The processing plant should be cleaned between every harvest or at the end of every day. Waste products will be contained within the processing plant then moved to the incineration area in closed containers.			
4. People			
4.1 Staff and visitor access should be managed (through access controls and signage) and the risk they present should be assessed.			
4.2 The farm biosecurity rules should be explained to all visitors.			
4.3 Measures to prevent disease entry should be applied to all persons entering and exiting the farm (for example, dedicated changing areas, farm footwear and hand washing facilities), and for persons moving between productions areas of different disease status within the farm.			
4.4. Access to sensitive areas (for example, hatchery) should be restricted.			
4.5 Production units should be managed separately to reduce the risk of disease spread within the farm. Staff should be assigned to production units. Staff responsible for movement between production units should practice additional biosecurity measures (eg increased cleaning of equipment, hands, shoes).			

Guidelines	Responsible Person	Frequency	Notes (eg location of record)
4.6 When moving between ponds or departments, all staff should wash hands, shoes, and equipment with saline solution to prevent disease transmission.			
5. Animals			
5.1 Animals should only be introduced to the farm if they are of known health status and that status is of equal or better status than animals on the farm. Translocation approvals or permits must be obtained if required by the receiving state or territory authority.			
5.2 If the health status of introduced animals is unknown (for example, wild broodstock; seed stock of unknown health status) the animals should be isolated from other farm populations in separate production units or dedicated quarantine facilities.			
5.3 A strategy for producing domesticated broodstock that produce specific-pathogen-free should be implemented.			
5.4 Where feasible, treatment of quarantined animals may be considered to mitigate disease risks (for example, for external parasites). Treatments must be conducted in accordance with legislative and regulatory requirements.			
5.5 Movement of animals between different farm populations should only occur following consideration of the disease risks and with a view to maintaining high health status.			
5.6 If animal populations become sick, precautions should be taken to avoid contact with other farm populations until the cause is known and the situation resolved.			
5.7 Sick or dead animals should be removed from production units as soon as possible and disposed of in accordance with section 9.6 (see G37-G 38).			
5.8 Pond inlets and outlets should be screened to prevent entry of aquatic or other animals in the water supply.			
5.9 Pond and cage netting should be in place to limit the entry of predatory or scavenging animals to, or aggregation near ponds and cages..			
5.10 Measures should be put in place to prevent escape of aquatic animals.			
5.11 Predatory or scavenging animal populations should be controlled or excluded from production facilities.			

6. Water Guidelines	Responsible Person	Frequency	Notes (eg location of record)
6.1 The biosecurity risk of a farm's water source should be monitored and appropriate actions taken to manage any identified risks.			
6.2 Infrastructure for decontamination of water should be adequately monitored and maintained to ensure it remains effective.			
6.3 The hatchery's RAS system should be regularly inspected and maintained to address biosecurity risks.			
6.4 For ponds and the processing plant, water intake and outflows should be located to avoid cross-contamination.			
6.5 Concessions should be located to maintain epidemiological separation of populations and prevent disease transmission.			
6.6 Pipes and pumps should be regularly cleaned (to remove residues) and sun dried for decontamination.			
6.7 Pumps should not be shared between ponds.			
7. Feed			
7.1 The biosecurity risk of feeds should be considered and appropriate actions taken to manage any identified risks.			
7.2 When manufactured feeds are not used, live or unprocessed feeds should be assessed and tested for biosecurity risks prior to their introduction on the farm.			
7.3 Feed should be stored in designated areas that are secure from predators (eg rodents, birds). Storage areas should be regularly examined for evidence of rodents or other potential animal pathogen vectors. Container and warehouse integrity should be regularly inspected to ensure that risks of exposure are quickly identified and solved.			
8. Waste			
8.1 Waste products (for example, mortalities, water and effluent) should be assessed to determine potential biosecurity risk to the farm and the environment.			
8.2 Containment, handling and disposal of waste products should minimise identified disease transmission risks.			
8.3 Waste with risk to biosecurity (e.g processing waste) should be stored in secured containers until they reach appropriate waste disposal sites.			

Guidelines	Responsible Person	Frequency	Notes (eg location of record)
9. Equipment, vehicles and vessels			
6.1 Any equipment, vehicles or vessels brought onto the farm should be assessed for biosecurity risk.			
6.2 Procedures and infrastructure should be in place to clean and disinfect equipment, vehicles or vessels.			
6.3 The farm should have designated delivery and loading areas.			
6.4 Separate equipment should be assigned for use in production units. Where equipment must be used in multiple production units it should be cleaned, rinsed with saline solution, and sun dried prior to movement between units.			
10. Emergency procedures			
10.1 The farm biosecurity plan should include procedures for the response to a suspected emergency biosecurity incident.			
10.2 All farm staff should understand the farm's emergency procedures and their own role in an emergency. The contact information for the primary responsible person in the case of biosecurity emergencies should be displayed in public areas.			
11. Monitoring and audit			
11.1 The biosecurity plan should be reviewed following an annual risk assessment, or after any triggers for extraordinary review.			
11.2 Regular audits of the farm biosecurity plan (and effective record keeping of formal audits) should be conducted to ensure it is being implemented effectively.			

Annex 11: Aquatic Monitoring Plan

Victory Farms
Farm activities
Unit or Currency

Activities	Responsible Person	Comment
Egg Collection	Nsogbu Wadike (Aqua Manager)	Ensure BAP (best aquaculture pracrises) are followed to minimize broodstock stress and achieve good egg quality
Daily data collection	Maurice Musebe (Data Manager)	Real time data collection allows for immediate decision making to enhance welfare and health of fish
Feeding	Gladstone Sagada (Feed Manager)	Stricty adhere to fish daily nutritional requirement and needs
Water quality management	Nsogbu Wadike (Aqua Manager)	Daily water parametres tests(dissolved oxgen and temperature) and adjust farming practises (eg. feeding, handling)
Pumping schedule	Nsogbu Wadike (Aqua Manager)	Daily change of water and pumping depending on water quality results
Disinfection of eggs	Linda Bonah (Hatchery Manager)	Use of disinfectant to clean and in eggs before entry into incubation facility
Transport of live fish	Linda Bonah (Hatchery Manager)	Use of oxygen cylinder when transporting fish for optimal oxygen levels to increase welfare and redue stress
Net exchange	Tawa (Aqua Operations Manager)	Periodic net exchange in lake cages to ensure good water circulation and avoid net fowling
Bio-security	Steph Odinga (Security Manager)	Salt foot bath at entry points of farm and incubation facility and vehicle wheel disinfection gate
Fish health checks	Dr Kimosaki (Genetics Manager)	Daily visual health inspection and health assessment
Pond Hapa Management	Nsogbu Wadike (Aqua Manager)	Change pond hapas every 7 days, keep fish healthy, good oxygen and water circulation
Grading	Gladstone Sagada (Feed Manager)	Ensure fish is in the right size of net and feeding on
Harvesting	Yusuf Msendama (harvesting manager)	Following SOPs and protocol to ensure fish is iced and gets into processing immediately
Logistics	Onesmus Kimanzi (logistics manger)	logistics of processed fish involves the following factors, including the type of transportation, the quality of the fish, and the temperature at which the fish is transported. Use of real time data and temperature senors to monitor and optimize fish quality and freshness
Fish Processing	Arnold Ogada (Processing Manager)	Fish processing must ensure full health safety of fish products and proper sanitary conditions as well as selection of a process (e.g., sterilization, pasteurization) which render impossible the development of harmful micro-organisms and toxins
Quality Control	JohnKevin Maindi (Quality assurance manager)	Quality control (QC) of fish is a process that ensures fish is safe to eat, meets regulations, and has a long shelf life. QC also helps maintain the sensory properties of fish, such as its taste, color, odor, and texture.