

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROJECT REPORT

PROPOSED FISH HATCHERY AT IYENGA VILLAGE IN SHINYALU SUB-COUNTY, KAKAMEGA COUNTY

Location: Plot No. Isukha/Virhembe/441 at Iyenga Village, Shinyalu Sub – County in Kakamega County

Latitude: 0.236038” N and Longitude: 34. 829532” E

PROPONENT/FUNDING AGENCY:

The Coordinator,
Kenya Climate Smart Agriculture Project (KCSAP)
P. O. Box 27 – 50100 Kakamega, Kenya

Prepared for submission to the National Management Authority (NEMA) by:

Envertek Africa Consult Limited
EIA/EA Firm of Experts Reg. No. 7043
P. O. Box 2488 – 50100 Kakamega, Kenya
Email Address: envertekconsult@gmail.com

JUNE, 2019

CERTIFICATION

This is to certify that an EIA has been carried out for the Proposed Fish Hatchery on Plot No. Isukha/Virhembe/441 at Iyenga Village, Shinyalu Sub – County in Kakamega County. The study was carried out by NEMA registered EIA/EA experts in accordance with EMCA, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003 contained in the Kenya gazette supplement No. 56, legislative supplement No. 31 Legal notice No. 101 of 13th June, 2003. The experts also compiled this report. We the undersigned hereby certify that the information and particulars given in this report are correct as at the time the EIA was conducted.

FOR THE CONSULTANT, ENVERTEK AFRICA CONSULT LIMITED,

Dr. Stanley O. Omuterema

Lead Consultant,

Envertek Africa Consult Limited

Lead Expert Reg. No: 0125

Mobile phone No: + 254 (0) 722177461

E-mail address: omu53@yahoo.com

Signature

Date and stamp

THE PROPONENT, KENYA CLIMATE SMART AGRICULTURE PROJECT (KCSAP)

Name: _____

The Project Coordinator, KCSAP

Signature

Date and stamp

Mobile phone No: _____

LIST OF CONSULTANTS FOR THE ASSIGNMENT

Name	Affiliation	Signature
Dr. Stanley O. Omuterema	Lead Expert Reg. No: 0125	
Mr. William A. Onura	Associate Expert Reg. No: 6443	
Mr. Sandys K. Ngoya	Associate Expert Reg. No: 10404	
Mr. Erick N. Ondieki	Associate Expert Reg. No: 9031	
Ms. Lavender Achieng'	Associate Expert Reg. No: 10478	

LIST OF ABBREVIATIONS AND ACRONYMS

%	Percentage
⁰ C	Degrees Celsius
Cap.	Refers to ‘chapter’ in the Laws of Kenya
CBO(s)	Community Based Organization(s)
CGK	County Government of Kakamega
CO	Carbon-monoxide
CO ₂	Carbon-dioxide
Db	Decibels (a unit of measuring sound)
EA	Environmental Audit
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management and Monitoring Plan
ESP	Economic Stimulus Programme
FMP	Flood Mitigation Project
GOK	Government of Kenya
Ha	Hectares
KCSAP	Kenya Climate Smart Agriculture Project
KBS	Kenya Bureau of Standard
KFS	Kenya Forest Service
Km	Kilometers
Kshs.	Kenya shilling(s)
KWS	Kenya Wildlife Service
LVNWSB	Lake Victoria North Water Services Board
M	Meters
M ³	Cubic metres
mm	Millimeters
MOFD	Ministry of Fisheries Development
NEAP	National Environment Action Plan
NEC	National Environmental Council
NEMA	National Environment Management Authority
NMK	National Museums of Kenya
OSHA	Occupational Health and Safety Act
PPE	Personal Protective Equipment
PVC	Polyvinyl chloride
Reg. No.	Registration number
SFFG	Shibuye Fish Farmers Group
SHE	Safety Healthy Environment
spp	Species
TOR	Terms of Reference

DEFINITIONS OF OPERATIONAL TERMS

Authority: Refers to NEMA established under section 7 of EMCA, 1999.

Decommissioning: This is the permanent withdrawal from a site or close down of a facility for restoration.

Developer/Proponent: Means a person proposing or executing a project which is subjected to an EIA or undertaking an activity specified in the second schedule of EMCA, 1999.

EA: The systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing in conservation or preservation of the environment.

EIA: A systematic evaluation of activities and processes of an upcoming project/facility to determine how far these activities and programs conform to the approved environmental management plan of that specific project and sound environmental management practices.

EMP: Means all details of project activities, impacts, mitigation measure, time, schedule, costs, impact or activities, including monitoring and environmental audit during implementation and decommissioning phase of a project.

Environment: Physical factors of surroundings of human beings including land, water, atmosphere, climate, sound, odor, taste, the biological factors of animals and plants and social factor of aesthetics, culture and includes both the natural and the built environment.

Mitigation: Measures which include engineering works, technology improvement management ways and means of minimizing negative aspects, including socio-economic and cultural losses suffered by communities and individuals, whilst enhancing positive aspects of the project.

Project: Means any undertaking that may have an impact on the environment.

Scoping: Is the process of determining the content and extent of the matters which should be covered in the environmental information to be submitted to a competent authority for projects which are subject to EIA.

Screening: It is a coarse analysis of the possible impacts of an action with a view to identifying those impacts which are worthy of detailed study for a project to be considered for an EIA process or not.

Standards: Means the limit of discharge or emission established under the Act or under Regulations.

Waste: Includes any matter whether liquid, solid, gaseous or radioactive, which is discharged, emitted or disposed in the environmental in such a volume composition or manner likely to cause an alteration of the environment.

EXECUTIVE SUMMARY

Introduction

This document is an Environmental Impact Assessment (EIA) project report for the Proposed Fish Hatchery on Plot No. Isukha/Virhembe/441 at Iyenga Village, Shinyalu Sub – County in Kakamega County. The project Proponent consulted environmental experts licensed by the Authority to conduct an Environmental Impact Assessment (EIA) study for the proposed project and prepare a report for submission to the Authority, the National Environment Management Authority (NEMA). This report is prepared in accordance with Section 58 to Section 67 and Section 138 of the Environmental Management and Coordination Act (EMCA), 1999 (Cap. 387), amended 2015. The subsidiary legislation to the Act, the Environmental (Impact Assessment and Audit) Regulations, 2003 provides the framework for carrying out Environmental Impact Assessments (EIAs) and Environmental Audits (EAs) in Kenya by experts registered and licensed by the Authority. Environmental Impact Assessments (EIAs) should be followed by annual Environmental Audits (EAs) beginning 12 months from the date of commissioning of operations in order to determine the projects' compliance with regulations and set standards. The purpose of Environmental Impact Assessments (EIAs) is to identify potential positive and negative environmental impacts associated with the proposed project and thus provide recommendations on how to take advantage of the positive impacts on one hand and how to mitigate the negative environmental impacts on the other.

Methodology

The EIA team carried out the assessment using a combination of methods including ground surveys; review of the project-related documents; and interviews with the neighbours, project management and other interested people and parties including the area residents in the neighbourhood of the proposed project site.

Baseline information

The proposed site is neighbored by sugarcane plantations, tree plantations, indigenous forests, tea plantations, homesteads, cultivated parcels of land and two streams. Emphasis was placed on describing proposed project area and its neighbourhood in terms of resources, vegetation, land-use patterns, socio-economic activities, population, topography, climate and geology among others so as to provide a basis from which the potential impacts can be predicted. The proposed site is found at Iyenga Village, Shinyalu Sub – County in Kakamega County.. The main challenges facing development of the area are:

- a) The increasing population which poses pressure on land resource;
- b) Lack of properly defined public solid waste collection and disposal systems; and
- c) Poorly maintained storm drainage lines which are associated with silt-filled culverts.

Project description

The proposed development is a water pan. The proposed fish hatchery is funded by **Kenya Climate Smart Agriculture project**. The proponent intends to set up fish farming development which will have a fish hatchery, fish resource centre, fish products value addition and fish feeds production plant to help benefit the community economically and sustainably. The proposed design will be approved by the Public Health, the Physical Planning and the County Engineer's offices. The construction of the proposed project will employ best and modern building technologies and materials that conform to the Kenya Bureau of Standards (KEBS) and internationally accepted standards. These building materials will be obtained locally through best procurement agreements between the Proponent and the contractor(s).

Review of relevant legislative frameworks, relevant literature and project designs and documents

Existing literature on statutory and other requirements was also reviewed. During the assessment, various Acts and Regulations were reviewed to gather information which would help in preparing the project. This review was done in both Kenya policy papers, Acts of Parliament, codes and regulations and international frameworks. Some of the legislations that were reviewed include:

- 1) The Constitution of Kenya, 2010
- 2) Environmental Management and Coordination Act, 1999 (Cap. 387), amended 2015
- 3) Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009.
- 4) The Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006
- 5) Fisheries (General) Regulations, 2012
- 6) The Irrigation Act, Cap 347 (Revised Edition 2012)
- 7) Environmental Management and Coordination (Noise and Excessive Vibration, and Pollution Control) Regulations, 2008
- 8) Environmental Management and Coordination (Waste Management) Regulations, 2006
- 9) Public Health Act, 1986 (Cap. 242)
- 10) Occupational Safety and Health Act, 2007
- 11) Work Injury Compensation Benefit Act (WIBA), 2007
- 12) County Governments Act, 2012
- 13) Physical Planning Act, 1996 (Cap. 286)
- 14) The Water Act 2002
- 15) Environmental (Water Quality) Regulations and Standards
- 16) National Construction Authority Act, 2011
- 17) Traffic Act (Cap. 403)
- 18) Penal Code (Cap. 63)
- 19) National Environmental Policy, 2012
- 20) Sessional Paper No. 6 of 1999 on Environment and Development
- 21) World Bank (WB) Safeguard Policies
- 22) Rio Declaration on Environment and Development (1992)
- 23) World Commission on Environment and Development (1987)

The project report takes into consideration the requirements of these legislations and the County Government of Kakamega (CGK) by-laws. The writing of this report was adopted from various similar case studies within and outside the area. The proposed project design was heavily relied on in order to have a clear understanding of the proposed project.

Public participation

Public participation was conducted through interviews with the neighbours, project management and other interested people and parties including the area residents in the neighbourhood of the proposed project site. From the public consultation process it was evident that the people have no objection with the proposed project at the proposed site.

Potential environmental and social impacts

Potential beneficial and adverse environmental and social impacts associated with the proposed project were identified and discussed. The main positive contribution of the proposed project is developing a fish hatchery of approved design at Iyenga village in order to provide a source of quality fish fingerlings (numbers and size) to fish farmers within the beneficiary community. Other benefits

include: development of the area, revenue to the governments, increased demand for raw materials, creation of employment opportunities, improved aesthetics, optimal use of land and development in the area. A summary of these potential impacts and a brief description of their mitigation measures have been provided in table I below.

Table 1.0: Summary of potential negative environmental impacts

Area of concern	Proposed mitigation measures
Environmental degradation due to construction activities such as vegetation clearing, excavation and compaction and accidents	<ul style="list-style-type: none"> • Supervision of construction personnel by qualified consultant engineers • Properly demarcate area to be affected by the construction works to avoid spill-over effects to neighbouring areas • Strictly control construction vehicles to ensure that they operate judiciously and over designated areas to minimize destruction of vegetation • Spare some plants and re-establish vegetation in some or parts of the disturbed areas through implementation of a well-designed landscaping programme • Rehabilitate all areas inadvertently affected by the proposed project • Provide proper reinforcement and support of the structures under construction
Usage of construction materials	<ul style="list-style-type: none"> • Evaluate the project to ensure that the design optimizes the use of materials
Noise and vibrations	<ul style="list-style-type: none"> • Provision of ear muffs to workers in noisy environments
Storm water	<ul style="list-style-type: none"> • Constructing an open drainage system at the site to direct storm water into cut-off drains leading to the river
Pollution of water and the immediate environment arising from organic waste discharge	<ul style="list-style-type: none"> • Use species and system specific feeds in order 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
Chemical pollution resulting from the use of chemical therapeutants and antifoulants	<ul style="list-style-type: none"> • Use only approved veterinary chemicals and antifoulants • Where effective use environmentally friendly alternatives • Use the most efficient drug delivery mechanisms that minimize the concentrations of biologically active ingredients entering the environment • Use the lowest effective dose of therapeutants
Excessive energy consumption	<ul style="list-style-type: none"> • Use of energy efficient lighting (fluorescent tubes and energy saving bulbs) at the offices to be constructed
Increased demand on water resources	<ul style="list-style-type: none"> • Using large water storage containers to cope with potential shortages • Considering back-up sources such as harvesting and storing of rain water to curb potential stresses to the existing water supply during acute shortages
Solid wastes	<ul style="list-style-type: none"> • Installation of equipment such as dustbins for temporary holding of solid wastes • Regular collection and disposal of wastes to avoid accumulation at the site • Dead fish collected and subjected to immediate burning or burying

Area of concern	Proposed mitigation measures
Flooding of ponds	<ul style="list-style-type: none"> • Embankments should be made around the ponds to prevent entry of flood water into the fish ponds • An open drainage system to be constructed at the site to direct storm water away from fish ponds
Land contamination	<ul style="list-style-type: none"> • The waste storage area and other adjacent areas should be regularly sprinkled with crushed limestone (calcium carbonate) or other approved disinfectant to avoid any spread of disease
Degradation of air quality	<ul style="list-style-type: none"> • Properly aerate the facility to minimize foul smell build up
Health, hygiene and safety	<ul style="list-style-type: none"> • Fish feed handlers and cleaners should always have protective clothing
Social Disturbance	<ul style="list-style-type: none"> • Maximize use of local labour for unskilled positions to ensure socio-economic equity for the local population
Insecurity	<ul style="list-style-type: none"> • Fence the site to prevent intruders, predators and unauthorized personnel
Impacts to fish and fish ponds	<ul style="list-style-type: none"> • Fertilize ponds to stimulate the growth of microscopic plants “bloom” • Regulate bloom and the amount of fertilizer and introduced feeds into the pond • Keep the area up the fish pond off chemical substances • Make an earth bern or a drainage channel upslope from the fish pond to prevent entry of surface run-off

TABLE OF CONTENTS

CERTIFICATION	ii
LIST OF CONSULTANTS FOR THE ASSIGNMENT	iii
LIST OF ABBREVIATIONS AND ACRONYMS	iv
DEFINITIONS OF OPERATIONAL TERMS	v
EXECUTIVE SUMMARY	vi
LIST OF TABLES	xiii
LIST OF PLATES.....	xiii
1 INTRODUCTION.....	14
1.1 Background and rationale for EIA.....	14
1.1.1 Background to the proposed project	14
1.1.2 Purpose of the EIA	14
1.1.3 Objectives of the EIA.....	14
1.1.4 Terms of Reference (TOR) and scope for the EIA	15
1.1.5 Assessment methodology and limitations.....	15
2 BASELINE INFORMATION OF THE PROPOSED PROJECT AREA.....	17
2.1 Introduction	17
2.2 Proposed site neighbourhood and conditions	17
2.3 Challenges to development.....	17
2.4 Physical environment	20
2.4.1 Altitude and Climate	20
2.4.2 Rainfall.....	20
2.5 Biological environment	20
2.6 Physical environment	20
2.6.1 Climate.....	20
2.6.2 Air quality	20
2.6.3 Land formation and soils	21
2.7 Socio-economic information	21
2.7.1 Population	21
2.7.2 Physical and social infrastructure	21
2.7.3 Agriculture	21
2.7.4 Business activities and employment in the neighbourhood.....	21
3 PROPOSED PROJECT DESCRIPTION	22
3.1 Project design and components	22
3.2 Proposed project activities.....	22
3.3 Material input, sources and impacts associated with their use	23
3.4 Technology and machines to be used.....	24
3.5 Effects of the construction phase.....	25
3.6 Material storage and handling	25
4 RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK.....	26
4.1 Introduction	26
4.2 Institutional framework	26
4.2.1 National Environmental Management Authority (NEMA)	26
4.2.2 Environmental liaison units in other institutions with environmental management mandates in Kenya.....	26

4.3	Laws, regulations, codes and policies of Kenya with environmental relevance	27
4.3.1	The Constitution of Kenya, 2010	27
4.3.2	Environmental Management and Coordination Act, 1999 (Cap. 387), amended 2015....	27
4.3.3	Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009.....	28
4.3.4	The Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006.....	28
4.3.5	Fisheries (General) Regulations, 2012.....	28
4.3.6	The Irrigation Act, Cap 347 (Revised Edition 2012).....	29
4.3.7	Environmental Management and Coordination (Noise and Excessive Vibration, and Pollution Control) Regulations, 2008	29
4.3.8	Environmental Management and Coordination (Waste Management) Regulations, 2006	30
4.3.9	Public Health Act, 1986 (Cap. 242).....	30
4.3.10	Occupational Safety and Health Act, 2007	31
4.3.11	Work Injury Compensation Benefit Act (WIBA), 2007.....	32
4.3.12	County Governments Act, 2012	32
4.3.13	Physical Planning Act, 1996 (Cap. 286)	32
4.3.14	The Water Act 2002.....	32
4.4	Environmental (Water Quality) Regulations and Standards	33
4.4.1	Protection of Drinking Water Sources- Rivers, Streams and Lakes	33
4.4.2	Water Quality Monitoring.....	33
4.4.3	National Construction Authority Act, 2011	34
4.4.4	Traffic Act (Cap. 403).....	34
4.4.5	Penal Code (Cap. 63)	34
4.4.6	National Environmental Policy, 2012.....	34
4.4.7	Sessional Paper No. 6 of 1999 on Environment and Development.....	34
4.5	International framework	35
4.5.1	World Bank (WB) Safeguard Policies	35
4.5.2	Rio Declaration on Environment and Development (1992)	35
4.5.3	World Commission on Environment and Development (1987)	35
5	POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES	36
5.1	Introduction	36
5.2	Impacts during the construction phase	36
5.2.1	Removal and disturbance of flora and fauna	36
5.2.2	Excavation.....	37
5.2.3	Extraction of construction materials	37
5.2.4	Excess excavated soil.....	37
5.2.5	Soil compaction	38
5.2.6	Noise and vibrations	38
5.2.7	Construction wastes and pollution	39
5.2.8	Transition phase from construction to operation	40
5.3	Potential adverse impacts during the operation phase.....	41
5.3.1	Risks of animals and people drowning in the ponds.....	41
5.3.2	Impacts to water resources.....	41
5.3.3	Impacts to fish and destruction of fish ponds	42
5.3.4	Degradation of air quality	42

5.3.5	Creation of vector and rodents breeding grounds	43
5.3.6	Sewerage and waste water	43
5.4	Impacts during the decommissioning phase	44
5.4.1	Assessment.....	44
5.4.2	Mitigation to decommissioning phase impacts	44
5.5	Impacts cutting across phases	44
5.5.1	Fire	45
5.5.2	Increased demand on energy resource-use.....	45
5.5.3	Increased traffic flow	46
5.6	Impacts related to occupational health and safety	46
5.6.1	Assessment.....	46
5.6.2	Mitigation.....	47
5.7	Potential positive impacts	48
5.8	Record keeping and documentation	49
5.9	Public participation.....	49
5.9.1	Introduction.....	49
5.9.2	Outcomes of public participation.....	49
6	ANALYSIS OF PROPOSED PROJECT ALTERNATIVES.....	50
6.1	Introduction	50
6.2	“No-action” alternative.....	50
6.2.1	Assessment.....	50
6.2.2	Findings.....	50
6.2.3	Implications.....	50
6.3	Relocation Alternative	51
6.3.1	Assessment.....	51
6.3.2	Findings.....	51
6.3.3	Implications.....	51
6.4	Alternative land-uses	52
6.4.1	Assessment.....	52
6.4.2	Findings.....	52
6.4.3	Implications.....	52
6.5	The proposed development as described in the EIA report.....	52
7	ENVIRONMENTAL MANAGEMENT AND MONITORING.....	52
7.1	Environmental management	52
7.2	Proposed development without an EMP	53
7.3	Proposed Development with an EMP.....	53
7.4	Environmental monitoring and audits	53
8	RECOMMENDATIONS AND CONCLUSION.....	68
8.1	Recommendations	68
8.2	Conclusion.....	68
	REFERENCES.....	69
	APPENDICES	70

LIST OF TABLES

Table 1.0: Summary of potential negative environmental impacts.....	viii
Table 1.1: Proposed project summary.....	14
Table 1.2: Description of the proposed project phases	23
Table 1.3: Summary of the main construction material input into the proposed project.....	24
Table 4.1: Maximum permissible intrusive noise levels.....	29
Table 6.1: Proposed EMP for the construction phase of the Proposed Fish Hatchery	54
Table 6.2: Proposed EMP for the operation phase of the Proposed Fish Hatchery	58
Table 6.3 Proposed EMP for the decommissioning phase of the Proposed Fish Hatchery	62
Table 6.4: Proposed EMP for Occupational Health and Safety Impacts at the Proposed Fish Hatchery	65
Table 6.5: Proposed EMP for Monitoring the Proposed Fish Hatchery	67

LIST OF PLATES

Plates 2.1 (a and b): An existing fish pond at the proposed site(plate a) and sugarcane and tree plantations to the East of the proposed site.....	17
Plates 2.2 (a and b): Maize plantation and homesteads to the West of the proposed site(plate a) and tea plantation and an indigenous forest to the South of the proposed site(plate b).....	18
Plates 2.3 (a and b): Consultation with the SFFG and the land owner during the EiA Assessment (plate a) and bee keeping inside the indigenous forest next to the proposed site(plate b).....	18
Plate 2.4: The proposed project site	19

1 INTRODUCTION

1.1 Background and rationale for EIA

1.1.1 Background to the proposed project

The Kenya Climate Smart Agriculture Project (KCSAP) is a World Bank funded project that seeks to sustainably increase agricultural productivity, enhance resilience to climate change risks and reduction in Green House Gas (GHG) emissions. The KCSAP office in collaboration with the County Government of Kakamega wishes to utilize part of the funds in setting up a fish hatchery, fish resource centre, fish products value addition and a fish feeds production plant in Iyenga Village, Shinyalu Sub – County in Kakamega County to benefit the Shibuye Fish Farmers Group and the Iyenga Community. Below is a summary of the proposed project.

Table 1.1: Proposed project summary

Item	Description
Title	Proposed Fish Hatchery
Location	Plot No. Isukha/Virhembe/441 at Iyenga Village, Shinyalu Sub – County in Kakamega County.
Proponent	Kenya Climate Smart Agriculture Project (KCSAP) P. O. Box 27 – 50100 Kakamega, Kenya Contact Person; Mobile Number:
Owners	Shibuye Fish Farmers Group
Beneficiaries	Members of the cluster and fish farmers in Shinyalu Sub - County and its neighbourhood
Objective and scope	To establish a fish hatchery at Iyenga Village in order to help fish farmers in Shinyalu Sub-county and its neighbourhood easily access fingerlings and stock their fish ponds and therefore increase fish production in the area and enhance food security
Activities	Construction of 8 No. fish ponds and a resource centre; fencing of the farm; construction of a warehouse house, a store and pit latrines; production of fingerlings; training of farmers and fish farming

1.1.2 Purpose of the EIA

The proposed project is a fish hatchery categorized as a Medium-risk Project under the second schedule of section 58 (1), (5) of EMCA, 1999 (Cap. 387), amended 2015. Its beneficial and adverse environmental impacts cannot therefore be underestimated. The project requires an EIA carried out for it before it is implemented subject to Section 58 of the Act and Part VI, Section 31 (3) (a) (i) and (ii), of its legislative supplement, the Environmental (Impact Assessment and Audit) Regulations, 2003 which require all upcoming projects to have environmental assessments carried out for them before they are executed. EIA provides baseline information upon which subsequent environmental assessments are based. It also addresses mitigation options for potential impacts. The main purpose of an EIA is therefore to assist the Proponent, NEMA and all other stakeholders in understanding the potential environmental consequences of the project and thus provide a basis for making informed decisions on the project.

1.1.3 Objectives of the EIA

The following are the main objectives:

- a) To comply with EMCA, 1999 (Cap. 387), amended 2015;
- b) To identify and assess the likely negative and positive environmental impacts that would arise with the implementation of the proposed project;
- c) To identify and plan for measures for the mitigation of the identified impacts; and
- d) To provide a basis for decision-making to reviewers, the Authority and all other stake-holders.

1.1.4 Terms of Reference (TOR) and scope for the EIA

The assessment is expected to meet the objectives of EIA in order to ensure sustainable development. Hence, TOR outlining the expectations of the EIA were documented by the Proponent and the EIA team in accordance with the requirements of the Environmental (Impact Assessment and Audit) Regulations, 2003 in order to lay a basis for the assessment. The proponent and the EIA team did the following in order to achieve the TOR for this assessment:

- a) Generated environmental baseline conditions of the project area.
- b) Described the proposed project by giving clear accounts of its location; design; construction and operational activities; material usage; products and by-products including wastes to be generated in all phases and the methods of their disposal; and likely environmental changes.
- c) Obtained views and opinions of the interested and affected persons by undertaking public consultations by means of administration of questionnaires to neighbours, business operators and area residents in the vicinity of the proposed project.
- d) Reviewed legislations and regulations relevant to the proposed project and showed their relevance to the proposed project.
- e) Described and analyzed alternatives to the proposed project in relation the project site, design, technologies, processes and the reasons for preferring the proposed alternative.
- f) Established key areas of environmental, health and safety concerns focusing on both the positive and negative effects in relation to how they affect the biophysical, social, economic and cultural components of the environment.
- g) Analyzed impacts and recommended mitigation and enhancement measures for the adverse and positive impacts respectively. The analysis of potential impacts related to the location; design; applicable technologies; and construction and operation activities of the proposed project.
- h) Generated comprehensive environmental management and monitoring plans for the proposed project covering all its phases. The plans form a basis upon which all mitigation/enhancement measures will be carried out and specify the parties (organizations or individuals) responsible for the implementation of mitigation/enhancement measures and the schedule for their implementation and indicate the parameters to be monitored, frequency of monitoring, indicators of performance, parties responsible for monitoring and the associated costs.
- i) Generated a comprehensive EIA report in accordance with the Environmental (Impact Assessment and Audit) Regulations, 2003 and submitted the report and necessary soft and hard copies to the Authority for further instructions and/or approval.

1.1.5 Assessment methodology and limitations

This assessment was carried out in March 2019 in accordance with the procedures and protocols in the Environmental (Impact Assessment and Audit) Regulations, 2003. The assessment involved:

- a) Extensive site tours to physically inspect and document existing facilities at the site and natural and socio-economic features of importance;
- b) Environmental screening to determine the necessity and level of the EIA process;
- c) Interviews with the interested and affected persons including the project management team and neighbouring residents and business operators among other groups in the neighbourhood regarding the proposed project; and
- d) Desktop studies for documentary review on the nature of the activities of the proposed project, proposed project related documents, plans, designs, policy and legislative frameworks as well as the environmental setting of the area amongst other things.

The main limitation to the assessment is that some of the information was compiled based on responses of the owner and the stakeholders involved. There are difficulties in verification of some of this kind of information. The consultant has evaluated information obtained within the limits of the established scope of work.

2 BASELINE INFORMATION OF THE PROPOSED PROJECT AREA

2.1 Introduction

The proposed project site is found at Iyenga in Shinyalu Sub-county in Kakamega County. There are various fish ponds in the area. In the entire Shinyalu Sub-county, there are over 100 fish ponds. There are no fish hatcheries in the sub-county and many fish farmers travel long distances in search of fish fingerlings. This has in turn discouraged the rural community to invest in fish farming which is a profitable business especially in western Kenya. In this chapter emphasis was placed on describing proposed project area and its neighbourhood in terms of resources, vegetation, land-use patterns, socio-economic activities, population, topography, climate and geology among others so as to provide a basis from which the potential impacts of the proposed project can be predicted. The proposed site is found at Iyenga, Shinyalu Sub – County in Kakamega County.

2.2 Proposed site neighbourhood and conditions

The proposed project site is bordered by a swamp and maize plantations to the North; sugarcane and tree plantations to the East, indigenous forest and tea plantation to the South, homesteads and cultivated plots to the West. There are two streams bordering the proposed site which are converging to the North. At the time of the assessment the construction of the proposed project had not started. The site is undeveloped and is rich in indigenous vegetation. There is an existing fish pond at the proposed site. Plants growing at the proposed site are mainly short grasses, forbs and some scattered trees and shrubs. Some of the plants at the proposed site include such as *Lantana camara*, *Tithonia diversifolia*, *Markhamia lutea*, *Bischofia javonica* and *Spathodea nilotica*.

2.3 Challenges to development

The area faces a number of environmental challenges including:

- a) The increasing population which poses pressure on land resource;
- b) Lack of properly defined public solid waste collection and disposal systems;
- c) Risk of encroachment into wetlands for agricultural production and inadequate water supply;



Plates 2.1 (a and b): An existing fish pond at the proposed site(plate a) and sugarcane and tree plantations to the East of the proposed site



Plates 2.2 (a and b): maize plantation and homesteads to the West of the proposed site(plate a) and tea plantation and an indigenous forest to the South of the proposed site(plate b)



Plates 2.3 (a and b): Consultation with the SFFG and the land owner during the EIA Assessment (plate a) and bee keeping inside the indigenous forest next to the proposed site(plate b)



Plate 2.4: The proposed project site

2.4 Physical environment

2.4.1 Altitude and Climate

The altitude at the project area is about 1,542 m above sea level. The climate of the proposed project site identifies with that of the wider Western Region of Kenya. **Rainfall**

The area receives high annual precipitation. Rainfall is spread into two wet seasons. The long rains usually begin from March and end in June while the short rains span from August to October. The average annual rainfall is 1,000 mm. Temperatures range from 15 °C to 28 °C depending on the month of the year. The mean maximum varies from 22 °C in July/August to 28 °C in March. Diurnal temperature variations are minimal.

The wider Western Region experiences a total of about 2,500 hrs of bright sunshine per annum, which is equivalent to annual mean of approximately 6.8 hrs of sunshine per day. July and August are characterized by cloudiness and during these months, the average daily sunshine in the region is 4 hours. The area receives Northeast and Southeast monsoons that blow very steadily but without high intensity. Both wind run and mean wind speed are at a maximum in December and remain high during January, February and March coinciding with the dry season and period of higher potential evaporation. Evaporation is affected by temperature and sunshine factors and has its peak in March.

2.5 Biological environment

It is important to note that there are no ecologically sensitive environments; endangered, rare, keystone or endemic species or wetlands at or near the proposed project site. Shinyalu has gazetted forests and most of land is under sugar cane plantations. There are various indigenous forests in the area. The area has both exotic and indigenous tree species. The trees mainly found in the area include *Croton megalocarpus*, *Caltis duratii*, *Anigeria altissimo*, *Ficus exasperata*, *Funtumia clastica* and *Bosquea phoberos* among others. The trees are used mainly for ornamental, shade, boundary demarcation, fencing and production of fruits. There is high potential for agro-forestry activities due to high rainfall and fertile soils. However, this is limited by land fragmentation and high population growth.

2.6 Physical environment

2.6.1 Climate

The climate of the proposed project site identifies with that of the wider Western Region. Rainfall is spread into two wet seasons; the long rains usually begin from March and end in June while the short rains span from August to October. The peaks occur in May and September respectively. However, there are some variations in the timings due to climate change. The annual rainfall ranges from 1,000 mm to 1,500 mm per year. Temperatures range from 14 °C to 32 °C depending on the month of the year. The mean maximum varies from 22 °C in July/August to 28 °C in March. Diurnal temperature variations are minimal.

2.6.2 Air quality

Generally, gaseous emissions within the area are visible and are attributed to presence of automobiles such as vehicles and motorcycles. Air quality deterioration is also caused by dust and burning activities taking place in the area especially of solid wastes within the area and in farms and homesteads.

2.6.3 Land formation and soils

Most parts of the neighbourhood have gentle slopes that are covered by vegetation and this helps to prevent loss of soil and soil nutrients through soil erosion. The soils are predominantly loamy fertile soils which have high humus content with high water holding capacity and high nutrient availability and therefore favour crop cultivation an activity carried out by most of the residents in the area.

2.7 Socio-economic information

2.7.1 Population

The neighbourhood of the proposed site is densely populated due to the presence of Shinyalu Trading Centre. The area is characterized by linear settlement due to business activities along the Shinyalu - Khayega and Shinyalu – Kakamega Roads.

2.7.2 Physical and social infrastructure

Electricity in the area is supplied by the Kenya Power. There is no piped water in the area. People access water from protected springs and boreholes. Other sources of water include protected springs, water vendors and harvested rain water. Most homesteads have adopted water harvesting where they have tanks for storing harvested rain water from the roofs by the use of gutters. The area is served by traffic mainly on Shinyalu – Kaimosi Road and many other access roads. Communication is excellent for mobile reception from Safaricom, Airtel, and Telkom networks.

2.7.3 Agriculture

Farming forms a major source of livelihood in the area. The main crops grown are maize, sugarcane, bananas, beans, tea, sweet potatoes and vegetables. Animals kept include poultry, cow, sheep and goats. Farming is mainly concentrated and is extensively practiced in the rural areas.

2.7.4 Business activities and employment in the neighbourhood

Business entrepreneurs licensed in the area include salons, barber shops, hotels and retail shops, carpentry shops, motorbike repairs, wholesale shops, welding, bar and restaurant, distributors different products, bakeries and Mpesa and Airtel Money shops. These businesses provide employment opportunities to many residents in the area. Other sources of employment are government, financial and academic institutions. Banks such as KCB, Family Bank and Cooperative Bank that can offer credit facilities to entrepreneurs are located within Sabatia and Butere Towns that are the nearest town to the proposed project.

3 PROPOSED PROJECT DESCRIPTION

3.1 Project design and components

The Proposed Fish Hatchery will produce *Clarias gariepinus* (African catfish) and *Tilapia* spp fingerlings and will have the following components:

- i) A resource centre, a warehouse, and pit latrines
 - ii) 8 No. fish ponds
 - iii) 2 No. water reservoirs
 - iv) A fence around the farm to protect the farm from predators and unauthorized persons
-
- a) SFFG will identify a ten-member committee to oversee the management of the hatchery. The committee members will be trained and will work closely with the MOFD in Shinyalu Sub - County for technical advice.
 - b) In order to ensure sustainability of the hatchery, fingerlings will be sold to farmers at a cost effective price and the proceeds will be used to produce more fingerlings based on the local demand. In addition, 2 No. of the grow out ponds will be used to rear some fish to maturity for sale to get income for continued fingerling production and immediate members will be supplied with fingerlings and will remit 10 % of their produce to the group.
 - c) Appropriate trees, shrubs and grass will be planted at the farm for agro-forestry and landscaping purposes.
 - d) SFFG proposes to use an existing water reservoir as a source of water and this is to be supplemented by rain water to be harvested from the farm house's roof which is to be stored in a plastic tank to be purchased.
 - e) Adequate drainage channels will be constructed to direct run-off into cut-off drains leading to valleys in order to prevent surface run-off getting into the ponds.
 - f) Power from Kenya Power will be installed at the site.
 - g) The proposed site is connected by an access road to Shinyalu – Rondo Road at Iyenga.
 - h) Mobile phone (Airtel, Orange and Safaricom) network services are available in the area for connection to the proposed site.
 - i) Fire extinguishers will be installed in the farm house for fire suppression. Fire exit points will be marked within the building and a fire assembly point will be designated and marked outside the building. Fully equipped first aid kits and personal protective equipment (PPE) will be made available at the site.
 - j) Solid wastes from the farm will be collected in dust bins to disposal points.

3.2 Proposed project activities

The proposed project has three main overlapping phases. These are: construction, operation and decommissioning phases. At the time of the assessment the construction phase had not started. The activities under each phase are outlined (Table 1.2).

Table 1.2: Description of the proposed project phases

Phase	Main activities
Pre-construction	<ul style="list-style-type: none"> a) Preparation of the EIA project report b) EIA project report review and licensing
Construction	<ul style="list-style-type: none"> a) Demarcation and preparation of the proposed site and mobilization of construction personnel, equipment and material b) Removal of unwanted vegetation and rubbish c) Fencing of the farm and creation of access roads and gates for delivery of construction materials d) Digging up of fish ponds and the well e) Excavation and development of a fish resource centre, warehouse, store and pit latrines f) Management of wastes g) Use of machinery, human labour and construction materials including water
Operation	<ul style="list-style-type: none"> a) Stocking of fish ponds with fish b) Incubation and production of fingerlings c) Harvesting, sorting and gutting of fish and sale of fingerlings and fish d) Management of ponds and the farm e) Handling and management of solid and liquid wastes f) Health, hygiene and safety management g) Extraction and use of water from underground sources Repair and maintenance of the structures, equipment and other facilities h) Fire and safety management i) Environmental management and monitoring
Decommissioning	<ul style="list-style-type: none"> a) Demolition of structures a) Abandoning of fish ponds b) Draining of water from the fish ponds b) Rehabilitation and/or restoration of site c) Change of use

3.3 Material input, sources and impacts associated with their use

The proposed activities will use artificial and natural materials in all its phases. All materials to be used shall conform to the Kenya Bureau of Standards (KBS) requirements for quality. Extraction and usage of materials will have both beneficial and adverse impacts on the environment. Both on-site and off-site impacts are anticipated with the usage of these materials. The most common of these impacts are income circulation in the economy, creation of employment opportunities, off-site depletion of raw materials, land degradation, pollution, excessive demand on raw materials and health hazards. At the time of the assessment, the proponent or contractors had not established the sources the construction materials. Sources of materials have been suggested (Table 1.3). However, the choice of the sources will be at the discretion of the contractor, owners and proponent.

Table 1.3: Summary of the main construction material input into the proposed project

Materials	Provisional sources	Uses
Water	Nearby unprotected spring	Input in the construction works for concrete and aggregate preparation and cleaning
Wooden posts	Suppliers near the proposed site	Will support the chain link on the fence
Sand	Suppliers near the proposed site	Preparation of concrete for strengthening posts in the ground and for use in building construction and making the slab at the well
Ballast or hardcore	Suppliers near the proposed site	Preparation of concrete for strengthening posts in the ground and for use in building construction and making the slab at the well
Cement	Hard wares in Shinyalu	Preparation of concrete for strengthening posts in the ground and for use in building construction and making the slab at the well
Soil	From site after excavations	Leveling, refilling, landscaping works and making of pond embankments
Nails	Hardwares near the proposed site	For joinery purposes
Bricks or bush stones	Suppliers near the proposed site	Walling works
Timber	Timber yards near the proposed site	Roofing and making doors
Poles	Timber yards near the proposed site	Supporting structural works
Steel bars	Hardwares near the proposed site	Reinforcement and casement
Glass	Hardwares near the proposed site	For glazing windows
Iron sheets	Hardwares near the proposed site	Roofing
Nails	Hardwares near the proposed site	For joinery and roofing purposes
PVC material such as pipes	Hardwares near the proposed site	For water piping and insulations
Paint	Hardwares near the proposed site	For colourful external and internal finishes of the farm house

3.4 Technology and machines to be used

During construction of the resource centre, warehouse, store and pit latrines, the contractor shall employ modern and best building technologies which are not inferior to locally and internationally established building standards. Hand tools especially *jembes*, wheelbarrows, spades, fishing nets and sampling equipment shall be used. The main machines to be employed will include a water pump, a concrete mixer, a plate compactor, a power vibrator and a welding machine.

3.5 Effects of the construction phase

- (a) Deep excavation will take place at the project site to allow for laying the foundation of the farm house and store, digging pits for latrines and for the ponds. If excess soil is not properly disposed or utilized, it is likely to result into nuisance as a source of solid wastes. Excavation will create loose soils making it prone to both water or and wind erosion. This will cause a disturbance in soil quality and structure.
- (b) Soil dwelling organisms at the proposed site are likely to be affected by alteration or destruction of their habitats leading to eventual death and/or displacement.
- (c) Moving machinery will compact the soils as construction operations take place. Compaction has the undesired effect of hindering air and water penetration beneath the soil surface limiting aerobic activities of organisms in the process. Compaction will also enhance run-off during the rainy season.
- (d) The construction may be a potential source of pollution from spillage of paints and chemicals; poor sanitary facilities at the site for the construction labour force and visitors; improper waste disposal from the site; waste timber, polythene bags and plastics; dust from the excavation works and containers, metal, glass and inert substances such as soil and cement among others.

3.6 Material storage and handling

All materials to be used have to conform to the KBS requirements for quality. The materials will be kept in a store to be established at the site. The store for non-hazardous materials will be accommodated within the site office. Materials to be stored in this store shall include samples for review by consultants and inspectors. The store for non-hazardous materials shall have iron sheet walling and roof and a waterproof concrete floor to contain spills. Storage and handling of all hazardous chemicals shall be in accordance with manufacturer's instructions as outlined on the material safety data sheets.

4 RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK

4.1 Introduction

There is need to take care of the environment in order to ensure survival of human beings. The law has intervened to ensure that human beings are considerate, cautious and careful in their dealings with the environment. The laws governing the environment in Kenya include the constitution of Kenya, 2010; EMCA, 1999 (Cap. 387), amended 2015 and its subsidiary legislations; and other Kenyan and multilateral environmental laws. EMCA, 1999 (Cap. 387), amended 2015 was developed to harmonize and coordinate environmental management issues in Kenya by providing for the establishment of an appropriate legal and institutional framework for the management of the environment. The institution is NEMA. The Act covers all aspects of the environment. Kenya is a signatory to some international legislation. Some of these are relevant to this project and were reviewed for the purpose of writing this report. Environmental management issues are addressed differently in several legal statutes, but the main objective in all of them is sustainability. It is however noted that wherever any of the laws contradict each other, EMCA, 1999 (Cap. 387), amended 2015 prevails.

4.2 Institutional framework

4.2.1 National Environmental Management Authority (NEMA)

EMCA, 1999 (Cap. 387), amended 2015 provides for establishment of NEMA as the principal agency responsible for coordination, monitoring and supervision of environmental issues in Kenya. NEMA too has a cross-sectorial mandate to oversee the conduct of environmental assessments and audits through issuance of guidelines, regulations and registration of environmental practitioners. It reviews and approves reports for environmental assessments and audits in consultation with any relevant lead agencies. NEMA enforces environmental legislations through the Department of Compliance and Enforcement which is responsible for ensuring that projects comply with the various environmental regulations and standards. NEMA has appointed environmental inspectors whose powers and duties are listed out under section 117 of EMCA, 1999 (Cap. 387), amended 2015. The environmental inspector may also issue an improvement notice requiring an operator to cease any activity deleterious to the environment which is contrary to the Act. NEMA has power, to prosecute environmental offenders and offences committed under the Act and may earn the offender fines and prison sentences. NEMA works with the county environment departments and committees at the county level in undertaking inspection, monitoring and compliance enforcement.

Relevance: NEMA will review and approve this EIA report. County environment officers represent NEMA at the county level and are responsible for monitoring environmental protection or regulatory compliance at the county level. In this regard, Kakamega County NEMA office is expected to monitor regulatory compliance of the proposed project throughout its life cycle.

4.2.2 Environmental liaison units in other institutions with environmental management mandates in Kenya

NEMA is linked to sectorial lead agencies, private organizations and educational institutions through their environmental liaison units. These institutions include county environment departments, parastatals, learning institutions, NGOs and CBOs among others and are charged with implementation of environmental programmes and integration of environmental concerns in sectorial policies, plans and programs. Consequently, they monitor investment programmes at their respective sectorial levels.

Relevance: Relevant environmental liaison units are stakeholders in the proposed project and will have input into the EIA process.

4.3 Laws, regulations, codes and policies of Kenya with environmental relevance

4.3.1 The Constitution of Kenya, 2010

This is the sovereign law in Kenya. The constitution acknowledges the people of Kenya’s respect for the environment which is our heritage in its preamble. It also points out our determination to sustain it for the benefit of future generations. This is sustainability of the environment. Environmental provisions are included in:

- Cap. 4 on Rights and Fundamental Freedoms
- Cap. 5 on Environment and Natural Resources
- Cap. 10 on Judicial Authority and Legal System
- Fourth Schedule on Distribution of functions between National and County Governments
- Fifth Schedule on Legislation to be enacted by Parliament

Chapter 5, Part 2 has the following provisions on Environment and Natural Resources

- Article 69 – Obligations in respect of the environment
- Article 70 – Enforcement of environmental rights
- Article 72 – Legislation relating to the environment

Article 42 states that, “Every person has a right to a clean and healthy environment, which includes the right to:

- a) Have the environment protected for the benefit of the present & future generations through legislative & other measures, particularly those contemplated in Article 69; and
- b) Have the obligations relating to the environment fulfilled under Article 70

Relevance: This is the sovereign law in Kenya and points out our determination to sustain the environment it for the benefit of future generations. The Proponent must be committed to protecting the environment throughout the project life cycle.

4.3.2 Environmental Management and Coordination Act, 1999 (Cap. 387), amended 2015

It is a requirement that all projects listed under the second schedule of the Act undertake an environmental assessment and submit a report to NEMA for licensing before commencement. The subsidiary legislation to the Act, the Environmental (Impact Assessment and Audit) Regulations, 2003 provides the framework for carrying out EIAs and EAs in Kenya by NEMA licensed experts. EIAs should be followed by EAs which should be carried out to annually to determine the projects’ compliance with environmental regulations.

Section 3 (1) of the Act states that, “Every person in Kenya is entitled to a clean and healthy environment in accordance with the Constitution and relevant laws and has the duty to safeguard and enhance the environment”.

Section 58 (1) of the Act states that, “Notwithstanding any approval, permit or license granted under this Act or any other law in force in Kenya, any person, being a proponent of a project, shall before any financing, commencing, proceeding with, carrying out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the Second Schedule to this Act, submit a project report to the Authority, in the prescribed

form, giving the prescribed information and which shall be accompanied by the prescribed fee”. This fee is determined by the Authority.

Section 68 (3) states that, “The owner of the premises or the operator of a project for which an environmental impact assessment study report has been made shall keep accurate records and make annual reports to the Authority describing how far the project conforms in operation with the statements made in the environmental impact assessment study report submitted under section 58 (2).”

Relevance: The Proponent is carrying out this EIA in order to comply with sections 58 to 67 and 138 of the Act. The Proponent shall keep records of environmental issues, relevant licenses and permits and shall avail them to the Authority when necessary to prove compliance. The Proponent shall also be held responsible for any other matter in contravention of this Act.

4.3.3 Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009.

This Act applies to all wetlands in Kenya whether occurring in private or public land. It contains provisions for the utilization of wetland resources in a sustainable manner compatible with the continued presence of wetlands and their hydrological, ecological, social and economic functions and services.

Relevance: The proposed project is an important source of livelihood to the local community. The proponent shall comply with the provisions of the Act in protecting wetlands, preventing and controlling pollution and Siltation in rivers.

4.3.4 The Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006

The Act states that no person shall not 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 Environmental Impact Assessment License issued by the Authority under the Act.

Relevance: The Proponent has commissioned this environmental assessment study and seeks to obtain an EIA License from the Authority (NEMA) in compliance with the Act; the environmental management plan included in this report provides guidelines for the mitigation of potentially adverse impacts on natural resources.

4.3.5 Fisheries (General) Regulations, 2012

Protection of marine mammals and turtles

- (1) The maritime zones of Kenya are declared to be a marine mammal and turtle sanctuary.
- (2) No person shall—
 - (a) Kill any marine mammal or turtle;
 - (b) Chase any marine mammal or turtle with intent to kill;
 - (c) Harass any marine mammal or turtle so as to disturb its behaviour or breeding habits; or
 - (d) Take any marine mammal or turtle, alive or dead, including any marine Mammal or turtle stranded on land.
- (4) Any person who contravenes this regulation shall be guilty of an offence and liable to a fine not exceeding twenty thousand shillings or to imprisonment for a term not exceeding two years or to both.

4.3.6 The Irrigation Act, Cap 347 (Revised Edition 2012)

Functions and powers of the Board

- (1) The Board shall be responsible for the development, control and improvement of national irrigation schemes in Kenya.
- (2) The Board shall have and may exercise all such powers as are necessary to enable it to perform its functions under this Act, and, without prejudice to the generality of the foregoing, the Board shall have power among other to;
 - a. To design, construct, supervise and administer national irrigation schemes;
 - b. To conduct research and investigation into the establishment of national irrigation schemes.

4.3.7 Environmental Management and Coordination (Noise and Excessive Vibration, and Pollution Control) Regulations, 2008

These regulations prohibits under Section 3 (1) the causing of loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. Noise levels as provided for in the First Schedule of these regulations are presented in table 4.1 below.

Table 4.1: Maximum permissible intrusive noise levels

Zone		Sound Level Limits db(A) (<i>Leq, 14h</i>)		Noise Rating Level (NR) (<i>Leq, 14h</i>)	
		Day	Night	Day	Night
A	Silent Zone	40	35	30	25
B	Places of Worship	40	35	30	25
C	Residential: Indoor	45	35	35	25
	Outdoor	50	35	40	25
D	Mixed Residential (with some commercial and places of entertainment)	55	35	50	25
E	Commercial	60	35	55	25

Source: First Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration, and Pollution Control) Regulations, 2008

According to these regulations, Day means the time between 0601 hours and 2000 hours while night the time between 2001 hours and 0600 hours. In compliance with these regulations:

- a) Super-silent generators will be used;
- b) There will be no construction at night;
- c) Ear muffs will be provided to workers during construction;
- d) Regular maintenance/repair of contractor's vehicles and machinery will be enforced in order to minimize vibrations and noise;
- e) Any maintenance of construction vehicles and machinery will be carried out in the contractor's yard that may be onsite or off site; and
- f) The construction site will be enclosed in accordance with NCA requirements to minimize noise levels emanating from the construction site.

Relevance: All noise to be produced at the proposed site in all its phases shall be managed in accordance with the guidelines in this report or from other authorities in control of noise. The Proponent shall

be held responsible for any environmental nuisance resulting from noise pollution at the proposed site and for any other matter in contravention of these regulations.

4.3.8 Environmental Management and Coordination (Waste Management) Regulations, 2006

According to part II of the regulations, a generator of waste should:

- a) *Not dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle;*
- b) *Collect, segregate and dispose or cause to be disposed-off such waste in the manner provided for under these Regulations; and*
- c) *Ensure that the waste is transferred to a person who is licensed to transport and dispose-off such waste in a designated waste disposal facility.*

Relevance: All wastes from the proposed site will be managed in accordance with the procedures outlined in this report or as may be advised by the public health office and/or other authorities. The Proponent and contractor(s) will be held responsible for any environmental damage or nuisance resulting from wastes from the proposed project and site and for any other matter in contravention of these regulations.

4.3.9 Public Health Act, 1986 (Cap. 242)

Part IX of the Act on Sanitation and Housing, Section 115 prohibits nuisance by stating that, “No person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health.”

Section 118 (b) – (i), (p) – (q) and (s) defines nuisance in that order as:

- Any dwelling or premises or part thereof which is or are of such construction or in such a state or so situated or so dirty or so verminous as to be, in the opinion of the medical officer of health,
- injurious or dangerous to health, or which is or are liable to favour the spread of any infectious disease;
- Any street, road or any part thereof, any stream, pool, ditch, gutter, watercourse, sink, water-tank, cistern, water-closet, earth-closet, privy, urinal, cesspool, soak-away pit, septic tank, cesspit, soil-pipe, waste-pipe, drain, sewer, garbage receptacle, dust-bin, dung-pit, refuse-pit, slop-tank, ash-pit or manure heap so foul or in such a state or so situated or constructed as in the opinion of the medical officer of health to be offensive or to be injurious or dangerous to health;
- Any well or other source of water supply or any cistern or other receptacle for water, whether public or private, the water from which is used or is likely to be used by man for drinking or domestic purposes or in connection with any dairy or milk shop, or in connection with the manufacture or preparation of any article of food intended for human consumption, which is in the opinion of the medical officer of health polluted or otherwise liable to render any such water injurious or dangerous to health;
- Any noxious matter, or waste water, flowing or discharged from any premises, wherever situated, into any public street, or into the gutter or side channel of any street, or into any nullah or watercourse, irrigation channel or bed thereof not approved for the reception of such discharge;
- Any stable, cow-shed or other building or premises used for keeping of animals or birds which is so constructed, situated, used or kept as to be offensive or which is injurious or dangerous to health;

- Any animal so kept as to be a nuisance or injurious to health;
- Any accumulation or deposit of refuse, offal, manure or other matter whatsoever which is offensive or which is injurious or dangerous to health;
- Any accumulation of stones, timber or other material if such in the opinion of the medical officer of health is likely to harbour rats or other vermin;
- Any premises in such a state or condition and any building so constructed as to be likely to harbour rats;
- Any dwelling or premises which is so overcrowded as to be injurious or dangerous to the health of the inmates, or is dilapidated or defective in lighting or ventilation, or is not provided with or is so situated that it cannot be provided with sanitary accommodation to the satisfaction of the medical officer of health;
- Any public or other building which is so situated, constructed, used or kept as to be unsafe, or injurious or dangerous to health;
- Any occupied dwelling for which such a proper, sufficient and wholesome water supply is not available within a reasonable distance as under the circumstances it is possible to obtain;
- Any area of land kept or permitted to remain in such a state as to be offensive, or liable to cause any infectious communicable or preventable disease or injury or danger to health;
- Any chimney sending forth smoke in such quantity or in such manner as to be offensive or injurious or dangerous to health; and
- Any act, omission or thing which is, or may be, dangerous to life, or injurious to health.

Relevance: The Proponent shall be held responsible for any nuisance defined under section 118 resulting from the proposed site and for any other matter in contravention of this Act.

4.3.10 Occupational Safety and Health Act, 2007

This Act provides for the safety, health and welfare of workers and all persons lawfully present at workplaces where any person is at work, whether temporarily or permanently. Part II of the Act on General Duties states the following:

- Duties of occupiers according to: Section 6 (1) that, “Every occupier shall ensure the safety, health and welfare at work of all persons working in his workplace”.
- Section 6 (2) (b), “Arrangements for ensuring safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances”.
- Section 6 (2) (c), “The provision of such information, instruction, training and supervision as is necessary to ensure the safety and health at work of every person employed”.

Part VI, Sections 47 to 54 on Health General Provisions requires work places to be kept clean, properly ventilated, have enough lighting, have floors properly drained and have sanitary conveniences.

Relevance: The contractor(s) and the Proponent will ensure the safety and health of those to be employed at the site in all its phases. They will also be held responsible for any other matter in contravention of this Act. The EMP provided advises the Proponent and the contractor(s) on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost, as a basic guideline for the management of health and Safety issues.

4.3.11 Work Injury Compensation Benefit Act (WIBA), 2007

This Act provides for compensation for employees on work related injuries and diseases contracted in the course of employment and for connected purposes. The Act includes compulsory insurance for employees. The Act defines an employee as any worker on contract of service with employer.

Relevance: The proponent will ensure all contractor(s) have insured the staff involved in the construction. Compensation will be undertaken for any employee in cases of injury or disease in line with working.

4.3.12 County Governments Act, 2012

This Act gives effect to chapter eleven of the Constitution of Kenya to provide for county governments powers, functions and responsibilities to deliver services and for connected purposes.

Relevance: The proposed site is found in Kakamega County. The Proponent will abide by all laws, rules, regulations, guidelines and requirements by the CGK. The contractor and the Proponent will be held responsible for any other matter in contravention of this Act.

4.3.13 Physical Planning Act, 1996 (Cap. 286)

This Act makes specific provisions for physical planning. Section 25 (b) of the Act states that, “A local physical development plan shall consist of such maps and description as may be necessary to indicate the manner in which the land in the area may be used”.

Relevance: The Proponent will be held responsible for any matter in contravention of this Act and in breaking regulations by the Physical Planning Department of Kakamega County.

4.3.14 The Water Act 2002

The Water Act, 2002 provides the legal framework for the management, conservation, use and control of water resources and for the acquisition and regulation of right to use water in Kenya. It also provides for the regulation and management of water supply and sewerage services. In general, the Act gives provisions regarding ownership of water, institutional framework, national water resources, management strategy, and requirement for permits, state schemes and community projects. Part IV of the Act addresses the issues of water supply and sewerage. Specifically, section 59 (4) of the Act states that the national water services strategy shall contain details of:

Existing water services

- The number and location of persons who are not being provided with basic water supply and basic sewerage
- Plans for the extension of water services to underserved areas
- The time frame for the plan; and
- An investment programme

Part II, section 18, of the Water Act 2002 provides for national monitoring and information system on water resources. Following on this, sub-section 3 allows the Water Resources Authority (WRA) to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the Authority.

a.) The Water Resources Management Rules, 2007

As a subsidiary to the Act, a legislative supplement, The Water Resources Management Rules, 2007 was gazetted to guide all policies, plans, programmes and activities that are subject to the Water Act, 2002. The Water Resources Management Rules empower Water Resources Management Authority (WRMA) to impose management controls on land use falling under riparian land.

4.4 Environmental (Water Quality) Regulations and Standards

4.4.1 Protection of Drinking Water Sources- Rivers, Streams and Lakes

National Environment Management Authority (NEMA) has proposed regulations in order to protect drinking water sources. For the protection of rivers, streams and lakes, no person shall:

- Discharge, any effluent from sewerage treatment works or industry, that exceeds the discharge standards proposed.
- Carry out any activity near rivers, streams and lakes without an EIA license in accordance with the Environmental (Impact Assessment and Audit) Regulations, 2003;
- Abstract water from rivers, lakes and streams without a valid license from the water service board in accordance with the Water Act, 2002.

4.4.2 Water Quality Monitoring

For the protection of drinking water sources, the Ministry responsible for the water affairs, in consultation with the Authority, shall maintain regular water quality monitoring twice a year, once during low flow, and once during high flow period, as stipulated in the Water Act, 2002, Part III Section 18, schedule 17. Table (b) below shows the parameters and results to be looked at when monitoring the water quality for drinking water sources.

Table: Water Quality Monitoring for Drinking Water Sources

Parameter	Standard Results
pH	6.5-8.5
Suspended solids	30 (mg/L)
Nitrate – NO ₃	10 (mg/L)
Ammonia – N	0.5 (mg/L)
Nitrate – NO ₂	3 (mg/L)
Total Dissolved Solids	1200 (mg/L)
E-Coli	Nil/100ml
Fluoride	1.5 (mg/L)
Phenols	Nil (mg/L)
Arsenic	0.01 (mg/L)
Cadmium	0.01 (mg/L)
Lead	0.05 (mg/L)
Selenium	0.01 (mg/L)
Copper	0.05 (mg/L)
Zinc	1.5 (mg/L)
Alkyl benzyl sulphonates	0.5 (mg/L)
Permanganate Value	1.0 (mg/L)

4.4.3 National Construction Authority Act, 2011

The National Construction Authority (NCA) was established under an Act of parliament to oversee the construction industry and coordinate its development. Section 15 (1) of the Act states that, “A person shall not carry on the business of a contractor unless the person is registered by the Board under this Act”.

Relevance: The Proponent will select a contractor(s) who is/are registered with NCA. The proposed project will be registered in accordance with NCA requirements. NCA will ensure that the proposed project is constructed in accordance with laid down building standards and will be held responsible for any other matter in contravention of this Act.

4.4.4 Traffic Act (Cap. 403)

This is an Act of Parliament to consolidate the laws relating to traffic on the roads. Section 66 A (1) of the Act protects the occupational safety and health of drivers by stating that, “*No person shall drive a public service vehicle or a commercial vehicle for more than a total of eight hours in any period of twenty-four hours*”. All drivers who will drive vehicles to be used in the proposed project in all its phases shall operate in shifts of not more than 8 hrs in any period of 24 hrs.

Relevance: The contractor(s) and the Proponent will ensure that all drivers that will be used to mobilize materials at the construction site comply with all traffic rules.

4.4.5 Penal Code (Cap. 63)

The chapter on “Offences against Health and Conveniences” contained in the Code enacted in 1930 strictly prohibits the release of foul air into the environment, which affects the health of other persons.

Relevance: All wastes from the proposed site will be managed in accordance with the procedures outlined in this report or as may be advised by the public health office and/or other authorities. The Proponent will provide appropriate solid and liquid waste handling facilities for the proposed project throughout its project life cycle and will be held responsible for any environmental damage or nuisance resulting from wastes from the proposed project and site and for any other matter in contravention of this Code.

4.4.6 National Environmental Policy, 2012

Integration of environmental conservation and economic activities in the development process is a key policy statement in this policy paper.

Relevance: Throughout the proposed project life cycle, the Proponent will conserve the environment. Conservation measures at the proposed site will include a well-designed landscaping programme which will involve planting appropriate plants.

4.4.7 Sessional Paper No. 6 of 1999 on Environment and Development

The policy paper emphasizes that EIA must be undertaken by the developers as an integral part of a project preparation. It also proposes for periodic environmental auditing to investigate if developer is fully mitigating the impacts identified in the assessment report.

Relevance: The carrying out of this EIA and the preparation of this report is in compliance with this paper.

4.5 International framework

4.5.1 World Bank (WB) Safeguard Policies

The objective of the World Bank's environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment in the development process. The Proponent has carried out this EIA in compliance with Safeguard Policy 4.01 that deals with environmental assessment. The Safeguard Policy 4.12 relates to Involuntary Resettlement. No persons, businesses or facilities will be displaced from the proposed site.

Relevance: The Proponent will put in place mitigation measures outlined in this report and as will be advised through improvement orders in order to protect people and the environment from undue harm.

4.5.2 Rio Declaration on Environment and Development (1992)

Principle No. 10 of the declaration underscored that, “Environmental issues are best handled with participation of all concerned citizens at all the relevant levels.

Relevance: The Proponent encouraged and facilitated public participation at the site. Public comments must be treated with utmost relevance.

4.5.3 World Commission on Environment and Development (1987)

This commission commonly referred to as “the Brundtland Commission” focuses on the environmental aspects of development, with particular, the emphasis on sustainable development that produces no lasting damage to the biosphere and to particular ecosystems.

Relevance: The Proponent will put in place mitigation measures outlined in this report and as will be advised through improvement orders in order to protect people and the environment from undue harm.

5 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Introduction

The environmental baseline information collected and the project characteristics discussed form the basis for impact identification and analysis. The impacts that are expected to arise from the project could either be termed as positive or negative, direct or indirect, short-term or long-term, temporary or permanent depending on their nature, area of coverage and their duration in the environment and have been identified in all the phases of the proposed project cycle namely; construction, operational and decommissioning. This section discusses the impacts relating to the proposed project as well as precautionary and mitigation measures that can be adopted.

5.2 Impacts during the construction phase

During the construction phase, the following activities are likely to result into significant impacts: removal of vegetation; excavation; movement of vehicles and machinery; water and energy resource-use and solid and liquid waste management. These impacts among others are:

5.2.1 Removal and disturbance of flora and fauna

5.2.1.1 Assessment

Most of the plants at the proposed site will be cleared to pave way for digging of fish ponds, pit latrine and the well as well as laying foundations for the resource centre, warehouse and store. With the removal of fauna, several species of plants are threatened with death. There is a rich diversity of fauna mainly arthropods whose life is depended on the plants at the proposed site for shelter and food. The habitats of these animals will be altered or destroyed by clearing of these plants. Loss of vegetation from the site also means loss of valuable food for these animals leading to eventual death and/or displacement. Moving vehicles, machines and people used to ease the construction work will create additional damage to vegetation by their movement on the plants. The pressure to be exerted on the plants by the heavy vehicles, machines and people may interfere with the biological processes in the plants alongside leading to death of the plants. However, it is worth noting that considering the scale of the proposed project and commonly found flora and fauna within the project influence area, no significant adverse effects are envisaged on the ecology of the area. Similarly, there are no significant archaeological properties or environments. Hence, the anticipated impacts are minor.

5.2.1.2 Mitigation

Vegetation removal and disturbance during the construction phase will be experienced. It is however important to ensure that any flora and fauna removal and disturbance is restricted to the actual project area to avoid spill-over effects to neighbouring areas and that the same are restored by:

- (a) Ensuring proper demarcation of the project area to be affected by the construction works.
- (b) Strictly controlling construction vehicles to ensure that they operate judiciously and over designated areas to minimize destruction of vegetation.
- (c) Re-establishing vegetation in some or part of the disturbed areas through implementation of a well-designed landscaping programme by planting of ornamental trees, flowers and hedges. It is recommended that part of the topsoil excavated from the construction site be re-spread in areas to be landscaped to enhance plant health.

5.2.2 Excavation

5.2.2.1 Assessment

Excavation just like clearance of vegetation alters and/or destroys the habitats of these organisms. Excavation results into loose soil making soil prone to both water and/or wind erosion. This causes a disturbance in soil quality and structure though on a localized scale. Soil erosion results into siltation of water bodies receiving the run-off and eventually flooding in the lower areas.

5.2.2.2 Mitigation

- (d) Ensure proper demarcation of the project area to be affected by the construction works to avoid spillover effects to neighbouring areas.
- (e) All excavation and cutting to take place as instructed in the approved designs.
- (f) Ensure that all voids at the site including any water holding pan(s) are covered or filled up after construction to avoid injuries to people and/or animals.
- (g) Grass will be planted on these embankments to protect soil from erosion.

5.2.3 Extraction of construction materials

5.2.3.1 Assessment

The proposed project will require significant amounts of materials. The overall environmental impacts will be significant because of amounts required. Many construction materials are components of natural resources and their extraction has an effect of depletion of land resources and the subsequent off-site degradation of the environment.

5.2.3.2 Mitigation

- (a) The project will be evaluated to ensure that the design optimizes the use of materials.
- (b) Proper planning of transportation of materials will ensure that products of fossil fuels (diesel and petrol) are not excessively consumed.

5.2.4 Excess excavated soil

5.2.4.1 Assessment

Most of the excavated soil will be utilized at the site to adjust levels where necessary. However, if excess soil is not properly disposed, it is likely to result into nuisance as a source of solid wastes, dust and silt. Soil particles in form of dust in the air may cause respiratory diseases when they are inhaled.

5.2.4.2 Mitigation

- (a) Part of the topsoil excavated from the construction site to be re-spread in areas to be landscaped to enhance plant health.
- (b) Excess soil could be used in leveling the site, making bricks for walling purposes or be used in filling road potholes.
- (c) Excavated soil during the digging of fish ponds will be used to make embankments for the pond. These will be a good guard against run-off and flood waters into the ponds.

5.2.5 Soil compaction

5.2.5.1 Assessment

Ground moving machines compact soils. Compaction has the undesired effect of hindering air and water penetration beneath the soil surface and thus limiting aerobic activities of soil dwelling organisms. This may have negative consequences on soil productivity though at a localized scale. Compaction will also enhance run-off during the rainy season resulting into soil erosion.

5.2.5.2 Mitigation

- (a) Strictly control construction vehicles to ensure that they operate judiciously and over designated areas to reduce soil compaction.
- (b) Any compacted areas should be ripped off after construction to allow aeration of soil and ease infiltration of water into the soil.

5.2.6 Noise and vibrations

5.2.6.1 Assessment

Noise is unavoidable during the construction period. The construction works will most likely be a noisy operation due to the machines (mixers), incoming vehicles to deliver construction materials and communication among workers. The noise generated during any construction is at best described as part of a normal occupational hazard that workers in the construction industry face. Noise levels in construction works are usually below the threshold limit 90 dBA (can be transmitted to over 30 M away) that workers can be exposed to in an 8 hours working day and is consequently not of any major concern. Operations and people in the neighbourhood are likely to be affected since noise beyond 85 dBA (can be transmitted up to 30 M away) is itself a nuisance. The significance of noise impacts depends on whether the project would increase noise levels above the existing ambient levels by introducing new sources of noise. Noise and vibration impacts would be considered significant if the project would result in: a substantial permanent increase in ambient noise levels of more than 90 dBA in the project vicinity; exposure of persons to or generation of excessive ground-borne vibration or noise levels and a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. The effects of noise include:

- (a) Noise interferes with communication and can lead to tinnitus (ringing in the ears);
- (b) Nuisance;
- (c) Fatigue and tiredness, reduced efficiency, low morale and severe and permanent loss of hearing which may persist for several hours due to prolonged exposure to noise;
- (d) Deterioration of the environment within the project site and the surrounding areas through vibrations produced by heavy construction machinery;
- (e) Weakening of adjacent buildings resulting into cracking of their walls by vibrations.

5.2.6.2 Mitigation

Noise is to be minimized at the site and in the surrounding areas through:

- (a) Properly servicing and maintaining and tuning construction machinery such as generators and other heavy duty equipment to reduce noise generation or placing them in enclosures to minimize ambient noise levels;

- (b) Instructing truck drivers to avoid running of vehicle engines or hooting especially when passing through noise sensitive areas such as churches, residential areas, hospitals and schools;
- (c) Sensitization of truck drivers to switch off vehicle engines while off-loading and loading materials; and
- (d) Adhering to Kenya Noise Prevention and Control rule passed in 1996 under legal notice No. 296 as a subsidiary legislation to the Occupational Health and Safety Act (OSHA) of 2007 which require putting in place several measures that will mitigate noise pollution.

The following noise-suppression techniques will be employed to minimize the impacts of temporary construction noise and vibration:

- (a) Reasonable working hours should be maintained whenever possible to reduce the number of complaints concerning noise from the neighbouring residents;
- (b) Operation of shorter shift period for workers who come in direct contact with high concentrations of noise or other hazards;
- (c) Consider the rule which states that, “No worker shall be exposed to noise level in excess of the continuous equivalent of 90 dBA for more than 8 hours within any 24 hours duration”;
- (d) Post notices at the construction site informing the public of the construction activities, time and day; and
- (e) Provision of ear protective devices to prevent high frequency noise emitted by the high frequency machines during construction phase by both the proprietor and contractor.

5.2.7 Construction wastes and pollution

5.2.7.1 Assessment

During the construction phase, construction wastes including excess soil will form the main sources of pollutant. Potential sources of pollution may include:

- (a) Spillage of paints, cement and chemicals;
- (b) Improper disposal from the site of liquid and solid wastes including excess excavated soil;
- (c) Dust from the excavation, stone and shaping areas and from trucks carrying construction materials;
- (d) Pieces of waste timber, polythene papers, metals, glasses and tins among other wrapping materials;
- (e) Uncontrolled burning of wastes; and
- (f) Exhaust emissions containing contaminants such as nitrates and carbon-dioxide from automobiles including vehicles and machines and possible burning of wastes at the site.

5.2.7.2 Mitigation

- (a) All personnel working on the project are to be trained prior to starting construction. Specific training should be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles.
- (b) Construction vehicles’ drivers will be under strict supervision and instructions to minimize unnecessary trips and minimize idling of engines.
- (c) Dust emissions will be controlled by the following measures:

- i. Watering all dust-active construction areas to reduce dust emissions;

- ii. Covering all trucks hauling soil, sand and other loose materials and/or requires all trucks to maintain at least two feet of freeboard; and
 - iii. Paving or applying water when necessary or applying non-toxic soil stabilizers on all unpaved access roads and parking areas.
- (d) In order to reduce exhaust emissions, the following measures shall be implemented:
- i. Vehicle idling time will be minimized;
 - ii. Equipment will be properly tuned and maintained to good working conditions; and
 - iii. Proper planning of transportation of materials will be done to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road.
- (e) The following are the suggested measures to be observed during the construction of the proposed project so as to manage the effects of pollution:
- i. Carefully handling of chemicals and other potential pollutants. This should be achieved through prior training of the workers on use and safe disposal of these materials.
 - ii. Sawdust to be spread over spilt liquid pollutants and later be burned at a designated site away from any flammable materials at the construction site.
 - iii. Have a fully equipped first aid kit on the site at all times and ensure that trained first aid personnel are available to handle any incidents due to pollution at site. A typical first aid kit contains a first aid manual and is equipped with sterile adhesive bandages, safety pins, cleansing agent/soap, latex gloves; sterile gauze pads, bandages, non-prescription drugs, scissors, tweezers and antiseptic amongst others. First aiding can assist in containing blood loss among other emergency occurrences before medical attention is given.
 - iv. The contractor should provide PPE to all construction workers. PPE include masks, goggles, scarfs, footwear especially boots and overalls among other protective clothing as spelt out under section 101 (1) of OSHA 2007.
 - v. Operation of shorter shift period for workers in highly polluted working areas.
 - vi. Ensure presence of sanitary and waste disposal facilities at the construction site and their high standards of cleanliness.
 - vii. Any deliberate and purposeful burning must be controlled and supervised.
 - viii. Where possible material considered as waste may be re-used or recycled or be given to who may consider them useful for others uses.

5.2.8 Transition phase from construction to operation

During the transition phase from the completion of the development to the start of operations, the following will be done:

- a) Remove any wastes from the site.
- b) Extend sanitary and waste collection facilities at the site.
- c) Rehabilitate any areas adversely affected by the construction through spillages of pollutants at the site and any other areas disturbed as a result of the construction outside the site.
- d) Plant appropriate grass and trees at the site.
- e) Fence the site to protect it from the intruders and unauthorized persons and ensure privacy.

5.3 Potential adverse impacts during the operation phase

During the operation phase, the following activities are likely to affect the environment: risks of animals and people drowning in the ponds; over-extraction of water resources; death and theft of fish; creation of vector and rodents breeding grounds; degradation of air quality and sewerage and waste water.

5.3.1 Risks of animals and people drowning in the ponds

5.3.1.1 Assessment

Animals and people moving around the ponds could easily fall into the ponds and drown. The farm will be fenced and will be provided with a lockable gate. This will prevent entry of animals, children and unauthorized people into the dam area. Fish ponds that will be established in other areas outside the farm especially in other farms may suffer theft or become hazardous areas where domestic animals and children may drown.

5.3.1.2 Mitigation

- a) The pond areas will be fenced and will be provided with a lockable gate to keep away animals, unauthorized people and children.
- b) Grass around the ponds shall always be kept short so that it does not attract grazing animals.

5.3.2 Impacts to water resources

5.3.2.1 Assessment

SFFG proposes to use water to be extracted from the two reservoirs that will be constructed in the fish hatchery. Potential impacts on the water environment could result from over-extraction of ground water. However, the amount of water that will enter the ponds will be so insignificant that it may not result into conflicts with other water users or in depletion of underground water sources. Other impacts could result from reduced percolation to ground due to increase in non-permeable surfaces alongside increased storm water; contamination of water sources from waste water and chemicals, fuel and oil spills or leaks from various areas. If the sites for dumping solid wastes are not well taken care of, they may cause contamination to ground water source. The water that will be used in the ponds will serve the fish and will join surface water in the nearby stream.

5.3.2.2 Mitigation

- a) A water meter shall be installed at the site to monitor the quantity of ground water extracted from the reservoirs and used at the hatchery.
- b) All water users will be sensitized on the need to use water wisely.
- c) Limit water abstraction to that approved by the Water Resource Management Authority (WRMA).
- d) A tank of an appropriate capacity such as 10,000 litres to be installed for storage of water pumped from the well in order to ensure a steady supply especially during the dry season as the well could dry up.
- e) Plant trees and grass strips as a measure to increase the resident time of storm water on the ground to facilitate percolation and infiltration.
- f) Properly manage wastes as outlined in the report and implementation of a spill containment plan for management of leakages and spills.
- g) Use porous pavements and/or spaced slabs on pavements to facilitate infiltration.

- h) Install gutters and tanks to harvest and store rain water from the farm house so as to reduce run-off generation.
- i) Run-off to be handled by designing and construction channels to direct storm water into valleys. These must be designed to prevent ponding and flooding and must be kept open and no obstructions are to be built within them.

5.3.3 Impacts to fish and destruction of fish ponds

5.3.3.1 Assessment

Death of fish could result from poor pond management practices. Predators are a common feature at fish ponds. Birds such as the hummer cop and snakes are common in the area. This could prey on the fish from the ponds leading to loss of fish. Predator fishes could get into the ponds with the incoming water from the lake and the river. This will pose a threat to the fish in the ponds since they could prey on the fish in the ponds or introduce diseases. The people or playing children in the neighbourhood could steal fish from the ponds. If the level of surface run-off becomes higher than the embankments of the ponds, the flood water could easily get into the pond and kill, wash the fish stock out of the ponds and/or introduce predators or contamination into the pond. Use of fertilizers in the pond is good as it stimulates the growth of microscopic plants “bloom”. However excessive fertilization could lead to over-blooming leading to reduced oxygen circulation in water.

5.3.3.2 Mitigation

SFFG should employ the best pond management practices including:

- a) Clearing all bushes around the pond in order to remove hiding grounds for predators.
- b) Provide screens to the inlet pipes and ensure the inlets are the only entry points for water into the ponds by raising the banks of the ponds so that fish and other animals do not get into the pond through the inlet or by flooding water.
- c) The management should regularly visit and check the ponds to ensure that no children or thieves are roaming around the ponds.
- d) Fertilizing ponds to stimulate the growth of microscopic plants “bloom”.
- e) Regulating bloom and the amount of fertilizer and introduced feeds into the pond
- f) Keeping the area up the fish pond off chemical substances.
- g) Make earth berns or drainage channels upslope from the fish pond to prevent entry of surface run-off.

5.3.4 Degradation of air quality

5.3.4.1 Assessment

Air quality will be affected by dust which will be generated from: house-keeping activities such as: sweeping, exhaust emissions, decomposing wastes including fish gut contents and burning of wastes. Degradation of air quality will be worsened especially if there will be indoor congestion and if the solid wastes will be left uncollected for a long time. Exhaust emissions will include carbon monoxide (CO) and carbon dioxide (CO₂) due to incomplete combustion of fuel in poorly maintained vehicles coming at the site. The effects of the emissions may range from respiratory problems to affecting reproduction and development. Most of the pollutants are carcinogenic while others can contaminate food chains.

5.3.4.2 Mitigation

- (a) Internal roads will be maintained properly to reduce fugitive dust and provide for the smooth movement of vehicles.
- (b) Informatory signs shall be provided to encourage vehicle owners to maintain their vehicles.
- (c) Dust shall be suppressed by water spraying before sweeping.
- (d) Fish gut contents will be buried immediately after gutting.
- (e) Collection and disposal of wastes shall be done regularly and appropriately to avoid wastes decomposing at collection areas.

5.3.5 Creation of vector and rodents breeding grounds

5.3.5.1 Assessment

If the project commences with no well-designed storm water drains, the rain water may end up stagnating and hence creating conducive breeding areas for mosquitoes and other water based vectors leading to transmission of human diseases like malaria and cholera. The ponds themselves could become a potential breeding ground for mosquitoes if the circulation of water is not regular. Poor bush management practices around the ponds may also lead to breeding grounds mosquitoes.

5.3.5.2 Mitigation

- a) All hollow areas at the site should be filled with soil to prevent stagnation of water.
- b) The inlet and outlet pipes to the ponds should be properly fixed to ensure regular flow of water which will prevent water from staying in the ponds for a long time.
- c) Bushes and long grass around the dam will be cleared to prevent breeding of mosquitoes.

5.3.6 Sewerage and waste water

5.3.6.1 Assessment

The waste water could arise from water used to wash down fish gutting and handling areas and machines in the farm. Accidental flooding of waste water and sewerage system can flush into the storm water drainage system thereby creating biological hazards. Sewage and waste water have associated problems when they leak into the environment. Such problems include poor sanitation, nuisance and associated water-borne diseases. Poor surface drain management or large amounts of effluents may lead to blockage of drains which in turn could result to flooding and unsanitary conditions within the neighbourhood. Blocked drains produce bad odour and are a threat to general health, hence are environmentally unfriendly.

5.3.6.2 Mitigation

- (a) Regular inspection of the sewerage and drainage systems from the premises to minimize risk of flushing.
- (b) Periodic checks and regular maintenance should be carried out on all drainage channels and lines to the main sewer on the site.
- (c) All pit latrines will be cleaned daily and will be de-sludged every two years or whenever they near filling up.

5.4 Impacts during the decommissioning phase

5.4.1 Assessment

It is expected that the fish hatchery will produce fingerlings and fish annually in order to maintain a sustainable annual harvest. However, some farmers may abandon their fish ponds if they find them not profitable. Abandoned fish ponds become breeding grounds for mosquitoes and other disease causing agents. They are also hazardous areas that can lead to drowning. When fish ponds are abandoned, the pond areas will have to be rehabilitated in order to restore all damaged areas.

Demolition of structures is another critical part of decommissioning. The impacts of demolition include:

- a) The demolition works may lead to significant deterioration of the environment within the project site and the surrounding areas through noise and vibrations. Noise is a health hazard while vibrations have the effect of lowering the strength of adjacent buildings.
- b) Large quantities of dust will be generated during demolition works. Exhaust emissions will result from the machinery and equipment used in demolition. Dust and exhaust emissions are linked with health problems ranging from respiratory disorders to complex diseases of the respiratory system.
- c) Demolition of the project buildings and related infrastructure will result in large quantities of solid wastes. The wastes will contain the materials used in construction including concrete, metals, dry wall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since it is composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphates and ammonia which may be released as a result of leaching of demolition waste are known to lead to degradation of ground water quality.
- d) Impacts associated with occupational health and safety among others.

5.4.2 Mitigation to decommissioning phase impacts

- a) All farmers who intend to decommission their fish ponds shall prepare decommissioning plans and report the same to SFFG three months before decommissioning takes place. This will be reported to the Fisheries Officer for appropriate advice on how to manage abandoned fish pond areas.
- b) The water in the abandoned fish ponds will be drained and the inlets closed in order to prevent water from stagnating in the ponds.
- c) The ponds will be filled with soil initially used to make the embankments of the ponds.
- d) Decommissioning of a large number of ponds and alternative land-use options will be facilitated by appropriate professional personnel incorporating environmental experts among others.
- e) Mitigation for decommissioning phase impacts will follow general guidelines discussed in this report and in the decommissioning report which SFFG will prepare and submit to NEMA three months before decommissioning takes place.

5.5 Impacts cutting across phases

The following impacts could adversely affect the environment in one or more phases.

5.5.1 Fire

5.5.1.1 Assessment

If appropriate measures are not put in place, a fire outbreak can occur and cause great damage to property and even lead to death. Fires may start from lightening, leaking methane gas cylinders, poor handling of electrical appliances, leaving flammable material near fire points and careless disposal of lighting match sticks or cigarette stabs among others.

5.5.1.2 Mitigation

The following measures are important in mitigation of fires:

- a) The fish hatchery could be declared “A NO SMOKING ZONE” and clear notices of the same be displayed.
- b) Installation of fire extinguishers at strategic locations within and outside specific rooms such as stores and on the corridors as fire suppression measures. Areas where food is prepared should be equipped with fire blankets.
- c) The fire exits from the building should be labeled and clearly be seen.
- d) The proponent will liaise with a licensed fire officer when installing fire suppression equipment.
- e) An inventory should be made detailing all fire protection measures.
- f) A fire assembly point will be established outside the facility.
- g) Regular training of personnel concerning emergencies including those involving fire out-breaks.
- h) Regular inspection of the firefighting equipment which must be available on the site at all times.
- i) “NO SMOKING” and “FIRE EXIT” signs should be prominently displayed in the building.
- j) Subject to availability of resources fire alarms incorporating smoke sensors and fire hose reels could be installed.
- k) Enough parking spaces for emergency vehicles to be provided.

5.5.2 Increased demand on energy resource-use

5.5.2.1 Assessment

During the construction period, electricity may be required to run machines such as soil compacting machines and drills. Fuel will be required to run generators and construction vehicles. On completion, the project shall consume large amount of electricity for lighting and running of machines and equipment. More energy will be consumed by equipment and other electricity depended appliances in the building. Since electric and fuel in Kenya are generated mainly through natural resources, namely water and geothermal resources, increased use of electricity have adverse impacts on these natural resource bases and their sustainability. It is the government policy to minimize energy consumption. Use of electricity and fuel is also associated with other adverse impacts. Improper handling of electricity may lead to shocks, electrocution and damage to electrical appliances. On the other hand fuels are usually inflammable. Leaks and spills of the fuels may lead to explosions and fires leading to destruction of property injuries and deaths.

5.5.2.2 Mitigation

Some of the options for minimization of energy include:

- (a) Use of energy efficient night-time lighting only at the site;

- (b) Light sensor switches are to be provided to ensure outdoor lights are not used in daytime;
- (c) All energy using equipment used should be switched off when not in use; and
- (d) Consider installing alternative energy sources such as solar panels and generators not only for power back-up but also to reduce dependency on electricity.

Control of fires and explosions is important in energy use and management so as to: reduce damage on property, avoid injuries and accidents and protect electrical appliances and lives. In this case:

- (a) Weather proof all lighting and power points located outside the proposed building;
- (b) Install lightning arresters; and
- (c) Ensure proper handling, storage and use of fuel and electricity.

5.5.3 Increased traffic flow

5.5.3.1 Assessment

During the construction, there will be an influx of traffic to and from the proposed construction site. There will be increased movement for both vehicles and people on the existing access roads near the site. Vehicles especially those to be used in facilitating the construction work for example transportation of construction materials and/or construction workers or supervisors to the site. People coming to the site will be those seeking employment opportunities, workers, managers, environmental inspectors and suppliers of foodstuffs to the construction workers. Though increased traffic during construction is a short term impact, it has the effect of causing congestion on the access roads which may subsequently result in accidents on the roads. During the operation phase, traffic flow will increase due to the increase in number of people visiting the premises. These will include workers; visitors; members; clients and environmental inspectors among others. However, it is expected that traffic flow during the operation phase will be controlled and thus of no major concern.

5.5.3.2 Mitigation

- (a) Adequate space to be created at the entrance/exit along the access road to give drivers enough room to manoeuvre into and out of the project site;
- (b) Enough parking spaces are to be provided;
- (c) Proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road.

5.6 Impacts related to occupational health and safety

5.6.1 Assessment

There are three main types of occupational health and safety hazards that may be of concern. These are physical, chemical and biological. Potential physical hazards at the proposed development during the construction and operational phases will ordinarily include noise, accidents and accidental occurrences. Chemical hazards will involve exposure to harmful gases and chemicals either by inhalation, ingestion or by skin contact especially of volatile chemicals which penetrate the body. Biological hazards involve exposure to pathogenic organisms which may cause diseases. The following potential impacts could affect occupational health and safety:

- (a) Fire hazards
- (b) Noise and vibrations

- (c) Congestion
- (d) Poor sanitation and presence of potential environmental pollutants at the site including waste water, decomposing solid wastes, dust and exhaust emissions and used chemicals and equipment which could result into waterborne diseases such as typhoid.
- (e) Accidents including cuts, pricks and bruises; electrocution from naked electrical cables; falling in uncovered manholes and trenches, from raised places and on slippery or poorly constructed floors; drowning in the fish ponds and suffocation from gas accumulation or lack of oxygen in confined spaces. Accidents could result from lack of supervision and safety and job training, improper handling of machinery and hand tools and inappropriate carrying out of tasks.

5.6.2 Mitigation

Mitigation options to most of the occupational health and safety impacts such as noise and vibrations; fires and degradation of air quality have been discussed. Below are additional mitigation measures to more of the occupational health and safety impacts.

- (a) Provide appropriate PPE which must be worn in all situations where the body and skin are potentially exposed to hazards such as chemicals, harmful dusts, highly infectious wastes, sharp objects, burns and extreme temperature or are working in areas that present threatening experiences.
- (b) Provide equipped first aid kits and other facilities and services.
- (c) Ensure that trained first aid personnel are available on site at all times to handle emergencies.
- (d) Control of waterborne diseases by conducting regular maintenance of pipes and taps to fix leakages and prevent underground leakages which contaminates water; ensuring sanitation at the site as outlined in this report; regularly conducting chemical and bacteriological quality of the water to ascertain its suitability for consumption and treating water before drinking using approved home-based treatment methods such as filtration using life-straw, boiling and use of chemicals such as water guard.
- (e) Ensure adequate water supply to ensure high standards of sanitation that keeps to the minimum chances of disease outbreaks.
- (f) Construct pit latrines after advice from Public Health Officers to ensure underground water resources are not contaminated by human wastes. The latrines should always be kept clean.
- (g) Frequently train personnel in order to make them have a basic understanding of the tasks they handle, the hazards involved and how to manage them.
- (h) Ensure high standards of construction as recommended in approved design drawings including providing a working space of at least 10 M³ excluding the space above 4 M high as per the OSHA of 2007 and regular maintenance to increase the life of the building making it safe for occupation and to reduce the degree of pollution in the water supply system.
- (i) Provide hazard notifications, signage and warnings to warn visitors and staff of potential dangers that may exist in different areas of the facility, or warn the persons on potential consequences of their actions should be put in place.
- (j) Ensure employee welfare including provision of free or subsidized medical attendance if injured on work and making provisions for leaves and offs.
- (k) Opening windows and using exhaust fans at strategic points to allow good air circulation into and out of the houses and working areas.

- (l) Fence the site to protect the site, provide privacy to the site, reduce cases of trespass and theft and also control entry by straying animals and therefore avoid conflicts between workers at the site and the surrounding community.
- (m) Advising workers and visitors to take precautions not to cause any effect on their own health or to the health of other persons.
- (n) Allowing only controlled burning at the site.

5.7 Potential positive impacts

Some of the potential socio-economic gains of the proposed project include:

- (a) Improved security: Lighting up and fencing the proposed site will improve the security within the project area.
- (b) Increased production of fish and easy access to fingerlings: The project will establish a fish hatchery and fish ponds. This will provide farmers in the area easy access to fingerlings and will add fish production in the area and thus reduce reliance on the lake as a source of fish. More fish will readily be available to provide as an alternative source of protein to fish to members of the community especially children. This will improve growth and health in the area.
- (c) Enhancement of the economy: The proposed development project is estimated to cost millions of Kenya shillings over a period less 12 months. This means that the project will inject substantial capital into the economy. For instance, it is estimated that 70% of the project cost will be used in the procurement of materials for construction such as stones, bricks, sand, steel, tiles and cement among others. The supply of these materials translates into boosting the economy at both local and national levels. The multiplier' effect of this translates into increased revenue to the county and national governments in terms of tax and other service charges. In addition, there will be a positive gain for the revenue to be collected from the project proponent by the government including NEMA EIA license application fee among others.
- (d) Creation of employment opportunities: During construction, it is estimated that 30 % of the project cost will be reflected in employment of professional services and labour. These includes professional services of Physical Planners, Environmental Experts, Land Surveyors, Architects, Engineers and skilled and unskilled labour for about 20 – 30 people. During operation, one of the long-term major impacts since casual and permanent employees will be employed to work in the hatchery. Indirect employment will be created where suppliers of food stuffs and other goods and products will gain income by supplying their commodities.
- (e) Improved living standards: The project will by extension help improve the living standards of those who will get employed at the site including those operating related businesses or suppliers of foodstuffs and construction material or operation equipment.
- (f) Enhancement of public health and safety: The general enhancement of public health and safety will be achieved through proper management of solid and liquid wastes.
- (g) Improvement of the physical environment: The proposed building layout plan is indeed an attractive modern design development project in the area. Spill-off infrastructure development will entail road expansions, drainage improvements, as well as an improvement to the general aesthetic of the area. The proposed development adds to improved aesthetics of the local area. This will attract new residents and new businesses into the area.

5.8 Record keeping and documentation

In accordance with the EMCA (1999), records of environmental issues, relevant licenses and permits need to be kept and availed to NEMA or other government officers when necessary to prove compliance. These include waste disposal permits and records, accident registers, inspection records, training records, discharge monitoring reports, trading licenses and a list of all hazardous materials on site among others. For efficient management of the facility; to facilitate further assessments and to comply with the law, the following records will always be kept in addition to those mentioned above:

- (a) Documented emergency management procedures such as fire response plans;
- (b) List of materials according to approved classification schedule;
- (c) Staff training records in environmental issues and periodic review notes;
- (d) Health records;
- (e) Violation notifications and authorities' correspondence in relation to the environment; and
- (f) EA reports to NEMA in accordance with Section 68 (3) of EMCA, 1999.

5.9 Public participation

5.9.1 Introduction

Members of the public are supposed to participate and get involved because the project being carried out will affect them. Reference is made to Section 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003, which states that the proponent shall in consultation with the authority, seek the views of persons who may be affected by the project. The role of public consultation and involvement in EIA process is to assure the quality, comprehensiveness and effectiveness of the assessment and ensure that the public views are adequately taken into consideration in decision making process. This public participation was conducted through administration of questionnaires to the members of SFFG and the area residents including immediate neighbours of the proposed site.

5.9.2 Outcomes of public participation

The locals greatly appreciated that the proponent had given them a chance to participate in the decision making process concerning the proposed project. Issues raised included cleanliness and foul smell from the hatchery. After a lengthy discussion on the proposed project, the locals allowed the proponent to carry on the proposed project. The meeting was concluded as follows:

- a) Members of the community were happy that the project would partly solve the problems of unemployment. It was concluded that the proponent should give priority to the community members when offering job opportunities at the proposed site an issue that was reinforced by the area leaders. The people advised the proponent to put up a fence around the site in order to enclose the site and make it secure.
- b) Neighbours of the proposed project site were optimistic that the establishment and lighting of the proposed project would lead to improved security situation in the area and would open up the area for other development opportunities. The public participation comment sheets are provided as appendices.

6 ANALYSIS OF PROPOSED PROJECT ALTERNATIVES

6.1 Introduction

The purpose of this section is to examine feasible alternatives to the project. The benefits of the proposed project will be considered against any potential environmental cost. The general principle involved in identifying alternative option(s) to a proposed development is to ensure that the option chosen would result in optimal social, environmental and capital benefits not only for the developer, but also for the environment and stakeholders in the area. This section is a requirement by NEMA and is critical in consideration of the ideal development with minimal environmental disturbance. The following feasible land-use options will be compared in terms of cost and benefit criteria: environmental impacts, social acceptability, economics (including productivity of land-use) and design feasibility.

6.2 “No-action” alternative

6.2.1 Assessment

The selection of the “No-action” alternative would mean the discontinuation of the proposed project. Thus, the site is retained in its existing form. If this alternative is selected, the site is unlikely to undergo any major changes from its present condition and the vegetation present at the site will not be affected. This option may be based on the principles that the proposed:

- a) Site is environmentally sensitive such as having one or more threatened, rare, endangered, endemic or key stone plant or animal species or any other flora or fauna that is considered for preservation under an Act of Parliament;
- b) Site is found in an archaeological or historical site or is found to have a historically or archaeologically important material; and/or
- c) Project will have severe implications on the environment if implemented.
- d) Project is found in an area planned for other development plans in accordance with the Physical Planning Act, 1999, (Cap. 286) Revised Edition 2009; and/or
- e) The proposed plot has major issues regarding land ownership.

6.2.2 Findings

- a) The proposed development will not be an impediment to any other development in the area.
- b) The products of the proposed project will not have serious implications on the environment.
- c) There are no physical, biological, cultural and socio-economic features of concern at/or near the proposed site.

6.2.3 Implications

- a) The owner would be at a loss in terms of financial commitments already made in designing and planning for the project: application fees to the county government; professional fees to the project managers, architects, quantity surveyors, land surveyors, EIA lead experts, public health officers and physical planners and application for EIA approval and licensing from NEMA.
- b) There would be loss of jobs that the project is envisioned to create.
- c) The goals of the project including provision of fingerlings will not be realized.
- d) The county and central government will not gain from the tax income that the project would generate if implemented.

- e) It would discourage the proponent and any other local and international investors from investing in similar projects or in the area.

6.3 Relocation Alternative

6.3.1 Assessment

This option would mean transfer of the proposed development to another site. If this option is selected the proponent is required to look for an alternative site either within or outside the zone. This option may be based on the principles that the proposed development:

- a) Is to be sited in a zone planned for other developments or the project will be an impediment to future developments;
- b) Is a hindrance to an existing development;
- c) Is not compatible with other developments in the area; and
- d) As in the ‘no-development’ option the project site is ecologically sensitive area.
- e) The proposed plot has major issues regarding land ownership.

6.3.2 Findings

- a) The proposed development will not be an impediment to any other development in the area since there are other similar facilities in the neighbourhood.
- b) The products of the proposed project will not have serious implications on the environment in the neighbourhood.
- c) There are no physical, biological, cultural and socio-economic features of exceptional concern at or near the site.
- d) At the moment, the proponent does not have an alternative site.

6.3.3 Implications

- As in the ‘no-action’ option, the owner would be at a loss in terms of financial commitments already made in designing and planning for the project.
- It might take a very long time looking for and finding a similar sized land and completing all official transactions relating to change of land ownership.
- There is also no guarantee that the land would be available, and if such land is available, its cost might be beyond affordable means for the proponent.
- With the changing demand and supply at the market, the prices and availability of materials to be used may not be promising to the proponent at the time the proposal is finally approved by the authorities.
- As in the ‘no-development’ option, the owner would be at a loss in terms of financial commitments already made in designing and planning for the project.
- The processes of designing and planning will have to be started over again. This means that the proponent will have to undergo an extra expense in designing and planning for the project.

6.4 Alternative land-uses

6.4.1 Assessment

The option allows the developer to explore other alternative land uses for the site other than the proposed mixed development. This option requires application for change or extension of use to allow for the alternative development. This option may be based on the principles that the proposed development:

- a) Is not compatible with the existing land-uses; and
- b) As in the ‘no-development’ option, the project will have severe implications to the environment if implemented.

6.4.2 Findings

- a) The proposed development will not be an impediment to any other development in the area since there are other similar facilities in the neighbourhood.
- b) The products of the proposed project will not have serious implications on the environment in the neighbourhood.

6.4.3 Implications

- Change of use of land might take a long time to mature since it requires relevant authorities to approve the change of land-use.
- The new land-use may be incompatibility with current neighbourhood land uses or be massively objected by the residents in the neighborhood.
- As in the relocation option, the processes of designing and planning will have to be started over again thus presenting an extra expenditure to the proponent.
- With the changing demand and supply at the market, the prices and availability of materials to be used in the new land-use may not be promising to the proponent at the time the proposal is finally approved by the authorities.

6.5 The proposed development as described in the EIA report

The impacts and mitigation measures for this alternative are discussed in detail throughout this report. The positive impacts have also been identified. The Merits of this alternative are as follows:

- The property (land) value will appreciate and the investment made in the property will be productive from the optimal economic and spatial land-use.
- Security will be alleviated as the visual and aesthetic amenities are improved.
- The community will have a potential source of income through the supply of materials, self-sustainability, employment opportunities and will enjoy easy supply of fish and fingerlings.
- The local and national economies will improve from the revenue to be collected from the facility.

7 ENVIRONMENTAL MANAGEMENT AND MONITORING

7.1 Environmental management

Environmental management is best achieved by preparation and implementation of an Environmental Management and Monitoring Plan (EMP). The plan ensures that environmental impacts are identified and

mitigated during all phases of the project. The EMP presented below has been proposed for this project and outlines corresponding management strategies that will be employed to mitigate potential adverse environmental impacts and assigns responsibility for the implementation of the mitigation measures. All costs are estimates and may change in time and space. As project commencement and scheduling plans are developed and changed, components of the EMP might require amending. The EMP is generally prepared to ensure that the components of proposed project are operated in accordance with the design.

7.2 Proposed development without an EMP

This scenario is based upon the assumption that the proposed development would go on without any environmental management options being provided. The total project impact for the scenario is on the appreciably adverse side. This will show that if the project goes ahead without EMP, the adverse impacts on the existing environment would be major.

7.3 Proposed Development with an EMP

If the environmental management strategies discussed in the EMP are fully implemented, the adverse impact of the project would be reduced, and there will be an overall improvement in physical, chemical, biological and socio-economic environment of the region.

7.4 Environmental monitoring and audits

Environmental monitoring and audits are conducted to establish if project implementation has complied with established environmental management standards. Environmental monitoring and audits will be conducted to ensure that identified potential negative impacts are mitigated. EAs will be conducted annually and will be based on the EMP. EA reports will be submitted to the Authority.

Table 6.1: Proposed EMP for the construction phase of the Proposed Fish Hatchery

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
Removal of vegetation, excavation, compaction and ground surface sealing				
<ul style="list-style-type: none"> • Loss of valuable food and shelter for arthropods • Death and/or displacement of fauna • Soil erosion and siltation • Alteration or destruction of animal habitats • Increased run-off • Change of soil structure and texture • Reduced percolation and infiltration 	Re-establish vegetation through implementation of a well-designed landscaping programme	SFFG	High	5,000
	Level the project site to reduce run-off velocity and increase infiltration of storm water into the soil	SFFG and Site Manager	High	1,000
	Rip off any compacted areas to reduce run-off	Site Manager	Medium	1,000
	Provide interconnected open drains as a measure to control movement of surface run-off	Contractor and Site Manager	High	10,000
	Demarcate the project area to be affected by the construction works to avoid spill-over effects	Contractor and SFFG	Low	–
	Regularly inspect the waste water and sewerage systems	Site Manager	Medium	–
	Consider using porous pavements and/or spaced slabs on pavements to facilitate infiltration	Contractor	Medium	10,000
	Install gutters to harvest rain water from the roof of the building and water tanks to store the harvested water and thus reduce surface run-off	SFFG and Contractor	Medium	35,000 per 5,000 litre plastic tank
Noise and vibration				
<ul style="list-style-type: none"> • Hearing problems • Damage to the ears • Lowering the strength of buildings 	Switch off machines and vehicles that are not in use	Drivers and other machine operators	High	–
	Avoid hooting of vehicles at the site and when passing through sensitive areas such as churches, schools and hospitals	All drivers	High	–
	Keep all machinery in good condition to reduce noise generation	Contractor, Site Manager and all drivers	High	5,000 per service
	Keep all generators and noisy equipment in sound proof rooms or in enclosures to minimize ambient noise levels	Site Manager	High	10,000
	Provide workers in noisy areas with ear muffs	Site Foreman	High	500 per piece

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
	Carry out noisy works only during the day time when most of the neighbors' are at work	Contractor and Site Manager	High	–
Solid wastes				
<ul style="list-style-type: none"> • Soil and water contamination • Creation of breeding grounds for vectors, rodents and other disease causing and/or transmitting organisms disease • Choking of water bodies • Diseases • Nuisance • Global warming 	Use of an integrated solid waste management system (recycling, reuse, combustion and sanitary land filling)	Contractor and Site Manager	High	–
	Collect and dispose-off solid wastes from the site regularly to prevent them from piling at the site	Contractor and Site Manager	High	100 on every collection
	Ensure source separation and collection of wastes into recyclable and non-recyclable wastes by installation of double waste collection bins at each collection point	Contractor and Site Manager	High	4,000
	Remove from site and/or recycle/re-use at and/or away from site all machinery, equipment, structures and partitions that will not have been used up	Contractor and SFFG	Low	5,000
Extraction and usage of construction materials				
<ul style="list-style-type: none"> • Depletion of land resources • Solid wastes • Off-site degradation of the environment • Pollution • Health hazard • Conflicts with other users 	Evaluate and plan for the project to ensure that the design optimizes the use of construction materials	Contractor, SFFG and Quantity Surveyor	High	10,000
	Purchase construction materials incrementally to avoid excess materials being left behind	Contractor	Low	–
	Rehabilitate any areas adversely affected by the construction	Contractor and Site Manager	High	5,000
	Recycle and re-use some construction materials	Contractor	Medium	–
Dust and exhaust emissions				
<ul style="list-style-type: none"> • Health hazard • Visual obscurity • Degradation of air quality 	Water all dust-active areas to suppress dust	Site Manager	High	100 per day
	Pave or apply non-toxic soil stabilizers on all unpaved access roads and parking areas	Contractor and Site Manager	Low	5,000
	Spread sawdust over spilt liquid pollutants and later burn the sawdust at an appropriate site	Site Manager	Low	500

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
	Cover all trucks hauling soil, sand and other loose materials	Truck Drivers	Low	1,000
	Provide all construction workers with PPE	Contractor and Foreman	High	5,000
	Strictly enforce on-site speed limit regulations	Site Manager	Medium	–
	Avoid excavation works in extremely dry weathers	Contractor	Medium	–
	Minimize vehicle idling time	All drivers	Low	–
	Properly service, maintain and tune all equipment	Contractor, Site Manager and all drivers	High	5,000 per service
Water-use				
<ul style="list-style-type: none"> Over-extraction of water resources Conflicts over water-use Wastage of water Increased demand on water resources 	Recycle and re-use water	Contractor, Site Manager and all workers	High	–
	Ensure taps are not running when not in use	Site Manager and all workers	High	–
	Install bigger storage facilities (such as 5,000 litre plastic tanks) to be able to cope with potential stresses in supply	Contractor and	High	35,000 per 5,000 litre plastic tank
	Conduct regular checks, inspections and maintenance of pipes, taps and storage containers and tanks to fix leakages	Site Manager and all workers	High	5,000 per maintenance
Waste water and sewerage				
<ul style="list-style-type: none"> Health hazard and pollution Degradation of water resources 	Properly use and clean sanitary facilities daily	Site Manager and all workers	High	300 per day
Energy consumption				
<ul style="list-style-type: none"> Over consumption of electricity 	Switch off lighting fluorescent tubes during the day and all other electrical appliances when they are not in use	Site Manager and all workers	High	–

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
<ul style="list-style-type: none"> Health and safety hazard Risks of damage to electrical appliances 	Weather proof all lighting and power points	Site Manager	High	5,000
	Install meters to monitor energy consumption	Project Manager	High	5,000 per metre (Kenya Power rates apply)
Increased traffic flow				
Risks of accidents as vehicles and persons are entering or exiting the facility	Place prominent signage alerting parking areas for vehicles	Site Manager	High	1,000
	Regularly service vehicles to ensure that they are in good condition	All drivers	High	5,000 per service
Fires				
<ul style="list-style-type: none"> Injuries and deaths Destruction of property 	Prominently display ‘NO SMOKING’ signs at the site especially in areas where flammable materials are stored or used	Site Manager	High	1,000
	Put in place a variety of fire prevention measures (fire extinguishers, fire blankets, sand buckets and fire hose reels where appropriate)	Contractor and Site Manager	High	7,000 per fire extinguisher, 3,000 per fire blanket, 500 per sand bucket and 50,000 per fire hose reel
	Maintain first aid kits and cylinders at the site	Contractor and	Medium	1,500 per kit
	Regularly train personnel in relation to fire emergencies	Contractor and all workers	Medium	5,000 per trainee
Record keeping and documentation				
Environmental degradation	Develop procedures for documentation of records keeping of all environmental and health concerns	Contractor and Site Manager	High	500 per month

Table 6.2: Proposed EMP for the operation phase of the Proposed Fish Hatchery

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
Solid wastes				
<ul style="list-style-type: none"> • Pollution and nuisance • Creation of breeding grounds for vectors, rodents and other disease causing and/or transmitting organisms • Choking of water bodies • Blockage of drainage systems 	Use of an integrated solid waste management system (recycling, re-use, combustion and sanitary land filling)	Project Manager	High	–
	Collect and dispose-off solid wastes from the site after everyday	Project Manager	High	100 on every collection
	Ensure source separation and collection of wastes into recyclable and non-recyclable wastes by installation of double waste collection bins at each collection point	Project Manager	High	4,000
	Comprehensive biological organic matter management	Project Manager	High	–
	Cover the solid waste collection areas to minimize invasion by pests and rodents or other animals	Project Manager	High	1,000
	Separate solid and liquid hatchery wastes by spinning for ease of management	Project Manager	Medium	50,000
Pond management				
<ul style="list-style-type: none"> • Entry of surface run-off into the pond • Predation and theft to fish • Fish diseases • Growth of weeds in the pond • Death of fish 	Fertilize ponds to stimulate the growth of the microscopic plants “bloom” which is fed on by fish	Project Manager	High	500 every three months
	Fence the pond area 2 M from the pond edge to prevent entry by unauthorized persons	Project Manager	Medium	5,000
	Regulate bloom and the amount of manure, fertilizer and introduced feeds into the pond in order to maintain the water clear and promote penetration of light and circulation of oxygen	Project Manager	Medium	–
	Keep the area up the fish ponds off chemical substances such as herbicide sprays as these may be carried into the fish pond by surface run-off	Project Manager	Medium	–

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
	Make an earth bern or a drainage channel upslope from the fish pond to prevent entry of surface run-off which pollutes the pond and introduces foreign and toxic substances	Project Manager	High	1,000
Dust and exhaust emissions				
<ul style="list-style-type: none"> • Health hazard • Visual obscurity • Degradation of air quality 	Water all dust-active areas to suppress dust	All cleaners	High	100 per day
	Spread sawdust over spilt liquid pollutants and later burn the sawdust at an appropriate site	Project Manager	Low	500
	Minimize vehicle idling time near the site	All drivers	Low	–
	Properly service, maintain and tune all equipment where applicable	Project Manager	High	5,000 per service
	Provide adequate ventilation in the farm house and store by opening windows	All workers	High	–
Water-use				
<ul style="list-style-type: none"> • Over-extraction of water resources • Conflicts with other water users • Wastage of water • Increased demand on water resources 	Recycle and re-use water	Project Manager	High	–
	Ensure taps are not running when not in use	All workers	High	–
	Construct bigger storage facilities (such as 5,000 litre plastic tanks) to be able to cope with potential stresses in supply	Project Manager	High	35,000 per 5,000 litre plastic tank
	Conduct regular checks, inspections and maintenance of pipes, taps and storage containers and tanks to fix leakages	Project Manager	High	5,000 per maintenance
	Fix and use self-closing taps with shorter hand-wash cycles at some points of the building	Project Manager	Low	1,500 per tap
Liquid wastes and sewerage				
<ul style="list-style-type: none"> • Degradation of water resources • Health hazard and pollution 	De-sludge pit latrines whenever they fill up or where appropriate (every two years)	Project Manager	High	5,000 per maintenance
	Properly use and clean sanitary facilities daily	All users	High	300 per day

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
	Conduct regular checks to detect and correct waste water pipe blockages, damages and leakages	Project Manager	High	5,000 per maintenance service
Fires				
<ul style="list-style-type: none"> • Injuries and deaths • Destruction of property 	Prominently display ‘NO SMOKING’ signs at the site especially in areas where flammable materials are stored or used	Project Manager	High	1,000
	Inspect the fire equipment every three months	Project Manager	High	5,000 per service
	Maintain first aid kits and cylinders in the building	Project Manager	Medium	1,500 per kit
Energy consumption				
<ul style="list-style-type: none"> • High Mains-electricity consumption • Health hazard • Risks of fires • Risks of damage to electrical appliances • Increased demand on energy resources 	Use energy-saving lights such as fluorescent tubes	Project Manager	High	4,00 per bulb
	Use light-sensors to automatically switch-off lighting equipment during the day	Project Manager	Low	1,000 per switch
	Switch off lighting fluorescent tubes during the day and all other electrical appliances when they are not in use	All workers	High	–
	Install alternative energy sources such as solar panels and automatic generators not only for power back-up but also to reduce dependency on electricity	Project Manager	Medium	10,000 per solar panel and 35,000 per generator
	Weather proof all lighting and power points	Project Manager	High	5,000
	Install lightening arresters	Project Manager	Medium	10,000
Increased traffic flow				
Risks of accidents	Place prominent signage alerting road users of the presence of the dairy shed and parking areas	Project Manager	High	1,000
Record keeping and documentation				

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
Environmental degradation	Develop procedures for documentation of records keeping of all environmental and health concerns as outlined under section 4.8	Project Manager	High	500 per month

Table 6.3 Proposed EMP for the decommissioning phase of the Proposed Fish Hatchery

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
Solid wastes				
<ul style="list-style-type: none"> • Soil and water contamination • Creation of breeding grounds for vectors, rodents and other disease causing and/or transmitting organisms disease • Choking of water bodies • Nuisance • Global warming 	Use of an integrated solid waste management system (recycling, reuse, combustion and sanitary land filling)	Contractor and Site Manager	High	–
	Collect and dispose-off solid wastes from the site regularly to prevent them from piling at the site	Contractor and Site Manager	High	100 on every collection
	Ensure source separation and collection of wastes into recyclable and non-recyclable wastes by installation of double waste collection bins at each collection point	Contractor and Site Manager	High	4,000
	Remove from site and/or recycle/re-use at and/or away from site all machinery, equipment, structures and partitions that will not have been used up	SFFG and Site Manager	Low	5,000
Dust and exhaust emissions				
<ul style="list-style-type: none"> • Health hazard • Visual obscurity • Degradation of air quality 	Water all dust-active areas to suppress dust	Site Manager	High	100 per day
	Pave or apply non-toxic soil stabilizers on all unpaved access roads and parking areas	Contractor and Site Manager	Low	5,000
	Spread sawdust over spilt liquid pollutants and later burn the sawdust at an appropriate site	Site Manager	Low	500
	Cover all trucks hauling soil, sand and other loose materials	Truck Drivers	Low	1,000
	Provide all workers with PPE	Site Manager and Foreman	High	5,000
	Strictly enforce on-site speed limit regulations	Site Manager	Medium	–
	Avoid demolition works in extremely dry weathers	Site Manager	Medium	–
	Minimize vehicle idling time	All drivers	Low	–
	Properly service, maintain and tune all equipment	Contractor and Site Manager	High	5,000 per service
	Provide adequate ventilation in the houses for site caretakers	Site Manager	High	–

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
Noise and vibration				
<ul style="list-style-type: none"> • Hearing problems • Damage to the ears • Lowering the strength of buildings 	Switch off machines and vehicles that are not in use	Drivers and other machine operators	High	–
	Avoid hooting of vehicles at the site and when passing through sensitive areas such as churches, schools and hospitals	All drivers	High	–
	Keep all machinery in good condition to reduce noise generation	Contractor, Site Manager and all drivers	High	5,000 per service
	Keep all generators and noisy equipment in sound proof rooms or in enclosures to minimize ambient noise levels	Site Manager	High	10,000
	Carry out noisy works only during the day time when most of the neighbours are at work	Site Manager and all workers	High	–
	Provide workers in noisy areas with ear muffs	Foreman	High	500 per worker
Water-use				
Over-extraction and wastage of water resources	Recycle and re-use water	Site Manager	High	–
	Ensure taps are not running when not in use	Site Manager	High	–
Waste water and sewerage				
<ul style="list-style-type: none"> • Health hazard • Pollution 	Properly use and clean sanitary facilities daily	Site Manager and all workers	High	300 per day
Energy consumption				
<ul style="list-style-type: none"> • High mains-electricity consumption • Health and safety hazard 	Switch off lighting fluorescent tubes during the day and all other electrical appliances when they are not in use	Site Manager and all workers	High	–
	Wise use of electricity	Site Manager and all workers	High	–
Increased traffic flow				

Area of concern	Recommended measures	Responsible party	Priority level	Approximate cost (Kshs.)
Risks of accidents as vehicles and persons are entering or exiting the facility	Place prominent signage alerting parking area for incoming vehicles to the facility	Site Manager	High	1,000
Fires				
<ul style="list-style-type: none"> • Injuries and deaths • Destruction of property 	Prominently display ‘NO SMOKING’ signs at the site especially in areas where flammable materials are stored or used	Site Manager	High	1,000
	Put in place a variety of fire prevention measures (fire extinguishers, fire blankets, sand buckets and fire hose reels)	Site Manager	High	7,000 per fire extinguisher, 3,000 per fire blanket, 500 per sand bucket and 50,000 per fire hose reel
	Maintain first aid kits and cylinders at the site	Site Manager	Medium	1,500 per kit
Record keeping and documentation				
Environmental degradation	Develop procedures for documentation of records keeping of all environmental and health concerns	SFFG and Site Manager	High	500 per month

Table 6.4: Proposed EMP for Occupational Health and Safety Impacts at the Proposed Fish Hatchery

Area of concern	Management	Responsibility	Time frame	Approximate cost (Kshs.)
Registration of the premises	Register the premises under the Occupational Health and Safety Act Cap 514, of the Laws of Kenya is mandatory	Contractor, proponent and all occupants	One-off	5,000
General register	Keep a general register within the facility as stipulated in Section 62 (1) of OSHA	Contractor, proponent and all occupants	Continuous	500 per month
Incidents and accidents	Report any incidents and accidents using prescribed forms obtainable from the Occupational Health and Safety Office	Site Safety Officer	Continuous	500/month
	Conduct regular safety education and training	Site Safety Officer	Quarterly	5,000 per trainee
	Prepare a contingency plan for emergency response	Site Safety Officer	One-off	10,000
Insurance	Insure the premises as per statutory requirements (third party and workman's compensation)	Proponent and all occupants	Annually	5,000 per year
Safety healthy environment (SHE) policy	Develop, document and display prominently an appropriate SHE policy	Site Safety Officer	One-off	1,000
Sanitary conveniences	Provide suitable, efficient, clean, well-lit and adequate sanitary amenities at the site taking care of gender division	Contractor and proponent	One-off	50,000
Machinery/equipment safety	Ensure that machinery, equipment, PPE, appliances and tools comply with the prescribed safety and health standards and are appropriately installed, maintained and safeguarded	Contractor, proponent and all occupants	One-off	–
Storage of materials	Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse	Contractor, proponent and all occupants	Continuous	–
Safe means of access and safe place of employment	All floors, steps, stairs and passages of the premises must be of sound construction and be properly maintained	Contractor, proponent and all occupants	Continuous	–
Lighting	Provide adequate artificial or natural lighting in all parts of the premises where persons are working or passing	Contractor, proponent and all occupants	One-off	–
Emergency preparedness and evacuation procedures	Design suitable documented emergency preparedness and evacuation procedures for emergencies	Site Safety Officer	One-off	1,000
First aid	Have on site a stocked first aid box which is easily available and accessible	Site Safety Officer	One-off	1,500 per kit

Area of concern	Management	Responsibility	Time frame	Approximate cost (Kshs.)
	Have on-site persons trained in first aid and issued with a certificate by a recognized body	Site Safety Officer	One-off	5,000 per trainee
Fire protection	Regularly inspect and service fire-fighting equipment by a reputable service provider and maintain inspection records	Site Safety Officer	Every 3 months	5,000
	Prominently display signs such as “NO SMOKING” at the site especially in parts where inflammable materials are stored	Site Safety Officer	One-off	500
Ventilation	Provide adequate space within the premises to allow for adequate natural ventilation through circulation of fresh air	Contractor, proponent and all occupants	One-off	–
Electrical safety	Do not overload circuits	Proponent and all occupants	Continuous	–
	Clearly mark distribution board switches to indicate respective circuits and pumps	Contractor, proponent and all occupants	One-off	–
	Ensure that no live electrical wires are exposed	Proponent and all occupants	Continuous	–
	Earth all electrical equipment	Contractor and proponent	One-off	5,000
Disease incidences	Provide complete refuse collection and handling service	Proponent and all occupants	Continuous	5,000
Security	Fence the site and employ security personnel operating 24 hours	Contractor, proponent and all occupants	Continuous	50,000
	Install security alarms and/or surveillance systems	Proponent and all occupants	Continuous	
Air pollution	Suppress dust by sprinkling dusty areas with water	Contractor and all occupants	Continuous	–
	Ensure all traffic strictly adhere to on site speed limits	Contractor, proponent and all occupants	Continuous	

Table 6.5: Proposed EMP for Monitoring the Proposed Fish Hatchery

Parameter to be monitored	Frequency of monitoring	Indicators of performance	Responsible person	Estimated costs (Kshs.)
Air quality	Daily management of wastes, control of combustion of wastes, movement of vehicles and house keeping	<ul style="list-style-type: none"> • Clear air with no or minimal dust and emissions • Absence of bad odour 	Health Officer to be contracted by SFFG	–
Vegetation	<ul style="list-style-type: none"> • Measurement of percentage plant coverage every three months • Daily observation of plant growth 	<ul style="list-style-type: none"> • High plant coverage • Good health of plants 	Landscapist to be contracted by SFFG	1,000
Water quality	<ul style="list-style-type: none"> • Daily inspection of drainage channels • Daily observation of water colour from supply pipes, in the fish ponds and in the stream 	<ul style="list-style-type: none"> • High survival rates of fish in the stream • Reduced or no cases of water borne diseases 	Health Officer to be contracted by SFFG	–
Noise	Daily investigation of sound transfer	Reduced or no complaints from students, tutors and neighbours	Environmentalists to be contracted by SFFG	–
Land contamination	Daily inspection of the hatchery	<ul style="list-style-type: none"> • Reduced or no spills • Absence of scattered wastes • Reduced overflows of waste water and sewage 	Health Officer to be contracted by SFFG	–
Effluent/waste water	Inspect effluent every three months through WWSC	Presence of monitoring reports	Officials from WWSC	10,000

8 RECOMMENDATIONS AND CONCLUSION

8.1 Recommendations

The management is to comprehensively implement the recommendations below in order to improve on their level of compliance.

- a) Strict adherence to legal requirements in respect to use of PPEs will be required in order to avoid potential negative impact of the works to operating staff and the clients/customers.
- b) High standards of construction and regular maintenance practices are strongly recommended to increase the life of the project.
- c) Ensure record keeping and documentation are appropriately carried out to assist in building of self-auditing capacity.
- d) The development should be undertaken since it will ensure accessibility of the area residents to fish and fingerlings.
- e) Environmental auditing of the facility will be carried out annually to report and comment environmental performance/compliance.

8.2 Conclusion

The proposed development will have numerous positive impacts as has been outlined in this report. The negative environmental impacts that will result from establishment of the project can be mitigated with the options provided for in this report. The report concludes that if all the suggested mitigation measures and the above recommendations are put in place and if the proposed EMP is followed, the proposed project will not adversely impact on the environment.

From the foregoing, it is clear that:

- (a) The proposed project has actively involved the key neighbourhood stakeholders who did not object the development.
- (b) The project has sufficient public support.
- (c) If the proposed project is implemented with the proposed mitigation measures, adverse environmental impacts will be mitigated.

REFERENCES

Architectural design drawings for the proposed project obtained from the proponent

GOK (1930). Kenya Gazette Supplement Acts, Penal Code Act (Cap.63), Revised Edition 2009, NCLR, Nairobi

GOK (1989). Kenya Gazette Supplement Acts, Public Health Act (Cap. 242), Revised Edition 2012, NCLR, Nairobi

GOK (1996). Kenya Gazette Supplement Acts, Physical Planning Act (Cap. 286) Revised Edition 2009, NCLR, Nairobi

GOK (1999). Kenya Gazette Supplement Acts 2000, Environmental Management and Coordination Act, 1999 (Cap. 387), amended 2015, NCLR, Nairobi

GOK (1999). Kenya Gazette Supplement Acts, Sessional Paper No. 6 of 1999 on Environment and Development, NCLR, Nairobi

GOK (2003). Kenya Gazette Supplement Acts, Environmental (Impact Assessment and Audit) Regulations 2003, NCLR, Nairobi

GOK (2006). Kenya Gazette Supplement Acts, Environmental Management and Coordination (Waste Management) Regulations, 2006, NCLR, Nairobi

GOK (2007). Kenya Gazette Supplement Acts, Kenya Roads Act, 2007, NCLR, Nairobi

GOK (2007). Kenya Gazette Supplement Acts, Occupational Health and Safety Act, 2007, NCLR, Nairobi

GOK (2007). Kenya Gazette Supplement Acts, Work Injury Compensation Benefit Act (WIBA), 2007, NCLR, Nairobi

GOK (2008). Kenya Gazette Supplement Acts, Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2008, NCLR, Nairobi

GOK (2009). Kenya Population Census 2009, Government Printer, Nairobi

GOK (2010). Kenya Gazette Supplement Acts, Traffic Act (Cap 403), NCLR, Nairobi

GOK (2010). The Constitution of Kenya, 2010, NCLR, Nairobi

GOK (2011). Kenya Gazette Supplement Acts, Urban Areas and Cities Act No. 13 of 2011, NCLR, Nairobi

GOK (2011). National Construction Authority Act, 2011, NCLR, Nairobi

GOK (2012). Kenya Gazette Supplement Acts, County Governments Act, 2012, NCLR, Nairobi

GOK (2012). Kenya Gazette Supplement Acts, National Environmental Policy, 2012, NCLR, Nairobi

United Nations (1987). The World Commission on Environment and Development

United Nations (1992). Rio Declaration on Environment and Development, Rio de Janeiro

World Bank (WB) (1999). World Bank Environmental and Social Safeguard Policies, Washington DC, USA

APPENDICES

- Copy of Title Deed/Land ownership documents
- Copy of MOU
- Copy of architectural and structural design drawings
- EIA public participation comment sheets
- Copy of Lead expert NEMA EIA/EA license