# ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR

## THE PROPOSED HORTICULTURAL FARM, CONSTRUCTION OF AN OFFICE BLOCK BUILDING, STAFF QUARTERS, FOUR (4) PRODUCTION BOREHOLES & TWO (2) PONDS ON PLOT L.R. NO. KAJIADO/MAILUA/1579 IN MAILUA AREA, KAJIADO CENTRAL SUB-COUNTY IN KAJIADO COUNTY

**(GPS COORDINATES S 2°21'30.1572" E 36°54'31.716")**

This Environmental & Social Impact Assessment (ESIA) Study Report is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination (Amendment) Act, 2015 and the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019.

## DOCUMENT AUTHENTICATION

This Environmental and Social Impact Assessment Study Report is based on information made available by the client to the experts and findings from field assessment. The Environmental & Social Impact Assessment Exercise has been carried out according to the Environmental Management and Coordination Act, 1999 and Environmental (Impact Assessment and Audit) Regulations, 2003.

We the undersigned, confirm that the contents of this full study report are a true representation of the ESIA report for the Proposed Horticultural Farm, and all the onsite support facilities on Plot L.R. No. Kajiado/Mailua/1579; in Mailua area, Kajiado Central Sub-County of Kajiado County.

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## ACRONYMS

| | |
|---|---|
| ASL | Above Sea Level |
| CBD | Central Business District |
| CEC | County Environment Committee |
| CG | County Government |
| CPP | Consultation & Public Participation |
| CIDP | County Integrated Development Plan |
| $CO_2$ | Carbon Dioxide |
| EAC | East African Community |
| EE | Energy Efficiency |
| EHS | Environment, Health and Safety |
| EIA | Environmental Impact Assessment |
| ESIA | Environmental & Social Impact Assessment |
| EMCA | Environmental Management & Coordination Act |
| EMS | Environmental Management System |
| ERP | Emergency Response Plan |
| ESMP | Environmental & Social Management/Monitoring Plan |
| EPRA | Energy & Petroleum Regulatory Agency |
| ETP | Effluent Treatment Plant |
| GDP | Gross Domestic Product |
| GHG | Green House Gases |
| GoK | Government of Kenya |
| GPS | Global Positioning System |
| IEM | Integrated Ecosystem Management |
| KEBs | Kenya Bureau of Standards |
| KNBS | Kenya National Bureau of Statistics |
| KPLC | Kenya Power and Lighting Company |
| LAT | Latitude |
| LON | Longitude |
| LN | Legal Notice |
| LR | Land Registration |
| NEAP | National Environment Action Plan |
| NEC | National Environment Council |
| NCCC | National Climate Change Council |
| NCCRS | National Climate Change Response Strategy |
| NEMA | National Environment Management Authority |
| OHS | Occupational Health & Safety |
| OSHA | Occupational Safety and Health Act |
| OW&SCo. | Oloolaiser Water & Sewerage Company Ltd |
| PM | Particulate Matter |

| | |
|---|---|
| PPE | Personal Protective Equipment |
| SEM | Sustainable Environmental Management |
| SDGs | Sustainable Development Goals |
| SWM | Solid Waste Management |
| ToR | Terms of Reference |
| WMP | Waste Management Plan |
| WRA | Water Resources Authority |
| WWTP | Wastewater Treatment Plant |

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## EXECUTIVE SUMMARY

Pursuant to the prevailing legal requirements as envisaged in the EMCA (Amendment Act 2015) and to ensure sustainable environmental management, the proponent undertook this ESIA to provide relevant information and environmental considerations on the project. The proponent's intention is to seek approval from NEMA for the development of the proposed project.

By enactment, building and construction operation is a prescribed activity as per the Second schedule in section 58, of **Environmental Management and Coordination Act, CAP 387** among other law enactments. Under these laws, any activity out of character with its surrounding which is likely to cause substantial impact to the environment in areas such as waste disposal, sustainable resource use, ecosystem's maintenance, social environment, land use and water extraction; an Environmental Impact Assessment (EIA) report is required to assess such impacts and propose mitigation measures.

The proposed project report relates to the setting up of a horticultural farm and the construction of Offices and onsite housing, storage facilities, sanitary facilities, 4 (four) production boreholes, 2 (two) water dams, waste handling and disposal facilities and all the other associated amenities. The project site is in Lumbwa, Mailua area, in Kajiado County. The ESIA was conducted by a team of NEMA registered Environmental Experts.

The proposed project site, L.R. No. **KAJIADO/MAILUA/1579** is in **Mailua area, Kajiado Central Sub-County in Kajiado County; located off Kajiado-Namanga road, approximately 11km from the main road.**

The proposed project will involve civil, mechanical, structural, and electrical works; alongside farming activities. The proposed project will have components that will include; project design, implementation, operation and decommissioning.

The horticultural farm project will **involve propagation of fruit trees, herbs and spices for local consumption and commercial export; burrowing of two (2) water ponds for collection of rain water and drilling of four (4)**

**production boreholes.** The boreholes shall supply water on the farm (for irrigation) and for domestic use in the offices and staff quarters.

**The housing building shall be categorized into Senior Staff quarters & Junior Staff Quarters.** The units shall be utilized for accommodation by the staff employed by the Horticultural farm.

**The proposed project shall have the following components:**

i) **Setting up horticultural plots for propagation of fruit trees** *i.e. dragon fruits, avocados, herbs and spices.* Farming of these horticultural crops will be done on open fields; **and not in Greenhouses.**

ii) **An office building consisting of a Ground floor and a Mezzanine floor.** The ground floor shall be comprised of **offices, storage area and washroom area for male and female.** The mezzanine floor shall consist of **office spaces and storage.**

iii) **Senior Staff Quarters** for the personnel who will work on the proposed Horticultural project. The Proponent intends to construct **three (3) house units for senior staff.**

- **House 01** will comprise of **seven (7) Bedrooms, a lounge/dining area, a kitchen, store, a verandah and three (3) shower rooms/water closets.**
- **House 02** will consist of **a Ground floor and a First floor. The Ground floor will comprise of two (2) bedrooms, lounge area, kitchen/dining, a verandah and three (3) water closets/shower rooms. The First floor will comprise of a Master bedroom, one (1) bedroom, an entertainment area and two (2) bathrooms and a guest water closet.**
- **House 03 will comprise of three (3) bedrooms, a lounge area, kitchen/dining, store, a verandah and two (2) bathrooms.**

iv) **Junior Staff Quarters consisting of a total of 16 Rooms, a Kitchen, an open canteen, seven (7) shower rooms and water closets, dhobi area, passages and an open yard.**

Other amenities will include; **a guard house, a gate house, well-designed drainage system, water treatment plant system, solid waste handling and disposing facilities, a perimeter fence, adequate parking area for loading and offloading and other related salient features like drive ways.**

The project has been designed to cater for cultivation of a variety of fruit trees, herbs and spices for local market and commercial export. The horticultural crops will be produced under drip irrigation on open farm.

Major farm operations will include:

- Opening up the land for cultivation;
- Tilling of the land;
- Setting up of drip irrigation system;
- Setting up of solid waste management system;
- Preparation of the horticultural plots;
- Soil preparation and organic manure application;
- Crop propagation;
- Nursery bed establishments;
- Transplanting of the fruit seedlings to the open farm;
- Pest and disease management;
- Crops and fruits harvesting, sorting, storage and transportation;
- Waste management.

The development spurred on by regulators in Kenya and indeed globally, has recognized the need for change in order to safeguard the environment. In relation to this, environmental concerns have now been integrated in the planning and implementation processes of any proposed project in Kenya. The

key objective is to mitigate conflicts with the environment at the vicinity; during implementation and operational phases. In addition, it is now mandatory for the proponents of such projects to carry out Environmental Impact Assessments (EIAs) to enhance Sustainable Environmental Management (SEM) as well as controlling and revitalizing the much degraded environment.

The proposed development was noted to have positive impacts to the society both at regional and national level. The benefits will be experienced during the entire project cycle. They include the following:

- The optimal use of the land;
- Increase in land value arising from the development;
- Horticulture supports biodiversity by creating habitats for pollinators, birds, and other wildlife;
- The project will form a well-planned development and shall include key services and infrastructure;
- The development is in line with the planning policy and therefore compatible with the area;
- Increase in Government revenue and taxes;
- Contribution to the country's Gross Domestic Product;
- Increased Agricultural Productivity: High-value crops like fruits, vegetables, flowers, and spices contribute significantly to agricultural GDP;
- Increase in Export Revenue through the export of horticultural products earning valuable foreign exchange;
- Enhanced Food Security. Horticulture improves the availability of nutrient-dense foods, reducing dependence on imports and enhancing self-sufficiency;
- Value Addition through processing of horticultural produce (e.g. making juices, jams, and frozen products) reduces post-harvest losses, maximizing economic gains;

- Growth of Agro-Processing Industry. Horticulture drives the food processing industry by providing raw materials for canned, dried, or frozen products;
- Increase in exports and trade;
- Improvement of socio-economic services;
- Economic-investment;
- Provision of employment;
- Investments in irrigation, roads, and storage facilities for horticulture stimulate broader rural development.

On the other hand, there are a few negative drawbacks that are anticipated mostly during the construction phase of the project. They include the following:

- Impact to soil (including soil erosion) especially when laying the foundation and other earthworks and during land preparation;
- Contamination of water resources from unmonitored farming activities;
- Loss of biodiversity due to vegetation clearance to pave way for establishment of farm land;
- Increased noise and vibration mostly during construction phase;
- Constraints to the existing infrastructure i.e. water, power, surface drainage systems, roads among others;
- Clearing of the existing vegetation from the site; during land preparation which can result to land degradation (i.e. soil erosion) if not well managed;
- Air pollution as a result of dust particles emanating from excavation and construction activities. Exhausts from the involved machinery will lead to increased levels of noxious gases such as Sulphur, Carbon, and Nitrogen Oxides.

To minimize the occurrence and magnitude of the negative impacts, mitigation measures have been proposed against each of the anticipated impact. Other

measures have been integrated in the project designs with a view to ensuring compliance with applicable environmental laws and guidelines.

The measures include the following:

- Careful siting, planning and designing of the development to ensure that it is compatible with the environment;
- Erection of warning / informative signs (signboards) at the site during the construction phase;
- Soil compaction and watering of loose soils on all unpaved access roads and parking areas at the construction sites to minimize air pollution and erosion by the agents of soil erosion i.e. water, animals and wind;
- To reduce noise pollution, portable barriers to shield compressors and other small stationary equipment generating noise should be installed; Sensitization of workers on the need to switch off engines whenever possible; ensuring that the machinery is well maintained to inhibit frictional noise; install silencers whenever possible and ensure that construction work is carried out between 8a.m. and 5p.m. among other recommended measures.

For farming activities, the following mitigation measures are recommended:

- Greening of the farm land;
- Establishing of biodiversity banks;
- Ensure good soil conservation measures;
- Increase in vegetation cover to contain loose soils from being eroded;
- Control surface and storm water runoff;
- Utilize renewable energy sources like solar panels;
- Incorporate agroforestry to sequester carbon;
- Reduce reliance on synthetic fertilizers and pesticides;
- Install sediment traps or vegetative buffers to control runoff;
- Follow Integrated Pest Management (IPM) practices to reduce chemical use;

- Develop a waste segregation and storage area to manage waste effectively.

During the construction phase, the contractor shall put in place effective and efficient waste disposal systems. Waste such as excavated soil and debris will be recycled or properly disposed of by backfilling or dumping in approved grounds.

The management of the solid waste mostly during the operation period will be by the use of an integrated solid waste management system which will involve a hierarchy of options: source reduction, recycling, composting and reuse. Solid waste management shall be enhanced further through segregation of waste at source and contracting a reputable garbage collector registered with NEMA. Comprehensive landscaping will follow upon completion of the development to prevent soil erosion and upgrade the site to its appropriate environmental status.

Based on the EIA, a cost and benefit analysis indicates that the benefits far outweigh the associated costs and negative impacts. Major concerns should nevertheless be focused towards minimizing the occurrence of impacts that would degrade the general environment. This will however be overcome through close following and implementation of the recommended Environmental & Social Management and Monitoring Plans (ESMPs); which are strategically packaged with all environmental sustainability elements, tailored towards enhancing the adoption of Integrated Ecosystem Management (IEM).

In addition, the project proponent shall continue to work closely with the relevant agencies to enhance environmental sustainability and in addressing any issues of concern as identified or as may arise during the project cycle. This will ensure that environmental concerns are well addressed and integrated into the project cycle. This way, the co-existence of the proposed project with the environment during the entire project cycle will have been achieved.

The ideal strategy to counter identified adverse effects is avoidance but when this is not possible, alternative strategies of reduction, remediation and compensation should be explored. This can be achieved through primary measures that comprise part of the development design; or secondary measures designed to specifically address the remaining (residual) adverse effects of the proposed project. The potential impacts can be greatly reduced and this will be much determined by the technology used, nature of the materials, equipment used and level of diligence among others. The foreseeable impacts identified that may not be completely avoided are addressed in this report and potential recommended measures provided. As such, the proposed measures also explore opportunities available for improving the situation wherever possible. The initial design should facilitate a high degree of mitigation, built into the scheme from the onset so that the potential for adverse effects is substantially reduced. If consideration of mitigation measures is left to the later stages of the proposed project design, it can result in increased mitigation cost because early opportunities to avoid the need for such measures have been lost. In general, primary mitigation measures are likely to be more effective and less likely to cause secondary adverse effects (i.e. the mitigation measures themselves may in turn cause adverse effects.

# CHAPTER 1: INTRODUCTION

## 1.1 BACKGROUND AND RATIONALE FOR AN ENVIRONMENTAL IMPACT ASSESSMENT

The principle measure of sustainable development is that all activities which are carried out to achieve development must take into account the need for environmental conservation. The sustainability of the ecosystem requires the balance between human settlement development and the natural ecosystem, which is a symbiotic relationship. This can be achieved through careful planning and the establishment of appropriate management systems.

Consequently, a number of planning mechanisms have been put in place to ensure that minimum damage is caused on the environment. Environmental planning is also integrated with other planning processes such as physical planning, economic planning, and development planning. Environmental Impact Assessment (EIA) is considered part of environmental planning. EIAs are undertaken for proposed projects or on-going projects that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent National Authority (NEMA). As part of the EIA process, it is necessary to devise alternatives to avoid undesirable impacts. Besides the alternatives, identification of impacts may also lead to the development of mitigation measures. As a tool of environmental planning, EIA is therefore precautionary in nature.

The Proponent; **Mr. Raj Kirankumar Shah** proposes to establish a horticultural farm for the production of horticultural produce (fruit trees cultivation, herbs and spices) to be sold locally and also for commercial export; and the setting up of all the associated amenities to support the farm. The proposed project site is in Lumbwa area in Mailua; **Kajiado Central Sub-County in Kajiado County;** Land Registration No. **Kajiado/Mailua/1579; on GPS Coordinates S 2°21'30.1572" E 36°54'31.716"**

The farm is strategically located and on fertile land, with fairly good access roads so as to ensure the produce reaches the market in time. The proponent's

intention is to seek approval from NEMA for the implementation of a horticultural project and its associated facilities.

EIA is a systematic analysis of projects, policies, plans or programmers to determine their potential environmental impacts, the significance of such impacts and to propose measures to mitigate the negative ones. The underlying key principles of EIA are that every person is entitled to a clean and healthy environment and that every person has a duty to enhance and safeguard the environment as provided for by the Environmental Management and Coordination Act, 1999 and our constitution.

EIA is both a planning and decision-making tool. As a planning tool, EIA presents methodologies and techniques for identifying, predicting and evaluating potential environmental impacts of projects, policies, plans and programmes in the project cycle (planning, implementation, operation and decommissioning phases).

The EIA process presents decision-makers with the information necessary to determine whether or not a project should be implemented.

## 1.1 THE PROPOSED HORTICULTURAL PROJECT

The term Horticulture is derived from the Latin words: “hortus” meaning garden and “cultura” meaning cultivation. In ancient days the gardens had protected enclosures with high walls or similar structures surrounding the houses. The enclosed places were used to grow fruit, vegetables, flowers and ornamental plants. Therefore, in original sense “Horticulture refers to cultivation of garden plants within protected enclosures”. At present horticulture may be defined as the science and technique of production, processing and merchandizing of fruits, vegetables, flowers, spices, plantations, medicinal and aromatic plants. Horticulture is the branch of agriculture that deals with growing plants used by people for food and medicine, as well as gardens and other forms of ornamental plants.

Horticulture is divided into four branches:

i) Floriculture: the science of production and utilization of ornamental plants.
ii) Olericulture: the science of production and utilization of vegetable crops.
iii) Pomology: the science of production and utilization of fruit crops.
iv) Landscape horticulture: beautification and protection of the environment.

### 1.1.1 Horticulture in Kenya

When looking at horticulture production in Kenya, one notices that over the last decade there has been a considerable increase in its importance for both the local and export markets as well as for the processing industry. Kenya is endowed with diverse climatic and edaphic conditions favorable for the production of quality horticultural produces. Fruit Production is an important part of horticulture that plays a pivotal role in the livelihoods and food and nutritional security of the community in the country. Due to the existence of large agro-climatic diversity, favorable soil conditions and ample water resources, different tropical and subtropical fruit crops are grown in different parts of the country. Hence, a variety of fruits can be produced in the country making fresh-produce available year-round.

Kenya has also a comparative advantage for successful production of various fruit crops due to its proximity to major markets (Europe and Middle East) and availability of young and easily trainable work force. Fruit crops allow efficient utilization of resources like land, water, labor and agricultural inputs, resulting in higher income per unit of available resource while maintaining and developing the natural resource base. The contribution of fruits towards diversification of the economy of the country is also enormous. The development of fruit crops could provide the basis for the establishment of agro-industries, contributing for the transformation of the Kenyan agriculture.

Global production of fruit has tripled over the past 40 years, with most of the increases being recorded in the temperate regions. In recent years, the demand for fruit consumption is increasing. The trend will definitely continue to grow

as the awareness and purchasing power of the population is increasing. However, to meet the increasing consumer demand for fresh produce, the production and productivity of fruit crops produced in various parts of the country need to be improved. Modern fruits and vegetable production is critically dependent on knowledge. It needs technically-competent, skilled people in all parts of the industry who can respond quickly to market opportunities and production demands.

The Proponent intends to grow fruit trees such as the dragon fruit and avocado alongside spices and herbs like lemon grass, Moringa etc.

### 1.1.2. Dragon Fruit

A dragon fruit production business has been revealed as viable source of food, income and employment. The marketability of dragon fruit in local market is expected to be high because of limited number of commercial producers of dragon fruit. The fruit has medicinal properties, it used to prevent colon cancer and diabetes, neutralizes toxic substances such as heavy metals. It is concluded that dragon fruit production is profitable and has considerable potential for the expansion in the country. Excepts for high initial establishments cost due to the use of trellises, the other agronomic practices are easy and less expensive, hence the low maintenance cost. Hence dragon fruit production can be widely adopted in country. There is also need to shift from the traditional orchards and diversify the fruit basket, which meet the therapist demand of consumers & also suited to drought prone & degraded lands.

It is against this background that the Proponent sought to venture into agro-industry (fruit, herbs and spices) production to utilize land resource and address the ever rising demand for fruits and fresh vegetables. The proponent intends to cultivate fruit trees such as ***Dragon fruits, avocado etc.***; Spices and culinary herbs, for example, ***the green or dried leaves of rosemary,***

***lemon grass, Moringa, coriander, basil, parsley etc.*** for local consumption and export.

Dragon fruit is mainly available in three variants viz., ***red skin with white pulp (Hylocereus undatus), red skin with red pulp (Hylocereus monacanthus previously known as H. polyrhizus) and yellow skin with white pulp (Hylocereus megalanthus previously known as Selenicereus megalanthus)***. The red-fleshed varieties of dragon fruit are relatively rich in antioxidants. It is known to prevent colon cancer, diabetes and neutralizes toxic substances such as heavy metals; reduce cholesterol and high blood pressure. It is rich in vitamin C, phosphorus and calcium. The flavour of the fruit resembles to kiwi fruit. Dragon Fruits are low in fat and rich in minerals with the optimum Brix value of 15-180Bx. It is widely used as fruit salad in star hotels and restaurants. It can be processed to range of industrial products such as juice, jam, syrup, ice cream, yogurt, jelly, preserve, candy and pastries. The red and pink pulp of dragon fruit is used for extraction of natural colours. The flower buds of dragon fruit are used to make soups or mixed in salads.

Dragon fruit is a perennial long-lived plant with 20 years commercial life. In cultivation, it starts fruit production from the second year onward. It is propagated mostly by vegetative means using cuttings. The entire stem segment or part of stem segment of 15-30 cm mature cutting should be used to get better plants. To prevent diseases especially the rots, cutting are to be treated with fungicides and cured in a cool, dry area for 5-7 days before planting. The rooted cuttings are ready to transplant in the main field within 30-40 days in the nursery. The recommended spacing of 3.0-4.0 m x 3.0 m provides adequate air circulation and lowers the chances for occurrence of diseases where as in low fertile dry land areas denser plant population is recommended (3.0 m x 2.5 m spacing) to compensate the yield reduction per unit area.

Dragon fruit grows as a climbing cactus in shaded or semi-shaded positions under large canopies; it may be injured by extreme sunlight and can tolerate

some shade. Dragon fruit, while being a type of cactus, perform poorly under extremes of temperature and cannot tolerate high light and temperature. It requires warm climate thus it grows well in semi-arid regions (Feng-ru and Chung-Ruey, 1997a; 1997b). Optimum temperatures for growth are 18-25°C, with good relative humidity levels; it is tolerant of windy conditions and moderately saline soils.

In high radiation areas, overhead shading is often installed, which also helps reduce extremely high temperatures, which can limit flowering and fruit set. Recommendations for shading are to apply the minimal amount of shade required to prevent bleaching of the stems and ensure the plants are not water stressed as this reduces the crop's resistance to high light damage.

### 1.1.3. Avocado

An avocado is a tree fruit that originates in Mexico and Central America. Some archaeological research indicates that avocados were found in Mexico in 8000 B.C. and in Peru towards 3000-4000 B.C. The area of origin is not exactly known, given the existence of several wild populations. With a world production of 3.2 million tonnes in 2004, the avocado can be regarded as an international fruit. North and Central America are the main producers (80%) while the rest of the world supplies the remaining 20%.

Fruits represent an important horticultural commodity and the ever increasing hectarage of the avocado and its respective yield production contributes to export, local consumption and processing.

Kenya is one of the world's top producers of avocados, and is a key contributor to the country's economic growth. Kenya has seen a significant increase in revenue from avocado exports, earning up to Ksh19 billion in recent years. The country's avocado industry has experienced rapid growth as demand for Kenyan avocados continues to rise in international markets. Kenyan avocados are highly sought after for their premium quality and taste, making them a popular choice among consumers around the world. The country's avocado

exports have expanded to countries such as Europe, the Middle East, and Asia, providing a steady source of income for Kenyan farmers.

The government of Kenya has been actively promoting the avocado industry, providing support and incentives to farmers to increase production and improve quality standards. This has led to a significant boost in avocado production and exports, contributing to the country's overall economic growth. With the global avocado market expected to continue expanding in the coming years, Kenya is well-positioned to capitalize on this trend and further increase its revenue from avocado exports. The country's success in the avocado industry serves as a testament to the potential of the agricultural sector to drive economic growth and create opportunities for smallholder farmers.

Avocado production escalated from ***441,593 metric tons in 2022 to 518,500 metric tons in 2023, marking a 14.8 percent*** upswing. ***As of 2023, the avocado value had grown to Ksh19.4 billion, representing a 12 per cent boost in foreign income from exports.***

The avocado fruit was once a luxury food reserved for the tables of royalty but is today enjoyed around the world by people from all walks of life. Combined with its outstanding productivity in Kenya, the avocado has many uses and its nutritive value is exceptionally high. A serving of avocado provides about twice the amount of the daily requirement of several minerals and vitamins. For a fresh fruit, it has unusually high protein content – comparable to animal sources in quality. The high content of both minerals and proteins makes avocado a highly nutritious food; avocado oil is easily digestible and can have beneficial effects on the digestive system. The oil is largely unsaturated and as the sugar content is low – about 3%.

In Kenya, three Avocado races and their hybrids are grown at more or less the same latitude, ***the West Indian race*** is usually found between sea level and 1000 m, ***the Guatemalan race*** is best adapted to an altitude between 1000 and 2000 m while ***the Mexican race*** flourishes best from 1500 to 2500 m. Kenya has more than 40 varieties of avocado, including:

- ***Hass:*** *The most popular variety exported and sold locally. Hass avocados are known for their rich flavor, creamy flesh, and spherical shape. The skin turns from green to dark purple-black when ripe.*
- ***Fuerte:*** *A pear-shaped variety with thin, glossy skin that's easy to peel. Fuerte avocados are preferred for processing and sold locally. They have a lower fat content and fewer calories than Hass avocados.*
- ***Pinkerton:*** *A pear-shaped variety with dark or pale green skin.*
- ***Hurst:*** *A popular variety for export and local consumption*

Other varieties of avocado in Kenya include: ***Keitt, Reed, Booth 8, Simmonds, Nabal, Puebla, Tonnage, Ettinger, Hayes, and G6 and G7.***

### 1.1.4. Culinary Herbs & Spices

Culinary herbs are referred to as those fresh or dried parts of the plants that are used particularly for flavoring and adding fragrance in cooking. Either their leaves, flowers, seeds, bark, root, or whole plants can be consumed fresh as an ingredient for food recipe or can be processed into value-added products such as herbal tea, candies, jellies, and flavored oils or can be dried and stored for later use. Generally, the leaves used in cooking may be referred to as culinary herbs, and are used in Western and Continental cuisines for their aromatic flavors.

The proponent's intention is to seek approval from NEMA for the development of a horticultural farm and its associated facilities. The activities to be undertaken during the implementation of the horticultural project include:

- Construction works (office building, staff quarters, gate and guard houses and all other onsite support facilities,
- Opening up the land for cultivation,
- Setting up of shade houses/Nursery bed establishments for propagation of viable seeds/horticultural crops,
- Preparation of the horticultural plots,
- Soil fumigation and organic manure application,

- Fruit crop, herbs/spices propagation,
- Laying down of recommended pipe network and drainage systems,
- Setting up of an irrigation system,
- Pest and disease management,
- Fruits, herbs/spices harvesting, sorting, storage and transportation,
- Solid waste management system.

The Horticultural farm project will involve setting up of horticultural plots to propagate horticultural crops i.e. dragon fruits, avocados, herbs and spices for local consumption and commercial export; burrowing of two (2) water ponds and drilling of four (4) production boreholes. The boreholes shall supply water on the farm (for irrigation), used for domestic use in the office and staff quarters. This development will occupy **30 acres** out of the ***162.67 Hectares of land owned by the Proponent.***

The proposed development will comprise of the following building structures and all the associated facilities:

i) **Setting up horticultural plots for propagation of fruit trees *i.e. dragon fruits, avocados, herbs and spices.* Farming of these horticultural crops will be done on open fields; and not in Greenhouses.**
ii) **An office building consisting of a Ground floor and a Mezzanine floor. The ground floor shall be comprised of offices, storage area and washroom area for male and female. The mezzanine floor shall consist of office spaces and storage.**
iii) **Senior Staff Quarters for the personnel who will work on the proposed Horticultural project. The Proponent intends to construct three (3) house units for senior staff.**
    - **House 01 will comprise of seven (7) Bedrooms, a lounge/dining area, a kitchen, store, a verandah and three (3) shower rooms/water closets.**

- **House 02 will consist of a Ground floor and a First floor. The Ground floor will comprise of two (2) bedrooms, lounge area, kitchen/dining, a verandah and three (3) water closets/shower rooms. The First floor will comprise of a Master bedroom, one (1) bedroom, an entertainment area and two (2) bathrooms and a guest water closet.**
- **House 03 will comprise of three (3) bedrooms, a lounge area, kitchen/dining, store, a verandah and two (2) bathrooms.**

iv) **Junior Staff Quarters consisting of a total of 16 Rooms, a Kitchen, an open canteen, seven (7) shower rooms and water closets, dhobi area, passages and an open yard.**

**Other amenities will include; a guard house, a gate house, well-designed drainage system, water treatment plant system, solid waste handling and disposing facilities, a perimeter fence, adequate parking area for loading and offloading and other related salient features like drive ways.**

### 1.1.5. Environmental Impact Assessment

By enactment, building and construction operation is a prescribed activity as per the Second schedule in section 58, of **Environmental Management and Coordination Act, CAP 387** among other law enactments. Under these laws, any activity out of character with its surrounding which is likely to cause substantial impact to the environment in areas such as waste disposal, sustainable resource use, ecosystem's maintenance, social environment, land use and water extraction; an Environmental Impact Assessment (EIA) report is required to assess such impacts and propose mitigation measures.

In accordance with EMCA 1999; Part VI 58(2) which states that; The proponent of a project shall undertake or cause to be undertaken at his own expense an Environmental Impact Assessment study and prepare a report thereof where the Authority, being satisfied, after studying the project report submitted under subsection (1), that the intended project may or is likely to have or will have a significant impact on the environment, so directs.

The Environmental Impact Assessment study report prepared under this subsection shall be submitted to the Authority in the prescribed form, giving the prescribed information and shall be accompanied by the prescribed fee. This study report is therefore prepared as per the provisions of the Environmental Management and Coordination (Strategic Assessment, Integrated Impact Assessment and Audit) Regulations, 2003 LN 101 (Revision 2018) and Supplementary LN 31 & 32 of 2019. The proponent is therefore required to submit to NEMA a Full Study Environmental & Social Impact Assessment report (EIA) for approval.

## 1.2. PROJECT PROPONENT

The Proponent; **(Mr. Raj Kirankumar Shah)** intends to set up a Horticultural Farm and **Construct an Office building; Staff Quarters; burrow Two (2) Water Ponds & drill Four (4) Production Boreholes on Plot L.R. No. Kajiado/Mailua/1579 in Lumbwa, Mailua Area, Kajiado Central Sub-County in Kajiado County.** The main objective of the project is to develop the land owned by the Proponent; with an aim of generating income; increasing foreign exchange earnings; creating employment; increasing GDP from agriculture; improving the standard of living for the average family; improving nutrition for people whose diets are inadequate; and other benefits which the project will create.

The proposed project site is located on **Plot L.R. No. Kajiado/Mailua/1579 in Lumbwa, Mailua Area, Kajiado Central Sub-County in Kajiado County.** The proposed site is rightfully zoned for Agricultural use therefore the proposed project is in line with land subdivision guidelines for Kajiado County.

## 1.3. TERMS OF REFERENCE

The proponent**, Mr. Raj Kirankumar Shah**; will have to submit an ESIA Study report as part of the activities in Schedule 2 of the EMCA 1999 and revision 2015 (CAP 387) and Regulation 10 of the Environmental (Impact Assessment

and Audit) Regulations, 2003, Legal Notice No. 101. The aim of the ESIA Study is to:

i. Carry out environmental and social impact assessment of the proposed development.
ii. Undertake a comprehensive environmental baseline assessment of the proposed horticultural project.
iii. Undertake a comprehensive analysis of project alternative options.
iv. Evaluation of the legislations that govern and control environmental impact assessment and audits and advise the proponent on preferred mitigation measures.
v. Identify all areas of potential environmental challenges that may require monitoring and evaluation thereafter in line with unfolding social changes.
vi. Recommend enhancement measures to encourage positive aspects and mitigation/improvement measures against negative aspects.
vii. Prepare a comprehensive Environmental & Social Management Plan.
viii. Submit the report to NEMA and provide an acknowledgement letter.
ix. Follow-up on the review of the ESIA study report up to the issuance of the EIA license.

## 1.4. OBJECTIVE/PURPOSE OF THE ESIA

This ESIA is part of the EIA implementation framework in Kenya and is expected to assist NEMA in decision making concerning the project by highlighting the impacts and mitigation measures of the proposed project throughout the project cycle.

The objectives of this ESIA Study Report were to;

- Establish the baseline conditions of the proposed site.
- Evaluate the existing and anticipated impacts and propose measures to enhance the positive impacts and measures to reduce the effects of the negative impacts.

- Generate baseline data for monitoring and evaluating impacts, including mitigation measures during the project cycle.
- Seek views and concerns of all stakeholders in regards to the proposed project.
- Highlight environmental issues with a view to guiding policy makers, planners, stakeholders and government agencies to make environmentally and economically sustainable decisions.
- Incorporate Environmental & Social Management Plans and monitoring mechanisms.
- The key goal is to enhance cleaner and sustainable development during implementation and operation phases of the proposed project.


***Figure 1: The EIA implementation in Kenya***

The key purpose of the EIA is to ensure that the key environmental and social issues associated with the project are identified early enough so that the necessary mitigation measures are noted and integrated in the final project design. The ESIA report is part of the EIA implementation framework in Kenya

and is expected to assist NEMA in the issuances of an operational EIA license for the project in accordance with usual practice.

## 1.5. PROJECT JUSTIFICATION

The land is currently underutilized and it is suitable for agriculture. The proposed project would make the land profitable to the owner and also help create employment to the youth and earn the government income through revenue generation & various taxes. There is also need to enhance our ability to be food secure through horticulture production.

Horticulture boosts the growth of agro-processing industries by providing raw materials for canned, dried, or frozen products. It also serves as a backbone for economic growth in agriculture-centric economies and a significant contributor in industrialized nations, ensuring food security, employment, and trade benefits.

## 1.6. SCOPE OF THE ESIA

The scope of **ESIA** refers to the range of studies, analyses, and evaluations necessary to determine the potential environmental and social effects of a proposed project or activity. The scope sets the framework for assessing these impacts and identifying mitigation measures. Here's an outline of the scope during the ESIA for the proposed Horticultural farm & its associated facilities:

### 1.6.1. General

The study was conducted to evaluate the potential and foreseeable impacts of the proposed project. The physical scope was limited to the proposed site and the immediate environment as may be affected by or may affect the proposed project. Any potential impacts, (localized or delocalized) are also evaluated as guided by EMCA 1999 (Amendment 2015) and the Environmental (Impact assessment and Audit) Regulations 2003 and (Amendment 2019). This study report includes an assessment of impacts of the proposed site and its environs with reference to the following:

### 1.6.2. Description of the Proposed Project

The proposed project was described in terms of location and physical characteristics of the project area, the proposed project design, construction material input, waste and waste management methods to be put in place. This approach was important because it made it possible to know the likely sources of impacts, and suggest appropriate mitigation measures for their effective management.

### 1.6.3. Review of the Baseline Information

Baseline information gives the conditions of the environment in terms of resources and impacts, before a particular project is implemented. The EIA experts collected baseline information of the area to enable them predict likely impacts that the project would have on the biophysical and social aspects. This data is also useful for monitoring environmental changes that will occur after the project is implemented.

### 1.6.4. A Review of Policy, Legal & Administrative Framework

Several policies, legal and administrative arrangements, and protocols - both local and international - that have a direct bearing on the proposed development were reviewed. This was in an attempt to establish the frameworks within which the significance of the various impacts expected from the proposed development could be evaluated.

A lot of emphasis has been placed on those frameworks and protocols that have a direct bearing on building and construction projects. These include EMCA 1999 (Amendment 2015), EIA/EA Regulations (2003) amended in 2019, OSHA (2007), Water Quality Regulations (2006), Air Quality Regulations (2014) and Public Health Act Cap 242, laws of Kenya, among others. Relevant international policies and laws were also considered.

### 1.6.5. Assessment of the Potential Impacts

This is the very reason why any EIA is done. Environmental and social aspects associated with any project are normally felt on natural or human elements. It

is the duration, magnitude and extent of impacts on these elements that make the impact either positive or negative. These are the various social and physical parameters that are in continuous interplay within the general environment of any project and it is how the project will affect or will be affected by these parameters that will eventually lead to positive or negative perception in environmental terms.

### 1.6.6. Assessment of Project Alternatives

Any planning activity must strive to give practical alternatives with regard to resources allocation. EIA as a planning tool must therefore give options that can be pursued in order to get sustainable results. Project alternatives were assessed in terms of site, technology and design, implementation schedule and waste management. These alternatives were compared with the proposed project, in order to determine the most feasible project option.

### 1.6.7. Development of Mitigation Measures

Mitigation and management measures are meant to limit the extent of negative impacts that may arise as a result of a particular development alternative. It is important to note that potentially negative environmental impacts of a project may be bearable both to the environmental elements and the community, where sensible mitigation measures are suggested.

## 1.7. ESIA APPROACH AND METHODOLOGY

The ESIA approach and methodology is undertaken in accordance with the Environment Management and Coordination Act (EMCA) Cap 387 (No. 8 of 1999) (section 58 (1), Amendment 2015, Legal Notice No. 101 of 2003, Gazette Notice Dated 16th June, 2016), Environmental Management and Coordination (Strategic Assessment, Integrated Impact Assessment and Audit) Regulations, 2003 LN 101 and Supplementary LN 31 & 32 of 2019. The ESIA cycle will comprise of the following chain of activities:

i. Project screening
ii. EIA scoping

iii. Baseline data collection
iv. Analysis of project alternative options
v. Impact prediction and evaluation
vi. Stakeholder engagement and consultation
vii. Formulation of mitigation measures
viii. Environmental & Social Management Plans
ix. Preparation of a full study report

Information on baseline conditions of the project area was obtained through site visits and physical investigations, desktop studies, public consultations with locals residing in the project area, survey, photography, and discussions with key informants.

### 1.7.1. Approach

The ESIA largely involved an understanding of the project's background, its design and implementation plan. The approach to this ESIA comprised of seven steps as outlined below:

**Step 1: Screening**

Environmental screening is undertaken to help determine whether or not a proposed project falls within a category that requires an EIA prior to commencement. In addition, other considerations during the screening process include the determination of physical location of the proposed project, environmental sensitivity of the areas surrounding the project site, nature of community and social activities in the project area. In this case, the EIA consultants determined that the proponent was required to submit an ESIA Study report to NEMA, in order to obtain approval for the proposed development. The proposed project falls under high risk project since it is a large-scale agricultural project exceeding one hundred (100) hectares.

**Step 2: Scoping**

Scoping is considered the backbone of an EIA process, and is ideally undertaken at the project planning stage. The main objective of the scoping process is to establish the environmental and social priorities, set the boundaries for the assessment and define the ToR. Systematic and well-planned scoping forms the basis of an effective and efficient EIA process. It also helps avoid unfocused and voluminous reports. The scoping exercise enabled the EIA team to determine key issues: - site alternatives and justification of the project, identified the stakeholders, set the framework for assessing impacts and identifying mitigation measures.

**Step 3: Desktop studies**

Documentation review is a continuous exercise that involves a review of available documents on the project, including project set-up plans and architect's statement, engineering designs of the proposed development, land ownership documents, environmental legislation and regulations, and location maps, among others.

**Step 4: Site visit and assessment**

Site assessment was conducted on various days; the 24th February, 2024, 20th November and on 5th December, 2024 respectively; to establish: land ownership, usage and conflicts; landscape; any surface water bodies within the project area; and, the general environmental conditions of the project area and its environs. Various approaches were used for the public consultation process: key informant interviews and administration of questionnaires & Public participation meetings. Questionnaires were administered to the neighbours/general public within the project area to seek their opinion on the proposed development. Copies of the filled questionnaires have been attached to this report ***(See annex at the end of this report.)***

**Observations**

Field observations formed an integral part of the report as the experts gathered considerable information through observation. This involved site visits and recording the situation on the ground. Observations were also used as a tool for verifying the facts that were gathered through interviews and questionnaires.

**Photography**

Photos were taken to show the actual site of the proposed project area, resources on site and the neighbourhood. The photos are incorporated in this ESIA report.

**Secondary Data**

Various literatures were used in aiding the successful completion of this study report. They include: *The Kenya Gazettes supplement Acts 2000, Environmental Management and Coordination Act No.8 of Cap. 387, of 2012; Government printers, Physical Planning Act, 1999, Kenya Gazette supplement No.56, Environmental Impact Assessment Audit regulations 2003. County Integrated Development Plan for Kajiado County (2018-2022), Environmental Management and Coordination (Waste Management) regulations, 2006 Legal Notice No.12, the Public Health Act, Cap 242, the Factories and other places of Work Act and Water Act 2002, etc.*

**Step 5: Identification of Environmental/Social impacts and mitigation measures**

The characteristics of potential impacts were identified, evaluated and predicted using the baseline information on one hand and the features of the project on the other (cause-effect relationship). Sensible preventive and remedial measures for each negative impact are outlined in the ESMP.

**Step 6: Reporting**

The final ESIA report is written in accordance with the Environmental (Impact Assessment and Audit) Regulations of 2003 (Amendment 2019).

**Step 7: Responsibilities**

While the environmental experts provided the technical understanding on the baseline environmental status, potential impacts, mitigation measures for the predicted impacts, project alternative options and legal framework, the client/Proponent was expected to provide the following:

- Site map showing roads, service lines, buildings layout and the actual size of the site.
- Full details of proposed operations and activities, input materials, site operational outline, products and by-products and any wastes to be generated.
- Measures to be put in place for handling wastes and hazardous materials on the site.
- Land ownership documents and site history.

The output from the assessor was an ESIA study report comprising of an executive summary, study approach, baseline conditions, project design, project alternatives, existing and anticipated impacts and potential mitigation measures for anticipated negative impacts and a comprehensive environmental and social management plan (ESMP).

### 1.7.2. Methodology

Information on baseline conditions of the project area was obtained through site visits and physical investigations, desktop studies, public consultations with the local community in the project area, survey, photography, and discussions with key informants.

The main activities undertaken during the ESIA study included:

a) Consultations with the key project stakeholders, who included local leaders in the area, relevant government departments, members of the local community residing within the project area, property owners and the project proponent. These consultations were based on the proposed project, site planning and the project implementation plan;
b) Physical inspections of the proposed project area which included observation of available land marks, and evaluation of the activities being undertaken around the project site;
c) Review of available project documents;
d) Documentation of findings, data analysis and reporting; and
e) Submission of final ESIA study report to NEMA, for review and decision making.

# CHAPTER 2: PROJECT DESCRIPTION, DESIGN AND IMPLEMENTATION

## 2.1. NATURE OF THE PROJECT

The project proponent intends to **develop and subsequently operate a horticultural farm for propagation of horticultural crops & construct onsite support facilities**. The onsite support facilities shall consist of an Office building and onsite housing for staff (senior staff Quarters & Junior staff Quarters), 2 (two) water ponds, 4 (four) production boreholes, Sanitary facilities, Waste handling and disposal facilities and all the other associated amenities.

The project is in line with the need for agricultural sustainability, production of quality food, access to food crops, creation of employment opportunities and market demand for horticultural crops like *avocados and dragon fruits* etc. The project also aims at maximizing on the utilization of the land i.e. it aims at increasing the utility of the land.

## 2.2. PROJECT DESIGN

The study report is based on information and consultations with the proponent; the architects, details contained in the architectural plans and structural drawings of the proposed project. The project entails the establishment of a Horticultural farm for propagation of horticultural crops i.e. dragon fruits, avocados, herbs and spices for local consumption and commercial export; construction of an office building and onsite housing for staff; burrowing of two (2) water ponds and drilling of four (4) production boreholes. The boreholes shall supply water on the farm (for irrigation) and for domestic use in the office building and staff quarters. This development will occupy ***30 acres of land that is owned by the Proponent.***

The proposed development will comprise of the following building structures and all the associated facilities:

i) **Establishment of horticultural plots for the propagation of fruit trees, herbs and spices.**

ii) **An office building consisting of a Ground floor and a Mezzanine floor. The ground floor shall be comprised of offices, storage area and washroom area for male and female. The mezzanine floor shall consist of office spaces and storage.**

iii) **Senior Staff Quarters for the personnel who will work on the proposed Horticultural project. The Proponent intends to construct three (3) house units for senior staff.**

- **House 01 layout consists of a ground floor which will comprise of (7 Bedrooms, Store, Kitchen, lounge/dining area, 3 shower rooms and 3 water closets.**
- **House 02 will consist of a Ground floor and a First floor. The Ground floor will comprise of two (2) bedrooms, lounge area, kitchen/dining, a verandah and two (2) water closets/shower rooms. The First floor will comprise of a Master bedroom, one (1) bedroom, an entertainment area and two (2) bathrooms and a guest water closet.**
- **House 03 will comprise of three (3) bedrooms, a lounge area, kitchen/dining, store, a verandah and two (2) bathrooms.**

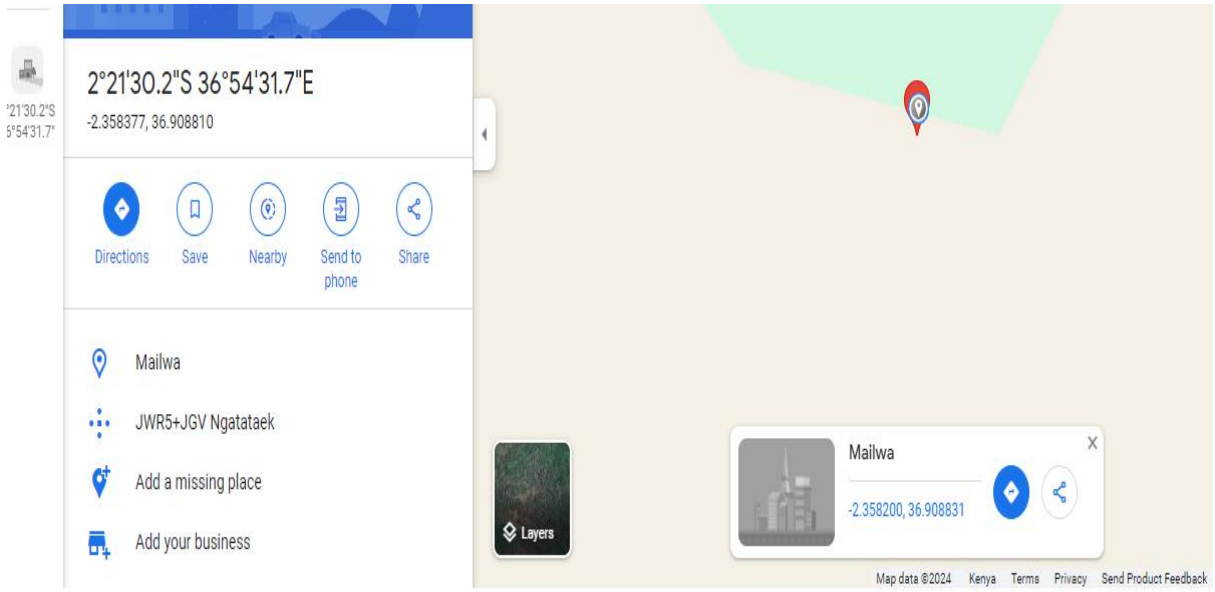
iv) **Junior Staff Quarters consisting of a total of 16 Rooms, a Kitchen, an open canteen, seven (7) shower rooms and water closets, dhobi area, passages and an open yard.**

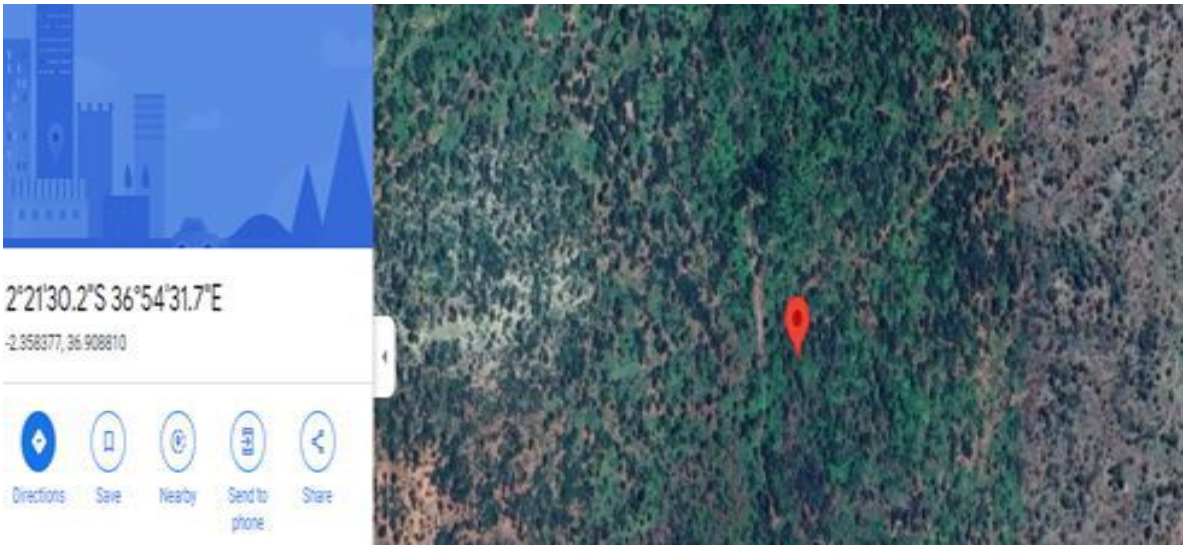
Other amenities will include; a guard house, a gate house, a fence, well-designed drainage system, water treatment plant system, solid waste handling and disposing facilities, a perimeter fence, adequate parking area for loading and offloading and other related salient features like drive ways.

## 2.3. PROJECT LOCATION

The project site is located approximately 11 km off Kajiado-Namanga road on plot **L.R. NO. KAJIADO/MAILUA/1579** within Lumbwa area in Mailua**;**

**Kajiado Central Sub-County in Kajiado County**. The project site can be accessed via a murram road at a **distance of approximately 76km** from Kajiado town. Administratively, it is situated within **Lumbwa area in Mailua; Matapato South ward in Kajiado Central Sub-County of Kajiado County**. Its defining coordinates are **S2°21'30.1572" E 36°54'31.716" on** Latitude -2. 3583770 and Longitude 36.9088100. The project site measures approximately **162.67 hectares** in size. The land is owned by the proponent (**MR. RAJ KIRANKUMAR SHAH**); land ownership documents have been attached in the annex section of this report.



## 2.4. PROJECT IMPLEMENTATION

*Pre-construction (planning) phase* did involve designing the project and seeking the appropriate approvals from the relevant authorities, scoping and environmental screening, site visits and analysis of the baseline information).

*Construction phase* (site clearance, acquisition of construction materials, transportation of building materials, construction works and setting up of horticultural plots). The *Operational phase* shall entail running and managing the horticultural farm as per the laid down rules and procedures; and eventually, decommissioning/abandonment phase (demolition of facility) after serving its course.

The proposed building development **i.e. the office building, staff quarters, gate houses** and all the other structural works will be constructed based on the applicable standards of Kenya. Other building standards including the Building Code and the British Standards BS 8110 and BS 5950, BS 4449, BS4461 etc. will be incorporated. Construction work will as well incorporate environmental guidelines as well as health and safety measures.

### 2.4.1. Site Preparation

The parcel of land will be prepared by excavations and demarcation to pave way for the proposed development. The implementation of the project's design and construction phase will start with thorough investigation of the site's biological and physical resources in order to minimize any unforeseen adverse impacts during the project cycle.

### 2.4.2. Construction Activities & Inputs

- **Construction materials**

These will include sand, cement, building stones, hard core stones, crushed rock (gravel/ballast), steel and wooden fixtures and fittings, glass, steel metals, timber, roofing sheets, painting materials among others. All these will be to the approved standards and shall be obtained from licensed dealers and especially those who have complied with the environmental management guidelines and policies. The construction will entirely put greater emphasis on locally available

materials. This will make both economic and environmental sense as it will reduce negative impacts during and after the construction. Building materials will be transported to the project site from their extraction, manufacture, or storage sites using Lorries. The building materials to be used in construction of the project will be sourced from the neighboring areas.

- **Construction machines including machinery;**

Include but not limited to excavators, trucks, concrete mixers and tools and other relevant construction equipment. These will be used for the transportation of materials, and in the construction works. Some of the machinery will use petroleum products to provide propulsion energy.

Water for construction purposes; this will be obtained from the boreholes existing on site.

- **Construction Activities**

The construction activities shall involve civil and engineering works as well as horticultural related activities.

a) Procurement of construction materials from approved dealers;
b) Transportation of construction materials and debris using heavy and light machinery;
c) Appropriate storage of the construction materials;
d) Site preparation i.e. site clearing, excavation and filling, laying of foundation, masonry works/building works including roofing, finishes, fixtures and fittings;
e) Disposal of the resulting debris/waste materials. All debris and excavated materials should be dumped on sites approved by NEMA through NEMA licensed waste handlers;
f) Electrical, civil, mechanical engineering and sanitary works; done by professionals;
g) Landscaping;
h) Storm water and drainage layout and laying of pavement blocks;
i) Completion of the development and operation after issuance of the occupation certificate and completion of works.

Farm related activities include:

a) Borehole drilling after acquisition of the authorization to drill from WRA;
b) Burrowing two (2) water ponds after the acquisition of relevant permits;
c) Opening up of the land in readiness of propagation of fruit trees, herbs and spices;
d) Preparation of the horticultural plots;
e) Soil fumigation and organic manure application;
f) Nursery bed establishment;
g) Setting up of an irrigation system;
h) Nursery establishment for propagation of horticultural crops;
i) Transplanting of the crops from the nursery to the main field.

### 2.4.3. Water Supply

The proposed project site already has access to borehole water which shall be utilized during the construction and operational phases. The proponent has also explored water harvesting alternatives by proposing to sink two (2) water ponds to collect rain runoff. The objective is to decrease the high water demands that are anticipated from the proposed project.

### 2.4.4. Solid Waste Management

The waste generated during construction and operation phases should be disposed by a NEMA licensed solid waste handler. The debris and solid waste generated during construction phase should be designated to approved dumpsites.

### 2.4.5. Liquid Effluent/Wastewater Management

This will be discharged into **Wastewater Treatment Plant (WWTP);** a facility designed to treat wastewater to remove contaminants and produce clean water suitable for discharge into the environment or reuse.

### 2.4.6. Workforce

The contractor will employ various workers at different capacities. It is also advised that he or she gets the workforce from the local area so that they can as well benefit and be part of the project. The project will make use of both skilled and unskilled workforce to implement the proposed development.

## 2.5. PROPOSED HORTICULTURAL PROJECT

The term Horticulture is derived from the Latin words: "hortus" meaning garden and "cultura" meaning cultivation. In ancient days the gardens had protected enclosures with high walls or similar structures surrounding the houses. The enclosed places were used to grow fruit, vegetables, flowers and ornamental plants. Therefore, in original sense "Horticulture refers to cultivation of garden plants within protected enclosures". At present horticulture may be defined as the science and technique of production, processing and merchandizing of fruits, vegetables, flowers, spices, plantations, medicinal and aromatic plants. Horticulture is the branch of agriculture that deals with growing plants used by people for food and medicine, as well as gardens and other forms of ornamental plants.

Horticulture is divided into four branches:

i) Floriculture: the science of production and utilization of ornamental plants.
ii) Olericulture: the science of production and utilization of vegetable crops.
iii) Pomology: the science of production and utilization of fruit crops.
iv) Landscape horticulture: beautification and protection of the environment.

When looking at horticulture production in Kenya, one notices that over the last decade there has been a considerable increase in its importance for both the local and export markets as well as for the processing industry. Kenya is endowed with diverse climatic and edaphic conditions favorable for the production of quality horticultural produces. Fruit Production is an important part of horticulture that plays a pivotal role in the livelihoods and food and

nutritional security of the community in the country. Due to the existence of large agro-climatic diversity, favorable soil conditions and ample water resources, different tropical and subtropical fruit crops are grown in different parts of the country. Hence, a variety of fruits can be produced in the country making fresh-produce available year-round. Kenya has also a comparative advantage for successful production of various fruit crops due to its proximity to major markets (Europe and Middle East) and availability of young and easily trainable work force. Fruit crops allow efficient utilization of resources like land, water, labor and agricultural inputs, resulting in higher income per unit of available resource while maintaining and developing the natural resource base. The contribution of fruits towards diversification of the economy of the country is also enormous. The development of fruit crops could provide the basis for the establishment of agro-industries, contributing for the transformation of the Kenyan agriculture.

Global production of fruit has tripled over the past 40 years, with most of the increases being recorded in the temperate regions. In recent years, the demand for fruit consumption is increasing. The trend will definitely continue to grow as the awareness and purchasing power of the population is increasing. However, to meet the increasing consumer demand for fresh produce, the production and productivity of fruit crops produced in various parts of the country need to be improved. Modern fruits and vegetable production is critically dependent on knowledge. It needs technically-competent, skilled people in all parts of the industry who can respond quickly to market opportunities and production demands.

The Proponent intends to grow fruit trees such as the dragon fruit and avocado alongside spices and herbs like lemon grass, Moringa etc.

A dragon fruit production business has been revealed as viable source of food, income and employment. The marketability of dragon fruit in local market is expected to be high because of limited number of commercial producers of dragon fruit. The fruit has medicinal properties, it used to prevent colon cancer and diabetes, neutralizes toxic substances such as heavy metals. It is

concluded that dragon fruit production is profitable and has considerable potential for the expansion in the country. Excepts for high initial establishments cost due to the use of trellises, the other agronomic practices are easy and less expensive, hence the low maintenance cost. Hence dragon fruit production can be widely adopted in country. There is also need to shift from the traditional orchards and diversify the fruit basket, which meet the therapist demand of consumers & also suited to drought prone & degraded lands.

It is against this background that the Proponent sought to venture into agro-industry (fruit, herbs and spices) production to utilize land resource and address the ever rising demand for fruits and fresh vegetables. The proponent intends to cultivate fruit trees such as ***Dragon fruits, avocado etc.***; Spices and culinary herbs, for example, ***the green or dried leaves of rosemary, lemon grass, Moringa, coriander, basil, parsley etc.*** for local consumption and export.

Culinary herbs are referred to as those fresh or dried parts of the plants that are used particularly for flavoring and adding fragrance in cooking. Either their leaves, flowers, seeds, bark, root, or whole plants can be consumed fresh as an ingredient for food recipe or can be processed into value-added products such as herbal tea, candies, jellies, and flavored oils or can be dried and stored for later use. Generally, the leaves used in cooking may be referred to as culinary herbs, and are used in Western and Continental cuisines for their aromatic flavors.

**Dragon Fruit**

Dragon fruit is mainly available in three variants viz., red skin with white pulp (Hylocereus undatus), red skin with red pulp (Hylocereus monacanthus previously known as H. polyrhizus) and yellow skin with white pulp (Hylocereus megalanthus previously known as Selenicereus megalanthus). The red-fleshed varieties of dragon fruit are relatively rich in antioxidants. It is known to prevent colon cancer, diabetes and neutralizes toxic substances such as heavy metals; reduce cholesterol and high blood pressure. It is rich in

vitamin C, phosphorus and calcium. The flavour of the fruit resembles to kiwi fruit. Dragon Fruits are low in fat and rich in minerals with the optimum Brix value of 15-180Bx. It is widely used as fruit salad in star hotels and restaurants. It can be processed to range of industrial products such as juice, jam, syrup, ice cream, yogurt, jelly, preserve, candy and pastries. The red and pink pulp of dragon fruit is used for extraction of natural colours. The flower buds of dragon fruit are used to make soups or mixed in salads.

Dragon fruit is a perennial long-lived plant with 20 years commercial life. In cultivation it starts fruit production from the second year onward. It is propagated mostly by vegetative means using cuttings. The entire stem segment or part of stem segment of 15-30 cm mature cutting should be used to get better plants. To prevent diseases especially the rots, cutting are to be treated with fungicides and cured in a cool, dry area for 5-7 days before planting. The rooted cuttings are ready to transplant in the main field within 30-40 days in the nursery. The recommended spacing of 3.0-4.0 m x 3.0 m provides adequate air circulation and lowers the chances for occurrence of diseases where as in low fertile dry land areas denser plant population is recommended (3.0 m x 2.5 m spacing) to compensate the yield reduction per unit area.

Dragon fruit grows as a climbing cactus in shaded or semi-shaded positions under large canopies; it may be injured by extreme sunlight and can tolerate some shade. Dragon fruit, while being a type of cactus, perform poorly under extremes of temperature and cannot tolerate high light and temperature. It requires warm climate thus it grows well in semi-arid regions (Feng-ru and Chung-Ruey, 1997a; 1997b). Optimum temperatures for growth are 18-25°C, with good relative humidity levels; it is tolerant of windy conditions and moderately saline soils.

In high radiation areas, overhead shading is often installed, which also helps reduce extremely high temperatures, which can limit flowering and fruit set. Recommendations for shading are to apply the minimal amount of shade required to prevent bleaching of the stems and ensure the plants are not water

stressed as this reduces the crop's resistance to high light damage. The proponent intends to set up about 35 shade houses to prevent the fruit crops from high radiation/light damage.

**Avocado**

An avocado is a tree fruit that originates in Mexico and Central America. Some archaeological research indicates that avocados were found in Mexico in 8000 B.C. and in Peru towards 3000-4000 B.C. The area of origin is not exactly known, given the existence of several wild populations. With a world production of 3.2 million tonnes in 2004, the avocado can be regarded as an international fruit. North and Central America are the main producers (80%) while the rest of the world supplies the remaining 20%.

Fruits represent an important horticultural commodity and the ever increasing hectarage of the avocado and its respective yield production contributes to export, local consumption and processing.

Kenya is one of the world's top producers of avocados, and is a key contributor to the country's economic growth. Kenya has seen a significant increase in revenue from avocado exports, earning up to Ksh19 billion in recent years. The country's avocado industry has experienced rapid growth as demand for Kenyan avocados continues to rise in international markets. Kenyan avocados are highly sought after for their premium quality and taste, making them a popular choice among consumers around the world. The country's avocado exports have expanded to countries such as Europe, the Middle East, and Asia, providing a steady source of income for Kenyan farmers.

The government of Kenya has been actively promoting the avocado industry, providing support and incentives to farmers to increase production and improve quality standards. This has led to a significant boost in avocado production and exports, contributing to the country's overall economic growth. With the global avocado market expected to continue expanding in the coming years, Kenya is well-positioned to capitalize on this trend and further increase

its revenue from avocado exports. The country's success in the avocado industry serves as a testament to the potential of the agricultural sector to drive economic growth and create opportunities for smallholder farmers.

Avocado production escalated from ***441,593 metric tons in 2022 to 518,500 metric tons in 2023, marking a 14.8 percent*** upswing. ***As of 2023, the avocado value had grown to Ksh19.4 billion, representing a 12 per cent boost in foreign income from exports.***

The avocado fruit was once a luxury food reserved for the tables of royalty but is today enjoyed around the world by people from all walks of life. Combined with its outstanding productivity in Kenya, the avocado has many uses and its nutritive value is exceptionally high. A serving of avocado provides about twice the amount of the daily requirement of several minerals and vitamins. For a fresh fruit, it has unusually high protein content – comparable to animal sources in quality. The high content of both minerals and proteins makes avocado a highly nutritious food; avocado oil is easily digestible and can have beneficial effects on the digestive system. The oil is largely unsaturated and as the sugar content is low – about 3%.

In Kenya, three Avocado races and their hybrids are grown at more or less the same latitude, ***the West Indian race*** is usually found between sea level and 1000 m, ***the Guatemalan race*** is best adapted to an altitude between 1000 and 2000 m while ***the Mexican race*** flourishes best from 1500 to 2500 m. Kenya has more than 40 varieties of avocado, including:

- ***Hass:*** *The most popular variety exported and sold locally. Hass avocados are known for their rich flavor, creamy flesh, and spherical shape. The skin turns from green to dark purple-black when ripe.*
- ***Fuerte:*** *A pear-shaped variety with thin, glossy skin that's easy to peel. Fuerte avocados are preferred for processing and sold locally. They have a lower fat content and fewer calories than Hass avocados.*
- ***Pinkerton:*** *A pear-shaped variety with dark or pale green skin.*
- ***Hurst:*** *A popular variety for export and local consumption*

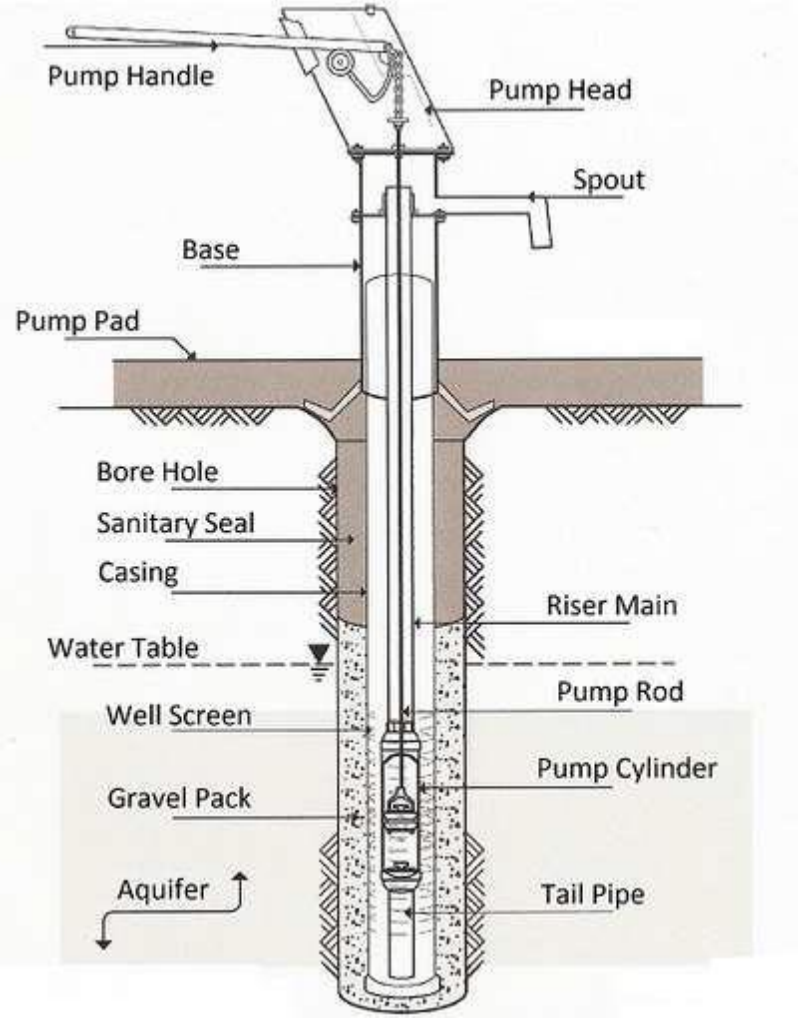
Other varieties of avocado in Kenya include: ***Keitt, Reed, Booth 8, Simmonds, Nabal, Puebla, Tonnage, Ettinger, Hayes, and G6 and G7.***

## 2.3. PROJECT DESCRIPTION FOR THE BOREHOLES

***Project Planning***

The planning and design of the project has already been done. A registered hydro-geologist conducted the field investigations which included geomorphological interpretation and hydrogeological reconnaissance to establish overview impression of the area. This led to the hydrogeological survey report that is in the annex. Part of the planning has also involved the WRA for providing the authorization/permit to conduct the drilling. This EIA project report also forms part of the planning process as it outlines both positive and negative impacts the borehole will have on the environment during drilling, operation and decommissioning and provides workable mitigation measures.

Drilling is preceded by geophysical survey by an authorized expert to establish the presence and depth to suitable aquifer. The findings are submitted to Water Resources Authority for approval. Drilling of the borehole is expected to commence upon approval of the project by all the relevant statutory authorities. The proponent will engage a down-the-hole rotary drilling method which is appropriate for this terrain. The well is constructed once the driller finds layers of fractures that produce enough water to meet the borehole owner's needs. After drilling, the installation process is followed by pump test which is carried out to determine aquifer properties and the optimum capacity of borehole. The pump test is conducted for continuous 24hrs, upon which the appropriate pump is selected.




***Borehole components: Source: Living Water International***

## 2.4. Project Design

The proponent has chosen to employ the services of rotary, down-the-hole hammer (DTH) technique. In terms of technology the alternative to this drilling technique is the cable tool or percussion drilling method. Cable tool method is cheap but drilling efficiency is affected and cannot work in areas with hard rocks.

Using a Down the Hole (DTH) Rotary drilling machine, the drilling contractor will drill up a borehole 8 inch in diameter and 270-m deep. It is estimated that the drilling will take four days and two more days for test pumping if no hard rock formation is encountered.

## 2.5. Project Implementation

The project is implemented as follows:

- Undertake a hydro geological survey (Survey report attached). This is either done by a licensed private hydro geologist or by the Water Resources Authority. The survey report contains the following information;
    - Recommended depth and Exact point of drilling.
    - Location map sheet, elevation and coordinates.
    - Hydrogeology and geophysics of the area.
- Application for Authorization to drill. This is obtained from the Water Resources Authority upon submission of the following documents;
    - Copies of hydro geological survey report in triplicate.
    - Copies of deed plan or title deed in triplicate.
    - Permit application form duly filled and signed.

### 2.5.1Drilling Procedure

An 8 inch diameter borehole is drilled and 6" steel plain casing installed up to the bottom depending on the productivity of the borehole. 2-4mm gravel pack is installed between the borehole wall and the casing. This is very essential as it filters water from the rocks (aquifers) before going into the screens. Borehole development follows after gravel packing with the use of compressor to flush out continuously for several hours until the water is clean. Test pumping is then carried out by performing a 24 hour continuous discharge test to ascertain the exact yield of the borehole in $m^3$/hr. Recovery test continues immediately after constant discharge test. The borehole is then covered by installation of permanent surface casing and finally a five (5) liters bottle of water is collected during test pumping and taken to government chemist to check on the chemical analysis of water.

### 2.5.2. Well Design

The design of the well should ensure that screens are placed against the optimum aquifer zones. The final design should be made by an experienced hydrologist.

### 2.5.3. Casing and Screens

The well should be screened with good quality screens considering the depth of the borehole. Stainless steel casing should be preferred. Screens of 6" diameter should be used. Slots should be of maximum 2mm in size.

### 2.5.4 Gravel Pack

The use of gravel pack is recommended within the aquifer zone, because the aquifer could contain sands or silts which are finer than the screen slot size. An 8.5 diameter borehole screened at 6", which should be sufficient. Should the slot size chosen be too large, the well will pump sand, thus damaging the plant and leading to gradual siltation on the well. The grain size of the gravel pack should be an average 2-4mm.

## 2.6 Well Construction

Construction can proceed once the design is agreed upon. In installing screen and casing, centralizers at 6 meter intervals should be used to ensure centrality within the borehole. This is particularly important to insert the artificial gravel pack all around the screen. If installed, gravel packed sections should be sealed off, top and bottom with clay (2m), the remaining annular space should be backfilled with an inert material and the top 5 meters grouted with cement to ensure that no surface water at the well head can enter the well and thus preventing contamination.

### 2.6.1. Well Development

Once screen, pack, seals and backfill have been installed, the well should be developed. Development aims at repairing the damage done to the aquifer during the course of the drilling by removing clays and other addictive from the borehole wall. Secondly, it alters the physical characteristics of the aquifer around the screen and removes fine particles.

The use of air or water jetting or the use of the mechanical plunger is recommended as a means of development. This method physically agitates the

gravel pack and adjacent aquifer material and it is extremely efficient in well cleaning.

Wells development is an expensive element in the completion of a well, but is usually justified in longer well-life, greater efficiencies, lower operational and maintenance costs and a more constant yield.

### 2.6.2. Well Testing

After development and preliminary tests, a long duration well test should be carried out. Well tests have to be carried out on all newly-completed wells because not only does this give an indication of the success of the drilling, design and development, but it also yields information on aquifer parameter which are vital to a hydro-geologist.

A well test consists of pumping a well from measured start at a known or measured yield and recording the rate and pattern by which the water level within the well changes. Once as dynamic water level is reached, rate of inflow to the well equals the rate of pumping. The duration of the test should be 24 hours with a further 24 hours for a recovery test or less, depending on the rate of recovery during which the rate discovery to SWL is recorded. The results of the test will enable a hydro-geologist to calculate the test recorded.

### 2.6.3. Pump Installation

After testing and analysis of the results the pump can be selected and installed. It is important to select the right type of pump, which matches the characteristics of the well. It should have the right capacity to lift the water directly to the storage tank. The pump should never be installed in the slotted section, but at least 2 meters above or below the screened section. The electric submersible pump should be protected with a cut-off switch 2 meters above the pump inlet level.

## 2.7. Construction materials

There are various materials that are used in drilling process. These are classified as temporary or permanent. Temporary materials are those that are used during the drilling process, while permanent materials are those that are employed for installation purpose. Temporary materials include; water, drill

foam and lubricating oil. Permanent materials include; casings and screens, gravel packs, bentonite and cement and submersible pump and GI pipes.

**a) Aggregates**

These should consist of inert sand, gravel or crushed stones. These are materials that eliminate the physical hazard and open space of the borehole but do not prevent the flow of water through the well bore. They should be uncontaminated and of consistent size to minimize bridging during placement. The aggregate should be no more that fourth of minimum wall diameter through which it must pass during placement. Because aggregate or sealant is usually poured from the top of the borehole, care must be taken to prevent bridging by slowly pouring the aggregate and monitoring the process with frequent depth measurement.

**b) Sealants**

Sealants will be used to provide water tight barrier to infiltration of the water into the well bore, in the annual space or in the fracture an opening adjacent to the bore. Sealant should consist of Portland cement-based grout, bentonite-clay, or combination of the two. Additives can be used to enhance or delay the specific properties such as viscosity, setting time, shrinkage or strength. Sealing mixtures should be formulated to minimize shrinkage and ensure compatibility with the chemistry of groundwater in the well.

The first sealant should be installed at the top most screened section immediately after the aggregate. The sealant should cover the whole length of topmost screen. The viscosity of the sealant should be low to ensure high rate of penetration of the top most screen, the sealant can be installed to the ground level. However if according to the original design the topmost screen is at depth, more aggregate can be installed after the curing, if the sealant is up to a depth of about 10m. More sealant should be installed to a depth of 3m, above which a water tight cement/concrete grouting will be installed to the surface or one meter below the surface depending on the future use of the land.

**c) Concrete apron slab**

A water tight concrete apron slab should be constructed. The top soil around the borehole should be excavated at a radius of one meter from the borehole to a depth of at least three meters and filled with water tight concrete to a minimum thickness of one meter. After grouting, the pit can be backfilled or concreted to the top depending on the intended future use of the land.

### 2.4.7. Estimated Project Budget & Projected Duration

The total estimated cost for the project is approximately Kenya Shillings; **Seventy Five Million, Seven hundred and Thirty Seven thousand and sixty six shillings (KES. 75,737,066.00).** Construction of the same will take approximately 1 year to complete.

# CHAPTER 3: DESCRIPTION OF BASELINE INFORMATION, INFRASTRUCTURE & SERVICES

## 3.1. INTRODUCTION

This section describes the project area's physical, biological and socio-economic environments. The project needs to put to consideration various environmental aspects as it shall make utility of environmental resources.

## 3.2. PROJECT AREA

The proposed project site is located on plot **Kajiado/Mailua/1579** on site coordinates, **S2°21'30.1572" E 36°54'31.716".** The project area lies in Kajiado Central Sub-county, Matapato South Ward, within Lumbwa village in Mailua area. Pastoralism forms major source of livelihood for the local communities. The vast land provides grazing ground and water for livestock. The animals kept include indigenous cattle, sheep, donkeys and goats.

Kajiado County is located in the Southern part of Kenya. The county borders the Republic of Tanzania to the Southwest, Taita Taveta County to the Southeast, Machakos and Makueni Counties to the East, Nairobi County to the Northeast, Kiambu to the North and Narok County to the West. The county covers an area of 21,872 Sq. Km.

## 3.3. PHYSICAL ENVIRONMENT

The physical environment can be described as the natural environment surrounding the proposed project site including the geology of the project site, the climate, soils, vegetation and the general topography.



### 3.3.1. Topography

Kajiado County main physical features include plains, valleys as well as sporadic volcanic ridges and hills. Lake Magadi has the lowest altitude of 595 metres above sea level while Ngong Hills in Kajiado North has the highest altitude of 2357 metres above sea level. The landscape within the county is divided into Rift Valley, Athi Kapiti Plains and Central Broken Ground. The Rift Valley is a lengthened depression on the western side of the county running from North to South. The floor of the Rift Valley in the county is broken by volcanoes, where the steep walls form plateaus and plains structurally forms features such as Mount Suswa and Lake Magadi.

***Source: County Integrated Development Plan; Kajiado County 2023-2027***

### 3.3.2. Climate

Kajiado County is primarily semi-arid. The climate is influenced by altitude, especially Mount Kilimanjaro, Ngong Hills, Chyulu Hills, Loita Hills and Mau Hills. The mean annual rainfall ranges between 300mm and 800mm but increases in Ngong Hills, Chyulu Hills and Nguruman Hills to about 1250mm per annum. The rainfall occurs in two seasons, the magnitudes which varies from the east to the west. The long rains occur in the months March-May and the short rains in October-December. Most of Kajiado County lies in the semi-arid and arid zones (Agro-climatic zones V and VI).

Rainfall is bimodal, with "short rains" from October to gradually from east to west across the County. In eastern part of the County, especially in Oloitokitok, Ong‟ata Rongai and Kitengela more rain falls during the "short rains" than

during the "long rains". In western Kajiado the majority of rain falls during the "long rains".

### 3.3.3. Hydrology

Kajiado County experiences long rains between March and May every year with short rains falling between October and December. The rainfall patterns vary from place to place depending on the converging – ascending air flow, air temperature, moisture bearing winds and mountain ranges. As at the year 2022, the average highest rainfall recorded was 389.9mm around Ngong hills and the slopes of Mt. Kilimanjaro. The lowest was 2.3mm recorded around Amboseli basin and the western parts of the county. This shows a negative trend in the average yearly rainfall received owing to the effects of climate change.

There are small streams draining into **Ngatataek River** within the project's site vicinity. These streams vary in their flows with higher intensities during the wet seasons in comparison to dry seasons. The water resources in this ecosystem are faced with numerous threats ranging from erosion, siltation and pollution. Further, livestock overgrazing during the dry season has led to the degradation of the water catchment which ultimately interferes with water quality and quantity flowing in the rivers and springs.

### 3.3.4. Drainage

The drainage system in Mailua area is inadequate. There is no existing drainage system to accommodate large amounts of water during heavy rains. There are several seasonal streams/rivers near the project site which dry up during the dry season.

### 3.3.5. Temperatures

Kajiado County has a cool dry climate with mean annual temperatures. Over the last seven (7) years, the mean annual temperature was 38.2°C with the years 2021, 2020, 2019 and 2017 receiving 29.2°C, 28.6°C, 28.4°C and 28.4°C, consecutively. This shows an increasing trend of temperatures recorded over

the past years. The highest temperatures of about 34°C, have previously been recorded around Lake Magadi while the lowest of 10°C, in Loitokitok on the eastern slopes of Mt. Kilimanjaro.

***Source: County Integrated Development Plan; Kajiado County 2023-2027***

### 3.3.6. Soils

The soil in and around the proposed site is moderately drained black clay-loam soil that remains unmodified covered by indigenous vegetation.

The area's soils include well drained, shallow to moderately deep; brown to dark brown, firm and slightly smeary, strongly calcareous, stony to gravelly clay loam; in many places saline and/or sodic soils and with inclusions of lava fields. (National Accelerated Agricultural Inputs Access Program Report, 2014). The three (3) geological regions in the county are Quaternary volcanic, Pleistocene and basement rock soils. They are mainly found in Rift Valley especially the Quaternary volcanic. In the Amboseli lake drainage system are the Pleistocene soils and the basement system rocks are found mainly along the river valleys and some parts of the plains. Basement rocks mostly comprise of various gneisses, cists, quartzite and crystalline limestone.

## 3.4. BIOLOGICAL ENVIRONMENT

### 3.4.1. Flora

Trees play an important role in our daily lives. The obvious ones they attract rain, act as water catchment areas, purify air, act as wind-breakers, block noise and dust, produce oxygen and in return take in carbon dioxide (act as carbon sinks), control soil erosion, act as a habitat (homes for birds and insects), absorb run off and also increase the aesthetic value among many others. Within the proposed site, there are indigenous shrubs and bushes and a dense vegetation canopy covering the tract of land.

## 3.5. SOCIO-ECONOMIC ENVIRONMENT

### 3.5.1. Administrative and Social Amenities

Social amenities in the area are not quite diverse owing to the fact that the site is in the rural where population density is quite low affecting economic development.

The county is sub divided into eight (8) administrative sub counties with a total of 19 wards. The project area lies in Kajiado Central Sub-county, Matapato South Ward, within Mailua village.

The nearby police station is **Namanga Police Station,** about 28kms from the proposed project site. The proposed site is also in close proximity to social establishments, like local dispensaries and schools.

### 3.5.2. Population Density

The county's population growth is 5.5 percent occasioned by migration from the neighboring counties attracted by employment opportunities and availability of land for settlement. Kajiado Central indicates the lowest population figures at 161,892 in 2019 census and projected at 179,319 in 2022.

Population density is the number of persons occupying an area divided by land area in square kilometers in a given time. The county average population density in 2019 was 51 persons per square kilometer. The projected population density in 2022 is 56.6 persons per square kilometer and is estimated at 63 persons per square kilometer by the end of the plan period. **Namanga location had the highest population at 18,515 and Mailwa with the lowest of 2,234. The overall population density was 27 people per km2. Mailwa location has the least at 11 people per km2.**

### 3.5.3. Economic Activities

The local communities depend on Namanga hill for water because of the existence of various rivers, springs, boreholes and shallow wells. Boreholes and shallow wells are recharged through water seepage to the underground system. There is little sedentary agriculture. Common crops grown include maize, beans, watermelons, pawpaw, tomatoes, oranges and avocadoes. The

community also own Mailwa and Ol Donyo Orok group ranches. Few households have non-farm small scale businesses such as selling of charcoal, firewood, honey, medicinal herbs and wood carving.

***The agriculture*** sector plays a critical role in the provision of food, livelihoods and wealth creation including employment opportunities in the County. Ecologically, the County has approximately 26,000 ha (1.2 percent) of land area in ecological zones II and III, 141,000 ha (6.4 percent) in ecological zone IV and the rest in ecological zones V and VI. Only 1670 km² (approximately 7.6 percent of the county) in ecological zone II, III and IV receive more than the 500 mm of annual rainfall which can support rain fed agriculture. Small scale farms have an average of 9 ha while large scale farms having an average size of 70 ha. The total acreage under food crops is 1,067 ha and the acreage under cash crops is 60 ha.

Horticulture is also gaining prominence, especially tomatoes, bulb onions and kales, floriculture is popular within the areas of Isinya, where greenhouse farming is used. This is mainly done under irrigation in green houses.

***Livestock keeping*** is the main source of livelihoods and a major economic activity in the County. The main livestock breeds are sheep, goat, beef and dairy cattle, commercial chicken, indigenous chicken, donkeys, pigs and camel. Livestock products in the County include beef, milk, skins, and hides. The average annual milk production per year is 10,356,823(2022) liters, beef production is 3,764,389 Kgs, chevon production is 2,674,113 kgs, poultry production is 345,600 and egg production is 1,440,000 trays. There are very few value additions ventures in the County.

***Source: County Integrated Development Plan; Kajiado County 2023-2027***

## 3.6. INFRASTRUCTURE & SERVICES

The county has 907.98 Km of roads registered under KeNHA. Of these, 416.76 Km are paved while 491.22 Km are unpaved. In addition, KeRRA has total registered roads totaling to 388.2 Km out of which 4.54 Km are paved while 383.68 Km are unpaved. KURA has a total registered paved roads totaling to

4.75 Km with 267.76 Km of being unpaved roads. The County Government manages 33.21 Km of paved roads and 4240.45 Km of unpaved roads. In total, Kajiado County has a road network of approximately 5842.36 Km.

### 3.6.1. Roads and Accessibility

The proposed site can be easily accessed using Kiajiado-Namanga route; approximately 8km from the highway.

***Proposed site showing the natural vegetation cover i.e. grass, shrubs, bushes, trees etc.***

### 3.6.2. Water Resources

The area has no any established water supply hence the need to sink boreholes. Drainage in the area is by small streams draining into **Ngatataek River**. Due to the unreliability and subsequent shortage of water in the area, boreholes are dug to supplement water needs for the residents. Largely, the county does not have a reliable source of water with the main sources of water being seasonal rivers, shallow wells, springs, dams, water pans and boreholes.

### 3.6.3. Waste Water Disposal

There is an increasing demand for adequate safe water provision and the need to have proper sewerage systems. The county's spatial plan provides for the future expansion of existing sewer lines and construction of new sewerage systems with modern efficient sewerage treatment facilities. Consequently, the residents of Mailua area utilize pit latrines. The entire development will rely on a Wastewater Treatment Plant to manage all its effluent waste.

### 3.6.4. Solid Waste Management

Solid waste management entails the handling, segregation, storage, collection, transportation, processing and disposal of solid waste.

The proponent shall engage a NEMA licensed solid waste handler to manage all the waste generated on site during construction and operation phases. The proponent is also encouraged to avail properly labeled trash bins on site to facilitate segregation of waste during the construction and operation period. The closest public dumpsite managed by the County Government is at Bissil. There are several private investors mandated to collect garbage from homesteads at a fee ending at the dumpsites.

### 3.6.5. Energy

Mailua area is well served by electricity from the national grid; however the project site is yet to be connected to the existing power grid. The proposed horticultural farm will make use of solar energy as the main source of power.

The major sources of lighting energy are electricity, solar, lantern and tin lamp. The Analytical Report on Housing Conditions, Amenities and Household Assets 2012 indicates that the percentage distribution of households using electricity is 39.8, tin lamp 39.8 and lantern 18.9 percent.

### 3.6.6. Communication Network

The area is served with low signal frequencies affecting communication.

Mobile telephone connectivity in the county is at 60% with major signal instabilities in parts of Kajiado West, South and Central. Internet connectivity has major signal oscillations in most parts of the county. Most areas are served with radio and television services with some areas having low signal frequencies. According to the 2009 census, landline connectivity was 0.9 percent in Kajiado Central constituency.


***Public Institutions around in the neighborhood (Mailua area)***

### 3.6.7. Socio-Economic Importance of the Proposed Project

High economic growth and the ever rising population in Nairobi has led to rapid increase in demand for high end retail stores and other social amenities to cater for the sophisticated consumers. Commercial development can include business, office or retail development, or a combination of the three. Commercial development can come in a range of sizes and scales. Such developments supports complete communities by ensuring residents have places to shop close to where they live.

A commercial mall is a complex of stores located in a building and it is managed as a single property. This retail format has shown the maximum growth because there, people can find a variety of shopping choices in a friendly and appealing environment, spending their time pleasantly.

Presently, Kilimani has a rich mix of cultures with a population consisting of individuals from diverse social backgrounds. It is known to host expatriates, high net worth individuals, renowned business persons, politicians, and foreigners alike. The area has a blend of maisonettes, modern apartments, mixed-use developments, and office suites. As Kilimani continues to grow and expand, investment opportunities for commercial developments in the area are on the rise with the key pull social amenities being good infrastructure, hospitals, education institutions, high end shopping malls and entertainment joints.

The proposed project will generate the following positive socio-economic impacts:

- The proponent will contribute towards the economic growth of our nation through revenue collection.
- The proposed project will serve as a source of income to the proponent thereby improving living standards.
- During the occupation phase of the project, the proponent will be required to pay taxes to the government hence contributing to the economic growth of our nation.

- The proposed project will indirectly contribute towards enhancement of security in the neighborhood.
- The proposed project will generate revenue to the County government through payment of connection and service fee.
- Provision of modern office spaces and shops to business persons.

Apart from the direct employment of construction workers, the proposed project will also benefit the following categories of individuals:

- *Transporters.* Investors in lorry and trailer transport will benefit greatly from the project. This benefit will extend to vehicle dealers and manufacturers, lorry drivers and turn boys.
- *Cement Manufacturers*. The local cement manufacturers and their employees and shareholders are direct beneficiaries of the development.
- *Manufacturers and dealers of other building materials*. Most of the building materials to be used are locally manufactured. Relevant companies, their workers and shareholders will be direct beneficiaries of the development.

# CHAPTER 4: POLICY, LEGAL & ADMINISTRATIVE FRAMEWORK

## 4.1. GENERAL OVERVIEW/BACKGROUND TO THE EIA PROCESS

Kenya has a policy, legal and administrative framework for environmental management. Under the framework, the National Environment Management Authority (NEMA) is responsible for ensuring that Environmental Impact Assessments (EIAs) are carried out for new projects and environmental audits on existing facilities as per the Environmental Management and Coordination Act 1999 revised in 2015.

EIAs are carried out in order to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts and developing mitigation measures for the negative ones. The guidelines on EIAs are contained in sections 58 to 67 of the Act, (EMCA, 1999).

The role of Environmental Impact Assessment (EIA) is to contribute to the planning of a new operation or major alterations of an already existing one. The systematic consideration of environmental impacts, which is the main feature of EIA, often leads to the identification of alternative engineering or siting options and/or mitigating measures. As a result, EIA can have a major positive influence on the project's design and implementation.

EIA is one of the basic features in an Environmental Management System (EMS). Often, undertaking an EIA is a legal requirement for a company before it can receive planning permission or a permit to operate a major installation.

A major benefit of a formal EIA is that it provides environmental baseline information and prediction of impacts against which future operations can be periodically audited. Carrying out an EIA requires some environmental expertise and insight in addition to technical knowledge concerning the project itself. For major projects, a multi-disciplinary team is usually assembled to research on further information, evaluate the impacts and propose practical

alternative options. Local public authorities are often good sources of information and they should be involved in the EIA process.

The key environmental benchmark instruments used in the policy, legal and institutional framework for the proposed project are discussed in detail in this section.

## 4.2. LEGAL FRAMEWORK

It was not until recently that the Government of Kenya provided a bill for the establishment of an appropriate legal and institutional framework for the management and protection of the environment. The same was enacted into law as the Environmental Management and Co-ordination Act, 1999 and received the presidential assent on 6th January 2000. The key national laws governing the management of environmental resources in the country are as outline:

This ESIA report was done in accordance with section 58 of the Environmental Management and Coordination Act (EMCA) No.8 of 1999 Second Schedule 9 (1); the Environmental (Impact Assessment and Audit) regulation, 2003; and The Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019. This section aims to identify the applicable regulatory framework in Kenya as relevant to the project. The EIA Consultants prepared detailed regulatory framework which includes relevant laws, regulations, policies and standards related to environmental, social, health and safety, and planning issues.

As a tool for better environmental planning, Environmental Impact Assessments (EIAs) have been identified as some of the key components in such like new projects' implementation. According to section 58 of the Environmental Management and Coordination Act (EMCA) No.8 of 1999 Second Schedule 9 (1); the Environmental (Impact Assessment and Audit) regulation, 2003; and The Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019; Every proponent undertaking a project

specified in the Second Schedule of the Act as being a low risk project or a medium risk project,

Legal requirements have been reviewed and applicable laws and regulations have been identified and summarized in this chapter.

### 4.2.1. The Constitution of Kenya, 2010

Kenya's Constitution was enacted on 27th August 2010 replacing the old one that had been in place since 1963. The Kenya Constitution is the supreme law of Kenya that binds all persons and all State organs at both levels of government. Section 42 of the Act under Chapter 5-Land and Environment, states that every person has the right to a clean and healthy environment; which includes the right to have the environment protected for the benefit of the present and future generations through legislative and other measures particularly those contemplated in Article 69; and to have obligations relating to the environment fulfilled under Article 70 of the Act. Section 69 of the Act on Environment and Natural resources confers that; the State shall establish systems of Environmental Impact Assessment, Environmental Audit and monitoring of the environment as an obligation in respect for the environment. This ESIA report is therefore provided for in the Kenyan Constitution as an obligation to care and safe-guard the environment for future generations.

***This ESIA report is therefore provided for in the Kenyan Constitution as an obligation to care and safe-guard the environment for both the present and future generations. The constitution of Kenya provides for sound management and sustainable development of all of Kenya's projects, both public and private investments.***

### 4.2.2. The Environmental Management and Coordination (Amendment) Act, 2015

This act came into force on 14th January 2000 and amended in 2015. It aims at co-coordinating environmental protection activities in the country. In its

preamble, the Act states that every person in Kenya has a right to a clean and healthy environment. Section 58 of the act requires that all new development projects undertake Environmental Impact Assessment (EIA) while section 68 requires all on-going project to have an Environmental Audit with a view to finding out if the process and activities have any negative impact on the environment and to propose mitigation measures to counter such impacts The Act gives every person in Kenya a right to a clean and healthy environment. It also confers upon every person the duty to protect and safeguard the environment. Part V of the Act provides measures for protection and conservation of the environment. Pollution of the environment through waste disposal, noise, dust, radiation, pesticides, and smells is prohibited. The Authority (National Environment Management Authority) may issue and serve on any person in respect of any matter relating to the management of the environment a restoration order to require the person on whom it is served to restore the environment as near as it may be to the state in which it was before the implementation of a project or action. Thus the polluter pays principle shall apply. The Act also provides for heavy penalties on any person who commits an environmental offence under Part XIII. Section 148 provides that the Act shall prevail over any written law in force immediately before the coming into force of this Act, relating to the management of the environment. Section 58 of the Act deals profoundly with Environmental Impact Assessment; The section requires that the project proponent shall apply for an EIA license to the authority (NEMA) after preparing a project report detailing the probable impacts of the project and the measures taken in the design, construction, operation and decommissioning phases of the project to mitigate negative impacts. The application for an EIA license is in the form of a project report, where the authority is satisfied that the report discloses sufficient measures to mitigate negative impacts, it may issue a license, but in case where the authority is of the view that the project will have significant impacts on the environment and that the project report does not disclose sufficient measures to protect and conserve the environment, then the authority may require that a full EIA study

be conducted. Section 68(4) requires that the owner of premises or operator of a project shall take all reasonable measures to mitigate any undesirable effects on the environment.

In the Act, *environment* is defined in broader sense to include the physical factors of the surroundings of human beings including land, water, atmosphere, climate, sound, odour, taste, the biological factors of animals and plants and the social factor of aesthetics and includes both the natural and the built environment. An environmental Impact Assessment thus looks into both biophysical and socio-economic implications of a project.

***A full study ESIA repot for the proposed Horticultural farm and onsite support facilities is hereby carried out and an EIA License should be acquired before commencement of construction works.***

### 4.2.3. The Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019

This regulation amended the Environmental (Impact Assessment and Audit) Regulations, 2003 by deleting regulation 7 and substituting therefore the following new regulations. 7(1) Every proponent undertaking a project specified in the Second Schedule of the Act as being a medium risk project, shall submit to the Authority a comprehensive project report prepared pursuant to a recommendation under sub-regulation (3) (a) specifying the following:

- The nature of the project;
- The location of the project including proof of land ownership, the GPS Coordinates and the physical area that may be affected by the project's activities;
- The activities that shall be undertaken during the project construction, operation and decommissioning phases;
- A description of the international, national and county environmental legislative and regulatory frameworks on the environment and socio-economic matters;
- The preliminary design of the project;

- The materials to be used, products and by-products including waste to be generated by the project and the methods of their disposal;
- The potential environmental impacts of the project and the mitigation measures to be taken during and after implementation of the project. Etc.

In preparing a project report under this regulation, the Proponent shall consider the issues specified in the Second Schedule.

***An ESIA is hereby prepared for submission to NEMA specifying all the issues highlighted under sub-regulation (4).***

### 4.2.4. The Environmental Management & Coordination (Noise & Excessive Vibration Pollution Control) Regulations, 2009

The regulations seek to control noise and vibration pollution generated from various sources. Regulation 13 prohibits any person from carrying out construction activities at night, if such activities are likely to generate noise above the levels set under second schedule of these regulations. Regulation 14(3) requires that any person carrying out construction, demolition, mining or quarrying work shall ensure that the vibration levels do not exceed 0.5 centimetres per second beyond any source, property boundary or 30metres from any moving source. Regulation 15 requires that any person intending to carry out construction, demolition, mining or quarrying work shall carry out an EIA. During the Environmental Impact Assessment studies the regulations requires that natural resources, land uses or activities which may be affected by noise or excessive vibrations from the construction, demolition, mining or quarrying shall be identified. Secondly, the EIA shall determine the measures which are needed in the plans and specifications to minimize or eliminate adverse construction, demolition, mining or quarrying noise or vibration impacts; and, finally to incorporate the needed abatement measures in the plans and specifications.

***The contractor /sub-contractor for civil works will be required to ensure compliance with the above regulations in order to promote a healthy and***

***safe working environment throughout the construction phase. This shall include regular inspection and maintenance of construction equipment and machinery and prohibition of unnecessary hooting of vehicles at the site. During the operational phase, farm equipment that are likely to generate noise when in use shall be regularly checked, repaired and maintained to eliminate excessive noise emission.***

### 4.2.5. Physical Planning Act

The physical planning Act no.6 of 1996 of the laws of Kenya is a legislative framework for systematic land use planning. The Act provides for the preparation and implementation of physical development plan for connected purposes. It establishes the responsibility for the physical planning at various levels of government in order to remove uncertainty regarding the responsibility for regional planning. The Act requires that the local authority to ask for an Environmental Impact Assessment for any further development activity.

***The Proponent has carried out an Environmental & Social Impact Assessment for approval by NEMA. The proponent has received approvals of the architectural designs from the department of Land & Physical Planning (Kajiado County). Additionally, the department was engaged during Public Participation process for the proposed development.***

### 4.2.6. Factories & Other Places of Work Act (Cap 514)

This Act covers provision for health, safety and Welfare. These aspects are outlined here under;

***a) Health***

Under health, there should be provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances.

***b) Safety***

Special precaution against gassing is laid down for work in confined spaces where persons are liable to be overcome by dangerous fumes. Air receivers and fittings must be of sound construction and properly maintained.

***c) Welfare***

Section 55 provides for the development and maintenance of an effective programme of collection, compilation and analysis of occupational safety. This will ensure that health statistics, which shall cover injuries and illnesses including disabling during working hours, are adhered to.

### 4.2.7. Public Health Act (Cap 242)

The public health Act regulates activities detrimental to health. The owners of the premises responsible for environmental nuisance such as noise and emissions, at levels that can affect human health are liable for prosecution under this Act. Noncompliance with the laid down regulations under the Act may lead to prosecution in a court of law. An environmental nuisance is one that causes danger, discomfort or annoyance to the local inhabitants or which is hazardous to human health.

***The Environmental Management Plan (EMP) advices the Proponent on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost. The proponent shall also contract a licensed waste handler to collect all waste from the site for disposal at approved dump-site and the proposed development shall be kept clean at all times and all provisions of this act shall be implemented. The proposed farm***

### 4.2.8. County Government Act, 2012

An ACT of Parliament to give effect to Chapter Eleven of the Constitution; to provide for county governments' powers, functions and responsibilities to deliver services and for connected purposes. Section 104; (2) the county planning framework shall integrate economic, physical, social, environmental and spatial planning.

Section 115; (1) Public participation in the county planning processes shall be mandatory and be facilitated through:

Provision to the public of clear and unambiguous information on any matter under consideration in the planning process, including;

- Clear strategic environmental assessments;
- Clear environmental impact assessment reports;
- Expected development outcomes; and
- Development options

Section 163 (e) gives powers to the county governments to prohibit businesses which by reason of smoke, fumes, chemicals, gases, dust, smell, noise, vibration or other cause, may be or become a source of danger, discomfort or annoyance to the neighborhood, and to prescribe conditions subject to which such business shall be carried on.

Section 173 states that any person who, without prior consent in writing from the council, erects a building on; excavate or opens-up; or injures or destroys a sewers, drains or pipes shall be guilty of an offence. Any demolitions and repairs thereof shall be carried out at the expense of the offender.

The Act under Section 176 gives power to the county government to regulate sewerage and drainage, fix charges for use of sewers and drains and require connecting premises to meet the related costs. According to Section 174, any charges so collected shall be deemed to be charges for sanitary services and will be recoverable from the premise owner connected to the facility. Section 264 also requires that all charges due for sewerage, sanitary and refuse removal shall be recovered jointly and severally from the owner and occupier of the premises in respect of which the services were rendered. This in part allows for application of the "polluter-pays-principle".

***The appointed Contractor/Proponent will mitigate against such impacts by ensuring strict adherence to the Environmental Management Plan provided in this full study report throughout the project cycle. The***

***proponent shall also work in liaison with the relevant County Government departments.***

### 4.2.9. Land Titles Act (Cap282)

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

Section 27 further provides that every certificate of title shall set out a description of the immovable property therein referred to, with figures and references necessary to identify it on the plan or map of the area in which it is situated, and a correct statement of the right, title or interest of the person to whom it is issued.

Sub section 4 of this section requires that there shall be attached to every certificate of ownership a plan of the land the subject of the certificate, and the plan shall be signed by the Recorder of Titles and the Director of Surveys, or such officer as the Director of Surveys may appoint.

***Copies of land ownership documents are attached to this Report in the annex section.***

### 4.2.10. The Way Leaves Act (Cap 292)

Under the Act, the government may carry any sewer, drain or pipeline into, through or under any land whatsoever but may not in so doing interfere with any existing building. Section 7 of the Act makes it an offence for any person who causes building to be erected over any sewer, underground electricity and telephone cables, drain or pipeline.

### 4.2.11. Building Code/Building By-Laws

Building code provides control on the construction, alteration and additions to all buildings. Building code provides building by-laws which specifies the standards for space about buildings, building lines, height of buildings, ventilations, circulation of air, size of habitable room, access, parking, electricity and structural safety of the building. It also provides for controls in the installation and modification of all aspects of sewerage system on any land (UNCHS, HABITAT, 1999).

By-law 3(2) of the building code provides that the following operations shall be deemed erection of a building:

- The alteration or extension of a building.
- The changing of the use or uses to which land or a building is put.
- Increasing or reducing the number of dwellings in a building.
- The carrying out of any drainage work.
- The formation or laying out of an access to a plot.

The building by-law further stipulates that any person who builds or causes a building to be erected, in whole or in part, after the approval plans have become invalidated by virtue of this by-law shall be guilty of an offence as stipulated under by-law 9(2). By-law 18(1) further stipulates that inspection should be done by the council before any proceedings in construction and after completion of construction, a certificate of completion should then be issued by the council before any occupancy or use of any given building after final inspection has been made as required under by-law 16(3). Any person who occupies, use or permit the occupation or use of any building before a certificate of completion has been issued by the council in respect thereof shall be guilty of an offence.

**Site and Space around the Buildings**

**a) Side spaces**

A building which is designed either wholly or in part for residential purposes shall be provided on at least one side with an open space of 8 feet or more in

width measured from the boundary of the nearest plot fencing as stipulated under building by-law18(1).

**b) Service areas:**

Unless the council otherwise agrees, an approved open area should be left on each plot for the purpose of serving any building thereon and the means of access to such area, shall be of approved dimensions.

**c) Building lines:**

The council usually prescribes a building line for any street or part of a street and a person who erects any building other than the boundary wall, fence, gate, step or such like projections from the building, nearer to the street than such building line, shall be guilty of an offence as provided under by-law (29).

**d) Siting of buildings:**

All new buildings should be sited on a plot to ensure hygienic and sanitary conditions and avoid any possible nuisance or annoyance to the owners or occupiers of neighbouring plots as provided under by-law (24).

**e) Access of plots:**

Every plot should be provided with at least one access from the road. Any access or alteration to an existing access to a plot should be sited and constructed to the satisfaction of council as stipulated under by-law (25).

**f) Obstruction to view:**

Nothing in these by-laws shall be deemed to authorize the formation, laying out, or material widening of any means of access or any erection which creates an obstruction to the view of persons using any street used by vehicular traffic, at or near any bend, corner, junction or intersection likely to cause danger to such persons.

**g) Stair cases ventilation and lighting:**

All common stairs and common passages should be adequately cross ventilated and for common stairs sufficient natural and artificial lighting should be provided.

**h) Water Supply:**

The building by-law (143) provides that before a certificate of completion is issued by the council, the plans of a building should show that an approved wholesome water sufficient for the purpose to which the building is to be put will be provided, and the supply so provided should be connected to the fittings and ready for use.

**i) Drainage:**

Plans for every building must show satisfactory provision for the drainage unless the council otherwise agrees. Where storey buildings are involved, they should be constructed in a way to allow efficient drainage of that storey building.

**j) Sewers:**

According to by-laws (194-198), no person should, without written consent of the council, erect, or cause to be erected any building over a sewer line. The council may cause a building constructed in contravention of this by-law to be altered, pulled down or otherwise dealt with and may recover a civil debt and any expenses incurred in so doing from the person erecting the same or the owner thereof.

**k) Ruinous or dangerous structures:**

Where any building appears to be in a ruinous, dangerous or dilapidated condition, the council may require the owner of such buildings to secure, repair, renew or otherwise make safe to the satisfaction of the council, such building or remove the same as stipulated under by-law (243).

**l) Domestic servant quarters:**

Under by-law (246), any person who except, with the written permission of the council, uses or permits the use of any building or part thereof erected for the specific purpose of housing domestic servants for the accommodation of any person other than such servants employed on the plot by the occupier of a building on the plot, shall be guilty of an offence.

**m) Unauthorized buildings and change of use:**

By-law (252) of the building code provides that any person who erects or permits erection of a building without first obtaining the approval of the council

to plans submitted in accordance with the relevant by-laws shall be guilty of an offence. By-law (256) further stipulates that any person, who shall except with the permission of the council use any building or part thereof to be used otherwise than for the purpose specified in approved plan, shall also be guilty of an offence.

### 4.2.12. The Environmental Management & Co-Ordination (Waste Management Regulations 2006)

**Legal Notice No. 121 Section 4-6 Part II** of the Environmental Management and Co-ordination (Waste Management Management) Regulations, 2006 states that: - 4. (1) No person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.

Any person whose activities generate waste shall collect, segregate and dispose or cause to be disposed of such waste in the manner provided for under these Regulations.

Without prejudice to the foregoing, any person whose activities generates waste has an obligation to ensure that such waste is transferred to a person who is licensed to transport and dispose of such waste in a designated waste disposal facility. In addition, the Regulations state that:

5 (1) a waste generator shall minimize the waste generated by adopting the following cleaner production methods:

i. Improvement of production process through:-

- Conserving raw materials and energy;
- Eliminating the use of toxic raw materials; and
- Reducing toxic emissions and wastes

ii. monitoring the production cycle from beginning to end by:-

- Identifying and eliminating potential negative impacts of the product
- Enabling the recovery and re-use of the product where possible;
- Reclamation and recycling

iii. Incorporating environmental concerns in the design and disposal of a product.

iv. A waste generator shall segregate waste by separating hazardous wastes from non-hazardous waste and shall dispose of such wastes in such facility as shall be provided by the relevant County authority.

(23) No person shall engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by Authority under the provisions of the Act.

***The proponent shall ensure that the main contractor adopts and implements all possible cleaner production methods during the construction phase of the project. The contractor shall implement the above mentioned measures as necessary to enhance sound Environmental Management and Waste Management. The project proponent will be responsible for implementing the legal notice No 121 throughout the project cycle. The waste management regulations provides room for a NEMA licensed waste handler to collect and dispose solid wastes appropriately.***

### 4.2.13. Environmental Management & Co-Ordination (Air Quality) Regulations, 2014

The objective of these Regulations is to provide for the prevention, control and abatement of air pollution to ensure clean and healthy ambient air. Section 5 states that no person shall act in a way that directly or indirectly causes, or is likely to cause immediate or subsequent air pollution; or emit any liquid, solid or gaseous substance or deposit any such substance in levels exceeding those set out in the first schedule.

Further, clause 6 stipulates that no person shall cause or allow emission of the priority air pollutants prescribed in the second schedule to cause the ambient air quality limits prescribed in the first schedule to be exceeded. Clause 25 (1) states that no person shall cause or allow the emission of visible air pollutants

from a stationary or mobile vehicle in excess of the limits set out under the prescribed standard.

Clause 33 states that no person operating construction equipment or handling construction material shall allow emission of particulate matter so as to adversely affect the limits set out in the first schedule. Clause 35 states that no person shall cause or allow stockpiling or other storage of material in a manner likely to cause ambient air quality levels set out under the first schedule to be exceeded. Clause 38 stipulates that no person shall cause or allow emissions of priority air pollutants set out under the second schedule from disposal of medical waste, domestic waste, plastics, tyres, industrial waste or other waste by open burning.

***During the construction phase, the contactor shall ensure that air pollution at the construction site is minimized for environmental protection, workers health, and in compliance with Air quality regulations. The contractor can adopt a variety of strategies contained in the EMP to reduce dust, emissions, and other pollutants.***

### 4.2.14. The Water Act 2016

The purpose of the 2016 Water Act is to align the water sector with the Constitution's primary objective of devolution. The act recognizes that water related functions are a shared responsibility between the national government and the county government. It also gives priority to use abstracted water for domestic purposes over irrigation and other uses.

This Act of Parliament provides for the regulation, management and development of water resources, water and sewerage services. Part II section 9 of this Act states that every person has a right to access water resources, whose administration is the function of the National Government. Part III section 11 states, the establishment of the Water Resources Authority (WRA) whose functions are stipulated in section 12 and include but not limited to receiving water permits applications for water abstraction, collection of water permit fees and water use charges.

Section 63 of the act states that every person in Kenya has the right to clean and safe water in adequate quantities and to reasonable standards of sanitation as stipulated in Article 43 of the Constitution. Section 143 states that a person shall not, without authority conferred under this Act;

- Wilfully abstract, interfere with, divert or obstruct water from any watercourse or any water resource, or negligently allow any such obstruction, interference, diversion or abstraction; or
- Throw, convey, cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive matter or thing into or near to any water resource in such manner as to cause, or be likely to cause, pollution of the water resource.

Section 147 states that a person who commits an offence under this Act, or under any Regulations made under this Act, shall, if no other penalty is prescribed in respect of the offence, be liable to a fine not exceeding one million shillings or to imprisonment for a term not exceeding two years, or to both such fine and imprisonment.

***The proponent shall ensure that all provisions to conserve water resources both surface and underground are observed and that the EMP is implemented effectively. The proponent has already acquired authorization permits from WRA to sink 4 boreholes.***

### 4.2.15. Occupational Health & Safety Act, 2007

This is an act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. This legislation provides for protection of workers during construction and operation phases. It is tailored at implementation of the EHS plan in compliance with the relevant sections of this Act. The Act provides for the safety, health and welfare of workers and all persons lawfully present at work places. It provides for the registration of workplaces. The Act

outlines safety requirements in the use of machinery to prevent accidents and injuries.

**PART VII –MACHINERY SAFETY**

- All plant, machinery and equipment whether fixed or mobile for use either at the workplace or as a workplace, shall only be used for work which they are designed for and be operated by a competent person.
- Every part of an electric generator, motor and rotary converter and every flywheel directly connected thereto shall be securely fenced.
- Every machine intended to be driven by mechanical or any other type of power shall be provided with an efficient starting and stopping appliance, the control of which shall be in such a position as to be readily and conveniently operated by the person operating the machine.
- Suitable striking gear or other efficient mechanical appliances shall be provided and maintained and used to move driving-belts to and from fast and loose pulleys which form part of the transmission machinery and any such gear or appliances shall be so constructed, placed and maintained as to prevent the driving belt from creeping back on to the fast pulley.

Every employer shall:

- Be responsible for the safe condition of tools and equipment used by his employees, including tools and equipment which may be furnished by the employees.
- Ensure that no equipment or portable power tools shall be used in an environment that contains or is likely to contain flammable vapors or substances unless they are intrinsically safe for such environments.

***The Act is relevant both during construction and operational phases of the project. The proponent shall ensure that safety measures are implemented in the use of tools and machinery within site and that protection of the workers and general public with any form of***

***interaction with the construction site is observed as stipulated in the act.***

### 4.2.16. Environmental Management & Co-Ordination (Water Quality) Regulations, 2006

Part 1V of the Act provides for the use of water for agricultural purposes. The Act states that; No person shall be permitted to use wastewater for irrigation purposes unless such water complies with the quality guidelines set out under the Eighth Schedule to these Regulations. The Act further states that no person shall abstract water from such body for irrigational purposes unless such water meets the standards set out in the Ninth Schedule to these Regulations.

The Act prohibits Water pollution by stipulating that No person shall discharge or apply any poison, toxic, noxious or obstructing matter, radioactive wastes, or other pollutants or permit any person to dump or discharge any such matter into water meant for fisheries, wildlife, recreational purposes or any other uses unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards set out in the Third Schedule to these Regulations.

***Wastewater discharged during the operational phase shall comply with the provisions of this regulation. The proponent proposes to set up a Water treatment plant to treat all wastewater emanating from the farm. The discharge must comply with the standards specified in this regulation before being allowed into environment in order to protect the quality of water resources and the ecological function of aquatic ecosystems. Water resources within the project site shall be protected from pollution.***

### 4.2.17. The Agriculture Act (Cap 318)

The Agricultural Act cap 318 of the laws of Kenya seeks to promote and maintain a stable Agriculture to provide for the conservation of the soil and its fertility and to stimulate the development of Agricultural land in accordance

with the accepted practices of good land management and good animal husbandry.

***The proponent, once operational shall acquire the relevant permits from regulators like Kephis and Pest Control Service Products Board (PCSPB).***

### 4.2.18. Food, Drugs & Chemicals Substances Act (Cap 254)

The Food, Drugs and Chemicals Substances Act (Cap 254) whose purpose is to make provision for the prevention of adulteration of food, drugs and chemical substances. This Act (which has been invoked for the consumption of genetically modified food), requires that food, drugs, cosmetics, devices and chemical substances should not be sold if they are unwholesome, poisonous, or adulterated. It further prohibits deceptive labelling.

***Proponent should ensure strict adherence to the above provisions.***

### 4.2.19. Employment Act, 2007

An Act of Parliament to repeal the Employment Act, declare and define the fundamental rights of employees, to provide basic conditions of employment of employees, to regulate employment of children, and to provide for matters connected with the foregoing.

***The proponent needs to comply with the provisions of this Act, since it is the principle law governing the relationship between employer and employees in the country.***

### 4.2.20. The Work Injury & Benefits Act, 2007

An act of Parliament to provide for compensation to employees for work related injuries and diseases contracted in the course of their employment and for connected purposes.

### 4.2.21. The Energy Act, 2019

The Energy Act, 2019 is the main law governing the energy sector outside of the upstream petroleum operations. It has five main functions to regulate the energy sector by delineating the sectorial functions of the National and County

Government; to provide for the promotion of renewable energy; to regulate geothermal energy; to regulate the midstream and downstream operation of the coal and petroleum sectors; and to regulate the production and supply of electricity.

***Proponent should observe the provisions of the Energy Act. Energy Audits for the horticultural farm should be conducted as stipulated by law.***

### 4.2.22. Climate Change Act, 2016

An ACT of Parliament to provide for a regulatory framework for enhanced response to climate change; to provide for mechanism and measures to achieve low carbon climate development, and for connected purposes.

The goal of the Act is to provide a regulatory framework for an enhanced response to climate change, and to provide mechanisms and measures to improve resilience to climate change and promote low carbon development. The Act requires public agencies to integrate the National Climate Change Action Plan in their activities, report on sectoral greenhouse gas emissions for the national inventory, put in place and implement sustainability measures, and to report annually all climate change related duties and functions. This Act grants NEMA the authority to monitor, investigate, and report on climate change compliance activities. The Act also creates a Climate Change Fund that will help promote and incentivize actions to prevent and limit climate change.

The Act establishes the National Climate Change Council whose functions include:

- Ensure the mainstreaming of the climate change function by the national and county governments;
- Approve and oversee implementation of the National Climate Change Action Plan;
- Advise the national and county governments on legislative, policy and other measures necessary for climate change response and attaining low carbon climate change resilient development;

- Approve a national gender and intergenerational responsive public education awareness strategy and implementation programme;
- Provide policy direction on research and training on climate change including on the collation and dissemination of information relating to climate change to the national and county governments, the public and other stakeholders;
- Provide guidance on review, amendment and harmonization of sectoral laws and policies in order to achieve the objectives of this Act;
- Administer the Climate Change Fund established under this Act; and
- Set the targets for the regulation of greenhouse gas emissions.

The National Environmental Management Monitoring Authority shall on behalf of the Council; investigate and report on whether public and private entities are in compliance with the assigned climate change duties; ascertain that private entities are in conformity with instructions prescribed under section 16 of this Act; and regulate, enforce and monitor compliance on levels of greenhouse gas emissions as set by the Council under this Act.

## 4.3. INSTITUTIONAL FRAMEWORK

At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environmental Management Authority (NEMA), the Forestry Department, Kenya Wildlife Services (KWS) and others. There are also counties and international NGOs involved in environmental activities that impact on the environment in one way or the other in the country.

The key institution which is relevant with regard to the proposed development is the National Environmental Management Authority (NEMA) which is responsible for the enforcement of the Environmental Management and Coordination Act (EMCA, 1999 and Review 2015 Cap 387) and subsidiary regulations and standards.

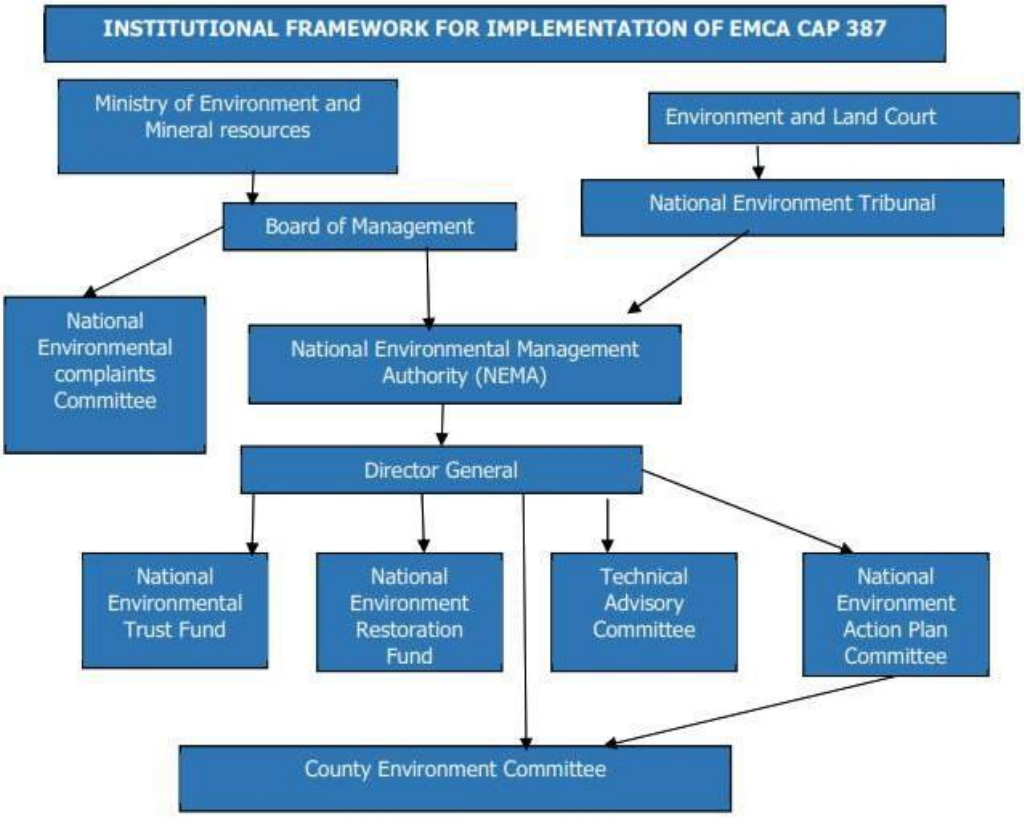



*Figure 2: Institutional Framework for EMCA Cap 387*

### 4.3.1. National Environmental Management Authority (Nema)

The object and purpose for which NEMA is established is to exercise general supervision and co- ordination over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. A Director General appointed by the president heads NEMA. The Authority shall, among others:

- Co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects with a view to ensuring the proper management and rational utilization of the natural resources on a

sustainable yield basis for the improvement of the quality of human life in Kenya.

- Take stock of the natural resources in Kenya and their utilization and consultation, with the relevant lead agencies, and develop land use guidelines.
- Examine land use patterns to determine their impact on the quality and quantity of the natural resources.
- Carry out surveys, which will assist proper management and conservation of the environment.
- Advise the government on legislative and other measures for the management of the environment or implementation of relevant international conservation treaties and agreements in the field of environment as the case may be.
- Advise the government on regional and international environmental convention treaties and agreements to which Kenya should be a party and follow up the implementation of such agreements where Kenya is a party member.
- Undertake and co-ordinate research, investigation and surveys in the field of environment and collect and disseminate information about the findings of such research, investigation or survey.
- Mobilize and monitor the use of financial and human resources for environmental management.
- Identify projects and programmes or types of projects and programmes, plans and policies for which environmental audit or environmental monitoring must be conducted under EMCA.
- Examine land use patterns to determine their impact on the quality and quantity of the natural resources among others. Moreover NEMA mandate is designated to the following committees:

### 4.3.2. County Environment Committee

The County Environment Committee has an oversight and decision making role at the County level. Like in the case of County Environment Committees, the County Environment Committees are responsible for the proper management of the environment within the province, which they are appointed. They are also to perform such additional functions as are prescribed by this Act or as may from time to time be assigned by the Minister by gazette notice.

### 4.3.3. Public Complaints Committee

The Committee is charged with the following functions:

- Investigating allegations/ complaints against any person or against the Authority (NEMA) in relation to the condition of the environment and its management.
- Prepare and submit to the Council periodic reports of its activities which shall form part of the annual report on the state of the environment, and to perform such other functions and excise such powers as may be assigned to it by the Council.

### 4.3.4. National Environment Action Plan Committee

This Committee is responsible for the development of a 5-year Environment Action plan among other things. The National Environment Action Plan shall contain:

- Analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time, and
- Analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity among other duties as the EMCA specifies.

### 4.3.5. Standards and Enforcement Review Committee

This is a technical Committee responsible for environmental standards formulation methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures. Standards and Enforcement Review

Committee consists of the members set out in the third schedule to the Environmental Management and Co-ordination Act.

### 4.3.6. National Environmental Tribunal

This tribunal guides the handling of cases related to environmental offences in the Republic of Kenya. The Tribunal hears appeals against the decisions of the Authority. Any person who feels aggrieved may challenge the tribunal in the High Court.

# CHAPTER 5: IMPACT IDENTIFICATION, PREDICTION AND EVALUATION

## 5.1. EXISTING IMPACTS

There were no notable negative environmental impacts on the site, at the time of the assessment.

## 5.2. ANTICIPATED IMPACTS

Impacts can be positive or negative, direct or indirect. The magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long-term or short-term, specific (localized) or widespread, reversible or irreversible.

Some impact mitigations have already been addressed in the proactive design and other mitigations can only be guaranteed through active, responsible management, helped by following the guidelines in the project's Environmental Management Plan.

**Table 1: Guideline table**

| Key | Type of impact | Key | Type of impact |
|---|---|---|---|
| ++ | Major positive impact | + | Minor positive impact |
| -- | Major negative impact | - | Minor negative impact |
| 0 | Negligible/ zero impact | NC | No change |
| Sp | Specific/localized | W | Widespread |
| R | Reversible | Ir | Irreversible |
| SH | Short term | L | Long term |
| T | Temporary | P | Permanent |

On the basis of information gathered during the field study, potential environmental impacts of the project are tabulated in Table 2.

| Impacts on or due to the implementation of the project | Remarks |
|---|---|
| **Changes in hydrology** | No effect to the hydrology of the area. There will be no obstruction to the flow of both surface and ground water resources, which is so because the soil in the area is not predominated with clay hence presence of surface and ground water is not notable. |
| **Pollution: Air/Dust/ Noise** | During construction: dust and exhaust emissions from involved machinery will affect air quality; construction activities, hooting of the involved vehicles and workers will generate noise and (vibration) which may have effect to the immediate neighbourhoods<br>Sound (respective) pollution control measures should be applied/adapted |
| **Site drainage** | Run-off will result from the increase impervious surfaces (roof catchments) of the proposed project. Due consideration should be taken on the surface drainage systems of the entire project and roof catchments.<br>The use of rainwater harvesting systems and suitable storage facilities may help in reducing run-off volumes within the site. |
| **Soil erosion** | Earthworks during construction will have an impact on soil erosion. During operation phase, soil erosion will not be a problem.<br>Incorporating appropriate soil conservation measures and proper drainage facilities during construction would mitigate the impacts. |
| **Water resources** | The site is connected to the main water pipe and the contractor will use this water for construction activities. There |

| | |
|---|---|
| | is no likelihood that this would put some strain on the water supply. However there has to be changes in the normal supply mostly during slabs lying/formation which demand a lot of water.<br>The operation of the proposed project will bring in additional water use within the area and hence additional water demand. Some pressure to the water supply is thus anticipated.<br>The use of rainwater from the roof catchments can however ease the anticipated pressure. The proponent should provide suitable rainwater harvesting systems (gutters, down pipes, storage facilities) |
| **Vegetation/Flora** | There is no significant vegetation on the site<br>Landscaping will be done within the site to improve the site appearance.<br>During occupation, any impact on vegetation/flora will be negligible |
| **Health and safety** | During construction, increased dust, noise and air pollution levels could impact on health and safety, particularly in the direct impact zone.<br>During the operation of the project health and safety will depend on the activities of the occupants. |
| **Disturbance of the public** | Disturbance to the public/neighbours would occur due to noise and dust during construction and traffic movement.<br>After construction, noise levels compared to the current situation will be negligible. |
| **Visual intrusion** | During construction, visual intrusion is attributed to construction works including construction traffic.<br>After construction of the project the situation will be permanent. In line with this, the proposed project should be |

| | |
|---|---|
| | blend in such a way to merge with existing environment and approvals by the county council. Visual impacts can be mitigated through controlling the operating hours and construction traffic, clearing debris after construction and landscaping the site. |
| **Construction materials** | Building stones will be required for the construction of the project. Other materials will include steel, plumbing materials etc. All these should be sourced from credible commercial suppliers who are sensitive to the general environment. Undesirable, hazardous or unauthorized materials should not be used. |
| **Construction waste** | Construction waste will be minimal. Proper disposal of waste generated is necessary; the waste should be disposed to the approved dumpsites, by licensed waste handlers. |
| **Clean on completion** | The contractor should ensure that when construction works are completed, the site is left clean and tidy. |
| **Positive impacts** | Construction activities will create jobs for skilled and non-skilled workers. Job opportunities for skilled personnel during the operation phase i.e. more engineers and technicians. |

### 5.2.1. Direct and Indirect Effects

**Employment and Income**

The facility will create employment opportunities especially during construction, thus generating wealth and livelihoods. Besides the direct employment, other forms of employment are likely to result from multiplier effects, such as increased urbanization, industrialization and local market for providing goods and services during both the implementation and operational phases.

### 5.2.2. Cumulative and Irreversible Effects

**Impacts of construction activities**

During the construction phase, sources of negative environmental impacts will emanate from the site preparation activities including excavation of soils, levelling of landscape and the subsequent construction activities.

The above activities will have varying negative impacts on the biophysical environment. Immediate negative impacts will include the subsequent disturbance of the exposed topsoil (the unpaved areas), which could lead to soil erosion and siltation. The combined effect of site preparation and construction activities on the site can lead to potential soil erosion problems.

Development on the transformed site may lead to continued soil loss especially during construction period when the ground is exposed. Soil wash out by the rains can lead to considerable ecological consequences.

In addition, there may be negative impacts related to visual intrusion, pollution, and negative socio-economic effects (including safety and health hazards) among other negative impacts if safe construction procedures are not followed.

### 5.2.3. Economic Effects: Short Term and Long-Term Effects

**Utility of the site**

The proposed development shall increase the value of the plot in which the project will be situated because it will entail construction of the operation space for the plot and hence exercising the full value of the area. The following are products, by-products and waste generated by the project:

a) Products, By-products and Waste generated during Project Construction

During the construction phase of the project, it is envisaged that the following products, by-products and waste will be generated:

- Dust emissions arising from excavation works of the proposed project site as well as emissions arising out of various construction activities, for example, VOCs from construction machinery and equipment,

- Timber, polythene sheeting and nails arising from the formwork that will be used to contain various concreting activities, empty cement bags, wet gunny bags (used for carrying concrete) etc.
- Fugitive oil spills arising out of improperly serviced trucks and construction equipment.
- Human effluent emanating from construction workers on the proposed site.

b) Products, By-Products and Waste generated during Operations.

Once the site is operational, products, by-products and waste generated shall mainly be household waste.

## 5.3. ISSUES OF CONCERN AND MITIGATION MEASURES

This part includes impacts during implementation/construction phase, operation phase and decommissioning phase on the following issues: *soil degradation; air quality; noise; oil wastes; water resources; solid and liquid waste management; drainage; terrestrial ecology, visual and landscape; traffic; public comfort; occupational health and safety (OHS); and energy.* Most of these key issues were identified during the scoping exercise and are clearly elaborated below:

### 5.3.1. Noise and Vibration

Noise is unwanted/undesirable sound that can affect job performance, safety and health. Psychological effects of noise include annoyance and disruption of concentration. Physical effects include loss of hearing, pain, nausea, and interference with communications when the exposure is severs.

Relatively high noise levels and vibrations are expected in the area during the construction phase and especially during the excavation period. Noise control measures should be implemented in the construction area if the noise levels exceed 90dB (A) for a continuous 8 hours exposure as per the requirements of the Noise Prevention Control and Prevention Rules, 2005 a subsidiary legislation to the occupational Safety & Health Act, 2007. In addition,

protection against the effect of the noise exposure among the workers should be effected.

***Potential Mitigation Measures***

- Construction work should be carried out during the specified time i.e. from 0730hrs to 1700hrs; noise generated during the day is not quite disturbing as compared to it being generated at night hours.
- Sensitize construction vehicles' drivers and machinery operators to switch off engines of vehicles when not in use.
- Workers should be provided with relevant personal protective equipment (PPE)/materials such as earmuffs and earplugs; when operating noisy machinery and when in noisy environment. These provide a physical barrier that reduces inner ear noise levels and prevent hearing loss from occurring.
- Suppressors or silencers on equipment or noise shields; for instance, corrugated iron sheet structures.
- Machinery should be maintained regularly to reduce noise resulting from friction.
- Provision of bill boards at the construction site notifying of the construction activity and timings.
- Manual labour is recommended in the construction phase, to reduce the noise emitted by construction machinery.

### 5.3.2. Loss of Soil Resources/Soil Erosion

Soil movement is common in construction projects. This mostly happens during the laying of foundations (earthworks) for the projects and site clearing. Most top loose material is excavated and transported elsewhere. Comprehensive soil erosion measures are thus important during the construction and operation phases:

***Potential Mitigation Measures***

- Provision of soil conservation structures on erosion prone areas to control occurrence of soil movement.

- Avoid unnecessary movement of soil materials from the site.
- Good management of the run-off/storm water to reduce its impact on loose soil.
- Control construction activities especially during rainy/wet conditions.
- Landscaping: Re-surface open areas on completion of the project and introduce appropriate vegetation where applicable.
- Provide appropriate drainage systems to manage surface run-off.

### 5.3.3. Impacts on Water Resources (Quality & Quantity)

Water is a universal resource and whose demand in the urban areas is high. The increase in demand for water will occur during the construction phase since some of the activities will require use of large quantities of water. Water will be sourced from local supplies as mentioned earlier in this report. During operation water demands may only be known upon establishment of the facilities.

***Potential Mitigation Measures***

- Encourage water reuse/recycling mostly during construction phase.
- Roof catchments of the building structures should be provided with rainwater harvesting systems (gutters, down pipes and water storage facilities) to enhance collection and storage of the runoff. Such water can be used in watering flower gardens, cleaning etc.
- Provide notices and information signs i.e. 'keep/leave the tap closed' etc. this will awaken the civic consciousness with regard to water usage and management.
- Install water-conserving taps that turn-off automatically when water is not in use.

### 5.3.4. Air Quality

The construction activities on the site will result to increased dust and gas emissions. Construction machinery and trucks generate hazardous exhaust fumes such as Carbon Oxides ($CO_2$), Sulphur Oxides ($SO_2$) and Nitrogen Oxides

($NO_2$). Dust particles caused by vibrations of machines and vehicle movement get suspended in the air mostly during dry spells.

***Potential Mitigation Measures***

- Provide Personal Protective Equipment (PPEs) such as nose masks to the affected workers on site during construction phase.
- Regular and prompt maintenance of construction machinery and equipment. This will minimize generation of noxious gases and other suspended particulate matter.
- Control over areas generating dust particles. Such areas should be regularly cleaned or sprinkled with water to reduce dust. The areas can be enclosed to mitigate effects of wind.
- Workers should be trained to understand the hazards that may be generated in such work environments.
- Workers should be encouraged to go for regular health check-ups to ascertain their health standards.

### 5.3.5. Oil Leaks and Spills

Oil/grease spills are noted to be prevalent in construction sites; and in most areas that make use of petroleum products. Such products contain detrimental elements to the environment since they contain traces of heavy metals such as mercury, lead and sulphur among others. Though this may not be common at the site, it is wise to control and observe the little that could occur especially during maintenance of the involved machinery.

***Potential Mitigation Measures***

- All construction machinery should be keenly observed not to leak oils on the ground. This can be done through regular maintenance of the machinery.
- Any maintenance work should be carried out in a designated area (protected service bays) and where oil spills are completely restrained from reaching the ground. Such areas should be covered to avoid storm water from carrying away oils into the soil.

- Car wash areas and other places handling oil activities within the site should be well managed and the drains from these areas controlled. Oil interceptors should be installed along the drainage channels leading from such areas.
- Develop a spill prevention and control plan to counter and manage emergencies that may occur/arise in the event of accidental spills.

### 5.3.6. Solid Waste Generation

Huge quantities of solid wastes are normally generated from construction activities. Such wastes include stones, wood, broken glasses, containers, rods of metal, pieces of iron sheets etc. There is need for proper management (proper disposal) of the solid waste expected from the site during construction phase.

***Potential Mitigation Measures***

- The contractor or proponent should work hand in hand with refuse handlers, NEMA and the County Council to facilitate sound waste handling and disposal from site.
- All solid waste should be taken for disposed of to the approved dumpsites and through licensed waste handlers.
- The waste should be properly segregated and separated to encourage recycling of some useful waste materials i.e. some demolished and excavated materials can be used as backfills.

### 5.3.7. Ecological Impacts

The site has no vegetation of conservation value hence the project will have no impact of ecology. It is however prudent to consider introduction of vegetation on site as part of environmental conservation initiative during the operation phase.

***Potential Mitigation Measures***

- Landscaping: Plant vegetation in all practical open areas on project completion.

- Manage the introduced vegetation on completion of the development to restore or improve the site.

### 5.3.8. Occupational Health and Safety (OHS)

During construction there will be increased dust, air and noise pollution. These are considered as negative impacts as they will significantly lower the quality of the environment.

***Potential Mitigation Measures***

- Capacity building and training of staff/workers with respect to Occupational Health, Safety and Environment. Provide safety measures for personnel, Personal Protective Equipment (PPE) - safety gear as per Health and Safety and Welfare – Special Provisions and Rules Regulations; conduct medical examination of workers as required by the Medical Examinations Rules of 2005 under the WORKPLACES Act (Cap 514) for occupations covered under Schedule 8 of the act.
- A first aid kit should be provided within the site and should be fully equipped (as per the First Aid Rules, 1977) at all times and managed by qualified and trained first aider(s).
- The contractor/proponents should initiate and develop effective emergency response plans ERPs to cater for various eventualities such as fire outbreaks, oil spills and other incidences that are likely to occur.
- Proper documented possible action plans (ERPs); need to be put in place in case of any incidences occurring.
- Where the workforce exceeds 20, the contractor should facilitate formation of a Safety and Health Committee, in accordance with the Health and Safety Committee Rules, 2004.
- The contractor should obtain a certificate of registration of Building or Construction from DOHSS.
- Appropriate abstracts should be displayed at strategic location including, the Workplaces Act, and Building Operations and Works of Engineering Construction, Rules, 1984.

### 5.3.9. Public Disturbance

Construction disturbances result from noise, lighting etc. such disturbances result in stress and other body reactions.

Disturbances may occur, which are likely to cause stress and other similar effects mostly during project implementation processes due to continued vibrations and noise generated by heavy machinery.

***Potential Mitigation Measures***

- Construction activities should be done only during the day.
- Erect billboards on the start of the project to psychologically prepare the people in the vicinity.
- The signs should indicate and inform the public when works starts and when it will be completed. Such information should be made clear for the interest of the motorists along the connecting roads.

### 5.3.10. Security

Security is a necessity for any development since it ensures that all planned activities run smoothly without any loss of construction materials especially during the construction phase. It (security) controls the movement within the site especially for intruders who might be injured by the materials and other hazardous features in the construction site. The area is well covered by communication networks and this to a great extent facilitates in security.

***Potential Mitigation Measures***

- The project site area should be enclosed with a secure wall all-around. Security should be beefed-up and movement within the site should be controlled.
- Provide lighting systems that illuminate the area well. Security alarms should be installed in strategic points all over the site area after completion of the project.
- Contractor should provide adequate security during the construction period when there is no work going on at the site. e.g. during the night and weekends.

- Provide a secure gate at the entrance to the site and also station some guards to man the gate and regulating movement in and out of the site.

### 5.3.11. Fire Hazards and Fighting

There are some operations that may pose a risk to fire occurrences at the construction site and even during operational period. These occurrences may arise during the construction phase but more in the operation/occupation phase since there will be extensive use of electricity in the houses, which are likely to cause Class C Fires. It should therefore be ensured that all operations during construction and occupation phases are in tandem with the Fire Risk Reduction Rules, 2007.

***Potential Mitigation Measures***

- Install an automatic fire alarm system for the entire project mostly on operation.
- All fire control and fighting facilities to be installed as per the requirements stipulated in the approved plans.

In addition to the above, the project management should consider the following:-

- Conduct regular fire drills/simulations to sensitize workers during construction phase.
- Adapt an emergency response plan for the entire project during occupational phase.
- Ensure that all fire fighting equipment are strategically positioned, regularly maintained and serviced.
- Provide fire hazard signs such as 'No Smoking' signs. Direction to exit in case of any fire incidence and emergency contact numbers should be provided.
- Provisions of marked fire exits and ensure that all fire exits are unobstructed at all times.
- The proponent to put up a trained fire fighting team in accordance with the Fire Risk Reduction Rules, 2007.

### 5.3.12. Construction Safety

Construction work can be particularly hazardous. Personal protective equipment, fire safety, electrical safety and other precautions are essential for safe construction work. Barriers and guards are also necessary to protect employees and visitors from physical hazards. Physical hazards that typically require barriers and guards are the following: Stairways, Open Manholes, Elevated platforms, Areas with moving machinery, Excavation sites, Construction sites, Temporary wall or floor openings, Doors opening into construction, etc.

***Proposed Mitigation Measures***

Follow these guidelines when visiting or working at construction sites:

- Do not walk, stand, or work under suspended loads. If you raise a load, be sure to crib, block, or otherwise secure the load as soon as possible.
- Avoid placing unusual strain on equipment or materials.
- Be prepared for unexpected hazards.
- Physical barriers should be implemented wherever physical hazards are identified to reduce accidents. These are specific to a particular type of hazard e.g. dust barriers, solid separators for excavation sites, temporary walkways that ensure safe passage.
- Signs that state DANGER, WARNING, or CAUTION are also required to ensure safety against existing hazards. They should be legible, visible, and brief.
- If any person identifies a mechanical hazard that is not sufficiently protected, s/he should notify the attending foremen, the Health and Safety Advisor or the *DOHSS office* immediately.

## 5.4. PROJECT COMPLETION AND DECOMMISSIONING

### 5.4.1. Project Completion

Construction work alters the site physically (e.g. pits and depressions) and biologically (e.g. removal of flora and fauna) and it's the responsibility of the

proponent to return it to its original state as closely as possible. This can be achieved through the following activities:

- Comprehensive Landscaping of undeveloped and disturbed areas should be done. Such areas should be sealed from pits and other depressions.
- All waste materials should be cleared and removed from the site. There should be no such materials as wood, glass, stones, scrap metals etc. however, these should be disposed appropriately.
- General rehabilitation of any excavated areas; quality vegetation should be introduced to add aesthetic value to the site. This should be regularly watered.
- All construction equipment and machinery should be removed and the old ones sold to the respective scrap materials handlers.

### 5.4.2. Project Decommissioning

Information pertaining to the decommissioning of the project at the end of its life cycle and associated impacts, proposed measures to return the site as far as possible to its suitable state.

The proponent shall plan, engineer and implement the decommissioning, demolition and clean-up of the mall and other associated structures. The proponent shall develop decommissioning designs so that hazardous and dangerous materials are safely removed and salvageable equipment and structures are protected before the remaining facilities are safely dismantled. The designs shall carefully consider reuse goals for the site and materials. It should however be noted that at the time of decommissioning of the project, a separate EIA for decommissioning shall be necessary.

**Existing Condition Evaluation**

The first step in engineering a decommissioning project is to evaluate existing conditions and plan for appropriate handling of all site conditions, materials or structures. The considerations to be considered shall include:

- Developing an inventory of hazardous and solid wastes, underground storage tanks and other subsurface structures to assure proper management.
- Identification of electric utilities and communication systems to ensure that active site operations continue uninterrupted.
- Assessment of historic structures and materials, which can be reclaimed to comply with preservation requirements (if applicable) and to maximize cost recover.

**Facility Demolition**

The development of demolition plans shall consider the structural stability of the units being taken down, clearance of adjacent structures and rigging requirements.

**Preparations for the site re-use**

Future site use is a key consideration because costs can be reduced by understanding which components of the site have to be removed versus built over or around. Topography and backfilling needs will be efficiently addressed relative to future construction and storm water management.

**Materials Recycling and Reuse**

Materials that can be recycled, reused, or salvaged shall be identified and removal planned accordingly to capture financial benefits.

**Integrated Safety Design and Review**

Safety for workers and the community is of great importance, and includes physical hazards, protection of water ways, and control of potential airborne hazards.

# CHAPTER 6: ENVIRONMENTAL MANAGEMENT AND MONITORING PLANS

## 6.1. INTRODUCTION

Environmental monitoring involves measurement of relevant parameters, at a level of details accurate enough, to distinguish the anticipated changes. Monitoring aims at determining the effectiveness of actions to improve environmental quality. The EMPs outlined in tables 2 and 3 addresses the identified potential negative impacts and mitigation measures as well as roles, costs and indicators which can be observed over a period of time, that can help to determine the effectiveness of actions to upgrade the quality of environment; as regards the subject project. The EMPs have considered both construction and operational phases.

Table 2: Environmental Management Plan during the Construction Phase of Onsite Support Facilities (Office Building & Staff Quarters)

| **Environmental/ Social Impact** | **Proposed Mitigation and aspects for monitoring** | **Responsibility for intervention and monitoring during design & construction period** | **Estimated cost Kshs.** | **Monitoring Mechanisms** | **Recommended frequency of Monitoring** |
|---|---|---|---|---|---|
| **Changes in hydrology/ impended drainage** | • Proper installation of drainage structures<br>• Install cascades to break the impact of water flowing in the drains<br>• Ensure efficiency of drainage structures through proper design and maintenance<br>• Provide gratings to the drainage | Contractor | 500,000 | Regular Inspection<br><br>Routine maintenance of all drainage | During construction and on completion of each structure<br><br>A continuous and regular |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design & construction period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | channels<br>• Regular checks on any sludge along drainage channels<br>• Visual checks of drainage channels for any leaks | | | channels | schedule throughout the construction period |
| **Loss of soil resources/Soil erosion** | • Control earthworks<br>• Rehabilitate degraded environment to avoid siltation and wash offs<br>• Compact loose soils<br>• Landscaping<br>• Ensure management of excavation activities<br>• Control construction activities especially during rainy conditions<br>• Provide soil erosion control and conservation structures where necessary<br>• Proper disposal of excavated loose soil | Contractor/Proponent | 600,000 | Inspection & Routine maintenance | Daily Erosion control measures: During construction and on completion of each structure |
| **Air pollution through dust and gaseous emissions** | • Control speed and operation of construction vehicles<br>• Prohibit idling of vehicles<br>• Water should be sprayed during the construction phase on excavated areas<br>• Regular maintenance of construction plant and equipment<br>• Engage sensitization among construction workers<br>• Proper use of PPEs | Contractor/Proponent | 450,000 | Regular Inspection/ observation | Daily |
| **Noise pollution** | • Sensitize drivers of construction machinery on effects of noise | Contractor/Proponent | 300,000 | Inspection/ observation | Random |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design & construction period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | • Construction activities to be restricted to daytime<br>• Workers in the vicinity of/ involved in high-level noise to wear respective safety & protective gear i.e. earplugs & earmuffs<br>• Appropriate selection of machinery/equipment | | | | |
| **Oil spills/leaks** | • Proper storage handling and disposal of new oil and used oil and related wastes<br>• Maintain plant and equipment to avoid leaks<br>• Maintenance of construction vehicles should be carried out in the contractor's yard (off the site) | Contractor | 200,000 | Inspection | Daily |
| **Water resource** | • Management of water usage. Avoid unnecessary wastage especially at the car washing bay<br>• Recycling of water during construction phase where possible<br>• Use of water conservation signs at the wash rooms and install water conserving taps | Proponent/Contractor | 400,000 | Inspection/ Observation | Random |
| **Contractor's lay down area** | • Special attention should be paid to the sanitary facilities on site especially disposal of human waste<br>• Garbage should be disposed of in accordance with NEMA requirements | Contractor | 200,000 | Routine Inspection | Daily |
| **Road safety** | • Enforce speed limits for construction vehicles especially along roads linking to the site<br>• Provide signboards at the site/entrance | Contractor/ Traffic police/Transporters | ..... ..... | Observation | Once a month |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design & construction period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | to notify motorists about the proposed development | | | | |
| **Public health and occupational safety** | • Ensure proper solid waste disposal and collection facilities<br>• Provide proper sanitary facilities for construction workers.<br>• Ensure effective wastewater/liquid effluent management<br>• Design of sewerage system should be as provided in the plans<br>• Provide first aid kits on the site<br>• Sensitize stakeholders/workers on environmental management<br>• Workers should be trained on occupational health and safety and First aid administration | Contractor/ Supervising foreman | 500,000 | Observation<br>Observation | Weekly for solid waste disposal and once a month for others. |
| **Loss of Biodiversity/ Vegetation** | • Landscaping and planting on all disturbed areas<br>• Planting flowers/grassing should be done just before the rains on dry spells | Contractor | 300,000 | Inspection<br>Observation | Daily<br>Weekly |
| **Fire safety training/ Emergency Response Procedures (ERPs)** | • To enhance health and safety preparedness among workers and general public<br>• Ensure equipment is in good working condition<br>• Put up emergency response contacts<br>• Put up ERP notification instructions<br>• Put up simple instructions on how to handle fires, product spills, armed robbery and product contaminations | Proponent/Contractor | 250,000 | Inspection | Monthly |
| **Record Keeping** | • Collection and analysis of relevant environmental data at the site | Proponent/contractor | 100,000 | Inspection | Weekly |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design & construction period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | • Data of maintenance of fire fighting equipment<br>• Vehicle movement in and out of the site | | | | |
| **Increased pressure on utilities** | • Employing water conservation techniques and only using the required amounts of water to prevent wastage.<br>• Employing power saving techniques such as switching off equipment when not in use, using natural light whenever possible.<br>• Using machines with power saving technologies i.e. high efficiency equipment.<br>• Inspecting the drainage facilities regularly to ensure they are free of debris that may reduce their efficiency. | Contractor/Proponent | Within project cost | Inspection | Daily |
| **Increased traffic congestion** | • Placing signs around the site notifying other vehicles about the heavy traffic and to set the speed limit around the site.<br>• Ensuring all drivers for the project comply to speed regulations.<br>• Ensuring all vehicles used for the project are in good working condition both legally and commensurate to their intended use. | Contractor/Project Proponent/Traffic police/Track drivers | 200,000 | Inspection | Daily |
| **Population Influx** | • Workers to be issued with jobs cards to monitor their movements in the site area<br>• Only authorized personnel should be allowed into the site<br>• Presence of a work registry book where workers sign in and out<br>• Educating the workers on proper | Project Manager/Contractor | Within Project Cost | Inspection/ Observation | Daily |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design & construction period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | sanitation methods<br>• Sensitizing the workers on HIV/AIDS<br>• Train construction workers on fire safety, first aid administration and OHS. | | | | |
| **Solid waste management (construction waste)** | • Following EMCA regulations on Waste Management, Legal Notice 121.<br>• Employing a waste management plan.<br>• Using waste minimization techniques such as buying in bulk.<br>• Allocating responsibilities for waste management and identifying all sources of wastes, and ensuring wastes are handled by personnel licensed to do so.<br>• Making available suitable facilities for the collection, segregation and safe disposal of the wastes.<br>• Creating waste collection areas with clearly marked facilities such as color coded bins and providing equipment for handling the wastes. The bins should be coded for plastics, rubber, organics, glass, timber, metals etc.<br>• Ensuring all wastes are dumped in their designated areas and through legally acceptable methods and that the bins are regularly cleaned and disinfected.<br>• Creating adequate facilities for the storage of building materials and chemicals and controlling access to these facilities.<br>• Ensuring bins are protected from rain and animals. | Project Proponent/Contractor /Public Health Officer/NEMA | 400,000 | Inspection Observation | Daily/Weekly |
| **Internal audits** | • Monitoring will involve measurements, | Proponent/ | 300,000 | Inspection | Random |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design & construction period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | observations, evaluations, assessment of changes in water quality, waste management, Noise levels, contractor safety etc. | Contractor | | | |

Table 3: Environmental Management Plan during the Operation Phase (Office Building & Staff Quarters)

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| **Solid Waste Management** | • Provide garbage bins inside the offices and around the staff quarters.<br>• Contract a licensed waste handler for solid waste management.<br>• Creating waste collection areas with clearly marked facilities such as colour coded bins for the different streams of wastes and providing equipment for handling the wastes.<br>• Ensuring all wastes are dumped in their designated areas and through legally acceptable methods and that the bins are | Proponent | 150,000 | Inspection | Daily/Weekly |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | regularly cleaned and disinfected.<br>• Assessing and creating opportunities for Regulation, Reducing, Reusing, Recycling, Recovering, Rethinking and Renovation.<br>• Ensuring bins are protected from rain and animals.<br>• No burning of garbage | | | | |
| **Increased pressure on utilities** | • Employing water conservation techniques and only using the required amounts of water to prevent wastage.<br>• Employing power saving techniques such as switching off equipment when not in use, using natural light whenever possible.<br>• Using machines with power saving technologies i.e. high efficiency equipment.<br>• Promptly detect and repair water pipes and tank leaks.<br>• Ensure taps are not running when not in use.<br>• Make use of rain water to reduce over reliance on borehole water.<br>• Inspecting the drainage facilities regularly to ensure they are free | Proponent/Farm Manager | Within project cost | Inspection | Daily/Weekly |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | of debris that may reduce their efficiency.<br>• Regularly testing the quality of borehole water.<br>• Ensuring the water ponds are debri free, treated and fit for use | | | | |
| **Increased Land value and land-use changes** | • Complying to zoning bylaws<br>• Collaborating with public and planning officials on the development and future developments<br>• Aligning the project's objectives with those of national and county development policies | Proponent | ……. | Observation | Annually |
| **Possible Security threats** | • Employing of security guards/competent security firm at the site and searching all vehicles and people entering the farm<br>• Use of CCTV cameras to monitor security within the premises<br>• Collaborating with the national police on security matters<br>• Placing alarms around the premises and establishing emergency preparedness and response procedures | Farm Manager/Proponent/ Kenya Police (Namanga Police Station) | 300,000 | Inspection | Daily/Weekly |
| **Increased Surface run-off** | • Using materials that mimic natural percolation of water.<br>• Landscaping to ensure there are areas where water will percolate | Proponent | Within project cost | Observation/ Inspection | Daily |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | underground.<br>• Constructing proper drains and monitoring them to ensure there are no blockages. This also includes ensuring the size of the drains can accommodate storm flows during the rainy season. | | | | |
| **OHS Risks** | • Employing an EHS/OSH plan.<br>• Provision of PPEs to all personnel working in potentially hazardous areas or with potentially hazardous equipment.<br>• Replacing the PPEs on wear and tear.<br>• Placing readable signs alerting people of hazardous areas such as slippery floors.<br>• Servicing equipment and machines to ensure efficiency.<br>• Providing fire-fighting equipment and maintaining them to ensure they are fully functional.<br>• Delineating fire and emergency assembly points and creating awareness to ensure all people working within the premises are aware of them, e.g. through the use of site maps on elevators, staircases etc.<br>• Putting in place an ERP and | Proponent | Within Project Cost | Observation/ Inspection | Weekly |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | ensuring all people in the project are aware of it and the procedures to follow commensurate to the level of emergency.<br>• Providing adequate storage for hazardous and flammable substances and controlling access to them.<br>• Monitoring the movement, handling and management of wastes to ensure they safely managed and don't present any EHS risks.<br>• Working with state agencies in the management of emergencies and disasters to ensure multilateral approaches to this management.<br>• Performing emergency drills on a frequent basis, setting benchmarks for response and evaluating performance to ensure continuous improvement of response and preparedness. | | | | |
| **Increased Traffic Congestion** | • Erecting visible and clear signs to control the movement of vehicles in and out of the farm.<br>• Having alternative entrances and exits for emergency operations.<br>• Ensuring all vehicles entering | Proponent/Traffic police department | Varying cost | Observation/ Inspection | Daily/Weekly |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | the farm comply with traffic regulations<br>• Making sure the proposed horticultural farm doesn't occupy the road reserves and complying with road and land demarcation obligations. | | | | |
| **Micro-climate modification** | • Advocating for the use of other renewable sources of energy such as solar energy<br>• Use of clean fuels<br>• Landscaping the site with indigenous species of plants<br>• Using sustainable drainage systems that mimic the natural percolation of water into the soil, and green roofs where possible<br>• Using efficient equipment that emit little or no waste<br>• Replace fossil energy sources<br>• Reduce air pollution emanating from the horticultural plots<br>• Carry out energy audits as required by law | Proponent/Tenants/ Project Occupants | Varying cost | Observation | Each quarter |
| **Socio-cultural Impacts** | • Integrating Equal Opportunity Principles in Procurement and human resource policies.<br>• Promoting social cohesion and integration among people in the area. | Proponent/Farm employees | Varying cost | | Quarterly |

| Environmental/ Social Impact | Proposed Mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring Mechanisms | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | • Creating awareness towards the diversity of cultures and different economic background of the people in the project area through sensitization.<br>• Allowing employees to form social groups and networks that build social capital.<br>• Targeting social investment programs towards the local communities and region. | | | | |

Table 4: Environmental Management Plan during the Establishment of the Horticultural Farm

| Environmental / Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design, and farm establishment period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| **Loss of Biodiversity/ Vegetation** | Land preparation for propagation of the horticultural crops. | • Greening of the farm land<br>• Establish biodiversity banks<br>• Design a landscape plan that enhances landscape aesthetic value using local and native | Proponent/Farm Manager | 500,000 | Once-off (during land clearing) | Landscaping will be required in areas outside the farm that have been impacted |

| Environmental / Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design, and farm establishment period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | vegetation<br>• Ensure proper demarcation of the project area to ensure minimal disturbance of flora and fauna and to avoid spillover effects on the neighboring areas<br>• Plant native species as windbreaks or hedgerows<br>• Avoid using harmful agrochemicals to protect pollinators and wildlife. | | | | |
| **Air Pollution** | Use of farm equipment/implements when setting up the horticultural plots;<br>Use of farm machinery and landscaping | • Sprinkling of water on exposed soil surface to minimize the generation of dust<br>• Adequate irrigation<br>• Regular servicing and maintenance of farm machinery<br>• Turning off engines when farm machines are not in use<br>• Insulate all generators & heavy | Proponent/Farm Manager | 200,000 | During each planting season | |

| Environmental / Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design, and farm establishment period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | farm equipment or place them in enclosures to minimize high noise levels<br>• Dust emissions from piles of soil or from any other material during land preparation should be controlled by wetting.<br>• Piles and heaps of soil should not be left over after land preparation is completed.<br>• Minimize dust through strict enforcement of onsite speed controls as well as limiting unnecessary traffic within the project site.<br>• Ensure that traffic routes on site are sprinkled with water regularly to reduce amount of dust generated by farm machinery | | | | |

| Environmental / Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design, and farm establishment period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | • Sensitize farm drivers to avoid unnecessary speeding when tilling the land.<br>• Scouting, spot spraying and integrated pest management. | | | | |
| **Loss of Soil Resources/ Soil Erosion** | Unsupervised Irrigation<br>Poor farming methods<br>Land clearing<br>Loss of vegetation | • Ensure good soil conservation measures.<br>• Increase vegetation cover to contain loose soils from being eroded.<br>• Control surface and storm water runoff.<br>• Excavated soils should be controlled and properly disposed to avoid blocking of storm water drainage system and subsequent soil erosion<br>• Preserve native vegetation buffers<br>• Use contour farming and terraces to | Farm Manager | Varying cost | Continuous | Control soil erosion;<br>Ensure constant supply of water on the farm;<br>Improve the quality of water; |

| Environmental / Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design, and farm establishment period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | reduce soil erosion.<br>• Apply organic fertilizers and practice crop rotation to maintain soil fertility. | | | | |
| **Contamination of Water resources (surface & underground waters)** | Use of pesticides and agro-chemicals; | • Adopt efficient irrigation systems, such as drip irrigation<br>• Ensure proper disposal of wastewater and prevent runoff into natural water bodies.<br>• Conduct regular water quality testing to prevent contamination. | Proponent/Farm Manager | 500,000 | Continuous | Implement the recommended Integrated Pesticide Management |
| **OHS Risks** | Accidents from the use of farm machinery & equipment during land preparation | • Train workers on safe handling of pesticides and fertilizers<br>• Ensure the availability of first aid kits and emergency response plans<br>• Regularly inspect farm equipment and | Proponent/Farm Manager | | Throughout the project cycle | |

| Environmental / Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design, and farm establishment period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | provide personal protective gear<br>• Proper use of PPEs<br>• Record all chemical related incidences or accidents<br>• Equip fire-fighting equipment and ensure that they are within reach<br>• Train staff on first aid administration and fire fighting | | | | |
| **Oil leaks and spills** | Use of farm machinery | • Ensure that all farm machinery/equipment is in good serviceable condition.<br>• Do not store oils in bulk. | Proponent/Farm Manager | | Continuous | |
| **Solid Waste Management** | Accumulation of organic and non-organic waste | • Compost organic waste for reuse as fertilizer<br>• Recycle or safely dispose of plastic and packaging materials<br>• Develop a waste collection and management plan for the farm. | Proponent/Farm Manager | | Continuous | |

| Environmental / Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design, and farm establishment period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| **Climate Change Risks/Impacts** | | • Utilize renewable energy sources like solar panels<br>• Incorporate agroforestry to sequester carbon<br>• Reduce reliance on synthetic fertilizers and pesticides | Proponent/Farm Manager | | Continuous | |
| **Disregard to Environmental Issues (Pollution)** | Lack of environmental monitoring tools | • Develop a monitoring framework to track environmental and social impacts<br>• Assign responsibilities to an Environmental personnel<br>• Set clear performance indicators, such as water usage levels, soil fertility rates, and employment statistics<br>• Conduct regular Environmental & Energy audits and adapt the ESMP based on monitoring outcomes. | Proponent | | Throughout the project cycle | Ensure continuous surveillance of environmental parameters to avoid deterioration of standards |

| Environmental / Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during design, and farm establishment period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | | | | | |

Table 5: Environmental Management Plan during the Operation Period of the Horticultural Farm

| Environmental /Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during farm operation period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| **Loss of Soil Resources/Soil Infertility** | Soil degradation due to compaction, and soil erosion | • Implement organic farming techniques, including composting and crop rotation;<br>• Minimize heavy machinery use to avoid soil compaction;<br>• Conduct periodic soil testing to monitor nutrient levels and pH;<br>• Use mulch or cover crops to protect the soil from erosion. | Farm Manager | 300,000 | Throughout the project cycle | Control farm activities to avoid the occurrence of soil erosion |
| **Management of Water Resources** | Over-extraction of water and pollution from | • Adopt water-efficient irrigation systems like drip | Farm Manager | 150,000 | Throughout the project cycle | Continuous monitoring of water quality |

| Environmental /Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during farm operation period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | agrochemicals. | irrigation;<br>• Schedule irrigation to match crop needs and reduce water wastage;<br>• Avoid excessive use of fertilizers and pesticides to prevent water contamination;<br>• Install sediment traps or vegetative buffers to control runoff. | | | | (borehole & the 2 water ponds) |
| **Management of Solid Waste** | Improper disposal of organic waste and plastic materials. | • Establish composting systems for organic waste;<br>• Collect and recycle plastic mulch, irrigation pipes, and packaging materials;<br>• Develop a waste segregation and storage area to manage waste effectively;<br>• Provide proper waste handling facilities such as waste storage chamber | Farm Manager | 10,000 per month | Throughout the project cycle | Contract a NEMA licensed waste handler. |

| Environmental /Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during farm operation period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | /receptacles for holding solid waste;<br>• Contract a NEMA licensed waste handler;<br>• Train farm workers on solid waste management techniques i.e. recycling, composting, reuse etc.<br>• Practice the 5Rs of waste management;<br>• Analyse the quantity and types of waste generated, storage conditions, and disposal methods;<br>• Monthly audits of waste management practices;<br>• Conduct waste logbook reviews and visual inspections. | | | | |
| **Air Quality Management** | Dust, odors, and emissions from machinery and various farm activities on site | • Maintain and service farm equipment regularly to reduce emissions;<br>• Avoid open burning | Proponent/Farm Manager | 200,000 | Throughout the project cycle | Engage OSHA Expert |

| Environmental /Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during farm operation period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | of organic or plastic waste;<br>• Plant windbreaks or hedgerows to minimize dust dispersion;<br>• Dust control measures like irrigation before tilling of the farm;<br>• Use of PPEs such as dust masks during farm operations;<br>• Integrated pest management; | | | | |
| **Management of the use of Agro-chemicals** | Potential use of agro-chemicals especially on Avocado farming | • Follow integrated pest management (IPM) practices to reduce chemical use;<br>• Store chemicals securely in a designated, ventilated area away from water sources;<br>• Train workers in safe application methods and proper disposal of agro-chemical | Proponent/Farm Manager | 150,000 | Throughout the project cycle | Monitor residual contamination of soil and water resources |

| Environmental /Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during farm operation period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | container;<br>• Use biodegradable pesticides or organic alternatives where feasible;<br>• Control the application of agro-chemicals in the required quantities and at the appropriate time to reduce the amounts that seep into the soil and potentially to nearby water bodies;<br>• Record every application (test soil and water biannually)<br>• Maintain an application logbook and conduct residue analyses. | | | | |
| **Climate Change Risks** | Greenhouse gas emissions from energy use | • Use renewable energy sources, such as solar panels, where possible;<br>• Optimize machinery use and upgrade to energy- | Proponent/Farm Manager | ..... | Throughout the project cycle | |

| Environmental /Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during farm operation period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | efficient models;<br>• Monitor and report energy usage to track reductions in emissions. | | | | |
| **Cultural & Social Considerations** | Disruption of local cultural practices or sites | • Identify and protect cultural heritage sites near the farm;<br>• Incorporate local knowledge and practices into farm management<br>• Promote educational programs about horticulture for local communities. | Proponent/Farm Manager | **……** | Throughout the project cycle | |
| **OHS Risks** | Production of horticultural crops | • Integrated Pest Management and control;<br>• Have a Safety and Health Work Plan;<br>• Adequate use of PPEs;<br>• Record all farm accidents and chemical spillages;<br>• | Proponent/Farm Manager | Varying cost | Throughout the project cycle | Safety Auditor |
| **Emergency Response Plan** | Farm accidents, pesticide spillages | • There must be well-designed and documented emergency preparedness plans including fire | Proponent/Farm Manager | **300,000** | Throughout the project cycle | |

| Environmental /Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during farm operation period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | emergency procedures;<br>• Train staff on ER;<br>• Ensure adequate signage around the farm;<br>• | | | | |
| **Fire Safety** | Use of easily flammable farm pesticides. | • Installation of adequate fire-fighting equipment;<br>• Regular inspection and servicing of fire extinguisher<br>• Inspection and servicing should be undertaken by a reputable service provider<br>• Records of inspections/maintenance should be maintained;<br>• Fire safety signs should be prominently displayed within the farm;<br>• Have a designated fire assembly point. | Proponent/Farm Manager | | | |
| **Electrical Safety** | Faulty electrical cables/equipment | • Circuits must not be overloaded;<br>• Distribution board switches must be | Proponent/Farm Manager | Varying Costs | Throughout the project cycle | Contract a qualified electrical technician |

| Environmental /Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during farm operation period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | clearly marked to indicate respective circuits;<br>• There should be no live exposed connections;<br>• Electrical fittings near all potential sources of ignition should be flame proof;<br>• All electrical equipment should be earthed. | | | | |
| **Oil Pollution** | Repair & maintenance of Farm machinery and equipment | • All servicing and maintenance of farm machinery must be done at the designated garage;<br>• Oil interceptors must be provided to minimize the occurrence of such accidental spills. | Farm Manager | 200,000 | Throughout the project cycle | |
| **Protection of Poisonous Substances/Products** | Use of agro-chemicals | • All poisonous chemicals to be properly stored and issued only to the people authorized to use them and only in the required quantities;<br>• Label all poisonous | Farm Manager | Varying Costs | Throughout the project cycle | |

| Environmental /Social Impact | Source of Impact | Proposed mitigation and aspects for monitoring | Responsibility for intervention and monitoring during farm operation period | Estimated cost Kshs. | Time Frame | Remarks |
|---|---|---|---|---|---|---|
| | | chemicals to reduce the chances of ingestion;<br>• All people manning the chemical stores must wear adequate PPEs;<br>• All chemical stores must be always under key and lock. | | | | |
| **Biodiversity Conservation** | Farm activities | • Retain natural vegetation and create biodiversity corridors;<br>• Monitor and manage the presence of invasive species;<br>• Avoid nighttime operations to minimize light and noise disturbances to fauna; | Proponent/Farm Manager | 300,000 | Throughout the project cycle | |

Table 6: Environmental Management Plan during the Decommissioning Phase of the Horticultural Farm & Associated Amenities

| Environmental/ Social Impact | Proposed mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring means | Recommended frequency of Monitoring |
|---|---|---|---|---|---|

| Environmental/ Social Impact | Proposed mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring means | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| **Emission of Air pollutants** | • Using efficient equipment and machines with efficient engines for low emission;<br>• Using clean fuels such de-sulphurized diesel and unleaded fuels;<br>• Using Dust screens;<br>• Removing components with potential of emitting hazardous gases or particulates separately and under caution to prevent emissions. | Project Proponent/ Demolition Contractor | To be determined | Amount of gaseous emissions per day: ppm in air per day Amount of particulate emission per day: ppm in air per day | Daily |
| **Loss of income/Reduced ability to support dependents/Loss of quality of life** | • The safety of the workers should surpass as a priority of all other objectives in the decommissioning project;<br>• Adapt a project-completion policy: identifying key issues to be considered earlier before decommissioning;<br>• Assist with re-employment and job seeking of the involved workforce;<br>• Compensate and suitably recommend the workers to help in seeking opportunities elsewhere. | Proponent | …… …… | | Once-off |

| Environmental/ Social Impact | Proposed mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring means | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| **Noise Pollution** | • Carrying out the decommissioning works only during the specified time from 0800hrs to 1700hrs where permissible levels of noise are high and acceptable;<br>• Machineries should be maintained regularly to reduce noise resulting from friction;<br>• Providing workers with Personal Protective Equipment such as earmuffs when operating noisy machinery and when in a noisy environment;<br>• Provision of signboards at the demolition site notifying people of the decommissioning activities and timings;<br>• Shielding the area to reduce noise propagation;<br>• No hooting at the entrance to the site. | Proponent/<br>Project Maintenance Office/<br>NEMA/<br>Area OHS Officer | To be determined during the time of project closure | Quality of PPEs (ear muffs, ear plugs)<br>Amount of noise generated: dB | Daily |

| Environmental/ Social Impact | Proposed mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring means | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| **Vegetation disturbance/Land deformation; soil erosion, drainage problems** | • Implement an appropriate re-vegetation program to restore the site to its original status;<br>• During the re-vegetation period, appropriate surface water runoff controls will be taken to prevent surface erosion;<br>• Monitoring and inspection of the area for indications of erosion will be conducted and appropriate measures taken to correct any occurrences;<br>• Fencing and signs restricting access will be posted to minimize disturbance to newly-vegetated areas;<br>• Comprehensive landscaping. | Demolition Contractor/ Project Proponent/ | 300,000 | | |
| **Traffic Congestion Impacts** | • Placing signs around the site notifying other vehicles about the heavy traffic and the set the speed limit;<br>• Ensuring truck drivers transporting demolition materials/wastes comply with speed regulations;<br>• Ensuring all vehicles used are in good working condition. | Project Proponent/ Demolition Contractor/ Traffic police department | 200,000 | Quality of the notice signs erected<br>Number of incidents per month<br>Complaints per month | Daily/Weekly/ Monthly basis |

| Environmental/ Social Impact | Proposed mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring means | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| **Solid Waste generation** | • Comply with EMCA regulations on Waste Management, Legal Notice 121;<br>• Employing a waste management plan, this will involve employing the 5Rs of waste management. (Reducing; reusing; recycling; recovering; repurpose; and renovation.)<br>• Removing reusable and recyclable material from the building before demolition to minimize the amount of waste;<br>• Allocating responsibilities for waste management and identifying all sources of wastes, and ensuring wastes are handled by licensed waste handlers;<br>• Making available suitable facilities for the collection, segregation and safe disposal of the demolition wastes;<br>• Ensuring all wastes are dumped in their designated areas and through legally acceptable methods. | Demolition Contractor/ Project Proponent/ City Council of Nairobi/ NEMA/ Public Health department | To be determined during the time of project closure | Amount of wastes generated per day i.e. kg/day per specific waste type.<br>Quality of PPEs<br>Quality and capacity of waste management equipment (bins, signs, PPEs etc.) | Daily |
| **Oil spillage & leakages** | • Clean and treat all oil contaminated areas;<br>• Safely dispose all used oil and oil handling materials. | Demolition Contractor/ Project Proponent/ | 100,000 | Frequency of documented incidents of oil spill/leaks | Once-off |
| **Occupational, Health & Safety** | • Employing an OHS plan that will outline all OHS risks and provide | Demolition Contractor/ | 500,000 | Number of incidents/acci | Weekly/Monthl y checks |

| Environmental/ Social Impact | Proposed mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring means | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| **Risks** | a strategy for their management;<br>• Ensuring all hazards such as movable parts are labeled;<br>• Raising awareness and educating workers on risks from equipment and ensuring they receive adequate training on the use of the equipment;<br>• Providing the workers with adequate PPEs and monitoring regularly to ensure they are replaced on time when they wear out;<br>• Placing visible and readable signs around where there are risks and undertaking the riskier demolition activities first and in isolation;<br>• Ensuring there is security in and around the site to control the movement of people/vehicles;<br>• Providing safe and secure storage for the waste and materials on the site;<br>• Placing visible and readable signs to control the movement of vehicles and notify motorists and pedestrians around the site;<br>• Providing fire-fighting equipment and in easily accessible areas;<br>• Ensure site personnel are well trained on fire-fighting and ERPs; | Project Proponent/ OHS department | | dents per monthly<br>Quality of all PPEs<br>Visibility and clarity of signs and alerts<br>Level of awareness among demolition workers | |

| Environmental/ Social Impact | Proposed mitigation and aspects for monitoring | Responsibility for mitigation, monitoring and/or maintenance after defects liability period | Estimated cost Kshs. | Monitoring means | Recommended frequency of Monitoring |
|---|---|---|---|---|---|
| | • Maintaining firefighting equipment regularly;<br>• Creating safe and adequate fire and emergency assembly points and making sure they are well labeled;<br>• Establishing emergency response procedures against hazards. | | | | |

# CHAPTER 7: ANALYSIS OF PROJECT ALTERNATIVES

## 7.1. INTRODUCTION

This chapter deals with possible alternatives which can be implemented or adopted by the project owner. The consideration of alternatives to a proposal is a requirement of many E.I.A systems. It lies at the heart of the E.I.A process and methodology. During the scoping process, alternatives to a proposal can be generated or refined, either directly or by reference to the key issues identified. A comparison of alternatives will help to determine the best method of achieving project objectives while minimizing environmental impacts or, more creatively, indicate the most environmentally friendly or best practicable environmental option.

This section outlines the main alternatives considered by project proponent, an evaluation of impacts of each alternative with clear information on the criteria used to assign significance and an indication of the main reasons for choosing the proposed development taking into account the environmental effects.

The proceeding subsections review these alternatives in the subjects of: location, time, design, inputs, existence and the base case with mitigation. The suggested alternatives compare three farming systems and provide an opportunity to choose the best technology in terms of water consumption, crop quality and productivity by using modern technologies.

### 7.1.1. No Action Alternative

The no development option entails leaving current status of the proposed project site as it is. Environmental effects of the proposed development will be avoided making the option desirable considering the state of the environment. This being the case, one of the reasons for implementation of the proposed development will not be realized. A significant investment which is to be spent on implementation of the proposed project, short and

long term employment opportunities will not be realized. This will invariably prevent injection of this amount into the Kenyan economy. From an environmental perspective, not carrying out this development may be the best option. Without the development, the area would remain a relatively undisturbed area. This area will continue to be impacted, although minimally, by anthropogenic and natural factors. From a socio-economic perspective the "no action" alternative may not be the best alternative as the numerous benefits to be gained from the proposed development both locally and nationally would not be realized and the resources in the area would continue to be underutilized. The vast tract of land would remain under-utilized under bush-land conditions and the proponent, the community and the country would lose out on the economic and social benefits that would accrue from the project

In order to enable the proposed project to seek different ways of minimizing its impacts on the environment and at the same time achieve its objectives several alternatives were assessed through its architectural and engineering designs and environmental planning through this ESIA. This not only justifies the course of action (base case) but also enables the risk management to follow a hierarchy of:

a) Avoidance: Temporal and spatial;
b) Elimination and minimization: non-structural ex-ante mitigation;
c) Elimination and minimization: structural ex-ante mitigation;
d) Elimination and Response: structural ex-post mitigation
e) Elimination, Recovery and Development: non-structural ex-post mitigation

### 7.1.2. Alternative Site

This option involves pursuing the proposal but on a different site meaning its impacts that are relevant to the proposed site or occur due to it will be avoided. The avoidance of these in-situ and ex-situ regional impacts would be the main benefit of this option but there will also be other impacts specific to the alternative site and due to specifications of

the proposed project, a different site away from Plot **L.R. No. KAJIADO/MAILUA/1579** would also increase logistic costs. Alternative sites are also not readily available since availability of land is low and in cases where such land is available for purchase, the proponent will have to spend a considerable amount of time and resources to complete transactions. The unpredictability of financial resources and the lag time required in acquiring and completing official transaction on it may take a long period. The proposed site was chosen because of its suitability as the project area has rich fertile soils and specific ambient conditions suitable for the production of horticultural crops.

The reason for choosing the current project location was driven mainly by the following factors:

- It is located in heart of an agriculture area;
- The site is rightfully zoned as agricultural land;
- The right climatic conditions to support horticultural farming;
- Availability of low cost irrigation water;
- The availability of workforce with agricultural experience;
- Low cost of solar power
- Minimal pressure exerted on the available resources/project inputs;

There is no guarantee that an appropriate and accessible land will be available at a reasonable cost within the project area.

### 7.1.3. Alternative Schedule

This option entails carrying out the proposal at a later time thereby offsetting its impacts to that time. Only benefit is if there are improvements in baseline conditions and technologies that may be involved with the proposal. However, these are not guaranteed and it may only lead to delays in development, therefore carrying out the proposed project with mitigation would be a preferred option due to this uncertainty. In addition carrying out the proposed project at later time

may lead to more operational and logistic costs due to increasing inflation and standards of living.

### 7.1.4. Alternative Designs

This option curtails undertaking the project but with different infrastructural designs that encompass: buildings, roads, power, water and sewerage. The presented project design was however achieved by considering the options available that would ensure cost-effectiveness and avoid or reduce environmental and social impacts as much as possible.

The project proponent has settled on horticultural farming of *dragon fruits, avocados, herbs and spices* after considering the following options:

**Horticultural crops farming:**

The production of horticultural crops offers lucrative business opportunities for Kenyan farmers, who earn an estimated 1 billion Kenya shillings per Month. (Study done by Tegemeo Institute of Egerton University, 2006).

However the industry relies heavily on use of agrochemicals for production especially in high altitude area. The large scale farmers who invest highly in irrigation infrastructure have to compete with small scale farmers whose investment is not so high.

**Horticultural farming in the open fields**

There are vegetables and fruits that thrive in temperate climates of Europe that would grow very well in Kenya. These crops however are referred to as summer crops grow in summer in Europe when the sunlight hours of the day are longer. In Kenya these flowers are produces under night light from electricity thus raising the costs of production. The high temperatures in the area and high winds would be good for production of only some fruit and vegetable varieties.

**Vegetable production under greenhouses.**

Greenhouses provide the best environment under which plants can be produced. This is because greenhouses shield plants from air borne disease carrying organisms, insect manifestation and extreme weather conditions. Greenhouses also minimize plant water requirements by minimizing water loss through high winds and temperatures. However the infrastructural development is capital intensive.

In line with the project's master plan the preferred design takes into account electric power options and uses the preferred option that would require: fewer disruptions to other users; more space for the development, and less costs.

The proponent has evaluated various alternative designs, materials to be used and technology. Various professionals were involved including Architects, Engineers, surveyors and environmental consultants. After extensive discussions, the various options were assessed and the optimal design, materials and technology were agreed as per the proposed plan, materials and technology. The proposed development design was chosen on the basis of the needs of the project. The proposed project design was the most preferred since it was able to meet commercial mall's requirements.

***Comparison of Alternatives***

The concept of the project that was planned to be implemented within the designated land owned by the Proponent; Mr. Raj for more detailed information, see Annex (land ownership documents)

The project concept aims to compare three farming systems and to identify the best alternative in terms of water consumption, crop quality, production quantities and economic viability.

The possibility of using solar energy as an alternative energy source has also been assesed. The use of alternative modern farming techniques such as; open field farming, is recommended as a viable alternative to farming in controlling in-door weather conditions (greenhouse farming).

Open field farming provides greater opportunities for expanding agriculture activities into regions not suitable for conventional farming.
The purpose of this particular project to conduct a comparison of various variables; i.e. *Energy consumption, water consumption, crop yield, running cost* on three separate agricultural models:

- Low-tech: Using simple hydroponic techniques under traditional plastic houses.
- Mid -tech: Advance hydroponic technology under a modern green houses with full control of irrigation, fertilization, pest and climate control conditions.
- High-tech: Advance hydroponic technology under a modern multi-span green houses with full control of irrigation, fertilization, pest and climate control conditions.

The summary of the planned alternatives are described in the following Table no. (19) as a comparison between the three farming models.

### 7.1.5. Alternative Inputs

***Electricity***

The proposed project has various options for its sources of the electricity and these are reviewed in contrast to the preferred option. The project area has access to the power grid. Electricity is supplied by KPLC. The proponent however prefers the option of installing solar panels as a renewable source of energy to power the proposed farm.

***Water***

The two main options that exist for water use is to either use a variety of sources that curtail: borehole, wastewater treatment plant recycling and rainwater runoff collected and stored in the water ponds. The former option which is the base case has the advantages of ensuring consistent supply while placing as minimal pressure as possible on the regional water demand and infrastructure. It also promotes wise use, water recycling and captures strategies that ensure effective usage and conservation of water. The disadvantages of this option are that it will

involve the construction of extra facilities and management resources for the treatment plant and therefore extra costs.

### 7.1.6. Alternative Inputs

Alternative for the materials that will be used in the project involve using locally procured materials (base case) with the exception of not using timber and the second option involves primarily importing materials and using timber. The former alternative is preferred option since it will ensure the project contributes to the national economy by creating business opportunities for the suppliers of these materials while conserving the environment by ensuring the most environmentally friendly suppliers are contracted. This option will also not use timber since most of the hardwoods available in Kenya come from the DRC where forestry is largely unregulated while local timber sources are in most cases not sustainable.

The proposed project will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security, environmental and aesthetic requirements. Equipment that saves energy and water will be given first priority without compromising on cost or availability factors. The building will be constructed using locally sourced bricks, cement, river sand (washed and clean), twisted metal that meet the Kenya Bureau of Standards requirements.

# CHAPTER 8: CONSULTATION AND PUBLIC PARTICIPATION

## 8.1. INTRODUCTION

As part of the EIA process, several key stakeholders were engaged to inform both the ESIA and the proposed project. These stakeholders were consulted based on their proximity to the project site and members of the general public within the neighborhood. The stakeholders were engaged through consultation meetings and the Public Participation Questionnaire forms (attached in the Appendix section). **Public consultation meetings were held twice; on the 20th of November 2024 and 5th of December, 2024 respectively.** The minutes of the 2 (two) meetings are attached in the Annex section of this ESIA full study report.

The three main purposes of this exercise include:

- Informing stakeholders about the project and its likely effects;
- Canvass their inputs, views and concerns; and
- To enable their views to be taken into account during the decision making process.

Thus to achieve this, public participation process was targeted at:

- Facilitating consideration of alternatives, mitigation measures and trade-offs (if any).
- Ensuring that important impacts are not overlooked and benefits are maximized.
- Reducing chances of conflict through early identification of contentious issues.
- Providing an opportunity for the public to influence the project design and operational plan in a positive manner.
- Improving transparency and accountability of decision making.
- Increasing public confidence in the ESIA process.

The comments stakeholders raised were collated and analyzed to see which issues are of concern and should be addressed through this study report (ESIA). This section highlights the comments raised by the consulted stakeholders and neighbours, whilst referencing to the impact assessment section and the proposed mitigation measures to elaborate how they contributed to the formulation of EMP of this report (as referenced in the EMP section). This was done in respect to the fact that public concern is fundamental to the delineation and management of the project's significant risks.

## 8.2. SUMMARY COMMENTS FROM STAKEHOLDERS

The following concerns were raised during public participation:

- Road accessibility
- Pressure on resources i.e. water

The recommendations from public consultations have been incorporated in the mitigation measures proposed in this report. Additional mitigation measures presented in the Environmental Management and Monitoring Plan (EMP) should be fully implemented to minimize the raised impacts. Analysis of the feedback received from the respondents show that the proposed project is accepted in the neighborhood and no major/significant concerns were raised.

***Photos showing stakeholder' engagement***

***Photo dated 20th Nov, 2024: During the first round of public participation***



***Photos taken during the second round of public participation meeting***

# CHAPTER 9: CONCLUSION AND RECOMMENDATIONS

In conclusion, the proposed project will have several positive economic impacts during its different phases that include: food security, increase in foreign exchange for the country, increase in exports and trade, creation of employment; stimulating development through revenue, taxes and income generation, contributing significantly to agricultural GDP, boosts the growth of agro-processing industry/food processing industry by providing raw materials for canned, dried, or frozen products, among other economic benefits. These will contribute to the achievement of vision 2030 and contribute to the betterment of infrastructure in the area.

However the project will present environmental and OHS risks similar to most agricultural, construction and infrastructure projects, which include: generation of wastes (agricultural and construction wastes; loss of biodiversity, changes in soil characteristics; emission of air pollutants amongst others. These risks can be adequately managed and monitored through the proposed mitigation measures and the proposed comprehensive EMP, which includes frameworks for developing waste management plans, OHS plans and hazardous materials safety plans.

Thus the National Environment Management Authority is advised to license the project subject to it complying with all other statutory requirements that the project subscribes to. The project should also develop a plan for continuous engagement with stakeholders that include members of the public (its neighbours) and government agencies/departments. This will be in compliance with the Environmental Management and Coordination Act of 1999 and the Environmental Impact Assessment and Audit regulations, 2003. Above all, the proponent should carry out Environmental Audit 12 months after the project is completed and operational.

The assessment established that there are no significant environmental impacts expected to ensue from the construction work and horticultural

farm establishment and its operation, provided that the proponent adheres to the proposed mitigation measures. The minor concerns of the project and the necessary mitigation measures have been highlighted in the report and mainly in the proposed Environmental Management Plan of the project.

The main activities to be carried out in the development of the proposed project includes: excavation/earthwork, actual construction and landscaping. Some of the recommendations made include, ensuring proper disposal of waste, use of safety nets/sheets, erection of safety warning signs, provision of the necessary personal protective equipment for the workers and ensuring materials are sourced from genuine suppliers and use of manual labour to minimize noise and air pollution. An Environmental Management Plan was established for the project describing the parameters to be monitored and suggesting how monitoring should be done, how frequently, who should be responsible.

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21) Kajiado County Integrated Development Plan 2018-2022.

## 11.0. ANNEX

- Copies of land ownership documents
- Copies of architectural drawings
- Copies of KRA PIN Certificate
- Copies of Certificate of Incorporation
- Questionnaire forms
- 2 Minutes of public participation meetings