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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (PROJECT REPORT)

(2019)

PROPOSED INDIAN SANDALWOOD (*Santalum album)* PLANTATION PROJECT

FOR:
SANDALWOODS PLANTATIONS LTD
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CONSULTANTS IN; Environmental Audits, Environmental Impact Assessments, Environmental Surveys, Environmental Statements, Environmental Monitoring; Formulation of Environment Policies; Water Quality and Waste Management

EXECUTIVE SUMMARY

The cultivation of sandalwood is an important economic activity which strongly influences the rate of land development and afforestation in which in turn is often the catalyst for sustainable development and regional development, and catchment areas for rain. Sandalwood cultivation may, however, result in the destruction of important habitats, change the hydrological regime of a region, and contribute to waterway pollution in terms of increased suspended solids and elevated levels of agro-chemicals. As the cultivation extends over large land areas, the impacts are regional in nature. In order to manage and reduce the environmental impacts related to plantation development implementation activities need to be subject to holistic planning; hence an environmental impact assessment is conducted.

The activities to be undertaken by the proposed sandalwood project include of the, preparation of essential growing beds and terraces and laying down of recommended pipe network and drainage systems to serve all the stations envisaged to be in place, including the of pioneer crop and plant management. Establishment of modes of operation for other activities such as procurement of inputs, pest and diseases control strategies and waste management activities will be reviewed to obviate potential future obstructions. In the decommissioning phase, the activities to be put in place include will dismantling of plant and all the equipment *in situ*, clearance, to avoid negative environmental repercussions.

To enable the project to operate and conclude efficiently, all the potential environmental impacts from the initial operations, operation phases and decommissioning phases will be documented through a range of workable and acceptable mitigation measures mentioned in this document. The proposed environmental management plan presented here was instigated by the project proponents in their quest for operation that will be beneficial both, the human and environment and is sincerely hoped that all the issues detailed here will be adhered to as much as practically possible to manage, control and avoid negative impressions that impinge on physical, biological, social, economic and environmental outlook of the project. Sandalwoods Plantations Ltd aims to implement a comprehensive policy that safeguards the environment, health, safety and welfare of the employees working on the tree plantation.

……. **……..**
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ACRONYMS AND ABBREVIATIONS

CFCs	Chloroflourocarbons
EIA	Environmental Impact Assessment
EA	Environmental Audit
EMCA	Environmental Management and Coordination Act
GoK	Government of Kenya
HSE	Health Safety and Environment
IPM	Integrated Pest Management
I**CM**	Integrated Chemical Management
NEMA	National Environment Management Authority
OEL	Operator Exposure Limit
PPE	Personal Protective Equipment
WHO	World Health Organisation

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1.0.0 INTRODUCTION

1.1.0 Overview

Sandalwood plantation development is defined as opening up of land areas for the purpose of cultivating sandalwood and carrying out other related activities such as land clearing, biomass management and disposal, earthworks, planting and re-planting activities. The aim of this Environmental Impact Assessment (EIA) is to provide guidelines an easy to follow and practical means for assessing environmental impacts, recommending mitigation measures and proposing monitoring for:

- Planning the actual extent and location of area to be planted
- Land clearing activities
- Biomass management and disposal

Sandalwoods Plantations Ltd deals in agricultural activities including horticulture and tree plantation farming, the company intends to plant seedlings of sandalwood tree at NOOSIDAN KAJIADO/ KAPUTIEI SOUTH /5387 Kajiado County.

A favorable policy environment has been instrumental in the success of the forestry industry in Kenya since 1966. Bodies such as Kenya Plant Health Inspectorate Service ensure that phytosanitary matters are adhered to. This helps in protecting the growers from diseases as well as low quality products from the industry. The major challenges facing this industry include environmental pollution and resource depletion, spread of diseases and pests and complaints from the public. Currently, the industry is more open to the public as opposed to the closed systems under which they operated before. Regular environmental audits as well as social audits are conducted to ensure that farms not only conform to good agricultural practices (GAPS) but also maintain environmental standards and favorable working conditions for their workforce. Compliance is enforced through codes of practice and certification by industry association.

Sandalwood and the sandalwood oil industry is one of the oldest in the world sandalwood has been traded for its fragrant wood and essential oils. The genus sandalwood grows naturally throughout the Pacific and Eastern Indian ocean regions. Sandalwood trees are evergreen ranging in size from tall shrubs to large trees. They grow in a variety of climates ranging from Australian desert to sub-tropical New Caledonia and at elevations from sea level to 1800 meters. It is distributed in Malaysia and Australia.

The species belonging to this genus are usually partial root parasitis plants, equipped with special structures (haustoria) on its root that penetrate the roots of host plants to obtain nutrients.

All species occur in natural forest in different Habitats most of the species are over exploited and are under threat as endangered species. The demand for the sandalwood is

increasing and the supply is on decline. Because of inconsistent supply the prices have gone up very steeply depriving its use in various industries.

The only alternative is to produce sandalwood commercially with high input and management technique to make a short term rotation crop.

From this background information, the proponent proposes to establish a plantation of sandalwood, for the purposes of afforestation and in the future be in the business of sandalwood processing.

1.2.0 Location of the project

The proposed project is located in Kajiado County, on a 30 HA land for the phase one of the project, which will eventually cover 100 Ha in the final phase. The road leading to the farm is off the 10 Km from Emali-Loitoktok highway at Duka Moja junction. The farm stands on longitude and latitudes 2.274034S, 37.530533° E NOOSIDAN KAJIADO/ KAPUTIEI SOUTH /5387 Kajiado County

1.3.0 The proposed project objectives

The farm will be involved in sandalwood production

	NUMBER/CAPACITY
Sandalwood plantation	Trees on 30 Ha first phase

- To be in the sandalwood business in East Africa
- To support the Government in its policy of creating employment, particularly for the local community
- To contribute to foreign exchange earnings for Kenya
- To contribute to the revenue base of the exchequer

1.5.0 Methodology

The assessment was conducted by use of the following methods:-

- Literature review, public and government sources
- Site reconnaissance
- Interviews with site personnel
- Use of an observation schedule
- Use of a checklist

1.6.0 Project cost

The estimated cost of the project will be Kenya Shillings **10,000,000 /-**

1.7.0 Sandalwood Overview

Santalum album, or **Indian sandalwood**, is a small tropical tree, and is the most commonly known source of sandalwood. It is native to India, Indonesia, and the Malay Archipelago. Certain cultures place great significance on its fragrant and medicinal qualities. It is also considered sacred in some religions and is used in different religious traditions. The high value of the species has caused its past exploitation, to the point where the wild population is vulnerable to extinction. Indian sandalwood still commands high prices for its essential oil, but due to lack of sizable trees it is no longer used for fine woodworking as before. The plant is widely cultivated and long lived, although harvest is viable after 40 years.

The height of the evergreen tree is between 4 and 9 metres. They may live to one hundred years of age. The tree is variable in habit, usually upright to sprawling, and may intertwine with other species. The plant parasitises the roots of other tree species, with a haustorium adaptation on its own roots, but without major detriment to its hosts. An individual will form a non-obligate relationship with a number of other plants. Up to 300 species (including its own) can host the tree's development - supplying macronutrients phosphorus, nitrogen and potassium, and shade - especially during early phases of development. It may propagate itself through wood suckering during its early development, establishing small stands. The reddish or brown bark can be almost black and is smooth in young trees, becoming cracked with a red reveal. The heartwood is pale green to white as the common name indicates. The leaves are thin, opposite and ovate to lanceolate in shape. Glabrous surface is shiny and bright green, with a glaucous pale reverse. Fruit is produced after three years, viable seeds after five.

1.8 History of Sandalwood (Santalum album)

Santalum album is commercially known as East Indian sandalwood and the essential oils distilled from fragrant heartwood is the East Indian sandalwood oil. Its has been recognized as one of the oldest perfumery material for several centuries. Indian sandalwood incense is perhaps the oldest known type of incense for over 4000 years. Herbalist believe that the incense helps promote an atmosphere of open-mildness, peace and spiritual awareness.

1.8.1 Origin of sandalwood

It is generally accepted that sandalwood is indigenous to Peninsular India. But some believe that it was introduced to India because of its gregarious habit and great adaptability to different climatic zones.

Recent research report based on DNA studies (Danica 2004) reveals that Indian Sandalwood has taken origin from Queensland of Australia and two independent races moved from India to Indonesia.

- **Distribution**

Indian sandalwood is distributed between 30 N and 40 S, from Indonesia in the West to Juan Fernandez Islands in the East and from Hawaiian Archipelagoes the North to New Zealand in the South. In India it is found all over the country and more than 70% is found in the southern states.

- **Habit**

Indian sandalwood is small evergreen tree attaining a height of 12 to 15 metres and a girth of 1 to 2.4 metres, with slender drooping as well as erect branching. It grows well under partial shade in the early stages but shows intolerance to heavy overhead shade in the middle and late stages of is growth. However, under plantation management with higher moisture levels and donor hosts, the trees have proven to grow exceptionally well. It has dense foliage capable of stopping the wind velocity and survives well along with other crops.

The tree flourishes well in altitudes from sea lvel up to 1800masl . generally in the wild is is believed that trees growing on stony or gravelly soils are known to have more highly scented wood, however in plantation grown sandalwood, the induction of stress during the growing period showed an increase in production of the trees.

The tree flourishes well where there is moderate rainfall of 600 to 1600 mm. sometimes sandalwood is found growing in gardens, where rainfall maybe as high as 2500mm.

1.9 Uses Of Sandalwood

Considerable work has been carried out on the chemistry of the bark, seed, heartwood and oil of sandalwood.

- **Bark**

The bark contains a potent chemical urs-12=en-3-beta-yl-palmitate (shankaranrayana 1980). It has been reported that this chemical compound has chemosterilant action and acts as an insect growth inhibitor.

Bark also contains small amounts of betasitosterol, fatty acids and 14% tannins.

- **Seed**

Tree produces fruits and seeds twice a year. They can be used to raise seedlings and can be used as an ingredient in the soap industry.

Deoiled seed meal prepared from decoated seeds contains 52.5% protein which can be used as animal feeds.

Sandalwood seed oil

It is a viscous slimy pale greenish yellow. The seed oil on reaction with zinc chloride yields a dark plastic solid, which when dissolved in benzene forms an ideal base for insulation tape.

Seed oil reacts with sulphur yielding a dark sticky rubber like product and hence classified under vulcanisable oils.

On pharmacological screening sandalwood seed oil was found to posses diuretic hypotensive, anti tremorogenic and antiviral activities.(Desai 1990)

2.0.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1.0 Policy Framework

2.1.1 Introduction

Concern has been growing in Kenya and at global level that many forms of development activities cause damage to the environment. The main challenge today is how to maintain sustainable development without damaging the environment. Environmental impact assessment is a useful tool for the protection of the environment from negative effects of development activities. Development projects must be viable, socially acceptable and environmentally sound.

It is now a statutory requirement that developers involved in the scheduled activities (*Second Schedule of EMCA*) conduct environmental impact assessment (EIA), especially for those activities that are likely to have significant impacts on human health and the environment.

2.2.0 Legal Framework

2.2.1 Introduction

The Environmental Management and Coordination Act (1999) provides for the legal and institutional framework for the management of the Kenyan environment. Under the framework law, the *Second Schedule* provides guidance of activities which should undergo Environmental Impact Assessment (EIA) while projects already in place should undertake annual Environmental Audits (EA). However, there are other national legislative provisions which project proponents will be required to comply with in regard to air emissions, effluents, solid waste, hazardous materials and work environment management. There are also international conventions which Kenya is signatory to. These are outlined below.

2.2.1 The principal National Legislation "triggered" by this proposal includes the following:

(a) *Environmental Management & Coordination Act (1999)*:

Part V provides for the protection of:

- rivers, lakes and wetlands (section 42)

- hill tops, hill sides, mountain areas and forests (section 44 & 45 – identification of such areas)
- environmentally significant areas (section 54)
- ozone layer (section 56)

The following agricultural activities are regulated under the *Second Schedule* in the Act: use of pesticides (including herbicides and fungicides), use of fertilizers and irrigation. Pesticides are hazardous materials and subject to hazardous materials management regulations.

(b) *The Agriculture Act Cap* 318
(c) *Forest Act 34*
(d) The *Pesticide Control Products Act Cap* 346
(e) The *Employment Act Cap 226/229*
(f) The Factories and other Places of Work Act Cap 514
(g) The Food, Drugs and Chemical Substances Act Cap 254
(h) The Irrigation Act Cap 347
(i) The Lakes and Rivers Act Cap 409
(j) The Minimum Standards of Housing (1965)
(k) The National Hospital Insurance Act Cap 255
(l) The National Social Security Fund Act Cap 258
(m) The Physical Planning Act (1996)
(n) The Regulation of Wages and Conditions of Employment Act Cap 229
(o) The Standards Act Cap 496
(p) The Trade Disputes Act Cap 234
(q) The Water Act, 2002
(r) The Workmen's Compensation Act Cap
(s) The Factories and Other Places of Work Act (CAP 514)
(t) The Agricultural Produce Export Act Cap 319
(u)

2.2.2 The International agreements/conventions "triggered" by this proposal include:

(a) Montreal and Kyoto protocols – green house gases & ozone depleting substances

The Montreal Protocol of 1996 deals with the elimination of the production and consumption of ozone-depleting chemicals (namely CFCs and Halons). The substances which are controlled by the Montreal Protocol include the following:

- CFCs (CFC-11,12,13, 112, 113,114,115, 211, 212, 213, 214, 215, 216, 217)
- Solvents (carbon tetrachloride, methyl chloroform) and
- Methyl bromide, HBFCs, HCFCs and Bromochloromethane (BCM)

The UNFCCC (adopted in 1992) is a global legal instrument for the control and management of greenhouse gases (GHG) which are not controlled by the Montreal Protocol. The Kyoto Protocol is an affiliated instrument which commits industrialized countries to achieve quantified targets for decreasing their greenhouse gas emissions.
Greenhouse gases are radiative gases of the atmosphere, both natural and anthropogenic, which absorb and re-emit infrared radiation. They include carbon dioxide (CO2), methane (CH4), nitrous oxide (NO2), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6). The importance of each gas is based on its Global Warming Potential (GWP).

(b) The Stockholm convention (2001) - pesticides

This is a global treaty aiming to protect human health and the environment from persistent organic pollutants (POPs). The convention focuses initially on twelve chemicals that can be grouped into three categories:

- *Pesticides:* Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene (industrial chemical and by-product), Mirex and Toxaphene

- *Industrial chemicals*: PCBs (also by-product)
- *Unintended by-products*: Dioxins and Furans

2.2.1 Codes of practice relevant to the proposed project

There are several codes / standards which the proposed enterprise could join and subscribe to. These include:

(i) Other certification bodies / standards include: EUREPGAP Control Points & Compliance Criteria, Max-Havelaar Fairtrade Standards, BV Non-Food Factory Inspection Technical Standard/Checklist

2.3: Relevant Legislation and policies:

There is need to make a review of all legislation and policies that have been agreed upon locally and/or internationally regarding the proposed project activities. This encompasses analysis of project activities, products and services. Environmental Impact Assessment (EIA) is a methodology used to identify the actual and probable impacts of projects and programmes on the environment and to recommend alternatives and mitigating measures. The assessment is required at all stages of project's development to ensure environmentally sustainable development for both existing and proposed public and private sector development ventures. The National EIA regulations were issued in accordance with the provisions of the Environmental Management and Coordination Act (EMCA) of 1999. The EIA Regulations must be administered, taking into consideration the provisions of the EMCA 1999 and other relevant state laws. The intention of the Act is to approve and license only those projects that take into consideration all aspects of

concern to the public as they impact on Human health and the quality of the environment. This EIA report takes into consideration the following policies and legal instruments:

2.3.1: National Environment Action Plan.(NEAP)

The NEAP for Kenya was prepared in mid 1990s. It was a deliberate policy effort to integrate environmental considerations into the country's economic and social development. The integration process was to be achieved through a multi-sectoral approach to develop a comprehensive framework to ensure that environmental management and the conservation of natural resources are an integral part of societal decision –making. The NEAP also established the process of identifying environmental problems and issues, raising environmental awareness, building national consensus, defining policies, legislation and institutional needs, and planning environmental projects.

2.3.2: Environment and Development Policy (Sessional paper No.6 of 1999).

The goal of this policy paper is to harmonize environmental and developmental goal so as to ensure sustainability. The paper provides comprehensive guidelines and strategies for government action regarding the environment and development.The World Commission on Environment (The Brundland Commission of 1987) recommends development that produces no lasting damage to the biosphere and of particular ecosystem. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. Similarly, socio-sustainable development is development that maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition, and shelter, cultural expression and political involvement.

2.3.3: The National Poverty Eradication Plan (NPEP) and the Poverty Reduction Strategy Paper (PSRP)

The NPEP has the objective of reducing the incidence of poverty in both rural and urban areas by 50 percent by the year 2015; as well as strengthening the capabilities of the poor and vulnerable groups to earn an income. It also aims at narrowing the gender and geographical disparities and at creating a healthy, educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for Socio Development (WSSD) of 1995. The plan focuses on the four WSSD themes of poverty eradication, reduction of unemployment, socio-integration of the disadvantaged people and creation of an enabling economic, political and cultural environment. This plan is to be implemented by the Poverty Eradication Commission (PEC) formed in collaboration with Government Ministries, community based organizations, private sector, non- governmental organizations, bilateral and multilateral donors. This strategy is important in raising human capabilities and thus human development. The PRSP has the twin objective of poverty reduction and economic

growth. The paper articulates Kenya's commitment and approach to fighting poverty; with basic rationale that the war against poverty cannot be won without the participation of the poor themselves.

2.3.4: Legal Framework:

Most existing environmental legislation in Kenya was originally formulated in response to specific problems. The thrust of the legislation is almost entirely negative; stressing what should not be done. It bears little relationship to environmental management, a concept emphasizing planning and incentives for environmental sound choices.

There are 57 separate statutes in Kenya, which relate to the protection of the environment and the management of natural resources, e.g. the 1989 Wildlife Conservation and Management (AMENDMENT) Act, and further 20 statutes, which relate indirectly to the environment. It is because of this lack of a comprehensive Act on the environment that the Environmental Management and Co-ordination Act No. 8 of 1999 was enacted. This Act was a review of the 77 statutes related to environment. The EMCA 1999 guarantees every Kenyan a clean and healthy environment.

A further deficiency of the legislation was that they did not provide any specific remedies or confer any rights on private citizens, either individuals or in groups, in the event of their interests being infringed upon by Acts of environmental mismanagement. Although the law of torts provides a framework within which many environmental problems can be resolved, its use in combating environmental problems is extremely limited.

2.3.5: Water Act of 2002;

This prohibits the pollution of water. Part II, Section (3) states " every water resource is hereby vested in the State, subject to any rights of user granted by or under the Act or any other law. In addition, the right to use of water from any water resources is vested in the Minister of Water Resources Development and Management, except to the extent that is alienated by or under the Act or any other written Law (Section 5). Consequently, a water permit must be obtained before using any water resource. Section 29 (1), (2) and (3) stipulates the procedure for obtaining a water permit, while Section (4) states "except as provided in Section 33, an application for a permit shall be subject to the public consultation and, where applicable, of environmental Impact Assessment in accordance with the requirements of the Environmental Management and Coordination Act, 1999"

2.3.6: The Public Health Act Cap 242

The public Health Act regulates activities detrimental to human Health. The owner(s) of premises responsible for environmental nuisance such as noise and emissions at levels that can affect human health are liable to prosecution under this Act. An environmental nuisance is one that causes danger, discomfort or annoyance to the local inhabitants or

which is hazardous to human health. It also outlines the standards of construction of sanitary facilities of any premises.

2.3.7: Environmental Management and Coordination Act (1999) and the Environmental (Impact Assessment and Audit) regulations, 2003.

This is an Act of Parliament that provides for the establishment of the appropriate legal and institutional framework for the management of the environment and for matters connected there with and incidental thereto. The Act recognizes the fact that the environment constitutes the foundation of national economic, socio-cultural and spiritual advancement.

1.1 Section 51 of the Act provides for the conservation of biological resources in-situ and mandates NEMA to issue guidelines that can be used to ensure that biological resources are protected. This include the development of land use guidelines that are compatible with the conservation of biological resources, selection and management of buffer zones including special arrangements for the protection of species, ecosystems and habitats threatened with extension. Section 112, 113, 114 and 115 provide for the application, granting enforcement and compensation for environmental easement, which may be done if, found necessary for purposes of conserving and enhancing the environment.

This Act requires every development likely to have an impact on the environment to undertake an environmental impact assessment. The second schedule of the Act states that any activity out of character with its surrounding; or any structure of a scale not in keeping with its surrounding; or any activity leading to major changes in land use must undergo an EIA.

2.3.7 Forest Act

) Forests may be classified as public, community or private forests.

(2) Public forests include—

(a) public forests classified under Article 62 (1)(g) of the Constitution; and

(b) forests on land between the high and low water marks classified under Article 62 (1)(1) of the Constitution.

(3) Community forests include—

(a) forests on land lawfully registered in the name of group representatives;

(b) forests on land lawfully transferred to a specific community;

(c) forests on any other land declared to be community land by an Act of

Parliament;

(d) forests on land that is lawfully held, managed or used by specific communities as community forests;

(e) forests on ancestral lands and lands traditionally occupied by hunter-gatherer communities; and

(f) forests lawfully held as trustland by the county governments, but not including any public land held in trust by the county governments under Article 62 (2) of the Constitution.

(4) Private forests include—

(a) forests on registered land held by any person under any freehold tenure;

(b) forests on land held by any person under leasehold tenure;

(c) any forest owned privately by an individual, institution or body corporate for commercial or non-commercial purposes; and

(d) forests on any other land declared private land under an Act of Parliament.

31 Creation and management of public forests

(1) All public forests in Kenya are vested in the Service, subject to any rights of user in respect thereof, which by or under this Act or other written law, have been or are granted to any other person.

(2) The Cabinet Secretary may, on the recommendation of the Board and after consultation with the National Land Commission declare through a Gazette notice any un-alienated public land or any land purchased or otherwise acquired by the Service to be a public forest.

32. Management of community forests

(1) All community forests shall be vested in the community, subject to any rights of user in respect thereof, which by or under this Act or other written law, have been or are granted to any other person.

(2) The Service shall register each community forest in accordance with Regulations prescribed in accordance with this Act.

(3) The Service shall notify the relevant county government of the registration of a community forest as soon as is practicable of the registration.

(4) Upon registration under subsection (2), the community may apply—

(a) to the county government for technical advice regarding appropriate forestry practices and conservation; or

(b) to the Fund, subject to availability of funds, loans from the Fund for the development of the forest.

(5) A community that establishes or owns a community forest may apply to the relevant authorities for exemption from payment of all or part of the land rates and such other charges as may be levied in respect of the land on which the forest is established.

33. Management of private forests

(1) A person who owns a private forest, including a forest in the course of establishment, on land owned by the person, may apply to the Service for registration of the forest under this section.

(2) The Service shall register a forest under subsection (1) where the forest meets the criteria prescribed in rules made under this Act.

(3) Upon registration under subsection (2), the owner of a private forest may apply—

(a) to the Service for technical advice regarding appropriate forestry practices and conservation; or

(b) to the Fund, subject to availability of funds, loans from the Fund for the development of the forest,

provided that the funds are obtained and utilised in accordance with the procedures set out by the Service.

(4) A person who establishes or owns a private forest may apply to the relevant authorities for exemption from payment of all or part of the land rates and such other charges as may be levied in respect of the land on which the forest is established.

34. Variation of boundaries or revocation of public forests

(1) Any person may petition the National Assembly or the Senate, for the variation of boundaries of a public forest or the revocation of the registration of a public forest or a portion of a public forest.

(2) A petition under subsection (1) shall demonstrate that the variation of boundaries or revocation of the registration of a public forest or a portion of a public forest does not—

(a) endanger any rare, threatened or endangered species; or

(b) adversely affect its value as a water catchment area; and prejudice biodiversity conservation, cultural site protection of the forest or its use for educational, recreational, health or research purposes.

(3) A petition made under subsection (1) shall be considered in accordance with

the provisions of the Petitions to Parliament (Procedure) Act and the Standing Orders of the relevant House.

(4) The Cabinet Secretary shall, within thirty days of the petition being committed to the relevant Committee, submit a recommendation on whether the petition should be approved subject to—

(a) the petition being subjected to an independent Environmental Impact Assessment; and

(b) public consultation being undertaken in accordance with the Second Schedule.

(5) If the relevant Committee, reports that it finds that the petition—

**** other relevant laws**

- ✓ Article 69 of the Constitution of Kenya on environment protection of environment and biodiversity.
- ✓ Forest conservation and management Act 2016 under section 22 which mandates KEFRI to be lead agency in forestry research and development.
- ✓ The provisions of Forest conservation and Management Act 2016 , provisions of sections 40, 60 and 61.
- ✓ The mandate of KEPHIS as provided nder KEHPIS 2012 , the seeds and palnt varieties Act (Ca 326) and the plant protection Act (Cap 324)

2.3.8: Institutional Framework:

For long time, several ministries and parastatals as lead agencies have been responsible for the environmental protection and natural resources management in Kenya. This fragmented responsibility led to conflicting ministerial objectives and created gaps in coverage and become one of the main constrains to effective environmental management. The government recognizing this problem and in 1999 enacted the Environmental Management and Coordination Act (EMCA). Under the Act, the National Environment Management Authority (NEMA) was established as the supreme regulatory and advisory body on issues of environmental management in Kenya. NEMA is mandated to co-ordinate and supervise the various environmental management activities being undertaken by the statutory organs with a view to promoting their integration into development policies, programmes, plans and projects that provide sustainable development and a safe and healthy environment to all Kenyans. The Key function of NEMA include: responsibility for policy formulation and direction for the purpose of the Act; setting national goals and objectives an determining policies and priorities for the protection of the environment; promotion of cooperation among public departments, local authorities, private sector and non-governmental and such other organization engaged in environmental protection programmes; and perform such other function as assigned by the Act.

The other agencies which will be involved in this process are the

- KEPHIS
- KWS
- KEFRI
- KFS

All the above mentioned will play a vital role in the implementation of the proposed project, and their feedback will make NEMA have an informed decision on the project.

2.3.9: Methodology:

This report was then prepared in accordance with the EMCA 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003 for submission to the National Environmental Management Authority (NEMA).

Preparatory meetings were held with key stakeholders at the beginning of the assignment. The initial meeting involved the production of the mutually agreed terms of reference for

the study. The EIA experts reviewed existing related legislation and regulation in Kenya and documents related. A review of literature and desk study complemented the field primary data. Field surveys were based on predetermined parameters and acceptable methodologies in environmental assessment.

The socio-economic thematic area of the study assessed the impacts of the proposed project on the socio-economic and human environments of the beneficiaries. It involved assessment of existing living conditions of the stakeholders. The views of the local community on the positive and negative impacts of the project were recorded, discussed and documented. In addition, the mitigation measures for any observed negative impacts as suggested by the stakeholders were analyzed and incorporated in the EMP in this report.

2.3 10: Scope of the Assessment.

The following steps are included, to the extent and at the level of detail appropriate to the size of the project:

- ✓ An environmental profile of the site.
- ✓ Project activities (including discharges, waste and emissions).
- ✓ Environmental impacts of project activities.

Physical environmental impacts considered in EIA typically include:
- Climate and air quality
- Water, including groundwater
- Geology and soils
- Ecologically sensitive areas and habitats
- Land use and surrounding activities
- Noise, vibration and radiation
- Visual quality

The socioeconomic factors may include:
- Population and demographic impacts
- Land-use and settlement
- Cultural and historical features
- Local economic structure
- Transport aspects

2.3.11: Benefits of an EIA.

Experience shows that Environmental Impact Assessments can also have a number of other benefits, including:

- ♦ Increasing employees' awareness of environmental policies and responsibilities,

- Identifying potential cost savings, including those resulting from waste minimization,
- Evaluating environmental training programmes,
- Providing an information base for use in emergencies and evaluating the effectiveness of emergency response arrangements,
- Enabling management to give credit for good environmental performance,
- Assisting relations with authorities by making them aware that complete and effective audits are being undertaken, and by informing them on the types of procedures adopted,

2.3.11 PROJECT ALTERNATIVES

- ✓ **LAND/ SITE**

The proposed project does not have any other land apart from the one they are holding. Therefore any other land apart from the current one.

- ✓ **MODE OF GROWTH**

The sedlings will be grown in the soil media, other mediums are not suitable, for the growth of this seedlings. The need firm, solid medium for their growth.

- ✓ **IRRIGATION METHOD**

The drip irrigation methods will be employed, this ensures water conservation. Overhead and sprinkler methods are not environmentally friendly in water scarce regions.

- ✓ Other methods employed in the development of this project will be; use of tractors, levelling and weeding done by human labour. Planting the seedlings and finally harvesting the finished products.

3.0.0 DESCRIPTION OF ENVIRONMENT

3.1.0 Climate and Agro-Ecological Conditions

The zone experiences a double rain-shadow effect from the escarpments and as a result, the basin receives less rainfall than the surrounding highlands. Rainfall received range from 650-700mm per year. There are two rain seasons with the long rains between April and June and the short rains in the period between October and December. The mean annual rainfall for the area is 693 mm, the pattern is however irregular and rainfall quite erratic. Wind speed range from 11-15kms/hr blowing normally towards the Southwest. Temperatures vary throughout the year between a maximum daytime temperature of 20-30^{0}C and a minimum night temperature of 10-14^{0}C. Monthly means vary from 15.9-18.5^{0}C. July has the coolest means and the least range while January and February have the warmest but the greatest mean range of temperatures.

Kajiado County is dominated by arid to semi-arid grasslands characterized by open grass plains, acacia woodlands, rocky thorn bush lands, swamps and marshlands (Ogutu et al. 2014). The main soils are poorly developed and shallow clayey soils in the flood- plains; brown calcareous clay loams, sandy soils, ash and pumice soils in the higher elevations; and basement rock soils which dominate large areas of the County, making pastoralism the only appropriate land use in most parts of the County (Ogutu et al. 2014).

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Biological Environments

3.2.0 Flora

The grounds are scantly covered by tuft grass and some countable numbers of Acacia tree species. General savanna type of vegetation.

3.2.2 Fauna

No significant large mammals were found at the time of assessment; however there are safari ants and some rodents. The project is not located in the wildlife corridors, as there

has not been any wildlife around. The region is developing and mostly composed of small scale farms.

Plate one: The proposed site region

3.3.0 Land use

Land in at the proposed site is categorized as community land, private land or public land and registered as leasehold or freehold interest.

The main land use in the area includes agricultural activities. Other land uses include small scale agriculture and small-scale commercial activities. Other activities include the pastoralism, both at small scale and medium scale. There are schools and dispensaries within the locality. The area basically has the Maa speaking people, who are changing their lifestyle from pastoralism to agriculture. Parcels of land have been converted into farms for food crops.

- ✓ Percentage of land with title deeds

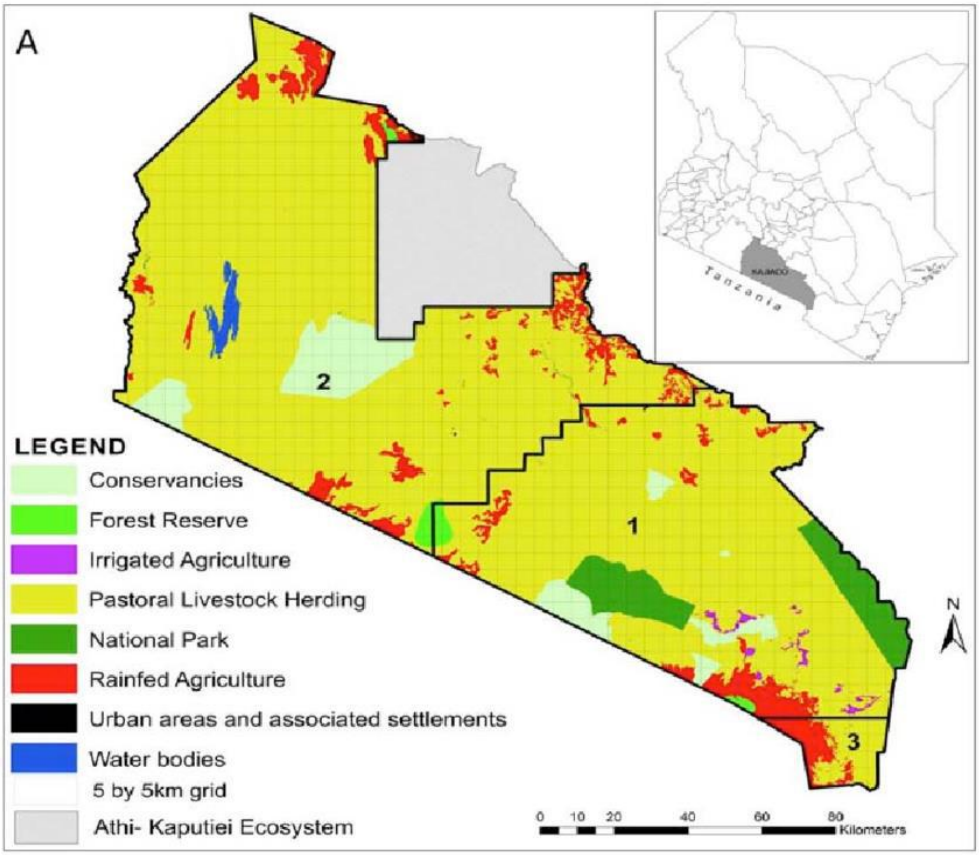
The percentage of land with title deeds in the county is estimated at 95 percent in rural areas and 5 percent in townships

- ✓ Incidence of landlessness

Though the county is endowed with expansive land resources, there are a few reported cases of landlessness as a result of irregular sale and transfer of matrimonial land particularly in rural areas.

- ✓ Settlement patterns

Human settlement pattern in the county is divided into urban and rural, with majority of thepopulation settling in urban areas compared to rural areas. The county has experienced intensified population pressure that has triggered land use/cover change compounded by climate change.


A
LEGEND
Conservancies
Forest Reserve
Irrigated Agriculture
Pastoral Livestock Herding
National Park
Rainfed Agriculture
Urban areas and associated settlements
Water bodies
5 by 5km grid
Athi- Kaputiei Ecosystem
1
2
3
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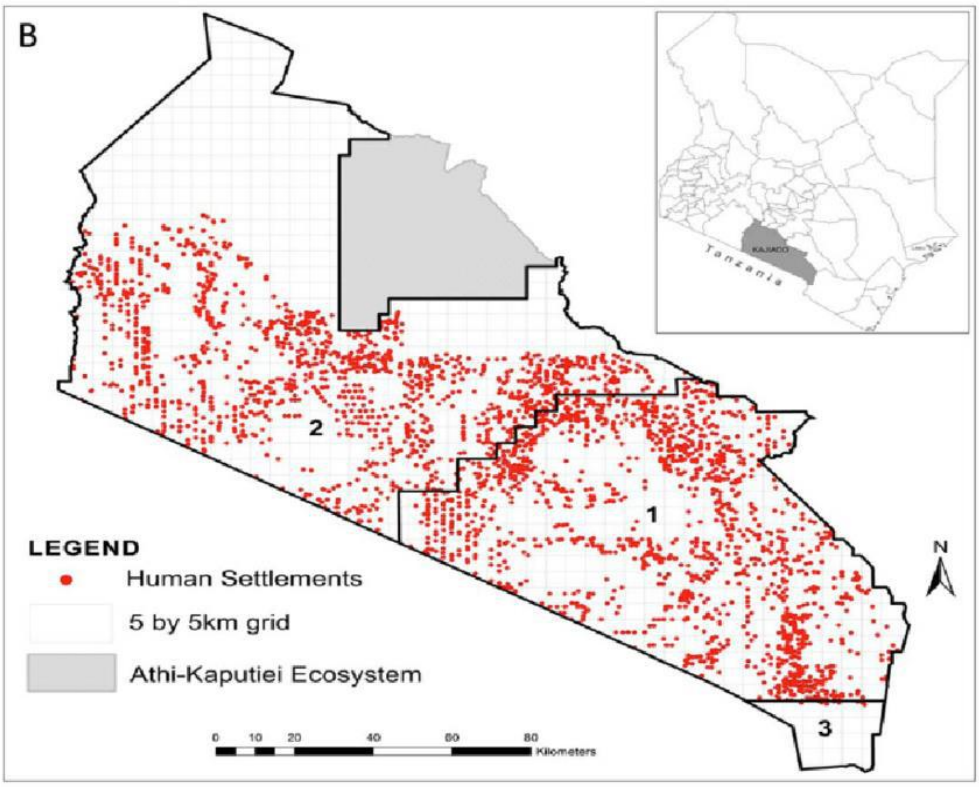
0 10 20 40 60 80
Kilometers
Tanzania
KAJIADO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5 by 5km grid
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Kilometers
Tanzania
KAJIADO

I4.0.0: IDENTIFICATION AND PREDICTION OF IMPACTS

Actions	Environmental impact areas / receptors							
	Human Health	Soil	Plants/Animals (above & belowground biodiversity)	Hydrology (water quality & quantity)	Air pollution / ozone depletion	Socio-economic / Cultural aspects	Aesthetics	Accidents
Land clearance & leveling		□	□	□	□		□	
Plantation trials				□				□
Plantation initial development				□				
Construction of drainage ways		□		□				
Soil conservation measures		□						
Application of fertilizers				□				
Control of diseases & pests (pesticide use)	□	□	□	□	□			□
Transport of products and farm inputs					□	□		□
Employment of workers						□		
Waste management at site: • Management of input stores – fertilizers & agro-chemicals • Management of	□	□		□		□	□	□

and other site facilities • Procurement of supplies								

5.0.0 PROPOSED HEALTH, SAFETY AND ENVIRONMENTAL POLICY

The company is in the process of developing a comprehensive HSE policy as detailed herewith.

5.1.0 Goal of the HSE Policy

Company understands that its activities will interact with the environment in a very complex manner and economic prosperity is dependent on how well the environment is taken care of.

The goal of the proposed HSE policy will therefore be to assist the company to maintain position with full commitment to minimize the negative impacts of the company's activities on the environment, to conserve existing habitats, reduce use of agrochemicals, improve its efficiency in the use of natural resources and ensure good health, safety and welfare of employees and the neighborhood. The company will be fully committed to complying with all Kenyan regulations and the highest standards of Good Agricultural Practice.

5.2.0 Elements of the HSE Policy

This policy will have the following essential elements:

(i) **Impact assessment guidelines:** These guidelines will provide for the assessment of the impacts of operations on the natural environment and in particular the effects of the pesticides and fertilizers used their effect on workers, spray operators, consumers, wildlife, and aquatic life and water resources.

(ii) **Pollution prevention and control:** The policy will provide for adoption of processes, practices, materials or products that avoid, reduce or control pollution.

(iii) **Efficient natural resource utilization:** To better utilize natural resources including water, the company wherever possible will incorporate recycling, treatment, process changes, control mechanisms, resource conservation and material substitution.

(iv) **Risk Reduction:** The HSE will lay down a strategy for minimizing health and safety risks to workers. The company will regularly conduct Health, Safety and Environmental audits whose outcomes will enable the company to fully understand the impacts of its operations and corrective actions to be put in place. Based on the outcomes, the company's Health, Safety and Environment Committee, will set objectives and targets for continuous improvement, prevention of pollution and reducing risks to workers and the environment.

(v) **In-house training:** All company personnel in positions of responsibility will be trained to ensure full understanding of the reasons, targets and requirements of the HSE policy.

(vi) **Effective communication:** The policy will provide guidelines to ensure effective communication channels, both internal and external, and at all levels.

(vii) **Enforcement:** To ensure that company operations are conducted in a safe and healthy environment and that the welfare of employees is monitored and maintained, managers, heads of departments and supervisors will be required to ensure that the HSE policy is enforced and observed by employees and those who may be affected by the company's activities.

(viii) **Right to know:** The Company will emphasize that employees and other persons affected by the rules contained in the HSE Manual must know, understand and adhere to the rules. Awareness-raising enhances the understanding of the roles and responsibilities of each worker.

(ix) **HSE Committee:** Factories and Other Places of Work Act (Cap 514) (GoK, 1992) Subsidiary Legislation, Legal Notice No. 31 of 2004, the company will establish a HSE Committee that will meet regularly to review current policy programmes and related matters that arise from weekly and monthly reports from within each department. The Committee will be responsible for the identification and design of action plans for continuous improvement.

(x) **Participatory processes:** Employees will fully participate and make suggestions in the development of the HSE guidelines.

(xi) **Personal Protective Equipment (PPE):** The HSE policy will require provision of PPE to ensure that the workers are adequately and appropriately protected from injury.

5.3.0 Pesticides Management

The overall aim with respect to pesticides is to reduce the pesticide load on the environment year after year whilst ensuring that pesticides application is safe. This takes place within set guidelines laid down by Codes of Practice and Statutory Regulations subscribed to. The company will maintain a continuous improvement strategy based upon audit and risk analysis using the following guidelines: -

- A system of ordering, transporting, receiving, storing and applying pesticides
- Methyl Bromide and other banned/restricted pesticides will not be used, the farm is currently not fumigating soil.
- Efficient and economical use of pesticides and fertilizers. These will be monitored daily, monthly, yearly, crop by crop and on a square meter basis.
- Prophylactic use of all pesticides is discouraged. Scouting will done to ensure that prophylactic use and blanket spraying are avoided whenever possible.

- Pesticides with least impact on mammalian, avian and aquatic life are of first choice.
- The spray programme will be a supervised exercise that links the levels of pest and disease monitoring and control through scouting and spot spraying. Once spraying has been done, adequate warning signs on entry will be displayed.
- Efforts to develop and implement an alternative pest and disease control strategy through the use of biological, physical and cultural control will be continually pursued. Integrated Pest Management (IPM) and Integrated Chemical Management (ICM) will also be encouraged.
- Over- or under-application of pesticides will be avoided and confirmation of this will be done through analytical examination of tissue samples.
- Knowledge of the various pesticides and their toxicity by the Technical Manager which ensures that the right pesticide is applied.
- Ensuring that individual operators do not exceed the Operator Exposure Limit (OEL) through an efficient logging system. All operators will be screened once every three months to monitor cholinesterase to ensure safe levels are adhered to and they are rotated once a month and assigned other duties.
- Monitor all pesticide usage in respect to relative toxicity and provide justification for the use of Class 1 pesticides.
- Ensuring that the technical personnel with overall responsibility for spray programmes and decisions on their application are suitably qualified and trained.
- Policy on professional development of senior and supervisory staff relating to pest and disease control and the minimizing of pesticide usage.
- Investigate ways of reducing waste and how to dispose off waste properly.
- To continually improve production practices so as to be more socially responsive and environmentally friendly.
- On-going research and development
- Worker training on pesticide toxicity/classification and first aid measures.
- Empty pesticide containers will be pressure-rinsed, punctured and flattened and then sent to the incinerator. The company will investigate the possibility of suppliers taking back the containers for disposal. Dilute pesticide residue (rinsate) from the containers will be used/mixed inside the spray mixture.

5.4.0 Fertilizers Management

The will promote the rational use of fertilizers so as to minimize negative environmental impacts while consistently attaining production. The following guidelines will be used: -

- Utilization of fertilizers and compost in line with Good Agricultural Practices
- Applying fertilizers based on sound principles, leaf tissue analysis and soil analysis to provide a guide to the soil nutrient levels and in particular nitrates,

phosphates, potash and magnesium levels. Leaf samples and soils are tested on a 2 monthly rotational schedule to check on any compound build-ups or depletions in the soil. Fertilizers will then be applied based strictly upon these results.

- All fertilizer usage are recorded
- Only qualified personnel will have responsibility for fertilizer programmes and decisions on their application
- Training of all personnel involved in and the rational use of these fertilizers.
- Fertilizers will not be applied to conservation areas, wildlife corridors or within 30 meters of watercourses.
- All of the organic waste will be composted to maximize nutrient recycling and maintain soil fertility
- Fertilization will be tied to soil, tissue and water analysis from the laboratory results
- The company will recycle waste water
- Any increases in fertilizer usage for the same period over the previous year must be justified.
- The composition of each fertilizer materials used will be determined. All fertilizer applications will be monitored and audited. Storage facilities will be constructed to contain any possible spills that could contaminate soil or water.

5.5.0 Water Resources Management

The company will foster efficient use of water through a range of conservation techniques. To ensure continual improvement, the following guidelines will be observed:

- Implementation of any action recommended during the Environmental Assessment Audits.
- Record and report the total water consumption, per production unit, in m^3/ha/day.

There will efforts to develop and implement effluent degradation strategies in order to avoid environmental pollution. The company will use chemical deactivation pits to clean spray wastewater. A constructed wetland will be put in place to polish the effluent before release to a natural water course.
Application of water to the soil will be based on sound agronomic principles of soil-water relations (using tensiometer readings) to provide a guide to the soil water status.
All water utilized will be/is metered and recorded

5.6.0 Soil Resource Management

The objective here is to ensure that all land use practices are carried out in an environmentally responsible manner in line with the Code of Good Agricultural Practice. As indicated above, fertilizers will be applied based on sound principles, leaf tissue and soil analysis to provide a guide to the soil nutrient levels and in particular nitrates, phosphates, potash and magnesium levels.

The following “best practice” methods for soil conservation will be applied:

- *Grassing*: all earth areas not specifically required to be tilled will be grassed and terraced to minimize erosion.
- *Drainage*: all drainage will be in concrete or precast culverts to avoid soil erosion.
- *Maintenance* of indigenous vegetation.
- *Planting* of appropriate species on the farm
- *No cultivation* will be carried out on land with a slope of more than 35% in accordance with the Agriculture Act. Also, no cultivation will be carried out on land less than 25 m from the river.

5.7.0 Waste Management

5.7.1 Polythene

- To minimise environmental pollution caused by polythene, company will ensure:
- that all used polythene is collected, bailed and transported to a recycling facility
- That all used polythene is returned to the storage facility.
- That no polythene is incinerated and will be bought from only the licenced dealers.

5.7.2 Paints and thinners

- To minimize soil pollution by paint disposal, the following will be done:
- Training of painters on safe disposal of thinners and paints.
- Implementing a system for collecting waste material and incineration.
- Implementing a system for safe disposal of paint containers

5.7.3 Non-organic waste

- Fertilizer sweepings will be re-used.
- Chemical spillage will be soaked in sawdust and disposed in approved disposal sites.

5.7.4 Organic waste

- Plant refuse, the result of pruned, discarded in the field will be composted to produce organic manure, we are in the process of ordering a machine that can turn the organic waste into pellets, which we can easily bring back into the crop as an organic fertilizer.
- Biodegradable materials like cartons and other packing materials will be re-used or shredded and composted.

5.7.6 Waste timber

Waste timber will be re-used on the farm.

5.7.7 Toilet & Septic Tanks

The company will construct toilets with septic tanks for the workforce.

5.8.0 Biological Resources Management

- To protect and conserve wildlife, natural habitats, respecting and enhancing the landscape character, the company will emphasize efficient use of resources including energy, water, land use practices, use of pesticides, fertilizers, compost, prevention of pollution and conservation of natural flora and fauna and the landscape. To ensure no damage is done to these resources, the company will strictly follow guidelines regarding avoidance of use of pesticides and has a full understanding of:-
- Mammalian Toxicity -WHO Classification
- Aquatic Toxicity - Red List
- Avian Toxicity - Green List

5.9.0 Air Pollution Management

To reduce negative impacts on the air, the following measures will be observed:

- Non-use of methyl bromide for fumigation due to its ozone depleting effects.
- Incineration of materials will be minimised and all organic waste will be composted and polythene wastes recycled.
- Use of unleaded petrol and regular servicing of the company vehicles to reduce emissions.
- Use of products with chlorofluorocarbons (CFCs) will be avoided as much as possible.

To minimize air pollution when spraying, the following measures are observed:-

- Minimizing and monitoring use of all pesticide products.
- Effective scouting will be done to minimize blanket spraying
- Use of Integrated Pest Management methods.

5.10.0 Health and Safety Management

The company will be responsible for the care, health and safety of all employees and any other person within its premises. The company is subject to the Factories and Other Places of Work Act (Cap 514) under the laws of Kenya. This law lays down the rules for Safety, Health and Welfare within factories and other places of work with a view to

ensuring suitable conditions of work and good health of workers. Under these regulations, Health and Safety Audits are required to identify any risks to employees and other persons. These risks will be then analyzed and corrective action plans drawn up.

The company has a responsibility, so far as is reasonably practicable, to prevent injuries or harm to its employees and every reasonable effort will be made to provide safe and healthy working conditions. These general guidelines shall apply:

- Ensuring management at all levels is aware of their responsibilities for health and safety.
- Ensuring supervisors and workers are aware of their roles to care for their health and safety and that of others.
- Training workers on health and safety techniques and that these are combined with production techniques in the following areas:-
    - The use and handling of chemicals.
    - Machinery and equipment use and & upkeep.
    - Electrical equipment use & upkeep.
    - Land preparation.
    - Post harvest procedures.
    - Transportation.
    - Personnel and home hygiene.

- To minimize risk of personnel injury in violence during possible industrial disputes, will:

    - The company will support the formation of a Health, Safety & Environmental Committee as required by the law. It will be responsible for HSE programs.
    - Ensures that workers' committee and management are in place and working together to prevent any potential problems.
    - Ensuring freedom of association of all workers.

6.0.0 PROJECT ACTIVITIES

6.1.0 Description of the project cycle

A project cycle involves several stages, which include project concept, feasibility study, operation, implementation and decommissioning phases. Each phase is associated with certain activities. The activities associated with each of these phases in the project are described below.

6.2.0 Project activities

6.2.1 Initial Phase

The following activities will be undertaken at onset of the project

Nursery establishment
_ Access road
_ Base camp
_ Site clearing
_ Biomass management & disposal
_ Earthworks, drainage & irrigation
_ Planting and maintenance of seedlings

Site preparation
_ Access road
_ Base camp
_ Utilities provision
_ Site clearing - underbrushing & clear felling
_ Biomass management & disposal
_ Earthworks, drainage, infrastructure
_ Cover crop establishment

Field establishment
_ Field lining & holing
_ Final culling
_ Transplanting

6.2.2 Operation phase

This phase shall involve the following activities;

- Procurement of inputs
- Application of fertilizers
- Planting of different varieties of rose bushes
- Irrigation
- Control of diseases and pests
- Harvesting, storage and packaging
- Waste management activities

6.2.3 Decommissioning phase

Although the project is expected to remain in operation for a long time to come, whether it remains operational depends on market conditions as determined by changes in

consumer preferences and competition. However, it is important to consider the types of activities which would arise as a result of closure of the enterprise and their potential environmental impacts. Decommissioning, for whatever reasons, would lead to stoppage of all production operations. The activities associated with this phase include; dismantling of plant and equipment, clearance of the site, closure of septic tanks and re-establishment of grass/vegetation on the land and possibly growing of other viable crops.
_ Nursery establishment
_ Removal of old trees
_ Evacuation of plantation staff & workers
_ Biomass management & disposal
_ Removal of equipment, machinery & structures
_ Field lining and holing _ Site restoration/ rehabilitation

7.0.0 PROJECT DESIGN

7.1.0 Project phases and area

The property on which the project will be laid out is 30 Ha.

7.2.0 Farm plan

7.3.0 Utilities

Fertigation - Precise fertilizer and water application can be centrally controlled. Production and quality both depend on how good and versatile this system is and how well it is run.
Fencing – Adequate provision for proper boundary fencing all around the farm has been made.

Land Development - Land development also includes ploughing, harrowing and application organic manure.

Electricity from KPLC & Standby Genset .

8.0.0 MATERIALS TO BE USED, PRODUCTS AND BY-PRODUCTS

8.1.0 Land

The land for this Project belongs to Sandalwoods Plantations Ltd. (see the attached title deed)

8.2.0 Materials and machinery

Farm machinery such as tractors shall be used during the. Materials use shall include pools from recycled plastic, wood, shade net, polythene, water pipes, and pumps among others.

8.3.0 Planting materials

Sandalwood seedlings

8.4.0 Agrochemicals

The chemicals to be used include fertilizers, pesticides, and compost.

8.4.1 Fertilizers

The total range of pesticides fertilizers to be used is ones approved by PCPB.

8.5.0 Water

Rainfed and a borehole will be sunk if need be, to supplement the needed water.

8.6.0 Planting materials

Sandalwood products (agroforestry products)

8.7.0 Energy

The main source of energy will be the Kenya Power and Lighting Co. Ltd. This is automatically backed up by a generator.

8.8.0 Products and by-products

The product from this project will solely be sandalwood tree. The by-product is mainly green manure comprising cuttings, broken vegetation.

8.9.0 Wastes and methods of disposal

Waste	Source	Disposal method
Packaging	packing materials	Recycling and /or sold to recyclers
Waste water	spray and fertigation	Deactivation Soak pits,

	stations	constructed wetland
Organic waste	Cultivation	Composting in lined pits.
packing boxes etc	variable	To be sold as waste paper
Used engine oil	Farm machinery maintenance	Application on posts (as a preservative), return to supplier
Agrochemical containers	Agrochemical usage	Collected by authorized handler for high temperature incineration

9.0.0 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The proposed project entails a number of activities which will be carried out during the different phases of project implementation. These activities have the potential to generate environmental and social impacts within the project area, its environs and nationally. This section analyzes the potential impacts of the proposed activities in the context of the project cycle and proposes feasible mitigation measures.

The impacts have been defined on the basis of the issues raised by the affected persons and the scoping assessment done by members of the EIA professional team. The areas of the impacts include the following:

- Soil (erosion, reduced biodiversity)
- Biodiversity (erosion, reduced plant biodiversity)
- Surface & ground water (mainly fertilizer, pesticide and human waste pollution of the river-, ground-water)
- Socio-economic (incomes, cultural values, health, (in)security)
- Settlements (unplanned settlements
- Air (pollution by vehicular emissions, ozone depleting substances)
- Traffic (risk of accidents along NBI-Gilgil road

The impacts associated with the various activities and proposed mitigation measures are given below;

Activities	Potential Impacts	Proposed Mitigation Measures
Construction Phase		
1. Land clearance and leveling 2. General cultivation harrowing	1. Soil erosion (-ve) 2. Loss of biodiversity (-ve) 3. Improvement of local	1. Avoid cultivation on slopes of > 35% 2. Introduce soil conservation measures

3. Sandalwood seedling trials 4. Infrastructure 5. Establishment more green lawns 6. Establishment of soil and water conservation measures 7. Other activities due to these primary activities – in-migration into the area, growth of illegal settlements	and national economy 4. Creation of employment opportunities 5. Elevated incidence of HIV/Aids (-ve) 6. Pollution in the water, land and air (-ve) 7. Occupational health risks (-ve) 8. Emergence of unplanned human settlements and associated problems (-ve) 9. Water conflicts (-ve) 10. Erosion of cultural values (-ve) 11. Social conflicts (-ve) 12. Generation of revenue to local and central government 13. Increased tree cover 14. Vehicular emissions and waste oils (-ve) 15. Generation of waste water (-ve)	e.g. grass strips, vegetation buffer strips along river banks 3. Create biodiversity banks 4. Introduce HIV/Aids awareness and education programmes 5. Introduce pollution prevention measures (avoiding spillage, over application of inputs, re-use and re-cycle byproducts) 6. Training and monthly rotation of pesticide sprayers, and determination of cholinesterase 7. Composting organic waste (see Plate 8) 8. Rain water harvesting, water recirculation 9. Hiring employees from the local area 10. Only the already recommended housing plans and designs shall be allowed 11. Provide awareness, education and personal protective gear for occupational health and safety of workers 12. Provide boreholes to reduce dependence on stream water 13. Introduce water saving technologies e.g. drip irrigation 14. Train personnel on water conservation. 15. Construction of wetlands to treat

		waste water (see Plate 7) 16. Calibration of spray and fertigation equipments to reduce waste
Operational Phase		
1. Procurement and storage of inputs 2. Planting 3. Fertigation 4. Harvesting 5. Storage 6. Control of diseases and pests 7. Packaging 8. Transport 9. Fuel storage	1. Pollution of air, water and land by pesticides & fertilizers (-ve) 2. Occupational health risks from pesticides (-ve) 3. Polythene waste from green houses (-ve) 4. Ground water contamination from latrines (-ve) 5. Solid waste problem from empty pesticide containers and paper cartons (-ve) 6. Pollution from liquid waste due to rinse water (-ve) 7. Organic wastes from plant residues and paper cartons (-ve) 8. Vehicular emissions and waste oils (-ve) 9. Improvement of local and national economy 10. Creation of employment opportunities 11. Elevated incidence of HIV/Aids and other diseases (-ve) 12. Emergence of unplanned human settlements and associated problems (-ve) 13. Erosion of cultural values (-ve)	1. Introduce HIV/Aids awareness and education programmes 2. Introduce pollution prevention measures (avoiding spillage, over application of inputs, re-use and re-cycle byproducts) 3. Prophylactic use of pesticides, spot application, scouting, non-utilization of methyl bromide, integrated pest management, fertigation, pesticide audits 4. Training and monthly rotation of pesticide sprayers, and determination of cholinesterase 5. Composting organic wastes (see Plate 8) 6. Rain water harvesting, water recirculation 7. Hiring employees from the local area 8. Only the already recommended housing plans and designs shall be allowed 9. Provide awareness, education and personal protective gear for occupational health and safety of workers 10. Segregate waste oils and incinerate at above 1200

	14. Social conflicts due to economic disparities (-ve) 15. Enhanced revenue for local and central government	^{o}C 11. Provide social amenities for the benefit of the local community (e.g. schools, roads, health facilities)
Decommissioning Phase		
1. Stoppage of operations (redundancies, dismantling of plant and equipment, closure of septic tanks)	1. Disused plant and machinery left on site (-ve) 2. Danger of explosions from methane release from septic tanks (-ve) 3. Increase in poverty due to loss of employment (-ve)	1. Provide safety net for workers who will be declared redundant 2. Provide closure plan incorporating methane recovery, leachate management 3. Salvage disused plant and equipment and sell as scrap materials

9.1.0 Significance of Impacts

The significance of the predicted impacts will depend on a number of factors such as size of impacted area, number of people that are likely to be affected, whether or not the impacted environment is degraded or sensitive, and the probability of occurrence of the impact. Table 8.2 presents an analysis of potentially significant environmental impacts due to implementation of the proposed project. The proponent has accumulated a lot of "good practice" experience in agricultural and floricultural enterprises over the years and has the capacity to effectively implement all the proposed measures to reduce or eliminate the negative environmental and social impacts. Furthermore, the company will be guided by a comprehensive environmental, health and safety policy.

10.0.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The company will employ “Best practices” in order to improve the implementation of the Sandalwood Project to forestall any predicted significant environmental impacts. To manage the predicted environmental and social impacts, the following environmental and social management framework is proposed:

10.1.0: PROPOSED ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Impact	Mitigation measure	Action plan	Responsible	Budget (Ksh)	Time frame
Pollution from agrochemicals	Use methods that minimize pesticide and nutrient load in the environment	Scouting, Spot spraying, integrated management, calibration of spray equipment, block treatment, safe disposal of wastewater through constructed wetlands	Farm Manager	80,000	During project operation
Increased accidents	Prevention and management of foreseeable accidents	Hazardous waste containment; carry out hazardous studies; meet the standard requirements practice, periodic testing of emergency plans, promote motivational safety, health surveillance, education and awareness, provide personal protective equipment, first aid equipment	Farm Manager	40,000	During project operation
Soil erosion	No cultivation of slopes of more than 35%; construct water velocity checks; safe water disposal to discharge points	Plant grass strips and construct terraces and safe disposal drainage lines, increase the ground plant cover in areas that are prone to erosion	Farm Manager	50,000	At operation and project cycle

Increased incidence of HIV/AIDS	Create awareness; educate workers and surrounding communities	Convene barazas; provide counseling services, provide HIV testing services;	Farm Manager	30,000	During the operational phase of the project
Ergonomics	Minimization of hazards due to heavy manual lifting/ handling of tools, materials	Provide fork lifts and/or handling machinery	Farm Manager	10,000	All phases of the project
Unplanned human settlements	Provide appropriate housing designs for workers	Make the housing designs and enforce them	Farm Manager	20,000	Durinng project cycle
Water conflicts	Diversify water sources to reduce potential conflicts and economize on water consumption	Harvest rain water, recycle wastewater, minimize spillages, leakages and use drip irrigation	Farm Manager	Nil	In the project phases
Social conflicts	Minimize infiltration of foreign cultures and	Recruiting employees from the surrounding communities, promote awareness and education amongst the different communities in the	Farm Manager	Nil	At the operational phase of the project

	differences in wage earnings	project area			
Ground water contamination from latrines	Reduce ground water contamination	Site the pit latrines at a safe distance from water sources determined by soil hydraulic conditions and slope	Farm Manager	20,000/-	Project cycle
Pollution from empty pesticide containers and paper cartons		Triple rinsing and dispose rinsate into a properly constructed hazardous waste landfill, puncturing the containers and disposing as hazardous waste	Farm Manager	70,000	Operational phase of the project
Organic wastes from plant residues and paper cartons	Recycle the organics into usable by-products	Compost all the organic wastes	Farm Manager	50,000	Operational phase of the project
Loss of aesthetics, risk of accidents due to abandoned plant and equipment	Restore the landscape to as close as possible to its original state	Clear the site of the abandoned plant and machinery and dispose as scrap metal	Farm Manager	200,000 /-	At decommissioning phase
Danger of explosions from methane release from septic tanks	Provide for a closure plan for the septic tanks	Exhaust the septic tanks and discharge into sewage works	Farm Manager	40,000	Operational phase
Increase in poverty due to	Provide safety nets	Provide counseling to workers for post closure of the business	Farm Manager	Nil	Operational phase

loss of employment					
Gaping holes at decommission phase	Dismantling of the site	Fill the gaping holes	Farm Manager	200,000 /-	Decommissioning phase

11.0.0 CONCLUSIONS

The project has clear social and economic benefits and will contribute to the improvement of the quality of life for the people associated with it and the neighbours and the society in general. The project will not be in any serious conflict with any major national physical or environmental protection policies. The on-site or off-site anticipated impacts identified are of varying significance and these could be adequately mitigated to reduce any threat to the environment. When the environmental and social management plan developed in the assessment is fully implemented and the health and safety and environment policy is set up, then this will result in an overall improvement in the environmental quality of the project area and it's surrounding.

12.0.0 COMMUNITY AND STAKEHOLDER PARTICIPATION

During the EIA process, members of the neighbouring community were approached for their views and valid comments. Comments from the neighbours /stakeholders were collected and are attached in the appendices.

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