COUNTY GOVERNMENT OF MACHAKOS
DEPARTMENT OF ROADS, TRANSPORT AND PUBLIC WORKS
P.O BOX 1996-90100
MACHAKOS.

THE ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED PHASED CONSTRUCTION OF MACHAKOS AIRPORT ON LR NUMBER 1491R WITHIN MACHAKOS NEW TOWN, MUVUTI-KIIMA-KIMWA WARD, MACHAKOS COUNTY.

Lat Long: -1.5493994, 37.2350961

Elevation: 1639.39 m asl

TERMS OF REFERENCE: NEMA/TOR/5/2/250

Prepared by:
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DECLARATION

This Environmental Impact Assessment (EIA) Study Report for the proposed airport within new Machakos town is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, Cap 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003 revised 2019.

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PROPONENT CERTIFICATION

I certify that the information I have provided above is, to the best of my knowledge, correct. I also recognize and agree that no construction activity, including but not limited to site preparation, demolition, or land disturbance, shall proceed for the above proposed project(s) until NEMA issues a final environmental decision for the proposed project(s), and until compliance with all other applicable KCAA approval actions (e.g., airspace approval) and special purpose laws has occurred.

_____ _____

Signature Date

_____

Name and Designation

Disclaimer: This report has been prepared in accordance with the requirements of the Environmental (Impact Assessment and Audit) Regulations, amended in 2019 under the Kenya Gazette Supplement No. 62, Legislative supplement No.16, Legal notice No. 31 of 2019, pursuant to The Environmental Management and Coordination Act, (EMCA) 2019 Amendment Act. All information contained in this EIA report and its associated information is confidential and may not be disclosed to any party other than the regulating party (National Environment Management Authority and TACs) and the receiving party; proponent County Government of Machakos.

Definition of Terms Used in the Report

For the purposes of this Report, the following terms and definitions are used.

- Proposed Project Area: The Proposed Project Area contains all structures and infrastructure associated with the Airport Area, Construction Camp, runways, taxiway, airport terminal, Water Pipeline etc. during the construction phase.
- Airport Area and Airport Footprint: The Airport Area, within the Proposed Project Area, will cover approximately 104 ha and the actual Airport Footprint will be approximately 60 ha within this. This Airport Footprint will comprise the runway, taxiways, aprons, helipads, terminals (presidential, passengers and general aviation), airplane hangars, cargo area, vehicle parking areas, ground service equipment, airport maintenance areas, rescue and firefighting services, control tower, fuel farm, wastewater treatment and waste management facilities. This area for LPDP is owned by the County Government of Machakos.
- A Construction Camp will be constructed within the Airport Area Footprint area and comprises site offices, laboratories, changing rooms, first aid station, vehicle parking and maintenance sheds, fuel tank area and water treatment plant. Prior to a waste treatment plant being constructed, septic tank systems will be utilized across the camp area.
- Road: The Proposed Project will make use of an existing road located approximately 3 Km off Kyumvi-Machakos road. The unsurfaced road will need to be widened at some areas and will be the responsibility of CGM to maintain.

LIST OF ACRONYMS

ARFF	Aircraft Rescue and Firefighting
BoD	Biological oxygen Demand
BCAS	Bird Collision Avoidance System
CDE	County Director of Environment
CG	County Government of Kisumu
CoD	Chemical Oxygen Demand
CSTR	Continuous Stir Tank Reactor
dBA	decibels
DOHSS	Directorate of Occupational Health and Safety Services
EA	Environmental Audits
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
EO	Environment Officer
EPC	Engineering, Procurement and Construction Contractor
GA	General Aviation
GIS	Geographic Information System
HTR	Hydraulic Retention Time
IBA	Important Bird/Biodiversity Area
ICAA	International Civil Aviation Authority
ICAO	International Civil Aviation Organization
ICF	International Finance Corporation
IFC PS	International Finance Corporation Performance Standards
ILS	Instrument Landing System
IATA	International Air Transport Association
MWT	Maximum take-off weight
MBR	Membrane Bio-Reactor
NEMA	National Environment Management Authority
OHS	Occupational Health and Safety
OMS	Operations and Maintenance Schedule
PPP	Public-Private partnership
PPE	Personal Protective Equipment
RESA	Runway End Safety Area
RFS	Rescue and Firefighting Services
RPB	Radiation Protection Board
SEM	Sustainable Environmental Management
SEP	Stakeholder Engagement Plan
SPCC	Spill Prevention, Control, and Counter measures
SWM	Solid Waste Management
TSS	Total Suspended Solids
VES	Visual encounter surveys

EXECUTIVE SUMMARY

Introduction

This Report presents the findings of an Environmental and Social Impact Assessment (ESIA) for the proposed Machakos airport on LR number **1491R**. The ESIA Study Report is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, Cap 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003 as revised in 2019. The land for which the airport is proposed is planned and defined through Local Physical Development Plan (**2014-2035)** under section 24 of the **then** Physical Planning Act Cap 286 prepared in reference to; Government land, Trust land and Private land. LPDP was developed in 2014 and signed by the Minister of land Hon Charity K. Ngilu and details;

i. Ensured an orderly, coordinated, harmonious and progressive development of the area in order to ensure health, safety, amenity, convenience and the general welfare of the Machakos County residents.
ii. Classified the area for residential, commercial, industrial, Airport and other purposes or uses.
iii. Determined the type and density of development in particular locality within Machakos as well as the conservation of the natural beauty of the area including rivers, hilltops, summits and valleys if they exist.
iv. Provided for routes for physical infrastructure (Airport, roads, railway), service way leaves (water and sanitation, electricity) communication routes.

This ESIA is undertaken in accordance with the Environmental Management and Coordination Act (EMCA), Cap 387 and subsidiary legislation under it. It serves several objectives that seeks;

1. To identify and assess all significant impacts of the proposed airport on the biophysical and human environment.
2. To draw an environmental management and monitoring plan with suitable mitigation measures;
3. To ensure environmental, health and safety factors are considered in the decision-making process; and
4. To inform the public and seek their views and concerns on the proposed airport.
5. To inform basis for decision making by NEMA.

A participatory approach has been employed to carry out the ESIA. This involved several desktop studies and review of all relevant available documents on the project activities and components. The Experts also reviewed all the available and relevant legal and policy documents, standards and guidelines. A reconnaissance visit was conducted to check the physical set up of the site and to collect views from all stakeholders within Muvuti-Kiima-Kimwe ward and all key stakeholders e.g. KCAA, NEMA, KAA, Ministry of Transport etc.

Environmental and Social Management and Monitoring Plan (ESMMP)

The ESMMP outlined in section eight of this report identifies issues of concern (potential negative impacts) and mitigation measures as well as responsibilities, costs and measurable indicators that can help to determine the effectiveness of actions to maintain and upgrade the quality of environment; as regards the proposed project. This monitoring is done in relation to the baseline environment. Regular monitoring is therefore necessary to monitor

the change in parameters. The ESMMP has considered for all phases; construction, operational and decommissioning.

Conclusion and Recommendation

Anticipated (potential) positive Impacts

The proposed Machakos airport has been designed based on environmental principles taking into consideration sustainable energy use, water and waste management best practices. Impacts associated with the development are generally localized within Muvuti/Kiima-Kimwe ward. The facility is located wholly on the county Government land define through local development plan for New Machakos town and will not cause displacement of people, institutions or economic activities. Livestock keepers noted herding on the airport grounds do not reside in the area. The project has no direct interaction with surface natural drainage, external air quality and noise levels. It is recommended that the Contractor shall fence off the proposed project site to keep off local intrusion by grazing livestock and wildlife in the short term. There will be limited ecological impacts on the wildlife dispersing into the airport grounds. Potential social disruption will be associated with reduced grazing area, truck movements and influx of workers into the area. The area, however, is not a sensitive habitat. However, the ESIA Experts CGM to engage KWS to undertake 3 to 6 month Wildlife Monitoring determine the grazing patterns of the Wildlife and wildlife Translocation. In the meantime, the appointed management for the Airport if for instance if under KAA will urgently consider providing a full fence on of the airport to keep out grazing animals.

Environmental statement

From the assessment, the EIA experts concludes that the proposed airport for is appropriate in relation to ICDP for Machakos County. This conclusion has been made in terms of environmental impact, site selection, public health and public participation responses/outcomes. By using a multi-criterion assessment model for economic, social, public health and environmental effects, this study indicates the proposed airport has taken much consideration of the public health and environment. This study finally offers some corresponding recommendations for improving the environmental impact assessment and enhancing the benefits of the proposed Machakos airport.

The ESIA report for the proposed airport has revealed that only **potential significant** issues maybe from;

i. **Pollutant emissions and Air Quality Management**: Source Emissions: The operation of the electricity generators at the substations, generators inside the aviation area, and the water/fire pump diesel engines at the pumping station are potential sources of air pollutant emissions. It is very difficult to reduce the air pollution impacts from aircraft except through more efficient operations and technology. The air pollution impacts of ground traffic can be reduced by switching to less polluting forms of transport (bicycle and bus rather than private vehicles). Dust from construction can be controlled by soil damping and wheel washing. Some airports compile emissions inventories and carry out air quality assessments to help identify how air pollution can best be tackled. Some of the measures that have been proposed or carried out to mitigate the effects of air pollution include measures to control the emissions or to penalize non-compliance. Measures proposed in airport master plans and environmental statements for minimizing air pollution impacts are:

- Working towards a reduction if the total number of vehicles that commute to and from the airport.
- A system of penalties for polluting vehicles.
- Introduction of charges to promote the use of lower emission aircraft
- Minimizing dust emissions by wheel washing, damping down and employing the use of covered vehicles for transportation.
- Conducting a Code of Construction Practice relating to air emission
- Carrying out air quality assessments periodically
- Use of low sulfur fuel and conduct of regular maintenance of the generators and diesel engines.
- Emission of air pollutant from source can also be reduced by shutting down the combustion engines when not in use.

ii. **Vehicular Emissions**: The movement of vehicles serving the terminal and vehicles going to and from the airport increases the emission of air pollutant such as the particulate matter, oxides of nitrogen and carbon monoxide in the vicinity. The following methods of abatement are being employed to reduce the emission of pollutant to the ambient air: (i) Shutting down the combustion engine when not in use; (ii) Minimizing the vehicular traffic, appropriate design of access roads provided to avoid traffic jams to reduce air pollution; (iii) Provision of adequate buffer zones where pollution concentrations is highest to reduce the impact of emissions; (iv) Providing suitable green belt to reduce the impact of air pollution; and (v) Maintain the vehicles moving within the airport, routinely perform emission checks.

iii. **Noise Level Management**: The operation of compressor, electricity generators, water/fire pump engine, and the take-off and landing of aircrafts are the possible sources that increase the noise level at the aviation area in excess of those typically found in the project environs. Controlling the noise at source is an important option in noise control strategies. Appropriate noise barrier/shields, silencers, etc. are provided wherever possible. The following measures shall be implemented to mitigate the sonic impacts (noise attenuation): (i) Switching off the combustion engines when not in use; (ii) Proper maintenance of equipment to reduce the high noise levels; (iii) Use of noise absorbing material at the buildings; (iv) Electricity generators and water/fire pumps to be provided with acoustic enclosure for effective noise reduction. Also, electricity generators to be provided with exhaust muffler capable of effective noise reduction; and (v) The sources of intermittent noise generating equipment such as compressors to be provided with appropriate acoustic barriers to reduce the noise level generated from the operation of these units.

iv. **Grievance Redress Mechanism**: It will be necessary for airport management appointed agent to establish a Grievance Redress Mechanism to cater to grievances and complaints that are directly related to the project cycle in its various stages. Although the Involuntary Resettlement policy is not triggered by the project, it is likely that some environmental impacts like noise and dust pollution, among others, may trigger complaints from nearby settlements even if they are

located outside of the airport boundaries. The following benefits based on good international practice justify the need for an internal GRM for CGM. Benefits to Project include; (i) Provides information about project implementation to the public; (ii) Provides an avenue to comply with government policies and regulations; (iii) Provides a forum for resolving grievances and disputes at the lowest level; (iv) Resolves disputes relatively quickly before they escalate to an unmanageable levels; (v) Facilitates effective communication between the project and affected persons; (vi) Helps win the trust and confidence of community members in the project and creates productive relationships between the parties; (vii) Mitigates or prevents adverse impacts of the project on communities and produces appropriate corrective or preventive action and (viii) Helps avoid project delays and cost increases, and improves quality of work. Benefits of GRM to other Stakeholders and persons potentially affected by the construction; (i) Provides a cost-effective method to report their grievances and complaints; (ii) Establishes a forum and a structure to report their grievances with dignity, and access to a fair hearing and remedy; (iii) Provides access to negotiate and influence decisions of the project that might adversely affect them and (iv) Facilitates access to information. In order to address external grievances and complaints, a typical Grievance Redress Mechanism is therefore proposed to CGM, which can be modified appropriately as needed. The GRM implementing unit within CGM shall be a Grievance Redress Committee (GRC) comprising CGM Project Manager, Supervising Consultant Resident Engineer; CGM Environmental or Social Officer and Contractor representative.

v. **Bird strike during operation**: There should be a relocation of the existing dumpsite to avert bird strike. Even if the landfill is not located in the approach path of the airport's runway, it still poses a hazard because of the birds' ability to fly away from the landfill and into the path of oncoming planes.

Institutional capacity and strengthening plan

CGM has put in place elaborate plans to ensure the environment is safeguarded and that safety and health of the workers and proposed airport users within the airport grounds are protected through clear elaborate environmental, health and safety policies that are guided by local and international safeguards including ICAO. Policies and procedures must be put in place to ensure that safety and health issues are adequately taken care of especially in the aviation environment in which the proposed air will operate. Construction and operations of the Terminal will have impacts on the environment (mainly occupational) but none are anticipated to the external environment and social settings (neighbouring residential and institutional premises. It is, therefore, imperative that precautions are taken to ensure that these internal impacts are minimized through a concerted effort from the Project Management Team and the Contractor(s). The Supervision Team will review and activate the contents of the Environmental Management Plan and direct the Contractor(s) to prepare a Construction-specific Environmental and Social Management Plan that should be in line with the ESMP as well as the guidelines established by the appointed airport Management Agent. Other responsibilities will include the following; (i) Appointed airport Management Agent will be responsible for coordination activities and liaisons, particularly in

regard to the natural resources on site (relocation of the wildlife), construction, quality control and social issues during the project implementation. This may partly be achieved through the Supervision. (ii) The stakeholders will be responsible for overseeing that the implementation of the environmental management plans is undertaken. (iii) Constant consultation with the Kenya Civil Aviation Authority (KCAA) and other operators such as Kenya Airways, Ground Support Services providers, Cargo Handlers, Immigration Department, Kenya Revenue Authorities among others shall be ensured at all times. In addition, the development and implementation of the GRM is critical. In order to ensure that the provisions of the ESMP have been fully integrated into the implementation process, an ESMP Implementation Committee will need to be established. This Committee, to be chaired by the Manager, Environment at will also comprise of the Airport Engineer, Environment Officer, the Health and Safety Officer, the Airport Fire Safety Office and the House Keeping Department as well as the Security Agents around the airport. The role of this Committee will be ensure compliance with the established regulations as outlined under this report and full integration of the ESMP provisions in the implementation process.

Essential Stakeholders proposed for sustainable waste management at the airport

- Passengers passing through public areas, parking lots, garages, curbside pickup and drop off areas, restrooms, holding areas, and food courts
- Tenants such as businesses, airlines, and concessions (including taxi, hotel, rental cars, flight kitchens, and other industries that operate at the airport)
- Airline employees (including ground crew, cabin cleaning crew, catering);
- Employees of airport authorities, government offices, business agencies, etc.
- Maintenance operations and support facilities
- Contractors of the airport and its tenants, including aircraft cleaning and service, janitorial services, waste haulers, and construction contractors
- Machakos County solid waste management team.

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1 SECTION ONE: INTRODUCTION

1.1 Background Information

This Report presents the findings of an Environmental and Social Impact Assessment (ESIA) for the proposed Machakos airport on LR number **1491R**. The ESIA Study Report is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, Cap 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003 as revised in 2019. The land for which the airport is proposed is planned and defined through Local Physical Development Plan (**2014-2035)** under section 24 of the **then** Physical Planning Act Cap 286 prepared in reference to; Government land, Trust land and Private land. LPDP was developed in 2014 and signed by then the Minister of land Hon Charity K. Ngilu and details;

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Machakos New Town where the airport is planned is designed in a modern user friendly way that will facilitate rapid growth of businesses. It is planned to international standards in the model of other recent cities like Dubai and Singapore. It will house modern office parks, manufacturing factories and sky-scrappers that will be complimented by beautiful and luxurious living spaces that include public parks as well as residential facilities.

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4. To inform the public and seek their views and concerns on the proposed airport.
5. To inform basis for decision making by NEMA.

1.2 The project proponent

The project proponent is County Government of Machakos. The County Government of Machakos in 2014 undertook a plan dabbed Machakos New Town Local Physical Development Plan, a result of efforts

of a multidisciplinary team of experts from the Built Environment; those that are mainly involved in the field of Urban and Regional Planning. The Machakos County Government will oversee the implementation and enforcement of this proposed airport as defined in the Local Physical Development Plan (LPDP). The plan provides land use allocations, plot sizes, and the development guidelines for different uses. Before the physical implementation of this Plan (i.e. construction on site), designs which includes infrastructural, structural, architectural, etc. must be submitted and approved by the relevant departments of the County Government. The designs for the airports includes the following:

- Technical designs for the development of transportation infrastructure;
- Technical designs for the development of electrical energy and communication infrastructure;
- Technical designs for the development of water, sanitation, and solid waste management infrastructure;
- Architectural and structural designs of various building typologies.

1.3 The state of the proposed site and the neighbourhood

The proposed site is Muvuti-Kiima-Kimwe ward within planned area of the new Machakos town. The Long Term Local Physical Development Plan for Machakos New Town is a development blue print for a complementary town adjacent to the existing Machakos Old Town. The town can be considered to be an extension of the existing Old Town. The plan presents development proposals for the New town to guide development for a period of 20 years from 2014 to 2034. Its ownership and acceptability was ensured through stakeholders' participatory planning approach. Thus, the stakeholders' aspirations and visions for the new town were taken into consideration. The development aims at creating a new decentralized development focus for Machakos County. It is a town that builds on the concept of sustainable development by providing a comprehensive mix of land uses to cater for all the needs of Machakos town residents, local and international investors, and visitors.

1.4 The scope and Objectives of the proposed Project

The proposed project aims to:

- To provide a suitable basic airport in Machakos County in pursuit of LPDP for New Machakos town. The airport will cover an area of approximately 104 acres. The airport activities will consist of the following components:
    i. Construction of the runway length of up to 1350 meters.
    ii. Construction of taxiway and terminal.
    iii. All other associated amenities.

1.5 Objectives of the ESIA Process

This ESIA is undertaken in accordance with the Environmental Management and Coordination Act (EMCA), Cap 387 and subsidiary legislation under it. It serves several objectives that seeks;

- Facilitate an understanding of the elements of the existing baseline conditions that are relevant to resources/receptors that could be significantly impacted by the Proposed Project;

- Identify the aspects of the proposed airport likely to result in significant impacts to resources/receptors;
- Determine and assess the significance of the impacts of the proposed Machakos Airport;
- Identify the environmental, social, health and safety aspects of the proposed Machakos airport that need to be managed and recommend appropriate and justified mitigation and enhancement measures;
- Determine and evaluate the significance of residual impacts;
- Document how stakeholders have been engaged during the ESIA Process, and how stakeholder feedback has been considered in the ESIA; and
- Develop an Environmental and Social Management Plan Framework (ESMP Framework) to set out the links between the Environmental and Social Management System (ESMS), full ESMP and environmental and social sub-plans.

1.6 Scope of the ESIA

A Scoping Report was prepared at the commencement of the ESIA process to set out which environmental and social topics should be included in the assessment. The potentially significant environmental and social issues that were identified during the ESIA scoping process, and that have been addressed within this ESIA, are as follows:

- **Traffic and Transport;**
- **Air Quality;**
- **Noise and Vibration;**
- **Biodiversity e.g. bird strike management**
- **Water Resources;**
- **Geology and Soils;**
- **Archaeology and Cultural Heritage;**
- **Landscape and Visual;**
- **Waste Management;**
- **Resource Efficiency;**
- **Socio-economics, including Health and Safety; and**
- **Cumulative Impacts.**

For each of these topics, the impacts of the Proposed Project have been assessed during the construction phase, during Phase 1 of the operation phase, when the Proposed Project will become operational, and during the operation phase when the Proposed Project will be fully delivered.

2 SECTION TWO: THE ESIA METHODOLOGY

2.1 Introduction background

Environmental Impact Assessment (EIA) refers to a critical examination of the effects of a proposed project on the environment before its implementation. Impacts describe any negative and positive environmental influence caused by a project. EIA is applied on the basic principle that the effect of a project on the environment needs to be established before it is implemented. The basic assumption is that if a proper EIA is carried out then, the safety of the environment can be properly managed during the projects implementation, commissioning, operation and decommissioning. A project is defined as a specific set of human activities in a particular location and time frame and intended to achieve an objective(s). The term environment is used in its broadest possible sense to embrace not only physical and biological systems but also socio-economic systems and their inter-relationships.

2.2 Process description

- Introduction/Background: Project Description (List and clearly describe ALL components of project proposal including all connected actions). Attached is a map or drawing of the area with the location(s) of the proposed action(s) identified
- Project Purpose and Need
- Described the affected environment (existing conditions) and land use in the vicinity of project
- Alternatives to the Project: Described any other reasonable actions that may feasibly substitute for the proposed project, and include a description of the "No Action" alternative. If there are no feasible or reasonable alternatives to the proposed project, explain why (attach alternatives drawings as applicable).
- Environmental Consequences-Special Impact Categories. The analysis under each section must comply with the requirements and significance thresholds as described in the ESMP.

2.3 Specific analysis

2.3.1 Air quality

- Will the proposed project(s) cause or create a reasonably foreseeable emission increase? Prepare an air quality assessment and disclose the results. Discuss the applicable regulatory criterion and/or thresholds that will be applied to the results, the specific methodologies, data sources and assumptions used; including the supporting documentation and consultation with federal, state, tribal, or local air quality agencies.
- Are there any project components containing unusual circumstances, such as emissions sources in close proximity to areas where the public has access or other considerations that may warrant further analysis? If yes, an analysis of ambient pollutant concentrations may be necessary.
- Is the proposed project(s) located in a nonattainment or maintenance area for the National Ambient Air Quality Standards (NAAQS) established under the Air Quality Regulations of 2004?

2.3.2 Biological resources

Describe the potential of the proposed project to directly or indirectly impact wildlife, and plant communities and/or the displacement of wildlife. Be sure to identify any state species of concern (Candidate, Threatened or Endangered).

- Are there any candidate, threatened, or endangered species listed in or near the project area?
- Will the action have any long-term or permanent loss of unlisted plants or wildlife species?
- Will the action adversely impact any species of concern or their habitat?
- Will the action result in substantial loss, reduction, degradation, disturbance, or fragmentation of native species habitats or populations?
- Will the action have adverse impacts on a species' reproduction rates or mortality rate or ability to sustain population levels?
- Are there any habitats, classified as critical by the federal or state agency with jurisdiction, impacted by the proposed project?
- Would the proposed project affect species protected under the Migratory Bird?

2.3.3 Climate

- Would the proposed project or alternative(s) result in the increase or decrease of emissions of Greenhouse gases (GHG)?
- Will the proposed project or alternative(s) result in a net decrease in GHG emissions (as indicated by quantitative data or proxy measures such as reduction in fuel burn, delay, or flight operations)? A brief statement describing the factual basis for this conclusion is sufficient.
- Will the proposed project or alternative(s) result in an increase in GHG emissions? Emissions should be assessed either qualitatively or quantitatively as based on Aviation Emissions and Air Quality Handbook.

2.3.4 RESOURCES

- Does the proposed project have an impact on any publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or an historic site of national, state, or local significance? Specify if the use will be physical (an actual taking of the property) or constructive (i.e. activities, features, or attributes).

2.3.5 Farmlands

- Does the project involve acquisition of farmland, or use of farmland, that would be converted to non-agricultural use and is protected?

2.3.6 Hazardous materials, solid waste, and pollution prevention

- Would the proposed project involve the use of land that may contain hazardous materials or cause potential contamination from hazardous materials? (If yes, attach record of consultation with appropriate agencies). Explain.
- Would the operation and/or construction of the project generate significant amounts of solid waste? If yes, are local disposal facilities capable of handling the additional volumes of waste resulting from the project? Explain.
- Will the project produce an appreciable different quantity or type of hazardous waste? Will there be any potential impacts that could adversely affect human health or the environment?

2.3.7 Historic, architectural, archeological, and cultural resources

- Describe any impact the proposed project might have on any properties listed in, or eligible for inclusion in the National Register of Historic Places. (Include a record of your consultation and response with the National Museum of Kenya)
- Describe any impacts to archeological resources as a result of the proposed project. (Include a record of consultation with persons or organizations with relevant expertise, if applicable).

2.3.8 Land use

- Would the proposed project result in other (besides noise) impacts that have land use ramifications, such as disruption of communities, relocation of residences or businesses, or impact natural resource areas? Explain.
- Would the proposed project be located near or create a wildlife hazard. Appropriate actions will be taken, to the extent reasonable, to restrict land use to purposes compatible with normal airport operations.

2.3.9 Natural resources and energy supply

- What effect would the project have on natural resource and energy consumption? (Attach record of consultations with local public utilities or suppliers if appropriate)

2.3.10 Noise and noise-compatible land use

Will the project increase noise or more for a noise sensitive area that is exposed to noise at or above the recommended 80 dB noise exposure level when compared to the no action alternative for the same timeframe? (

2.3.11 Socioeconomics, environmental justice, and children's health and safety risks

- Would the project cause an alteration in surface traffic patterns, or cause a noticeable increase in surface traffic congestion or decrease in Level of Service?

- Would the project cause induced, or secondary, socioeconomic impacts to surrounding communities, such as changes to business and economic activity in a community; impact public service demands; induce shifts in population movement and growth, etc.?
- Would the project have a disproportionate impact on minority and/or low-income communities? Consider human health, social, economic, and environmental issues in your evaluation. Refer to subsequent sections which provides the definition for the types of adverse impacts that should be considered when assessing impacts to environmental justice populations.
- Would the project have the potential to lead to a disproportionate health or safety risk to children?

If the answer is "YES" to any of the above, please explain the nature and degree of the impact. Also provide a description of mitigation measures which would be considered to reduce any adverse impacts.

2.3.12 Visual effects including light emissions

- Would the project have the potential to create annoyance or interfere with normal activities from light emissions for nearby residents?
- Would the project have the potential to affect the visual character of nearby areas due to light emissions?
- Would the project have the potential to block or obstruct views of visual resources?

If the answer is "YES" to any of the above, please explain the nature and degree of the impact using graphic materials. Also provide a description of mitigation measures which would be considered to reduce any adverse impacts.

2.3.13 Water resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

i. Wetlands

- Does the proposed project involve state regulated wetlands or non-jurisdictional wetlands? Delineations must be performed by a person certified in wetlands delineation by Water Resources management Authority.
- If there are wetlands impacts, are there feasible mitigation alternatives? Explain.

ii. Floodplains

- Would the proposed project be located in, or would it encroach upon, any 100-year floodplains?
- Would the project cause notable adverse impacts on natural and beneficial floodplain values?

iii. Surface waters

- Would the project impact surface waters such that water quality standards set by state, local, or tribal regulatory agencies would be exceeded or would the project have the potential to contaminate a public drinking water supply such that public health may be adversely affected?
- Would the water quality impacts associated with the project cause concerns for applicable permitting agencies or require mitigation in order to obtain a permit?

iv. Groundwater

- Would the project impact groundwater such that water quality standards set by state, local, or tribal regulatory agencies would be exceeded or would the project have the potential to contaminate an aquifer used for public water supply such that public health may be adversely affected?
- Would the groundwater impacts associated with the project cause concerns for applicable permitting agencies or require mitigation in order to obtain a permit?
- Is the project to be located over a WRA-designated Sole Source Aquifer?

If the answer to any of the above questions is "Yes", consult with the WRA and provide all agency correspondence as an attachment to this form.

2.4 **Permits**

List all required permits for the proposed project. Has coordination with the appropriate agency commenced? What feedback has the appropriate agency offered in reference to the proposed project? What is the expected time frame for permit review and decision?

2.5 Mitigation

Describe those mitigation measures to be taken to avoid creation of significant impacts to a particular resource as a result of the proposed project, and include a discussion of any impacts that cannot be mitigated.

2.6 Public involvement

Describe the public review process and any comments received. Include copies of Public Notices and proof of publication.

2.7 Cumulative impacts

Discuss impacts from past, present, and reasonably foreseeable future projects both on and off the airport. Would the proposed project produce a cumulative effect on any of the environmental impact categories above? Consider projects that are connected and may have common timing and/or location. For purposes of this Form, generally Experts used 3 years for past projects and 5 years for future foreseeable projects.

Table 1-2-1: ESIA significance factors considered

Significance Factors	Description
Extent/Magnitude	Potential impact was quantified with range limits wherever possible and relevant modeling may be undertaken in order to predict impacts for appropriate factors.
Reversibility	A reversible impact is one in which the condition which the impact effects can be returned to the baseline condition prior to the impact.
Duration	The length of time of an impact may be short, medium or long term. Typically, this is defined as <5 years, 5-15 years and >15 years respectively.
Standards	Complying with the national and international standards, which may exist for a particular impact, also helps define the potential significance of an issue.
Sensitivity of receptors	In many areas the sensitivity is further defined by consultation and baseline surveys, which helped detail the existing environment. Areas designated nationally or internationally should be considered as sensitive areas and impacts minimized wherever possible.

NB: In this ESIA study, all the aspects illustrated have been considered here and were part of a more complete and exhaustive exercise. However, we aimed to establish a baseline scenario that can be useful in the future for prognostic assessment of emission standards and waste management during airport auditing upon approval and operation as well as in identifying knowledge gaps, and providing a framework for future comparative risk assessment.

2.8 ESIA Experts

NEMA registered EIA/EA Experts undertook the ESIA and prepare a study report as provided for in the Environmental (Impact Assessment and Audit) Regulations of June 2003 revised 2019. The Experts were:- **Appendix 3** is copies of experts' registration certificates and practicing licenses.

Table 2-2: List of Experts involved in the study ad their roles.

NAME OF Expert	Position	Task and Assignment	SUMMARY OF QUALIFICATION EXPERIENCE		
			QUALIFICATION	**GENERAL EXPERIENCE**	**RELEVANT EXPERIENCE**
Moses Kololo	Team Leader-ESIA Lead Expert	Supervisory and overall Coordination ESIA Standards and Specification, Impact determination analysis, Environment and Social Management Plan and sustainability aspect of the project. Proposal and managing of green design for the proposed project.	BSc. (Env. Science),	10 Years in Environmental management services	8 Years
Peter Oluoch	EIA-Lead Expert	Supervisory and overall Coordination ESIA Standards and Specification, Impact determination analysis, Environment and Social Management Plan and sustainability aspect of the project. Proposal and managing of green design for the proposed project.			
Dan Ahenda	Ecologist-EIA Associate Expert	Baseline assessment of the project- Ecological monitoring	BSc. Environmental Science-Egerton University.	7 Years	5 Years
Eng. Paul Gacheru Macharia	Civil Engineer	Planning, design and oversee construction and maintenance of proposed airport structures and infrastructure, water and sewerage systems.	University of Nairobi. Master of Science in Civil Engineering (Transportation Engineering)	10 years	5 years
Alex Maina	Project Sociologist	Project Sociologist: Consultative public participation and highlighting of community issues and concerns with regard to proposed Machakos airport	Master of Philosophy in Environmental Management - EIAs Bachelor of Arts (Sociology with IT) Egerton University	8 years	4 Years

3 SECTION TWO: PROJECT DESCRIPTION

3.1 The nature and location of the Project

This chapter provides a description of the physical characteristics and operational elements of the Proposed Project, including earthworks, construction and operational arrangements. This chapter considers the following principal elements of the Proposed Project:

Design and technical specifications;

- Earthworks and construction management;
- Onsite and offsite infrastructure;
- Site layout and built form; and
- Operational considerations.

The airport configuration has been driven by market demand and international standards (International Civil Aviation Organization (ICAO), International Air Transport Association (IATA) and the Kenya Civil Aviation Authority. The vision for the technical development is focused on a single roof concept, space optimization, extension options, functionality and efficient operations, above average commercial space and optimized capital expenditure. The airside configuration will initially consist of a single runway with space for an additional runway in the future. One parallel taxiway will be constructed in order to improve the runway capacity and airside operations.

3.2 Land use budget

The site for the proposed Machakos new town covers a total area of **891.86 Ha**. The actual planning area covers 769.44 Ha and has been segregated into different land uses based on Physical planning standards, demand of the various facilities, and the client's proposals. **Proposed airport falls within transportation and covers 104 hectares**. The table below shows the proposed land use budget that was used in preparing the structure plan. It indicates the different land use allocations and their respective areas in Hectares and gives the percentages of each. These percentages are compared to the National average from the Physical Planning Handbook. The plan illustrates the different land use allocations presented in table 3-1 below in terms of location and size.

Table 3-1: Land use budget for the proposed new Machakos town

Land Use Number	Land Use	Area (Ha.)	Percentage (%)
0	Residential	144.77	18.81
1	Industrial	53.89	7.00
2	Educational	46.95	6.10
3	Recreational	170.82	22.20
4	Public Purpose	64.25	8.35
5	Commercial	75.53	9.82
6	Public Utility	55.02	7.15
7	Transportation	158.22	20.56
Total		**769.45**	**100.00**

Note: Proposed airport falls within transportation and covers 104 hectares.

3.3 Components of the proposed airport

In summary, the Proposed Machakos will include, the following key elements:

- A Runway (1350 m in length by 45 m in width) and one parallel taxiway in order to improve runway capacity and the airside operations;
- A Passenger Terminal will comprise check-in counters, security check points, gates, passenger boarding bridges, immigration and emigration counters, and retail and commercial areas;
- A Water Pipeline be installed from the County supply to a water treatment plant within the Airport Area to provide water for the construction phase; and
- 3.5 km roads to link the airport to the national B62 Road joining at the as well as other roads linking Machakos to Konza City.

Additional facilities will include;

- General Aviation Terminal;
- Presidential Terminal;
- Cargo area;
- Air Traffic Control (ATC) tower;
- Aircraft Rescue and Firefighting (ARFF) building;
- Ground Service Equipment (GSE) maintenance building;
- Catering area;
- Police and anti-terror building;
- Aircraft maintenance hangar;
- Administrative area;

- Access security;
- Power distribution;
- Waste management area;
- Wastewater treatment facility;
- Fuel farm; and
- Car parking.

3.4 Description of Proposed Project Facilities, Components and Activities

Information on the various airport elements and Associated Facilities is included below. This is followed by sections on the airport development phasing and construction and operation activities.

3.4.1 Runway

The runway alignment has been determined based on the consideration of prevailing wind conditions, regional airspace, local obstacles and site geometry. The International Civil Aviation Authority (ICAA) recommend that the airport runway layout be orientated so that the usability factor of the airport is not less than 95%. Taking into consideration the wind direction (southeast) and to minimize earthworks (cut and fill), the runway is designed to run in a northwest/southeast direction to comply with standards. Runway operational modes and assignments have been assessed based on airspace and runway capacity requirements and route mix. This informs the overall operational concept, Passenger Terminal location and airline assignment assumptions. Taxiway layouts have been developed to support proposed runway operational modes and optimize airfield efficiency, minimizing taxi times and delays. The runway will be 1350 Metres long and 45 m wide. At both ends of the runway, a stop way will be constructed. The runway shoulders will be 7.5 m wide and a Runway End Safety Area (RESA) of 180 m length and 160 m width will be provided at both ends of the runway.

3.4.2 Passenger Terminal

The Passenger Terminal will be the main terminal for the airport and will comprise 10 check-in counters, six security check points, 10 gates, six passenger boarding bridges, immigration counters for arrival and departure. Approximately 4,700 m2 of the terminal will be reserved for retail and commercial activities (shops, lounges, offices, etc.). The attached drawings provides a schematic representation (cross section) of the building.

3.4.3 General Aviation Terminal

The General Aviation (GA) Terminal will be a one level building with elevated sections for administrative offices and technical rooms.

3.4.4 Airport Support Facility Requirements

Support areas will be required to accommodate a wide range of facilities, many of which are likely to be planned and delivered by third parties (such as aircraft maintenance, rescue and firefighting services, cargo, and catering facilities). The Master Plan for the support areas provides a framework for the structured

development of these areas, coordinated with the wider airport development plan. This will be refined over the concession period to suit the demands from third party operators.

3.4.5 Cargo

The cargo facility will include the following main areas:

- Cargo Terminal, including customs, import and export, manipulation areas, storage for refrigerated goods, hazardous materials, animals, etc.; and
- Landside parking (trucks and employees).

3.4.6 Air Traffic Control (ATC) Tower

The facilities for the ATC tower have been designed according to international regulations. These will comprise the tower itself, work stations for the controllers and the radar, electrical equipment room, uninterrupted power supply (UPS) room, break rooms and kitchen.

3.4.7 Rescue and Firefighting Services

The Rescue and Firefighting Services (RFFS) facilities will include:

- A Fire Station (the ARFF building), including offices, garages and other complementary functional areas;
- A service bay for parking and maintenance of rescue and firefighting vehicles;
- A RFFS training area; and
- An additional water supply in case of emergency.

3.4.8 Ground Service Equipment

The GSE services will include the following related activities:

- Passenger services;
- Load control;
- Ramp handling; and
- Aircraft servicing.

The GSE maintenance building will be located in the service area to near the Passenger Terminal. It will provide space for servicing and repair of all vehicles and equipment used for the servicing of aircraft. These consist of a number of special vehicles that are not roadworthy, i.e. that are not allowed to use public roads and can therefore not be serviced outside the Airport Area unless trucked to and from the garage.

The main components of vehicle and GSE maintenance will be:

- Vehicle and GSE parking and staging areas, both open and covered (shelters);
- Vehicle and GSE maintenance workshops, complete with special bays for equipment cleaning and painting;
- Large storage facility for spare parts and consumables (mainly oil, hydraulic fluid and grease); and
- Vehicle fuel station.

3.4.9 Catering

The catering facilities will consist of a facility where meals are prepared for inflight use. The facility will be able to handle up to significant meals per year. The building will be located in the service area to the east of the Passenger Terminal and include the following areas:

- Kitchen;
- Refrigeration areas;
- Storage areas; and
- Wash areas

3.4.10 Police and Anti-Terror Buildings

The police and anti-terror buildings will be located in the service area to the east of the Passenger Terminal. The police building facility will consist of a two-level building which will include the following main areas:

- Police station;
- Police administration areas (including lockers and staff rooms);
- Detention cells;
- Dog kennels; and
- Medical station.

The anti-terror building facility will consist will include the following main areas:

- Emergency operation centre;
- Closed-Circuit Television (CCTV) control room; and
- Accommodation for an Anti-Terror Unit.

3.4.11 Maintenance Repair and Overhaul

A Maintenance Repair and Overhaul (MRO) facility will be constructed to service aircraft to the east of the Airport Footprint. It will include:

- A hangar that can accommodate one Code E aircraft (heavy transport aircraft, such as a Boeing 747);
- Additional offices;
- Additional storages for flammables and explosives;
- Apron area that can accommodate one Code E aircraft; and
- An engine run-up stand.

3.4.12 Office Park

An office park will be located to the south of the Passenger Terminal. It will comprise the Airport Administration building, additional office buildings and canteen.

3.4.13 Fuel farm

The Fuel Farm will be located at the western part of the airport and will include the following main areas:

- Landside access;

- Truck maneuvering area;
- Above ground storage tank(s) containing jet fuel and surrounding security area;
- Technical facilities (e.g. pump stations, etc.);
- Airside maneuvering area; and
- Airside fueling station.

No underground storage tanks will be installed. Only jet fuel will be stored in the aboveground storage tanks. It is estimated that four each measuring 1,500 M^3 tanks will be installed in during the Proposed Project.

3.4.14 Fuel System

The apron has been designed with a hydrant fueling system. The dispensing method will use a hydrant at the end of the transfer fuel line. The transfer fuel line will terminate within a control valve vault, containing the piping system control valves, electrical power and fueling system controls. The electrical controls will consist of motor-operated control valves and fuel system control monitoring functions. From the control valve vault, the hydrant fuel line will be routed to the aircraft apron. The underground fuel piping system will have a cathodic protection system to prevent corrosion of steel pipes.

3.5 Infrastructure and Utilities

3.5.1 Airport Roads

Construction on the new roads of about 5 Km will be undertaken to connect the airport to the national B62 joining linking Machakos Town to Kyumvi along Mombasa Road. The road will be paved (bitumen) and is anticipated to initially comprise a 9M wide paved road (with paved shoulders of 1.5 m on each side). This will be upgraded to cater for two lanes of traffic in both directions in the future in accordance with the future traffic demand that will be established at a later stage. The overall road reserve will be provided. This reserve will be cleared of vegetation and not be hard surfaced. Services such as transmission lines (aboveground), water pipeline (to be confirmed), fibre, etc. will be installed within the unsurfaced road reserve. The road will be designed and developed taking cognizance of safety aspects, such as traffic lights, stop signs, speed humps, traffic calming zones, street lights, etc. The road will also incorporate drainage and storm water control systems.

3.5.2 Security Fencing

The perimeter protection will comprise internal and external double fencing, with a patrol road and security lighting between the two fences. A video surveillance system will be installed within the Airport Area. The external (landside) fence, demarcating public and private areas of land, will be 1.8 m high, with a three-strand razor wire anti-climb topping giving an overall height of 2.1 m above ground. The internal (airside) fence, demarcating airside and landside areas will be 2.4 m high, with a four-strand razor wire anti-climb topping giving an overall height of 2.9 m above ground. The fence will comprise 2.4 m high welded mesh panels fixed to steel posts, inclusive of additional security measures preventing burrowing.

3.5.3 Drainage

The drainage system will comprise a network of drainage trenches covering the entire Airport Footprint. Surface water from the apron areas will be treated through oil separators. There will also be two retention basins designed to manage the storm-water runoff and prevent erosion of the surrounding areas.

3.5.4 Wastewater and Waste Management

A permanent wastewater treatment facility will be constructed on the site as part of the construction phase and be located to the passenger parking area and gas station. A central waste collection and management area will be used for gathering, handling, sorting and storing of all solid waste generated on the airport. Waste generated during the operation phase will likely include the following hazardous and nonhazardous (including recyclable) waste streams.

- Inert wastes (concrete and masonry);
- Scrap metal (ferrous and non-ferrous);
- Putrescible waste;
- Cooking oils;
- Wooden pallets;
- Tyres;
- Plastics;
- Paper and cardboard;
- Domestic waste from administrative duties;
- Glass;
- Waste electrical equipment;
- Waste oils;
- Oil contaminated filters and rags;
- Batteries;
- Medical waste;
- Contaminated soils; and
- Chemical containers

3.5.5 Permanent Electricity and Water Supply

Machakos Water And Sewerage Company Ltd and Kenya Power will be responsible for supplying water and power respectively. An estimated average of 175 M^3 and a maximum of 500 M^3 of water per day will be required during operation of the airport. The maximum hourly rate is estimated at 50 M^3/h. A back-up underground supply reservoir of 1,000 M^3 is foreseen within the Airport Area. There are also plans to install a rainwater capture for re-use at the airport. The amount of electricity to be consumed during operation is estimated at 4 MW. The main airport substation, that will provide power supply to the airport, will be located directly east of the Terminal. It will accommodate the emergency generators, high voltage equipment, regulators, transformers and a control room. A dedicated fuel tank for supply to the

emergency generators will also be accommodated within the facility. The rest of infrastructure required for the permanent supply of electricity and water are considered as Associated Facilities.

3.5.6 Lighting

The airfield ground lighting for the runway, taxiway and apron and the airfield lighting control system have been designed following ICAO requirements. The airfield ground lighting for the runway considers the following systems with LED technology:

- Inset threshold lights/elevated wing bars light (high intensity);
- Inset runway end lights (high intensity);
- Inset runway centerline lights (high intensity);
- Elevated runway edge lights (high intensity);
- Elevated stop way lights;
- Inset touch down zone lights (high intensity);
- Rapid exit taxiway indicator lights (RETIL Lights);
- Precision Approach Path Indicator (PAPI); and
- Approach Lighting System (high intensity).

The lighting for the taxiways will include centerline lights, stop bar lights, runway guard lights and retroreflective markers. The lighting for the apron will comprise edge markers and floodlighting.

3.5.7 Bird Control System

As per the Aerodromes Certification Manual, the operator will prepare an Aerodrome Manual as part of the documents for the Airport Certification. This will also include a Wildlife Hazard Management Plan. This document will describe the procedures to manage wildlife hazards (such as bird strikes), including arrangements for assessing wildlife hazards, arrangements for implementing wildlife control programmes and persons responsible for dealing with wildlife hazards. Several measures exist against to manage wildlife hazards, such as audio signal devices that beep to scare birds, removing empty nests in trees, implementing wildlife management measures to control and oversee the local habitat at the airport, netting or draining of streams, grass management, removing waste disposal sites, limiting other attraction to birds or bird monitoring systems. JKIA for example, installed a bird collision avoidance system (BCAS), which detects, recognizes, deflects and monitors birds. The system deflects birds with a loud audio signal and gathers data for statistical purposes. The measures that will be adopted at Machakos Airport will be confirmed at a later stage.

3.5.8 Obstacle Limitation Surfaces

In accordance with ICAO requirements, Technical team will implement a zone entitled 'obstacle limitation surfaces' (OLS), with the aim of defining airspace around the airport to be maintained free of obstacles to permit safe airport operations. This zone will extend approximately 5 km in all directions from the runway. There will be controls on siting and heights of structures within this zone.

3.6 Associated Facilities

Associated Facilities are facilities that are part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.

- As stated earlier Machakos Water And Sewerage Company Ltd and Kenya Power will be responsible for supplying water and power respectively for the operation phase. Limited information is currently available with regard to the design (in particular route alignment) or the date of these services. However, the stated institutions will be obligated to provide water and power at least six months before the proposed airport begins operation.
- A waste water treatment plant is planned in the vicinity of the Airport Area. Further details of the exact location and capacity of the wastewater treatment plant and the pipeline route to the Airport Area are not currently available.

The identified Associated Facilities will likely result in environmental and social impacts. As mentioned above, Machakos Water And Sewerage Company Ltd and Kenya Power have responsibility for the supplying water and power and, thus, they also have responsibility for assessing and managing any environmental and social impacts in line with relevant legislative and regulatory standards.

3.7 Construction Phase

3.7.1 Site Compound and Welfare Facilities

A Construction Camp will be constructed within the Airport and comprise site offices, training centre, laboratory, changing rooms, canteen, clinic, vehicle parking and maintenance sheds, fuel station/storage facility. The Construction Camp will also include a steel yard, carpentry, two batching plants and a cement warehouse. The Construction Camp will cover an area of approximately 1 ha. A waste water treatment plant is also located just outside the Construction Camp site area. It is estimated the Proposed Project will generate approximately 500 jobs during the peak construction period. The projected locals targeted for hiring is 60%. No onsite accommodation will be provided for any employees, contractors or subcontractors. The employees will live offsite in their own accommodation and transported to the site by company vehicles of contractor.

3.7.2 Construction Activities

As part of the site enabling works, and agreed by the County Government of Machakos, the vegetation in the Airport Footprint will be cleared. This will be undertaken in accordance with guidance on biodiversity and chance finds in the event that items of cultural heritage value are encountered. Following the site vegetation clearance, the construction of the airport facilities and infrastructure will commence, starting with earthworks. The Construction Camp will be used as the base for the management and coordination of these activities. All construction equipment will be maintained, refueled and parked in designated, hard standing areas within the Construction Camp. Aggregate for the Proposed Project will be sourced from a licensed quarry located 10 km to the northeast of the Construction Camp. Aggregate will be transported via the upgraded quarry road to the Airport Area. Five borrow pits are proposed to obtain fill material and six spoil areas have been demarcated in the Airport Area. Approximately 1 m

depth of material will be removed from each borrow pit. Approximately 3,000,000 m^3 of cut will be excavated and 2,000,000 m^3 will be filled in order to level the Airport Footprint. Excess cut material and spoil from site clearing and levelling activities will be largely used for filling and shaping borrow pits and landscaping around the Airport Area following construction. A temporary asphalt plant will be constructed to the northwest of the Airport Area, which will be used during the construction phase of the Proposed Project. Similarly, concrete batching plants and mechanical plants will be developed to assist with construction activities.

3.7.3 Resource efficiency

No surface water bodies requiring dewatering are present within the Airport Area; however, the south-eastern section of the runway crosses a non-perennial stream. According to survey, no water has been reported in the stream. It is anticipated that approximately 465 m^3 of water per day will be required during the construction phase of the Proposed Project, mainly used for the two concrete batching plants, earthworks/fill, Construction Camp site and roads watering, and sand washing. The Water Pipeline will be laid along the edge of a local road located to the southeast of the Airport Area and will provide water to the Construction Camp. No homesteads will be impacted by the Water Pipeline route. Water Pipeline route belongs to the public and therefore, no resettlement or compensation is anticipated. Solid waste will be collected onsite at designated areas and will be disposed of offsite to licensed facilities. Fuel will be delivered to the Construction Camp area and stored onsite in a fuel station/storage facility. The fuel station will include bulk fuel storage in up to seven diesel tanks, each with a capacity of 75,000 litres.

3.7.4 Operation Phase

The operational specifications of the airport cannot be accurately determined in this ESIA. It is estimated that the Proposed Project will permanently employ approximately 400 people. Civil aviation workers currently working at other airports will be offered job opportunities at the Proposed Project. Support areas are required to accommodate a wide range of facilities, many of which are likely to be planned and delivered by third parties (such as cargo, aircraft maintenance and catering facilities). The Master Plan for the support areas provides a framework for the structured development of these areas, which is to be coordinated with the wider airport development plan. However, this will need to be refined over the concession period to suit the demands from third party operators.

3.7.5 Closure and Decommissioning

Closure and decommissioning of the proposed airport may comprise the dismantling and demolition of all structures and removal of above-ground grade concrete footings and foundations within the Airport Area, unless alternative arrangements are made for transfer of certain facilities to local groups (government or private) under mutually acceptable agreements covering the transfer of long term liability. The potential decommissioning impacts are therefore likely to be similar to those identified in the construction phase and similar mitigation measures to those discussed for the construction phase are likely to be adopted during closure and decommissioning. Given that the decommissioning programme

is uncertain and will only be developed towards the end of the Proposed Project operation phase, the assessment of impacts during closure and decommissioning has not been considered in detail in this ESIA.

3.7.6 Project Cost

The proposed project is estimated to cost a total of two hundred and fifty million Kenya Shillings (**KSh.250, 000,000**).

4 SECTION THREE: POLICY, LEGAL ADMINISTRATIVE FRAMEWORK

4.1 Introduction

This section explores a general overview of legal and regulation guidelines that are relevant to the proposed airport both at the global and national scale. This has been done to ensure that adequate measures are taken by the proponent to abide by the existing laws, policies and regulations, and international best practices for waste handling. Legislation, laws, policies and regulations specific to environmental management can directly or indirectly affect the development of proposed project. A brief discussion on the various legal frameworks involved for this project is presented in subsequent sections. County Government of Machakos will strive to ensure that all required environmental procedures described in this section will be complied with, in order to demonstrate their commitment and responsibility to protecting the environment. The following ***International standards*** have been considered

i. **WHO Policy and Guidelines (www.who.org)**
www.searo.who.int/LinkFiles/Publications_and_Documents_prevention_guidelines.pdf
www.searo.who.int/en/Section23/Section1108/Section1835/Section1864_8658.htm

ii. **ii. International Organization for Standardization (ISO) (www.iso.org)**

iii. **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal**. Basel Convention Secretariat (www.basel.int). Medical Waste is considered a hazardous waste under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The Basel Convention imposes use of a prior informed consent procedure for movement of such wastes across international borders. Shipments made without consent are illegal. Parties have to ensure that hazardous waste is disposed of in an environmentally sound manner (ESM. Strong controls have to be applied from the moment of generation, to its storage, transport, treatment, reuse, recycling, recovery and final disposal

iv. **World Bank, Operations Policy**: The purpose of World Bank Good Practice Note is to increase the awareness of the health risks related to occupational exposure, provide a list of resources on international good practices available to minimize these risks, and present an overview of some of the available product alternatives on the market.

4.2 Policy framework

4.2.1 Kenya's Vision 2030

Kenya Vision 2030 is the country's development blueprint covering the period 2008-2030. It aims to transform Kenya into a newly industrialized, "middle income country providing a high quality of life to all its citizens by the year 2030". The vision was developed through an all-inclusive and participatory stakeholder consultative process, involving Kenyans from all parts of the country. The Vision 2030 is based on 3 key pillars; Economic Pillar, Social Pillar, and Political Pillar. The economic, social and political pillars of Kenya Vision 2030 are anchored on the following foundations: macroeconomic stability; continuity in governance reforms; enhanced equity and wealth creation opportunities for the poor; infrastructure; energy; science, technology and innovation, land reform; human resources development; security and public sector reforms.

Relevance to the project

In regards to the environment, Kenya aims to be a nation living in a clean, secure and sustainable environment by 2030. It also states that Kenya will harmonize environment-related laws for better environmental planning and governance. Specific strategies will involve promoting environmental conservation in order to provide support to the economic pillar flagship projects and for the sake of promoting the now Sustainable Development Goals.

4.2.2 National Environmental Policy, 2014

The National Environmental Policy is an outcome of the Sessional Paper No. 6 of 1999 entitled Environment and Development. The overall goal of the policy is better quality of life for present and future generations through sustainable management and use of the environment and natural resources. One of the objectives of the policy is to promote use of vital tools such as ESIA and Environmental Audits necessary to ensure environmental quality and resource productivity on long term basis.

The policy among other important objectives calls for promotion of domestication, coordination and maximization of benefits from Strategic Multilateral Environmental Agreements (MEAs). The policy further calls for integration of environmental concerns into development policies, plans and activities.

The National Environmental Policy proposes a broad range of measures and actions responding to key environmental issues and challenges. It seeks to provide the framework for an integrated approach to planning and sustainable management of natural resources in the country. It recognizes the various vulnerable ecosystems and proposes various policy measures not only to mainstream sound environmental management practices in all sectors of society throughout the country, but also recommends strong institutional and governance measures to support the achievement of the desired objectives and goals.

Relevance

The policy requires that any operations which will have significant **environmental and social** ***impacts, be undertaken with a sound environmental management plan.***

4.2.3 National Climate Change Action Plan, 2018-2022

Kenya's National Climate Change Action Plan (NCCAP), is a five-year policy instrument that aims to help the country adapt to and reduce the impacts of climate change over the long term. The NCCAP calls for action on climate change and addresses the options for a low-carbon climate resilient development pathway as Kenya adapts to climate impacts and mitigates growing emissions. The plan also addresses the enabling aspects of finance, policy and legislation, knowledge management, capacity development, technology requirements and monitoring and reporting.

The NCCAP has been prepared by the Government of Kenya, Ministry of Environment and Forestry with the intention to help national and county governments, businesses and communities to identify and plan for appropriate adaptation interventions to reduce the risks from the impact of climate change and prepare for future impacts. This will also help the country achieve the Big 4 Pillars, and make progress in achieving the Sustainable Development Goals (SDGs).

Relevance

All activities at the airport related to construction, operation and decommissioning must operate within NCCAP.

4.2.4 Sustainable Development Goals (SDGs)

The SDGs provide a framework for the entire international community to work together towards a common end making sure that human development reaches everyone, everywhere. If these goals are achieved, world poverty will be cut by half, tens of millions of lives will be saved, and billions more people will have the opportunity to benefit from the global economy. Up to 2015, the development agenda was centred on the Millennium Development Goals (MDGs), which were officially established following the Millennium Summit of the United Nations in 2000. The MDGs were supposed to be achieved by 2015, so a further process was needed to agree and develop development goals from 2015-2030. Discussion on the post 2015 framework for international development began well in advance. On 19 July 2014, the UN General Assembly's Open Working Group on SDGs forwarded a proposal for the SDGs to the Assembly. The proposal contained 17 goals with 169 targets covering a broad range of sustainable development aspects. SDGs represent a unique opportunity to promote public health through an integrated approach to public policies across different sectors (the Health in All approach defined by the WHO).

Relevance

Good health and well-being as well as a clean environment is essential for human health and well-being. By carrying out this ESIA study, this will ensure that the airport operations adheres to the various environmental management factors hence making it environmentally sustainable.

4.3 Kenya's Legislations Relevant to the proposed Project

4.3.1 The Constitution of Kenya (CoK) 2010

The Constitution of Kenya 2010 recognizes the environment as part of the country's Heritage; it thus provides for the right to a clean and healthy environment for every citizen. Articles 42 and 69 obligate the state to enact legislations to protect the environment. Part II (Environment and Natural Resources), (I) the State clearly undertakes to carry out the following:

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
- Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- Encourage public participation in the management, protection and conservation of the environment;
- Protect genetic resources and biological diversity;
- Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and

- Utilize the environment and natural resources for the benefit of the people of Kenya.

(II) "Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

Chapter 5 on land and environment emphasizes on the following:

- Land use and management shall by law benefit local communities;
- Community land is protected from encroachment by state;
- Rivers, forests and water bodies shall be protected by law;
- Equitable access to land; and
- County Governments will manage land in trust of the people in accordance with the constitution.

Relevance

County Government of Machakos will operate within the confines of the law as far is the proposed project is concerned.

4.3.2 Civil Aviation Act, No. 21 of 2013

The act is to enhance standing in relation to other members of the International Civil Aviation Organization (ICAO). According to the ICAO Safety and Oversight Audit Programme (USOAP), Kenya Civil Aviation Authority (KCAA) was established on 24th October 2002 by the Civil Aviation (Amendment) Act, 2002 with the primary functions towards; Regulation and oversight of Aviation Safety & Security; Economic regulation of Air Services and development of Civil Aviation; Provision of Air Navigation Services, and Training of Aviation personnel KCAA; as guided by the provisions of the convention on international civil aviation, related ICAO Standards and Recommended Practices (SARPs), the Kenya Civil Aviation Act, 2013 and the civil aviation regulations. Their mandate is to plan, develop, manage, regulate and operate a safe, economically sustainable and efficient civil aviation system in Kenya, in accordance with the provisions of the Civil Aviation Act, 2013. It is now mandatory under the Civil Aviation (Approved Maintenance Organization) Regulations, 2018 that an approved maintenance organization (AMO) have a dedicated Head of Safety amongst management personnel. At a minimum, the Head of Safety should have at least 5 years' experience in aircraft maintenance or flight operations and should have successfully completed a training in safety management systems course recognized by the KCAA. Also provided under the AMO regulations, is the prohibition of an AMO to operate with freelance personnel and maintenance engineers.

There is also a new requirement under the AOC Regulations, that the Head of Operations of an air carrier should have at least 3 years' experience in the management of a commercial air transport operation. Likewise, for aircraft maintenance engineers with no relevant technical training are now required to have a minimum of 5 years practical maintenance experience in order to obtain a license under the Civil Aviation (Personnel Licensing) Regulations 2018.

Under the Civil Aviation (Operation of Aircraft for Commercial Air Transport) Regulations, 2018 provisions relating to the minimum rest period for crews have been expounded upon. The provisions now include minimum rest periods in relation to the distance of a crew member's residence. The regulations also place an obligation on an operator to not allow any crew member to fly without being

in possession of accurate and up-to-date flight records for the preceding 28 days before the flight. Failure to adhere to the new provisions, an operator risks on conviction a fine of up-to KES 1 million, imprisonment for a period of up-to 1 year, or both. Furthermore, action to the contrary exposes an operator not only to the risk of a civil claims by its employees but also third parties on the further spectrum of negligent liability.

4.3.3 Environmental Management and Coordination Act 2015

The requirement of an EIA license is prescribed in Section 58 of EMCA. It provides that any person, being a proponent of a project, shall before financing, commencing, proceeding with, carrying out, executing or conducting any undertaking specified in the Second Schedule of the Act, submit a project report to the Authority in the prescribed form. The impact of a proposed airport on the environment is critical and the regulatory body charged with approving the environmental aspects of projects and issuing the relevant environmental licenses is the National Environment Management Authority (NEMA). The requirements of EMCA with respect to development projects reflect a worldwide appreciation of the adverse effects of unbridled development that now find a Constitutional anchor in the right to a clean and healthy environment and public participation as well as the obligations of the Courts under Article 70 of the Constitution. These concerns are aptly captured by the phrases sustainable development and the pre-cautionary principle. The relevant matters that the proponent has taken into account in screening the project for the necessity of an EIA include but are not limited to:-

i. The characteristics of the intended development;
ii. The location of the intended development and characteristics of potential impact;
iii. The size of the development as well as comparison with other neighboring developments;
iv. The probability of any environmental impact; and
v. The duration and reversibility of such.

Relevance

County Government of Machakos is undertaking a comprehensive ESIA study at their own expense as required by EMCA 2015 (Amendment Act) since the proposed structure is an activity out of character with its surrounding, with a structure of a scale not in keeping with its surrounding. Reference: Section 1 of the Second Schedule sets out projects which require EIA.

4.3.4 Environmental (Impact Assessment and Audit) Regulations 2003, amended 2019, Legal notice No. 31 and 32 of 2019.

These Regulations stipulate how an EIA will be undertaken and what the EIA study report should contain. It also provides regulations on Environmental Audits (EA), which the proponent will be required to undertake.

Relevance: It *is important to note that the proponent will fully comply with section 17 part 1 of EMCA regulation which states that "During the process of conducting an environmental impact assessment study under these Regulations, the proponent shall in consultation with the Authority, seek the views of persons who may be affected by the project"*

4.3.5 The Waste Management Regulations-2006

The EMCA Waste Management Regulations, 2006 is the governing law for waste management in Kenya. This regulation is described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69 of September 2006. The objective of this Regulation is to protect human health and the environment. The regulations consist of eight parts and classify various types of waste and recommended appropriate disposal methods for each waste type. This also contains requirements for handling, storing, transporting and treatment of all waste categories as provided therein.

The regulations also specified a series of responsibilities for the waste generator. As Kenya develop towards achieving Vision 2030 its imperative that all forms of development and waste associated with it is managed in a responsible manner. All Any waste (other than the hazardous waste) at all phases of the project shall be separated at source and disposed off in accordance with this act. Waste production shall be minimized as much as possible.

4.3.6 The Water Quality Regulations 2006

The EMCA Water Quality Regulation-2006 is concerned with the protection of water quality and applies to drinking water, industrial water, effluent discharge, water used for agricultural, recreational, fisheries, wildlife and other purposes. This Act is divided into 6 Parts as follows:

- Quality standards for sources of domestic water;
- Monitoring for sources of domestic water;
- Standards for effluent discharge into the environment;
- Monitoring guide for discharge into the environment;
- Standards for effluent discharge into public sewers and,
- Monitoring for discharge of treated effluent into the environment.

4.3.7 The Physical and Land Use Planning Act 2019

The new Physical and Land Use Planning Act, 2019 (the 2019 Planning Act) came into force on 5 August 2019, repealing the Physical Planning Act of 1996 (the 1996 Act). The 2019 Planning Act now governs matters relating to planning, use, regulation and development of land in Kenya.

Similarities of the 2019 Planning Act to the 1996 Act

- The government, at both national and county level, is tasked with the preparation of physical and land use plans. The national, county, inter-county and local plans are required to be integrated, and these plans shall collectively form the basis of how land is to be used in Kenya.
- County governments have retained their role of development control in their respective counties. All applications for development permission shall therefore continue to be made in the relevant county.
- Development permission must be sought prior to undertaking any development. A developer who does not obtain such prior permission risks criminal sanctions and demolition of the unapproved works.

Changes introduced by the 2019 Planning Act

- Increased public participation: Members of the public will now be given the opportunity to give their views and raise objections to various matters e.g. the suitability of the national and county plans.
- Classification of developments: Developments are no longer classified as either Class "A" or Class "B" but rather the 2019 Planning Act lists developments that require development permission. In this regard, developments such as subdivision, amalgamation, change of user, extension of user, extension of lease and approval of building plans will still require development permission to be issued by the relevant county government.
- Additional developments requiring approvals: Processing of easements and wayleaves will now require express development permission, as will siting of educational institutions, base transmission stations, petrol stations, eco lodges, campsites, power generation plants and factories.
- Definition of commercial and industrial use: There is also more clarity as to what constitutes a commercial use versus an industrial use. This will guide applicants in selecting the correct land use, depending on the nature of the project they wish to undertake.
- Pre-requisite for other licenses: Development permission in respect of commercial and industrial use is a pre-requisite for other licensing authorities granting a licence for a commercial or industrial use, or occupation of land.

Timelines

The 2019 Planning Act has also set timelines in relation to various matters, significantly:

- 6 years: The maximum time a person shall serve as Director General of Physical and Land Use Planning.
- 3 years: Period within which to commence a project before the development permission lapses.
- 2 years: Period within which the national plan should be completed.
- 90 days: Time allowed for land to be restored by the developer where development permission was not sought in advance, failing which the county shall restore the land at the cost of such developer.
- 60 days: If an applicant does not receive a response to their application for development permission after this period, such application will be deemed to have been approved.
- Every 10 years: Counties are required to prepare their respective county plans.

Relevance

The government, at both national and county level, is tasked with the preparation of physical and land use plans. The national, county, inter-county and local plans are required to be integrated, and these plans shall collectively form the basis of how land is to be used in Kenya. The project is defined by LPDP.

4.3.8 The Water Act 2016

The *Water Act, 2016* provides guidelines on use and management of the of the water resources and prohibits the water pollution. As per Part II, section 3 of this act 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"*. The act also species that a permit is required from The Water Resource Authority in case of supply to over twenty (20) users.

Relevance

The proponent will have to adhere to these regulations so as not to carry out any activity or operations that will cause pollution to all natural water courses.

4.3.9 EMCA (Air Quality) Regulations, 2014

This Regulation provides for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources such as mobile sources (e.g. motor vehicles) and stationary sources (e.g. industries) as outlined in the EMCA 1999. It also covers any other air pollution source as may be determined by the Minister in consultation with the Authority. Emission limits for various equipment and facilities have been set. The regulations also establish the procedures for the issuance of emissions licenses, measurement of emissions, inspection and monitoring programs, and reporting requirements.

Relevance to the proposed project

i. Appointed Airport Management Agent will obtain Emission Licenses

ii. Appointed Airport Management Agent will ensure Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying Kenya legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources. Emissions from point sources will be avoided and controlled using air pollution control devices according to good international industry practice, depending on ambient conditions, through the combined application of process modifications and emissions controls. County Government of Machakos has also undertaken ambient quality assessment prior to licensing/ operation for future monitoring practices. Baseline air quality monitoring at and in the vicinity of the site was undertaken to assess background levels of key pollutants, in order to differentiate between existing ambient conditions and project-related impacts.

iii. Appointed Airport Management Agent will ensure that measurements of pollutants are carried out by a laboratory designated by the Authority in order to determine compliance with the prevailing allowed levels of exposure; Appointed Airport Management Agent will also ensure that record of measurements carried out under paragraph (c) are reported to the Authority on a quarterly basis; and take exposure reduction measures recommended under Part IX of the Fifth Schedule. [S.32 (c) (d) (e) AQR, 2014].

iv. The location of ambient air quality monitoring stations will be established based on the results of scientific methods and mathematical models to estimate potential impact to the receiving air shed from the airport taking into consideration such aspects as the location of potentially affected communities and prevailing wind directions in accordance with international guidelines.

Measuring and/or estimating environmental parameters and potential environmental impacts (e.g. during combustion), such as: emissions to air (e.g. CO, CO2, NOx, SOx, CH4, NMVOCs, PM, ozone, particulates, odour) by calculation and/or direct measurement and process equipment (e.g. from acid gas removal unit etc.); fugitive emissions (e.g. from valves); vented emissions (e.g. from storage and loading facilities); and other process emissions will be undertaken

4.3.10 The Occupational Safety and Health Act, 2007 (No. 15 of 2007)

The Act applies to all workplaces where any person is at work, whether temporarily or permanently. The objective of this Act is to secure the safety, health and welfare of persons at work; and protect persons other than persons at work against risks to safety and health arising. Under Section 16 of this Act, it is mentioned that *no person shall engage in any improper activity or behavior at the workplace, which might create or constitute a hazard to that person or any other person.* This Act repealed the Factories and Other Places of Work Act and provides general duties of occupiers of work places. The Act provides for safe use of plant, machinery and equipment and states that 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.

Though not explicitly provided, the act and the rules made there under have various sections on hazardous materials that apply to medical wastes. The OSHA stipulates that an employer shall not require or permit his employee to engage in the manual handling or transportation of a load which by reason of its nature is likely to cause the employee to suffer bodily injury. It also states that any person supplying, distributing, conveying or holding in chemicals or other toxic substances shall ensure that they are packaged, conveyed, handled and distributed in a safe manner so as not to cause any ill effect to any person or the immediate environment.

Relevance

The proponent is required to comply with all the provisions of the Act throughout the Company's activity cycle such as operation and maintenance of workplace, provision of PPEs, management of hazards, forming health and safety committees and reporting all the accidents and near misses.

4.3.11 Public Health Act Cap 232

The *Public Health Act Cap 232* makes provisions for securing and maintaining health. It consists of directives that affect human health. Under Part IX section 115 of this Act, it is stated that no person or institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Any noxious matter or wastewater flowing or discharged into a watercourse is deemed as a nuisance. The Public Health Act Cap 247, Section 3 gives provisions for use of poisonous substances. It refers to regulations for protection of persons against risk of poisoning, imposing restrictions or conditions on the importation, sale, disposal, storage, transportation or use of poisonous substances. This Act also requires persons concerned with importation, sale, disposal storage, transportation or use of poisonous substances to be registered and licensed and provides measures for detecting and investigating cases in which poisoning has occurred.

Relevance

County Government of Machakos will ensure that ash waste from the aviation operation and activities are properly managed so as not to cause nuisance to public health.

4.3.12 The County Government Act 2012

Under this Act, Machakos County assumes a number of roles in its area of jurisdiction, which includes the Kiima-Kimwe area. Devolution to county governments has impacted all kinds of developments in an area. The administrative changes have impacted operational plans and costs. Section 160 (a) of The County Government Act, Chapter 265 empowers every County Government to establish and maintain sanitary services for the removal and destruction of, or otherwise dealing with, all kinds of refuse and effluent and, where any such service is established, to compel the use of such service by persons to whom the service is available.

Section 201(1) – (4) expands the jurisdiction of local authority to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of the health, safety and well-being of the inhabitants of its area or any part thereof and for the good rule and government of such area or any part thereof and for the prevention and suppression of nuisances. The by-laws so made may control, regulate, prevent, prohibit or compel certain activities to be undertaken and prescribe offences in case of contraventions.

Relevance

The airport is located within Machakos County and its operation must abide by the conditions of this Act.

3.3.13 Climate Change Act No. 11 of 2016 and related polices and Plans

The Climate Change Act (Republic of Kenya, (2016a) provides a regulatory framework for an enhanced response to climate change and proposes measures to achieve low-carbon climate development. The act requires that both national, county governments and private sectors mainstream climate change responses into development planning, decision making and implementation in all sectors of the economy. It also puts in place the climate change governance structure in Kenya, with the coordinating body being the Climate Change Directorate and establishes a National Climate Change Council responsible for overseeing climate change actions. The act also calls for the development of the NCCAPs every five years. The National Climate Change Framework Policy (Ministry of Environment and Natural Resources, 2016), approved by Cabinet in 2018, aims to ensure the integration of climate change considerations into planning, budgeting, implementation and decision making at the national and county levels and across all sectors.

Relevance

County Government of Machakos is required to mainstream climate change in their operation by having internal Climate Change Policy to manage the impacts of climate change and many identified actions to address these impacts. Mitigation actions especially for Green House gases management should be a priority for the County Government.

5 SECTION FOUR: DEVELOPMENT CONTEXT-BASELINE INFORMATION OF THE STUDY AREA

5.1 Introduction

This chapter illustrates the description of the existing environmental status of the study area with reference to the prominent environmental attributes. The study area covers the location falling within 10 km radius around the proposed airport. The existing environmental setting is considered to adjudge the baseline environmental conditions, which are described with respect to climate, hydro- geological aspects, atmospheric conditions, and water quality, and soil quality, vegetation pattern, and ecology, socio-economic profiles of people, hydro-geological aspects, land use and archaeological importance. The primary baseline monitoring consists of meteorology, ambient air quality, noise levels, water quality, soil quality and ecology (aquatic and terrestrial). The land use, geology, demography, is based on the secondary data collected from various Government, semi-Government and public-sector organizations. The methodology for conducting the baseline environmental survey was obtained from the guidelines given in the EIA/EA Regulations of 2003 revised in 2019. Baseline information with respect to air, noise, water and land quality in the study area were reviewed from previous samples. The meteorological parameters play a vital role in transport and dispersion of pollutants in the atmosphere. The collection and analyses of meteorological data, therefore, is an essential component of environmental impact assessment studies. The long term and short term impact assessment could be made through utilization and interpretation of meteorological data collected over long and short periods. Since the meteorological parameters exhibit significant variation in time and space, meaningful interpretation can only be done through a careful analysis of reliable data collected very close to the site.

5.2 Area Overview

The Proposed Project is to be situated within Machakos Municipality. The Proposed Project Area is approximately 60 km southeast of Nairobi City. The Airport Area covers an area of approximately 104 Ha, which is defined by the LPDP attached.

5.3 Site Terrain and aspects

Machakos County has an altitude of 1000 – 1600 metres above sea level. The planning area is characterized by a hilly terrain with an altitude of between 1525 to 1640 metres above sea level as shown below (Map 5-1). There are four distinct slopes at the Machakos new town site. The land to the East of Maruba Dam is flat (shaded grey). To the West of Mitheu River is an East facing slope (shaded yellow). To the East of the Mitheu River is a North West facing slope (shaded purple). Adjacent to Mwania River, on the East, is a South West facing slope (shaded blue). Map 4 shows the direction of slopes at the site. The terrain includes both plains and rolling hills, with occasional isolated hills, ridges and mountains projecting above the plains.

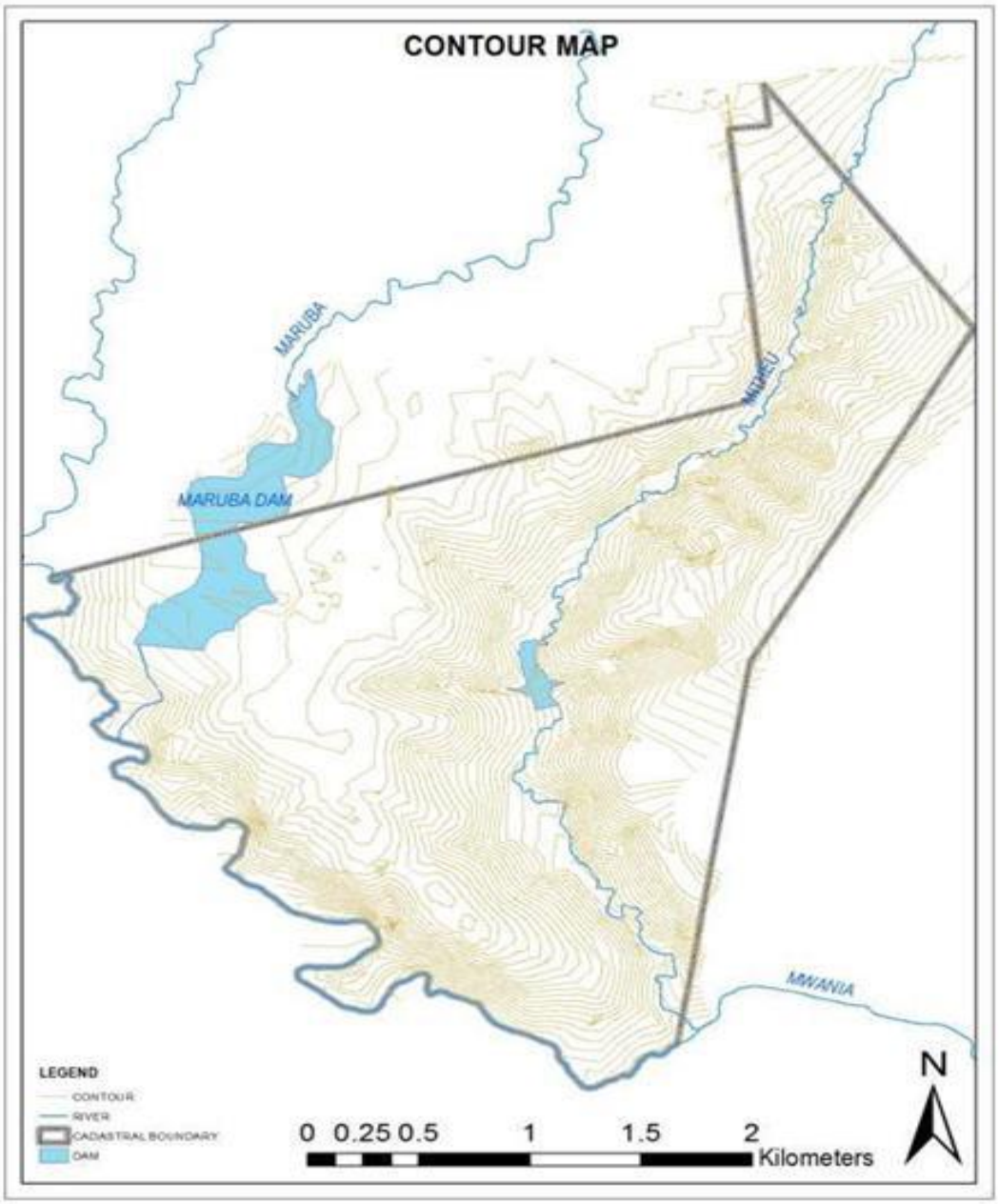

Figure 5-1: Contour Map-Source: Field Survey, 2021

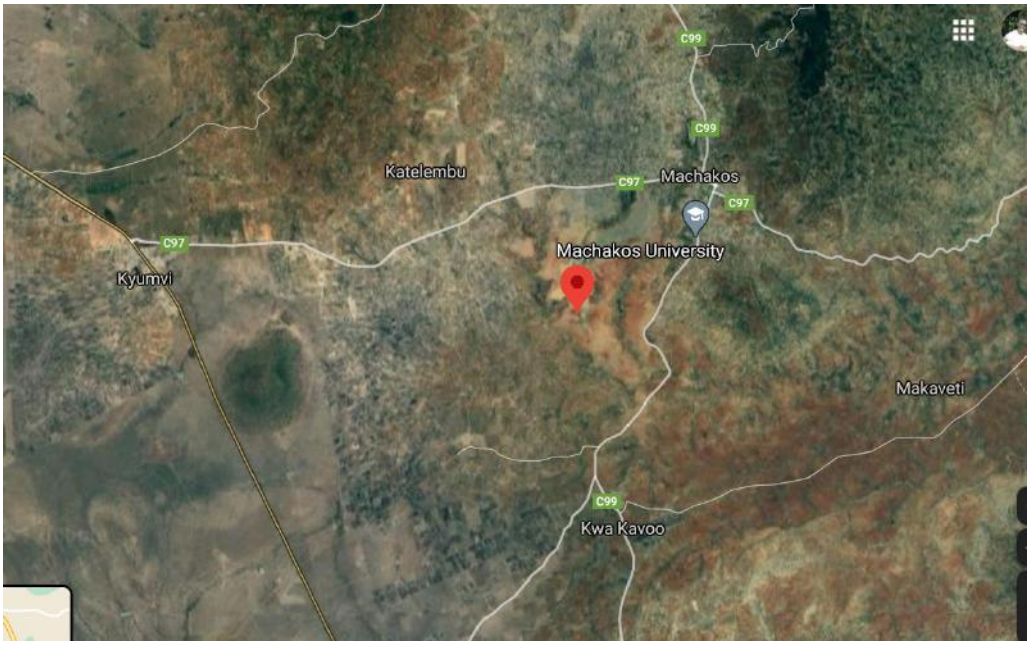

Figure 5-2: Google earth view of the location of the airport within new Machakos town.

5.4 Geology and Hydrology

5.4.1 Geology and soils

The major lithologies in this area are ingnious and metamorphic rocks. These rocks are known to be compact, dense, have few fault lines, cracks, joints and are nonporous. For this reason they make poor aquifers and have therefore contributed to failure of many boreholes in the region.

The rocks exposed in the area consist of intensely folded basement rock system of gneisses and schists which include limestone, amphibolites and quartzites as well as the predominating biotite granitoid gneisses. The rocks have been metamorphosed and granitized to a considerable degree. The soils in the planning area are strongly related to the geology and geomorphology, with the hills and plains/uplands as the determining landforms. This parent material in combination with a mountainous topography has resulted in the formation of somewhat excessively drained, reddish brown, stony and rocky sandy clay loam soils that vary in depth. The plains and uplands that surround the hills consist of variety of less metamorphosed rock. The flat plains consist of ferromagnesian gneisses in which poorly drained, black cracking and swelling firm clay soils are found. In the dissected uplands well drained dark reddish brown clay and sandy clay soils are formed in a gneiss parent material. Differences in the permeability or chemical characteristics of the rock have resulted in the formation of the different soils.

5.4.2 Hydrology and drainage

Within the wider planned area of new Machakos Town, there are three rivers, namely Maruba, Mwania and Mitheu Rivers. Maruba River flows from the North towards the South and drains into Maruba Dam. The river then becomes an outlet of the dam and joins Mwania River to the South. Mwania River flows from the North to the South East. Mitheu River flows from the North East to the South East of the site and becomes a tributary of Mwania River.

Groundwater normally occurs in pores and interstices of various rock formations depending on the geological conditions and Physiography of the area, the permeability and porosity of the rock formations, the degree and depth of weathering, fracturing of the rock formation and the historical tectonic conditions of the area. The recharge conditions are also very important factors.

In general groundwater in volcanic rocks is limited to fractures and erosion levels within the volcanic succession. Fresh lavas are usually not water bearing because of their massive and impervious nature. The most significant aquifer system in the study area is the Upper Athi Series aquifer system. The groundwater potential in the Basement System towards the east is generally lower than that of the volcanic areas to the west.

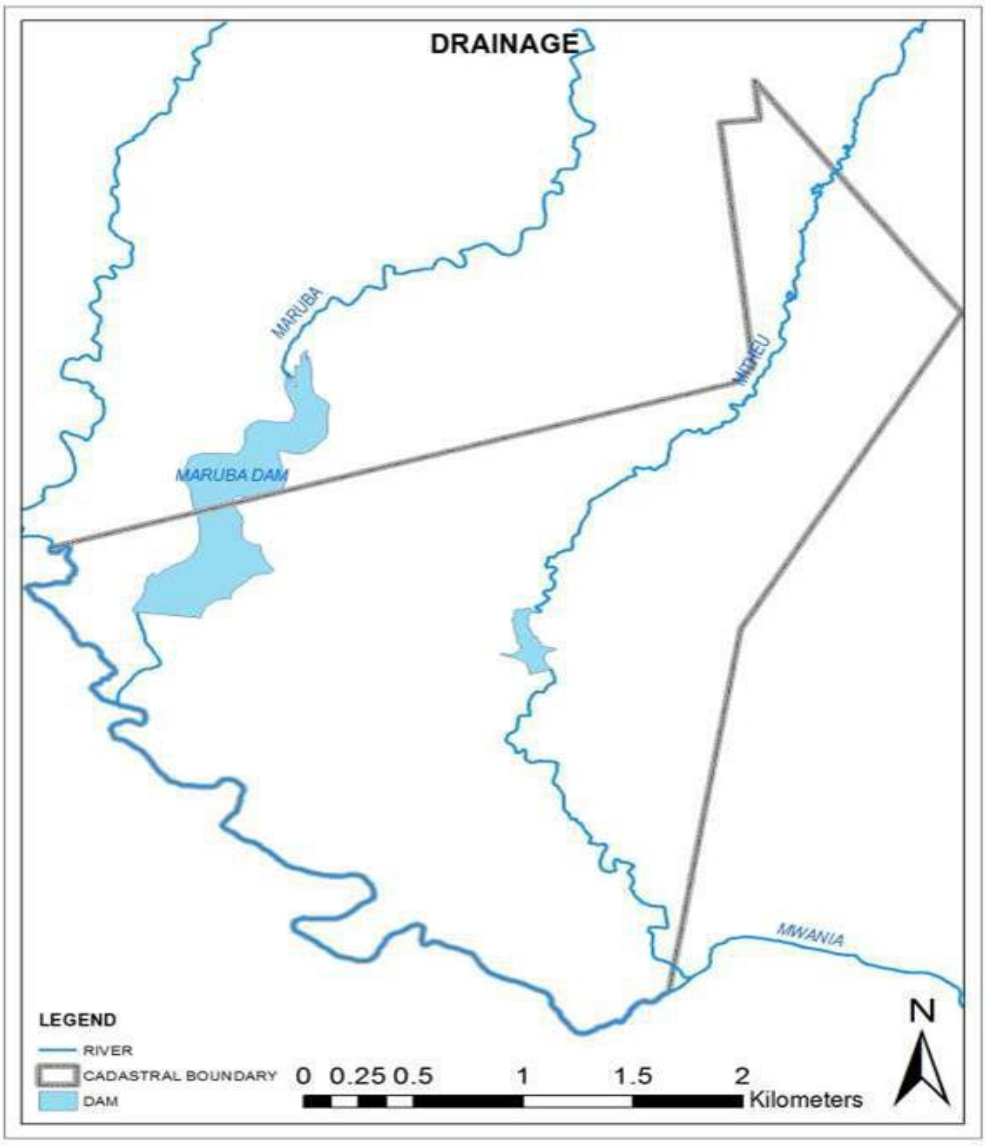

Figure 5-3: Drainage Map-Source: LPDP, 2014

5.5 Biodiversity

The vegetation on site ranges from short grass, shrubs and a few acacia trees. Maize grown in the existing agricultural fields also forms part of the vegetation. The photo below presents a section of the site covered with grass and shrubs. The Proposed Project Area is located outside national protected areas. The nearest

protected area is Machakos Peoples Park located approximately **10 k**m away (northeast), Oldonyo Sabuk National Park 80KM away and Maanzoni Sanctuary. The Proposed Project Area does not include Wetland Important Bird Area (IBA). The Proposed Project Area is characterized by two vegetation types: anthropic landscapes, grassland and wooded grassland. Birds, mammals, amphibians and reptiles have been identified within and in the vicinity of the Proposed Project Area.

Plate 5-1: The vegetation on site ranges from short grass, shrubs and a few acacia trees

5.6 Biological Environment

5.6.1 Introduction

Ecology is the study of surrounding environment wherein various living or biotic groups live together and form a system of existence where every component, whether small or big is interdependent and hence is an indispensable part of an Ecosystem. In an ecosystem, plants are important as primary producers of a food chain followed by small organisms that are food of the other organisms. An ecosystem gets disturbed even if a single member of it gets extinct. The various ecosystems constitute of the man and animals, plants, microorganisms, aquatic and desert animals and so on. Humans are dependent on their environment, as are all other organisms. Any change in the environment affects the living things and their behaviour. All organisms are dependent on each other in many ways. Destruction of one organism in the environment can lead to the destruction of other organisms. Technological advances have given humans the ability to exert great influence over the environment of all living things. However, the ability of ecosystems to sustain humans is becoming increasingly stunted. For this reason, it is necessary to understand ecology in order to survive. The ESIA studies would be very much incomplete if proper

attention is not provided towards project's impact foreseeable on flora and fauna of the study area. Accordingly, conducted the necessary survey of terrestrial flora, fauna and literature review of aquatic. New planned Machakos Town lies in the Athi-Kapiti plains which are dry savannah, open grassland with scattered scrubs and bushes. The vegetation in this area has great influence from the climate, fire, wildlife and human activities. The Ecology of Savannahs can be described as "Multiple Stable States" (Citation). Savannahs tend to grow as either open grassland with almost no trees or as dense woodland with many trees and less grass. Transitions between these states are rapid and that it was difficult to maintain a mixture of the two states. According to Sharam (citation), Savannahs generally do not undergo succession after disturbance, but will switch back and forth between their multiple stable states without any intermediate stage.

5.6.2 Flora

5.6.2.1 Trees and scrubs

The majority of trees in these savannah plains are Acacias, Commiphoras, or Terminalias. All of these trees are drought resistant and share the same characteristics that protect them from fires that often ravage these plains. Some of the dominant trees identified in the area are;-

- Whistling thorn (Acacia drepanolobium) (Ant-galled Acacia). This tree has hard, hollow spheres at the base of its thorns, filled with biting ants. The tree actually encourages these ants by both providing homes and food in special flower-like structures called "extra-floral nectaries". These trees grow in abundance wherever the soil is saturated.
- Balanites (Balanites aegyptia) (Desert Date): The Balanites tree is often confused with Acacia trees, but can easily be identified by its green thorns. This tree produces date-like nuts which are fed on by some wild animals like the warthogs.
- Yellow Fever tree (Acacia xanthophloea); The Yellow Fever Tree is a common site in wet areas, such as along rivers.
- Umbrella tree (Acacia tortilis). The seedlings of this tree are cannot survive bush fires,
- Euphorbia tirucalli; Euphorbia tirucalli is an unarmed shrub or small tree 4-12 (-15) m high with brittle succulent branchlets 7 mm thick often produced in whorls, green and longitudinally finely striated, with white to yellowish latex. It appears to grow on almost any soil type. This plant is important for it;- Protects bare soil in dry areas from wind and water erosion; Can be used in land reclamation programmes since it is very drought resistant; Is widely planted for ornamental purposes and is an extensively used as boundary, barrier, support or hedge plant in rural areas of East Africa.

5.6.2.2 Grasses;

The project locations are covered with a huge variety of grasses all of them having the same traits that encourage and protect them from fire during the dry season. Grasses in this area include the Tetrapogon bidentatus and Chrysopogon anchieri species. These grasses form the basic food for the many herbivores inhabiting this area.

5.6.2.3 Forests

There are no gazetted forest reserves within the immediate area of influence of the project site.

5.7 Settlement

There are no human settlement at the site. However, within the wider span, Settlement patterns in is determined by two factors urbanization and agro-ecological (soil fertility and rainfall) potential. Specifically in the rural areas of the project road, settlement patterns have no defined sequence as one settles next to the fathers homestead, on inherited land or a distance on purchased/inherited land parcels. Naturally, the location is inhabited by the Kamba tribe. Even in the more cosmopolitan Machakos Town, the Kamba is still the dominant community.

5.8 Road and Transport network

Machakos is mainly accessed from the nearby Nairobi County via Mombasa Road (A104/A109), a class 'A' international trunk road that links the port city of Mombasa to Nairobi. Other Primary and Secondary roads in Machakos County which are of bitumen standards, classified as class C and class D by KenHA are as follows:

- Kyumvi- Kaseve- Mwala Road (C97),
- Katumani- Wote Road (C99),
- Mathatani - Kaloleni - Kaseve Road (D527),
- Lukenya – Kenol- Ngoleni Road- (D519),
- C99 Katumani- A109 Konza Road (D522).

The proposed Machakos New Town is located west of the C99 and south of the C97. The national road A109 is located approximately 15 km west of the proposed development.
A109: This is a national road running north/south and intersects the C97 with a T-intersection that runs east into Machakos town. This national road is located west of the proposed development. The A109 from Athi River to C97 (Machakos Turnoff) is under design and is planned to be a dual carriageway in the future.

Road C97: It is a class C road located north of the proposed development running West to East of the development. The C97 is a two-way single carriageway main collector connecting Machakos town to the A109 that connects to Athi River town and Nairobi city to the North and to Mombasa to the South. There are no future planned roads improvements envisaged for this road.

Road C99: It is a class C road located east of the proposed development running North South from Machakos town to Katumani and onwards to Makueni. The C99 is a two-way single carriageway main collector connecting Machakos town to the Katumani Road and onwards to Katumani. The C99 also intersects with the D522 a few kilometres from Katumani.

Road D522: It is a class D road located south of the proposed development running east from A109 to the C99. This is currently a gravel road of approximately 9 km and is mainly used by trucks to and from

Machakos and Mombasa. It is the preferred alternative route as it enables them to access Machakos and surrounding towns without having to go through the C97/A109 intersection.

5.9 Airports and Airstrips

Currently, there exists no airstrips in the Machakos County but there are plans to construct a 4km long runway as part of the Konza Techno City. The proposed Airport in Konza is to act as an alternative to Eldoret Airport – bringing cargo and jobs to Machakos and exporting fruits and flowers. The Jomo-Kenyatta International Airport is approximately 60 Km from Machakos town. It serves as a gateway for international air traffic and hub for domestic airports in Nairobi and Kenya. Wilson Airport is used mostly by general aviation for both domestic and international flights. The domestic flight is extensively for tourism, health care and agriculture. Wilson is also the major international gateway commonly used by business executives. The airport is located approximately 65 Km from Machakos Town. It is the busiest airport in Kenya and third busiest in Africa. KAA is currently undertaking Airport development based on the NASP of 2010. The development phases are scheduled in the short, medium and long term and by target year 2015, 2020 and 2030 respectively. The JKIA and Wilson airports shall be able to handle passengers and cargo from the proposed Machakos New Town.

5.10 Climate and Rainfall

The study area experiences average rainfall of between 500mm and 1000mm annually. The rainfall is bimodal and the rainfall figures in Athi River are one major and one minor monsoon seasons. The major monsoon season is experienced in the months of March, April and May and is called the long rains. The minor monsoon seasons occur between October and December, referred as short rains (Mbegera, 2010).The climate has been changing over the years. On average, the warmest month is March.

- On average, the coolest month is August.
- The average annual maximum temperature is: 24.0° Celsius (75.2° Fahrenheit)
- The average annual minimum temperature is: 11.0° Celsius (51.8° Fahrenheit)

The mean monthly temperature ranges from 12°C on the coldest months (July-August) to 25°C on the hottest months (March and October). (Republic of Kenya, 2002a).Annual average temperatures are in the region of 30°C.

6 SECTION FIVE: CONSULTATIONS AND PUBLIC PARTICIPATION

6.1 Introduction

Consultations with various stakeholders and public participation is important throughout the ESIA process. This is in line with the requirements of Legal Notice No. 101, Kenya Gazette Supplement No. 56 of June 13th 2003, the Environmental (Impact assessment and Audit) Regulations, 2003 revised 2019. CPP is deemed necessary as it is beneficial in various ways:

- Obtains local and traditional knowledge that may be useful for decision-making;
- Facilitates consideration of alternatives, mitigation measures and tradeoffs;
- Ensures that important impacts are not overlooked and benefits are maximized;
- Reduces conflict through the early identification of contentious issues;
- Provides opportunity for the public to influence project design in a positive manner;
- improves transparency and accountability of decision-making; and
- Increases public confidence in the EIA process.

6.2 Stakeholder analysis and stakeholder engagement plan

It is important to note that the proponent is in the process of fully complying with section 17 part 1 of EMCA regulation which states that "During the process of conducting an environmental impact assessment study under these Regulations, the proponent shall in consultation with the Authority, seek the views of persons who may be affected by the project". During the ESIA study, the extensive consultations was done to ensure that all stakeholders are informed of the proposed project and are involved in it. The consultations was in form of: -Community consultative meetings on site, lead Agencies consultations, wider public reach through the mass media and site visits, interviews and discussions. A Stakeholder Engagement Plan (SEP) was developed. A stakeholder is defined as any individual, organization or group which is potentially affected by the Project or which has an interest in the Project and its impacts. The objective of stakeholder identification is to establish which stakeholders may be directly or indirectly affected either positively or negatively ("affected parties"), or have an interest in the Project ("other interested parties"). It is important that particular effort will be made to identify any disadvantaged and vulnerable stakeholders who may be differentially or disproportionately affected by the proposed airport project or who may have difficulty participating in the engagement and development processes.

Note:

i. The presidential directive on containment of Corona Virus that ban in person meetings greatly affected the undertaking of planned CPP meetings in Machakos Counties.

ii. Consultants had drafted a letter to Ministry of interior to organize for series of meetings with the shareholders identified in the SEP.

Table 6-1: SEP for the proposed airport

Stakeholder group	Stakeholder type		Connections to the Project	Timeframe and mode
	Affected party	Other interested party		
Local Communities				
▪ **Machakos Municipality within Muvuti-Kiima-Kimwe Ward** ▪ **Wider Machakos County community** ▪ **Users of local public amenities** ▪ **Employees of surrounding government institutions and public amenities.**			Households and communities that will receive impacts (positive or negative) as a result of the Project – e.g. positive employment opportunities, provision of ınfrastructure services or negative Impacts associated with installation and operation	Week 1
National, County Government and political offices				
▪ **Kenya Civil Aviation Authority** ▪ **CEC, Environment and Natural Resources-Machakos County** ▪ **Development control office-Machakos County** ▪ **Ward Administration** ▪ **Area MCA** ▪ **NEMA Office, Machakos County**		✓	Oversee the procedures to contain conflict and ensure the ESIA process is coordinated smoothly for decision making.	Week 2
Ministry of Interior and Coordination of National Government				
▪ **Deputy Commissioner** ▪ **Assistant Commissioners** ▪ **Chiefs**		✓	Ministry of Interior and Coordination of national Government has primary importance to the Project with permitting meeting requirements that must be met by the Project and responsibilities for calling for public meetings at the project venue or any suitable venue.	Throughout the ESIA process

6.3 Methodology used in Public Consultation

6.3.1 Courtesy Call to Deputy County Commissioner office

This involved briefing the Deputy County Commissioner on the purpose of the planned ESIA exercise on the proposed Machakos Airport:

i. The need for conducting an ESIA as per NEMA requirements contained in the Environment Management and Co-ordination Act.
ii. Brief by the Deputy County Commissioner on the administrative issues boundaries of within the project catchment.
iii. Environmental challenges facing the Kiima-Kimwe ward and management issues.
iv. The expectation of the community and ways in which County Government of Machakos can further work in harmony with community once the project kicks off.

Note:

Stakeholder's consultation had not been fully finalized by the time of this submission.

7 SECTION SIX: ANTICIPATED IMPACTS AND MITIGATION MEASURES

7.1 Introduction

This section provides a brief indication of the significant potential positive and negative environmental impacts relating to the operation of at the proposed airport. Once a potential issue and/or potential impact has been identified it is necessary to identify which activity or aspect of the operation result in the impact. By considering the cause of the issue, the probability of the activity resulting in an impact can be determined. The associated impact can then be assessed to determine the significance and to define mitigation or management measures to address the impact. The potential environmental impacts associated with activities during operation are may be significant and long lived and mitigated in an Environmental Management Plan (EMP). This chapter outlines the generic methodology that was followed when determining and evaluating impacts. This generic methodology was used when assessing the significance of the impacts related to the key issues and potential impacts raised. Human activities have a positive or negative, direct or indirect impact on the biological and physical environment. The nature and degree of impact however varies depended on the location and the type of operation in this case an expansion within a steel mill factory.

NB: Impacts were grouped into two categories based on their assessment of their significance is assessed:

a) Impacts for which there are published standard criteria, regulations or for which levels of acceptability have been determined. Few countries have published clear criteria for acceptable environmental impact (Environmental Quality Objectives-EQOs); research is urgently needed in most African situations to address this issue.

b) Impacts for which the assessment has to be based on the qualitative judgment of various stakeholders:
   i. Opinions of qualified decision makers in County Government of Machakos, or Sectoral departments based on the government's national and sectoral development policies;
   ii. Opinions of specialists (e.g. environmentalists, ecologists, sociologists, urban planners);
   iii. Past documented experience of similar projects such as LPDP.
   iv. Surveys of public opinion as to acceptability of impacts.

7.2 Criteria used to determine the Consequence of the Impact

Table 7-1: Criteria used to determine the Consequence of the Impact

Rating	Definition of Rating	Score
A. Extent – the area over which the impact will be experienced		
Local	Confined to project or study area or part thereof (e.g. site) Muvuti-Kiima-Kimwe ward.	1
Regional	The region, which may be defined in various ways, e.g. cadastral, catchment, topographic	2
(Inter) national	Nationally or beyond	3
B. Intensity – the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. Duration – the timeframe over which the impact will be experienced and its reversibility		
Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years	3

The combined score of these three criteria corresponds to a Consequence Rating in Table 6-2 below

Table 7-2: Method used to determine the Consequence Score

Combined Score (A+B+C)	3-4	5	6	7	8-9
Consequence Rating	Very low	Low	Medium	High	Very high

Table 7-3: Probability Classification

Probability – the likelihood of the impact occurring	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

The overall significance of impacts was determined by considering consequence and probability using the rating system prescribed in Table 6-4.

Table 7-4: Impact significance ratings based on impact probability and consequence

		Consequence				
		Very High	High	Medium	Low	Very Low
Probability	Definite	Very High	High	Medium	Low	Very Low
	Probable	Very High	High	Medium	Low	Very Low
	Possible	High	Medium	Low	Very Low	Insignificant
	Improbable	High	Medium	Low	Very Low	Insignificant

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed in Table 6-5 below

Table 7-5: Impact significance categories and definitions

Impact significance	**Definition**
Very High	The activity should only be approved under special circumstances.
High	The potential impact will affect the decision regarding the activity/development
Medium	The potential impact should influence the decision regarding the Activity/development.
Low	The potential impact may not have any meaningful influence on the decision regarding the proposed activity/development.
Very Low	The potential impact is very small and should not have any meaningful influence on the decision regarding the proposed activity/development
Insignificant	The potential impact is negligible and will not have an influence on the decision regarding the proposed activity/development.

Finally, the impacts were also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in Table 6-6

Table 6-7-6: Impact status and confidence classification

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')
Confidence of assessment	
	Low
	Medium
	High

The determination of 'significance' incorporates judgments of the above together with the potential magnitude of the impact. In addition, the frequency of impacts upon the receiving environment is a factor in determining the significance. An impact that is moderate in size but continuous can be more significant than one that is infrequent or rare.

Project impacts can also be considered direct or indirect:

- Direct: Effects directly attributable to the company's project activities or actions; and
- Indirect: Effects not directly attributable to the operational activities.

The determination of significance is therefore dependent upon decisions of the below factors in section 6.3.

7.3 ESIA significance factors that were considered

Significance Factors	**Description**
Extent/Magnitude	Potential impact should be quantified with range limits wherever possible and relevant modeling may be undertaken in order to predict impacts for appropriate factors.
Reversibility	A reversible impact is one in which the condition which the impact effects can be returned to the baseline condition prior to the impact.
Duration	The length of time of an impact may be short, medium or long term. Typically, this is defined as <5 years, 5-15 years and >15 years respectively.
Standards	Complying with the national and international standards, which may exist for a particular impact, also helps define the potential significance of an issue. With regard to the proposed project, this would consist of both Kenyan and international guidelines.

Sensitivity of receptors	In many areas the sensitivity is further defined by consultation and baseline surveys, which help detail the existing environment. Areas designated nationally or internationally should be considered as sensitive areas and impacts minimized wherever possible

7.4 Anticipated Impacts of the proposed project

This chapter briefly reviews the potential impacts of proposed airport and aviation. The potential negative impacts of proposed airport and aviation include land take, noise, air pollution, climate change, water use, and effects on the social structures of local communities. Positive impacts include direct and indirect employment, and social (and economic) benefits to people who fly. These impacts can typically be split into impacts from

- Construction/operation of airports and associated projects, and possibly closure if, say, a runway is relocated;
- The airport terminal and ground operations, flights, access to the airport (cars, buses, parking etc.) and associated projects such as hotels and airport related office developments.

7.4.1 Anticipated (potential) positive Impacts

i. **Job creation:** The proposed airport plant will directly or indirectly create jobs for the locals.

ii. **Aviation provides** the only worldwide transportation network, which makes it essential for global business and tourism. It plays a vital role in facilitating economic growth, particularly in developing countries.

iii. **Air transport** will improve quality of life by broadening people's leisure and cultural experiences. It provides a wide choice of holiday destinations around the world and an affordable means to visit distant friends and relatives.

iv. **Air transport** will contribute to sustainable development. By facilitating tourism and trade, it will generate economic growth, provides jobs, increases revenues from taxes, and fosters the conservation of protected areas.

v. **The airport network** will facilitate trade and the delivery of emergency and humanitarian aid relief anywhere on earth, and ensures the swift delivery of medical supplies and organs for transplantation. Air services enable global marketing of goods and services, providing a competitive transportation medium, especially for time-sensitive products and trade with distant markets. Over 80% of businesses reported that air services are sometimes important for their impact on sales, with almost 60% considering them either vital or very important. Companies reported that on average, 25% of all sales are dependent on air services.

vi. **Globalization** -The average distance travelled tends to increase as people take long-haul holidays and do business in countries which now have more favourable political and social environments. The airport will help Machakos County participate in the global market by increasing access to main markets and allowing globalization of production. Air transport will also encourage Machakos County and Kenya to specialize in activities in which they have a comparative advantage, and to trade with countries producing other goods and services.

7.4.2 Potential negative impacts

i. The current environment on the project catchment is rural and the communities are highly dependent on subsistence crop farming and micro-informal economies (small informal trade). In combination, the construction activities at the airport, excavation of materials from the borrow pit sites, increased heavy road traffic and increased use of the site will significantly alter the current sense of place of the local communities. Although the extent of these changes and how they will be perceived by the local residents (and visitors), it is anticipated that the current rural sense of place will change in the short to long term as a result of both the direct airport construction activities and the indirect activities related to other proposed projects on the locality. The activities which are likely to impact on the sense of place are the following:

- The fencing of the airport will permanently change access to public land once people of Kiima-Kimwe ward can no longer cross the runway to get to the main road due to the fence that will be erected around the site to reach the main road.
- The **civil works** for the airport will also have an impact on the community members dependent on public land for grazing in the and will create a visual distortion for the residents close to the project area, causing a general sense of change.
- During construction, heavy road traffic will intensify on the roads between B97 and surrounding roads and the airport causing altered sense of place through the noise, dust or mud, and safety hazards posed by the increased trucking along the rural roads. This will place additional pressure on the existing road networks in and around the settlements of Soweto from both project and non-project related vehicles.
- There will be a further increase in the numbers of in-migrants (contractors) workers from outside the Machakos locality contracted to work on the project. These workers will be accommodated at the worker's camp (on site) and various hotels/ Air B&Bs in Machakos, which will increase the potential interaction between them and the local communities (specifically those who will be staying at hotels). The worker's camp will be located at the airport close to the communities of Machakos.
- Once the construction is completed, air traffic is forecasted to be two weekly flights and 20 flights a week (as of 2030). This will further change the sense of place for the communities located in close proximity to the airport.
- Construction and operation phase activities will directly alter the visual impression of the airport, specifically as a result of intrusive construction noise during the day (drilling and crushing of rocks), additional lighting at night during construction (due to the presence of the worker's camp). During operations the visual intrusions will continue due to the increased number of flights landing and taking off as well as when lighting is required for night-time flights (in the future).

7.4.3 Air pollution

The potential of air pollution from the operation of the airport are emission from aviation operations. The measurements must be done to evaluate ground concentrations of the following: particulate matter PM, volatile organic compounds (VOCs), sulphur oxides SOx, and nitrogen oxides NOx in the environment in relation to the applicable guidelines provided by the national Draft air Quality guidelines and the World Health Organization (WHO). The main source from the operations will be experienced during the landing and take-off and taxing of on-ground aircraft (LTO) and events that are within the 1,000m above ground level (climb out and approaching landing), pollutant concentrations are likely to be notable above the airport grounds. On-site contribution from support equipment including power generators, tractors, pushes cars, motorized ladders, passenger busses and service vehicles are negligible. The pollution indicators will be sampled on ground for the runway, generally indicated compliance with WHO limits. Air pollution can affect the health of people, animals and plants. It can promote eutrophication (essentially over-fertilization) of water, leading to excessive plant growth and decay. It can also deteriorate buildings and materials and smell bad. Airports and aviation generate air pollution through a range of sources:

- Combustion of aviation fuel – which is mostly composed of kerosene - produces nitrogen oxides (NOx), carbon monoxide (CO), Sulphur oxides (SOx), hydrocarbons and particulates. It also releases the greenhouse gas carbon dioxide (CO2).
- As engines are working inefficiently on approach (as they only use about 30% of the available power) a certain amount of unburnt kerosene is released. These unburnt fuel droplets are a source of volatile organic compounds (VOCs) and give rise to odours.
- As aircraft tyres get worn and burnt during take-off and (especially) landing, they release particulate matter (PM).
- Fuel dumping by aircraft releases unburned aircraft fuel into the air. This is a rare occurrence and usually only takes place in emergencies. In these circumstances, aircraft are expected to dump fuel over water where possible, and at an altitude where they are likely to evaporate before reaching the surface.
- Vehicles travelling to and from the airport, and ground service equipment (tugs for aircraft and baggage, fuel and catering Lorries, buses and vans that transport passengers etc.) generate NOx, CO2, particulates and (indirectly) ozone through the burning of petrol and diesel fuel. • Fuel storage tanks and transfer facilities can lead to the release of VOCs.
- Aircraft and airfield maintenance (painting, metal cleaning, de-icing etc.), and emergency and fire training use complex chemicals which can release VOCs.
- Construction of airport-related projects can lead to dust, emissions from asphalt laying etc. (Kenney, 2006).

Table 7-7: Impacts of, and standards for, air pollutants at the proposed airport and aviation

Potential Pollutant	Background	Impacts on human health, habitats and species
Carbon monoxide (CO)	CO is produced when fuels are burned at too high a temperature or where there is too little oxygen	When inhaled by people and animals, CO bonds to the haemoglobin in the blood, and reduces the oxygen carrying capacity of the red blood cells. The resulting lack of oxygen in the body causes cells to die.
Nitrogen oxides (NOx), nitrogen dioxide (NO2)	Nitrogen oxides (NOx) comprise nitric oxide (NO) and nitrogen dioxide (NO2). NO is oxidized in the atmosphere to form NO2. NO2 is acidic and highly corrosive.	NO has no significant human health impacts. NO2 can increase a person's susceptibility to, and the severity of, respiratory infections and asthma. Long-term exposure to high levels of NO2 can cause chronic lung disease. High NO2 levels damage foliage, decrease plant growth, and reduce crop yield. Deposition of nitrogen compounds can lead to soil and water acidification. NOx can cause eutrophication of soils and water, which alters the species composition of plant communities and can eliminate sensitive species. NOx is a component of photochemical smog.
Ozone (O3)	Ozone is generated by photochemical reactions from NOx and volatile organic compounds, and is an indicator of photochemical smog.	Ozone can irritate the eyes, nose, throat and lungs. At high levels it can increase death rates due to lung and heart problems. It can reduce visibility. High ozone levels can be toxic to wildlife, and can lead to a reduction in growth of forests and crops, and altered species composition in semi natural plant communities. Ozone can damage materials such as rubber, fabric, masonry, and paint.
Particulate matter	Particulate matter is a complex mixture of organic and inorganic substances. Particulates are described by their size in micrometres (μm), e.g. PM10 are those smaller than 10μm. PM2.5 typically contain aerosols, combustion particles and recondensed vapours. Larger particles usually contain dust.	Of the air pollutants, particulates are worst for human health. For instance, they are responsible for up to 10,000 premature deaths through respiratory problems in the UK each year. PM10 can penetrate deep into the lung and cause more damage, whilst larger particles are typically filtered out through the airways' natural mechanisms. Particulates can damage surfaces and materials.
Sulphur Dioxide SO2	SO2 is a gas, but when it combines with water, it forms sulfuric acid, which is the main component of acid rain.	SO2 can cause coughing, make people more prone to respiratory infections, and aggravate asthma and chronic bronchitis. SO2 can attach itself to particles and, if these particles are inhaled, they can cause more serious health effects. Acid rain acidifies soils and water. This can affect aquatic life, cause deforestation, and alter

		the species composition of plant and animal communities. Acid rain can corrode building materials and paints.
Volatile organic compounds (VOCs), hydrocarbons	VOCs include a wide range of organic chemicals such as hydrocarbons (e.g. methane, benzene, toluene), halocarbons and oxygenates. VOCs have no colour, smell or taste, and they easily vaporize at room temperature.	Hydrocarbons can be hazardous to human health even at low levels, particularly if the exposure is long term. For instance, long-term exposure to benzene has been linked to an increased incidence of anemia and leukemia; toluene can affect the central nervous system; and moderate levels of formaldehyde can lead to irritation of the eyes, nose and upper respiratory track. Some VOCs can cause cancer. Odours from hydrocarbons are often annoying. Some hydrocarbons play a role in the formation of photochemical smog.

Note

It is very difficult to reduce the air pollution impacts from aircraft except through more efficient operations and technology. The use of the most polluting chemicals is covered by pollution prevention and control regulations. The air pollution impacts of ground traffic can be reduced by switching to less polluting forms of transport (bicycle, train and bus rather than private vehicles). Dust from construction can be controlled by soil damping and wheel washing. Some airports compile emissions inventories and carry out air quality assessments to help identify how air pollution can best be tackled. Some of the measures that have been proposed or carried out to mitigate the effects of air pollution include measures to control the emissions or to penalize non-compliance. Measures proposed in airport master plans and environmental statements for minimizing air pollution impacts are: Working towards a reduction if the total number of vehicles that commute to and from the airport ; A system of penalties for polluting vehicles ;Introduction of charges to promote the use of lower emission aircraft ; Minimizing dust emissions by wheel washing, damping down and employing the use of covered vehicles for transportation ; Conducting a Code of Construction Practice relating to air emission and Carrying out air quality assessments periodically.

7.4.4 Impact on Climate:

The so-called 'greenhouse effect' occurs when sunlight passes through the atmosphere, warming the earth; heat from the earth's surface is re-emitted; and this heat is partly absorbed by the atmosphere, trapping the heat. Higher atmospheric concentrations of greenhouse gases - notably carbon dioxide (CO2) but also methane, NOx and others cause the atmosphere to absorb more heat from the earth's surface, and lead to higher levels of warming, or climate change.

Airports and aviation generate greenhouse gases in three main ways:

i. Flights are by far the largest source. Aircraft emit large quantities of CO2 and NOx during flights, particularly during take-off and landing. NOx emissions at altitude react to either increase ozone concentrations or decrease methane concentrations in the atmosphere. While this leads to global warming and cooling respectively, the two occur in different regions and latitudes and do not cancel each other out. Water vapour from combustion also contributes to the formation of contrails, and persistent contrails are also thought to cause additional cirrus cloud formation (although the scientific certainty of the precise impact is less compared to other greenhouse gases);

ii. Ground traffic is the second largest source. Vehicles (including construction vehicles) travelling to and from the airport, and around the airport generate CO2;

iii. Airport buildings require electricity and heating. Unless this comes from sources that do not use fossil fuel (e.g. hydro or wind power), the energy production will generate greenhouse gases. Airport construction also generates CO2 through 'embodied energy'.

Proposed Mitigation measures include

- Airlines (or air passengers) can also sign up to a range of 'carbon offset' schemes, where the carbon impacts of flying can be offset, for instance through tree planting or support for renewable energy in developing countries. However, the schemes vary widely in terms of the assumptions they make and price they charge; there is concern about their 'additionality' (whether they lead to new action or simply support action already taking place anyway); and arguably they simply make people feel better about their unsustainable behaviour rather than encouraging people to fly less.
- Ground traffic generates CO2 through the burning of fossil fuels. As with air pollution, this can be reduced by switching to cycling, trains and buses. Electric vehicles can be used on-site, but they still generate greenhouse gases indirectly, since their power comes from power stations, most of which burn fossil fuels. Car use can be discouraged by making parking at airports expensive (although care needs to be taken that this does not lead to parking in nearby neighbourhoods instead); provision of bus lanes; and locating public transport terminals more conveniently to the airport than car access points.
- Airport buildings can be made very energy efficient, or even 'energy negative' if they incorporate renewable energy technologies such as photovoltaics. Energy plants can be made more efficient,

and electricity supplies to airports can come from 'green' sources. However airports use only a small proportion of the energy used for flying, so any gains here are minor in the overall scheme of things.

Note:

The proposed airport takes place within the industrial land already planned and defined through LPPDP under Physical and Land Use Act of 2019 by and it does not involve any vegetation land which clearly indicates that, impact on the climatic conditions from the proposed airport will be insignificant. Few if any measures for reducing the effect of aviation on climate change are proposed in airport master plans and environmental statements. Mitigation measures are usually aimed at reduction of air emissions and improvement in ground transportation rather than directly targeting climate change as an issue on its own.

7.4.5 Biodiversity (or nature conservation, or flora and fauna) impacts

Biodiversity impacts refer to impacts on plants and animals. These include reduction in the type and extent of habitats; bird strike and road kill; disturbance from light pollution, noise and aircraft/vehicle movements; and air pollution. Habitat loss occurs when previously 'green' areas are built on, destroying the habitats of the plans and animals that live there. Habitat fragmentation happens when a larger area of habitat is split into smaller areas, for instance if it is split by a road or fence. This can make it difficult for animals to forage for food, breed and migrate. Animals with very consistent foraging patterns (like badgers) or breeding patterns (like toads) may continue to move from one habitat fragment to the other, and may be hit by cars. Some animal species have large land requirements, and may be affected by habitat loss or fragmentation even if these reduce the animals' habitat a little bit. Habitat degradation reduces the attractiveness of the habitat for the plants and animals on it. This could result, for instance, from the ground being churned up and/or compacted, vegetation clearance, replacement of one type of vegetation by another (e.g. herb-rich grassland by turf), storage or disposal of rubble on the site, litter, or land contamination.

7.4.5.1 Bird strike

Bird strikes occur when aircraft hit birds during take-off and landing. Roughly 85% of bird strikes involve aircraft below 800 feet, and up to 40% of bird strikes take place beyond the airport perimeter (CAA, 2001). The number of bird strikes at a given airport is a function of:

- The number of birds near the airport: airports in an area of high bird density are likely to have more bird strikes than airports in areas of low bird density.
- The types of birds near the airport: the likelihood of a bird being struck by an aircraft depends in part on the height at which it flies and its flight patterns. For instance, oystercatchers and starlings are much more likely to be hit by an aircraft than pheasants and grey herons (DfT, 2006a).
- The number of aircraft landings and takeoffs at the airport: the greater number of aircraft movements, the greater the likelihood of a bird strike.

Because birds are a significant hazard to aircraft, control measures are used at many airports to reduce bird strike. These measures can include landscaping, waste management measures, use of noise and flare guns, and use of falcons. The whole purpose of these measures is to disturb birds-there is a clear conflict between aircraft safety and large bird populations. Measures to control birds also extend beyond the airport boundary.

7.4.5.2 Road Kills

Road kill occurs when animals get hit by vehicles, for instance on access roads to airports. No formal data are collected on road kill numbers, but evidence suggests that they can be significant. For instance, Naturewatch (2007) suggests that more than 10% of the badger population is killed on airport roads each year; and Mead (2020) suggests that 10-30% of many bird species are killed by cars each year, with owls being particularly badly affected. Road kill due to airport traffic is unlikely to be a major impact over and above existing levels of road kill, but could be major if the airport requires a new road.

7.4.5.3 Light pollution

Light pollution from airports and roads can attract animals either directly or indirectly (e.g. they attract insect prey which, in turn, attract bats and birds – and their predators). This can affect migration patterns where animals travel off-course because they are attracted to light. Once they arrive at the light source, birds may circle the source, become disoriented and exhausted, and collide with structures or other disoriented birds. Light pollution can also affect animals' rhythms of waking, sleeping and hibernation (Rich and Longcore, 2006).

7.4.5.4 Noise impacts on biodiversity

The sensitivity of wildlife to the noise of aircraft, airport ground operations and airport access roads varies greatly from species to species. Such noise can cause some wildlife notably a range of grassland and woodland birds to avoid areas near them, reducing the density of those animal populations (Kaseloo and Tyson, 2014). Animals' breeding success can also be reduced by noise. Studies have shown that some birds are disturbed by noise affecting noise and migration, although other species can tolerate exposure at the same level.

7.4.5.5 Aircraft movement

Animals can be disturbed by the movement of aircraft and vehicles. For instance, a study of birds near the Liverpool John Lennon Airport found that aircraft movement had limited effect on the birds, but the cumulative impact of multiple sources of disturbance, including dog walkers and vehicles, was significant (Peel Airports, 2006). Biodiversity impacts are particularly significant if they affect sites of nature conservation importance:

- At the international level: Special Protection Areas (for birds), Special Areas of Conservation (for habitats) and Ramsar sites (wetlands)
- At the national level: Site of Special Scientific Interest
- At the regional level:
- At the local level.

7.4.6 Noise

Noise from aircraft and from traffic going to and from airports is probably the most obvious environmental impact of the aviation industry because it is easily perceived and annoying, especially where this occurs frequently. Aircraft noise is generated by both the engine and the airframe and is most evident during landing and take-off and under frequently-used flightpaths. Other sources of noise include noise generated from taxiing aircrafts, the application of reverse-thrust (an optional braking aid on landing), engine tests and on-site vehicular traffic. Also, noise impacts can extend to vehicular c to and from the airport, and construction noise.

The effects of noise pollution include:

- Loss of concentration
- Sleep disturbance
- Anger, frustration and powerlessness to control the noise
- Fear of accidents and of potential increase in frequency of noise
- Cardiovascular effects (not well established)
- Mental health (may affect but not cause it)
- Diminished educational achievement (due to either direct effect or loss of teaching time due to noise disruptions) (Parliamentary Office of Science and Technology, 2003)
- Prolonged or excessive exposure to noise can cause hypertension and is chaemic heart disease.
- Adverse effect on performance, for example in reading, attentiveness, problem solving and memory.
- Deficits in performance can lead to accidents.
- Noise above 80dB may increase aggressive behaviour.
- The main social consequence of hearing impairment is the inability to understand speech in normal conditions, which is considered a severe social handicap (WHO, 2001).

Noise also affects the breeding and feeding habits of birds and also encourages unnecessary expenditure of energy as the move towards or away from the sound source, thereby exposing them to predators (White Young Green Planning, 2006) The significance of noise impact depends on a variety of factors such as volume, duration, location (e.g. countryside vs busy street), time of the day and frequency of noise (deep low noise travels longer distances and can be felt in buildings) (Defra, 2004).

Mitigation

- Putting strict regulatory constraints on the amount of noise that can be generated by aircrafts and on the flight paths to be followed.
- Refusing planning permission where noise levels exceed 66dB(A)Leq at daytime and 57 dB(A)Leq at nighttime

- Making technical adjustments to thrusts, angle of flight decent/ take-off, speed of aircraft accent etc. (POSTNOTE, 2003).

7.4.7 Waste impacts

In practice, airport operations encounter various types of waste, including: Municipal Solid Waste (MSW); Construction and Demolition Debris (CDD); waste from aircraft flights (deplaned waste); compostable waste; hazardous and industrial waste; and lavatory waste. For MSW and CDD, airports have choices in how to manage collection, treatment, storage, and disposal. Those choices, when considered and carried out in beneficial ways, can improve airport operations and minimize environmental impacts. The below categories of wastes are expected to be generated.

7.4.7.1 Municipal solid waste (MSW)

This is the type of waste that the airport will have the most choice in managing. MSW is made up of everyday items that are used and discarded, such as aluminum and steel cans, glass bottles and containers, plastic bottles and containers, packaging bags, paper products, and cardboard. Airport MSW comes will be from four primary sources as follows:

1. Terminal waste – from public areas and airport administrative offices;
2. Tenant waste – from terminal retail and concessions;
3. Airline waste – from airplanes and airline offices; and
4. Cargo waste – from cargo operations

7.4.7.2 Construction and demolition debris

Another common type of waste at expected at the proposed airport is Construction and Demolition Debris (CDD). CDD can come from land clearing, excavation, or as the name implies construction and demolition at the airport. CDD may include such materials as concrete, wood, metals, soil, bricks and masonry material, asphalt, rock, stone, gravel, and sand, roofing materials, drywall, carpet, plastic, pipe, and others.

7.4.7.3 Waste from aircraft flights (deplaned waste)

Waste from airplanes (deplaned waste) is a specific type of MSW that is removed from passenger aircraft. Almost 20% of an airport's total MSW comes from deplaned waste after flights. Deplaned waste includes "galley waste" materials typically collected by airline caterers as part of the de catering process, including compactor boxes, waste carts (bags), food carts, and bonded carts which may be subject to more rigorous disposal methods.

7.4.7.4 International waste

Special attention has to be made for international waste. This is generally waste from international flights, but also can include the waste from the terminals that international flights service. When waste originates from countries with different policies and regulations, there is a risk of introduction of plant pests,

diseases, and other contaminants. For these reasons, this waste is sometimes called quarantined waste (QW). Although international waste is often similar in material type to MSW, airports generally handle and process international waste separately from other waste types. In many cases international waste is incinerated on-site, or the airport arranges for it to be packaged and sent for disposal.

7.4.7.5 Compostable and biodegradable waste

Airports generate waste that is biodegradable. Food waste from terminals: food that is not consumed, or waste generated during food preparation is one of these. Airport landscaping activities also generate green waste trees, shrubs, and grass clippings, leaves, and similar vegetation generated by landscape maintenance. These types of organic wastes can be composted, but airports are now developing other creative means of disposal. These types of wastes can also be categorized as MSW, although these often have different treatment options than MSW.

7.4.7.6 Hazardous and industrial waste

These types of waste products consist of oils, solvents, and other chemical waste from activities such as aircraft and ground vehicle washing and cleaning, fueling operations, aircraft maintenance and repair including painting and metalwork, engine test cell operations, de/anti-icing operations, ground vehicle maintenance, and abandoned aircraft. These types of wastes tend to be closely regulated by state law, and require special treatment, storage, and disposal, and therefore this document does not address hazardous and industrial waste management.

7.4.7.7 Lavatory waste

Lavatory waste is considered as a special type of waste and contains chemicals and potential enteric pathogens and can present risks to the environment and human health if not handled properly. Caution must be taken to ensure that releases of lavatory waste do not occur.

Airport Stakeholder	Types of Waste Generated
Airport Authority	Food, paper, plastic (in many forms), aluminium cans, restaurant and cafeteria grease and oil, electronics. Light bulbs, green waste from lawn cutting and landscaping, general rubbish, airport construction waste (concrete, asphalt, building materials, wood), soil, construction equipment waste, regular rubbish items.
Aircraft Maintenance Firms	Food, packaging, oils, greases, solvents, packaging, wooden pallets, general rubbish.
Airport Concessionaires and Shops	Food, general rubbish, paper, toner cartridges, batteries, light bulbs, plastic bottles, aluminium cans, packaging.
Airport Fuel Farm and Suppliers	Paper, toner cartridges, batteries, light bulbs, plastic bottles, aluminium cans, food and general rubbish, mechanical oils and greases.
Air Traffic Control (ATC)	Paper, toner cartridges, computer printouts, light bulbs, batteries, food and general waste, mechanicals oils and greases.
Airlines	Food and drink containers, newspapers and magazines, food waste (from lounges/cafeterias), light bulbs, printer toner, paper, documents and computer print outs, mechanical oils and greases.
Cargo Terminal Operators	Tires, fluids, lights bulbs, batteries, wood and wooden pallets, plastic wrapping material, green waste from lawn/garden care and landscaping, paper, computer printouts.
Fixed Base Operator (FBO)	Paper, toner cartridges, lights bulbs, batteries, plastic, aluminium cans, food and general rubbish, mechanical oils and greases.
Flight Catering Centres and Kitchens	Food and beverage waste, cardboard boxes, paper, plastic items, packaging, food packaging, food wrappers, oils and grease, aluminium cans, plastic bottles, plastic and glass containers.
General Aviation/Business Jet Centre	Paper, toner cartridges, batteries, electronics, plastic bottles, aluminium cans, food, general rubbish, mechanical oils and greases.
Government Agencies	Paper, toner cartridges, batteries, electronics, plastic bottles, aluminium cans, food, general rubbish.
Ground Equipment Maintenance Firms	Paper, toner cartridges, light bulbs, plastic bottles and aluminium cans, packaging, wooden pallets, mechanical oils and greases.
Ground Handling Agent	Paper, toner cartridges, lights bulbs, batteries, plastic, aluminium cans, food and general rubbish, mechanical oils and greases.
Ground Transport Interchange	Food waste, waste paper, rags/cloth, newspapers, magazines, green waste from lawn care and landscaping.
Passengers	Food, aluminium cans, plastic bottles, packaging, newspapers, magazines.
Restaurants	Retail and food and beverage waste, cardboard boxes, paper, plastic items, packaging, food packaging, food wrappers, oils and grease, aluminium cans, plastic bottles, plastic and glass containers.

Figure 4: Summary of waste expected to be generated.

7.4.8 Impacts on Water resources

Airports, airport-related development and aviation has a potential to affect water quality in several ways. First, building works can lead to polluted construction run-off which can affect nearby water bodies. This is typically dealt with by setting up buffer zones around waterbodies (streams, ponds, estuaries etc.) within Kiima-Kimwa Ward where machinery is not permitted. Second, during operation, rainwater that falls on parking lots, building roofs, aprons and taxiways, and other areas with hard surfaces will run off either into drains or (if good drains are not in place) into nearby water bodies or ground water. Typically the proposed development will not be allowed to go ahead unless it puts measures in place to treat the chemicals and other pollutants from this surface water or rainwater run-off. However during hard rains the drains and their controls can be overwhelmed, and pollution of waterbodies can occur. Third, airports create a range of potential pollutants including de-icing agents, maintenance and painting chemicals, testing of fire equipment, and fuel leakage and spillage from refueling and storage. These can either be

leached into ground water or can contaminate storm water run-off which can pollute nearby water sources. Such instances are monitored by the authorities and fines can be levied. Nevertheless, it is worth considering the height of the water table, whether the airport has an internal drainage system and arrangements for monitoring.

Wastewater from an airport's operations typically goes to a sewage treatment plant. That can be a problem if the plant is already at or near capacity. In such cases it is often possible to expand the treatment plant or upgrade its equipment to cope with the additional flow. **The NEMA consent programme will help to ensure that the** development are not built where their wastewater cannot be adequately treated. On a less local level, fuel dumping from flying aircraft can cause water bodies to be polluted. Aircraft often dump excess fuel before landing as a safety measure: to protect the aircraft's structure and landing gear, reduce the chance of a brake fire, and or to ensure a safe landing. During fuel dumping, jet fuel (mostly kerosene) is ejected from the aircraft's wing tips, tail or aft fuselage. Air traffic controllers are instructed to direct planes dumping fuel away from populated areas, over large bodies of water, and in specified areas where possible. Kerosene evaporates rapidly in the atmosphere and typically little survives in liquid form when it reaches the Earth's surface; at that point it impacts water quality much like an oil or gas spill. Cumulatively fuel dumping may be having a significant impact.

7.4.9 Impacts on Heritage / culture

Heritage (or cultural) assets include archaeological remains, both above ground and buried; historic buildings and sites such including listed buildings, cemeteries, parks, historic areas and landscapes; and other structures of architectural or historic merit. Ancient woodlands are often valued and protected for their biodiversity, but their sheer age also gives them heritage value. The Machakos County archaeologist and local conservation officer(s) is expected to normally keep a list and map of heritage assets, including areas with potential but not yet confirmed archaeological remains. Heritage assets can be affected by proposed aviation and airports several ways:

- They can be razed or built over to make way for airport-related development.
- Their structure can be affected by vibrations from aircraft or road traffic: there are concerns, for instance, that this could happen at Machakos Peoples Park situated nearby.

Ideally, heritage assets should be preserved in their context, including the wider landscape in which they are seen. Mitigation (as opposed to avoidance) measures include digging up archaeological artefacts, recording them, and moving them to a museum; preserving buildings or archaeological remains in a different setting (e.g. as part of the open space in an office development, or under a car park with a raised ground floor); and taking them apart and moving them to a different location. However it is impossible to replace the sheer age of heritage assets. Often it will not be possible to mitigate impacts on them.

Measures proposed in airport master plans and environmental statements for minimizing impacts on heritage/ culture include the following:

- Carrying out archaeological surveys to reduce the loss of possible earthworks during construction.
- Rerouting of construction traffic.
- Geological survey, evaluation and excavation where necessary

- In situ preservation of archaeology.
- Design amendments and sensitive landscape works.
- Keeping a careful record of details of character and construction.
- Dismantling and reconstruction of timber-framed sections of some buildings.

7.4.10 Landscape and visual impacts

Airports and airport-related developments affect the landscape by removing existing landscape features such as trees and hedges and replacing them with buildings and tarmac. At night, the lights of the runways, aircraft and terminals increase light pollution. The following components of the landscape will potentially be affected by the proposed development:

- Physical factors: geology, landform, climate and microclimate, drainage, soil, ecology.
- Human factors: archaeology, landscape history, land use, buildings and settlements.
- Aesthetic factors: proportion, scale, enclosure, texture, colour views as well as sounds, smells, tastes and touch.

The less developed and more attractive the original landscape is, the bigger the landscape impacts of an airport or airport-related development is likely to be. National Parks, Areas of Outstanding Natural Beauty and (to a lesser extent) Heritage areas designated because of their attractive landscapes and managed so as to ensure that these landscapes are preserved. Airports and airport-related developments can also have visual impacts. These refer to the impacts of landscape change on people: on the views that people have from their homes, offices, footpaths, cars as they drive past etc. All developments have a 'zone of visual intrusion' from which they can be seen, and an environmental statement will often show this on a map. The more people can see the development, the closer they live and work to the development, and the clearer their lines of sight are (rather than, say, their views being blocked by high hedges), the bigger the visual impact will be. The landscape and visual impacts of developments often change over time. For example hoardings or bunds (long low hills made out of spare soil) may be put up during construction and taken down during operation. Plantings will grow over time, softening the features of the development.

Mitigation

Typical mitigation measures include good design of buildings, possibly including green roofs; the erection of some kind of screen (wall, planting, bund) between the viewer and the development; locating parts of the development further away from viewers or hiding taller buildings behind shorter ones to soften their impact; and careful use of colours, choice of street furniture (lamps, benches, waste containers) etc. Light pollution can be reduced by keeping lighting (e.g. of parking lots) to the minimum levels needed for safety, and through the careful choice of light fixtures such as the use of flat-glass lanterns in car parks. Some buildings, particularly airport terminals, can be very attractive, and many people prefer the aesthetics of a well-designed and well-managed development to those of derelict, scrubby areas. In such cases, the development is a visual improvement. Other measures may include landscape engineering, tree planting and ground modelling.

7.4.11 Risk to third parties

Airport-related development and aviation pose risks to air passengers and others ('third party risk'). These include road accidents from passengers and workers travelling to and from airports, airplane crashes, terrorism threats, the effects of wake turbulence from aircraft, and health problems of flying for passengers and airline staff. This section discusses only third party risk to people who live and work near airports.

7.4.11.1 Road accidents related to airport operations.

However, increased traffic near an airport is likely to increase the risk of accidents. Increased use of bus and train both safer forms of travel than the private car can help to reduce this risk.

7.4.11.2 Airplane crashes.

Flying is a particularly safe form of travel: someone is probably more likely to be involved in an accident when driving to an airport than during the subsequent flight. That said, take-off and landing are the most dangerous phases of aircraft operations, so most crashes occur at or near the ends of runways. Government must responded to this risk by designating Public Safety Zones (PSZs) at the proposed airport, which restrict what new development can be located in these zones. PSZs are usually triangular-shaped, pointing away from the end of the runway. Their shape and size is determined based on the number of flights at the airport, the likelihood of a crash, where the crash might occur, and the likely consequences of a crash. PSZs have two contours:

- 1 in 10,000 individual risk: nobody should live or work all day in these zones; and
- 1 in 100,000 individual risk: new development in this contour is restricted and existing development should be removed if suitable opportunities arise.

7.4.11.3 Terrorism at airports and on aircraft.

This could directly affect communities living near airports if a terrorism attempt succeeds. It could also affect them indirectly in the form of increased police activity, congestion when there are roadblocks, etc.

7.4.11.4 Effects of wake turbulence from aircraft.

Flying aircraft produce wake turbulence as a result of Newton's Third Law: for every action there is an equal and opposite reaction. Wake turbulence is caused by the 'downwash' caused as aircraft rise in the air, and the vortices (whirlwind) caused at the aircraft's wing tips as the vacuum above the aircraft wing and the pressure below the wing meet. The strength of the wing tip vortices is proportional to aircraft weight, and inversely proportional to aircraft speed, wingspan and air density. At ground level, wake turbulence causes unusual wind currents, and sometimes small whirlwinds. Wake turbulence may cause tiles to come off roofs.

Table 7-8: Potential negative impacts and mitigation measures

CONCERN	POTENTIAL NEGATIVE IMPACTS	PROPOSED MITIGATION MEASURES
SITE PREPARATION AND AIRPORT CONSTRUCTION PHASE		
Dust disturbances	▪ Eye and skin irritation; ▪ Impairment of normal sweating of the skin as it blocks pores on the skin; ▪ Chocking of the throat; ▪ Respiratory difficulties; ▪ Difficulty in breathing; ▪ Potential cause of chest complication and ailment	▪ Employees involved in the installation and operation work to be provided with dust masks; ▪ Project management and contractor to enforce strict use of personal protective clothing; ▪ Complains of dust related aliments among employees given access to medical attention.
Noise disturbances	▪ Reduced concentration of people ▪ Shouting during conversation among workers on site ▪ Noise induced hearing loss among workers who are continuously exposed to high noise levels ▪ reduction in productivity and efficiency of the workers at the workplace ▪ Stressing the worker and thus reduced concentration.	▪ Diverting or closing rights of way could mitigate noise to certain communal areas as well as effects on visual appreciation ▪ During construction, sound attenuation of plants and noise barriers within a site compound would reduce the ground noise during the construction period. ▪ The access routes of the contractors could be diverted to minimize the impact on the local communities. ▪ Where significant amounts of waste are generated the soil could be re-used or the aggregates recycled. ▪ Keeping construction waste to a minimum ▪ All construction works installation works to be limited to daytime only; ▪ All employees likely to be exposed to ear noise to be provided with ear protectors; ▪ Contractor to ensure strict enforcement on user of ear protectors; ▪ Where applicable and possible exceptionally noisy machines to be fitted with noise reduction devices; ▪ Any employee who may complain about ear related pain and or complication while at work to access medical attention at the expense of the contractor or project proponent; ▪ Where employees are likely to be exposed to continuous
All categories of waste as discussed in 7.4.3	▪ Cause visual pollution making such areas unsightly. ▪ Poorly managed and disposed waste can attract dieses vectors ▪ Can be injurious to those working at the project	▪ solid waste to be handled, managed and disposed according to the waste management regulations; ▪ Waste handling bins to be provided for workers onsite, each bin should have a lid which should always be covered; ▪ Colour code to be used to distinguish waste bins of different waste; ▪ Solid waste to be disposed only at licensed disposal sites; ▪ In a case of cement bagging, they can be stored recycled or put into different usage.

Occupational injuries	▪ complete incapacitation of the affected employee ▪ loss of life ▪ Increase in Costs of litigation and compensation	▪ Appropriate personal protective equipment such as safety belts for workers working at height to be provided. ▪ Proper use of PPE provided. ▪ Appropriate training of workers of ways of working safely. ▪ Appropriate supervision at workplace. ▪ Rest times to be strictly observed to reduce stress. ▪ Noise and dust and other factors can result in reduced concentration to a level of causing and accident to be appropriately mitigated.
Impacts on heritage/ culture include the following:	▪ Loss of key heritage assets for individuals and community	▪ Carrying out archaeological surveys to reduce the loss of possible earthworks during construction. ▪ Rerouting of construction traffic. ▪ Geological survey, evaluation and excavation where necessary ▪ In situ preservation of archaeology. ▪ Design amendments and sensitive landscape works. ▪ Keeping a careful record of details of character and construction.
Landscape and visual impacts	▪ Eye pollution	▪ Good design of buildings, possibly including green roofs; the erection of some kind of screen (wall, planting, bund) between the viewer and the development; locating parts of the development further away from viewers or hiding taller buildings behind shorter ones to soften their impact; and careful use of colours, choice of street furniture (lamps, benches, waste containers) etc.
Social impacts	▪ Behavioural change such as alcoholism among construction workers in the camps ▪ Emergence of new cultures ▪ STD and HIV AIDs ▪ Drug and substance abuse	▪ Awareness creation on topical issues among residents such as STD and AIDS, drug and substance abuse
AIRPORT OPERATIONAL PHASE		
Local air quality degradation	Air quality health hazards such mainly bronchial infections, skin problems, visibility, etc. for employees and public are likely effects from uncontrolled air pollution. Concentrations of dioxins in air water and soil in the food chain to levels dangerous to human health	▪ Combustion of aviation fuel – which is mostly composed of kerosene - produces nitrogen oxides (NOx), carbon monoxide (CO), Sulphur oxides (SOx), hydrocarbons and particulates. It also releases the greenhouse gas carbon dioxide (CO2). ▪ As engines are working inefficiently on approach (as they only use about 30% of the available power) a certain amount of unburnt kerosene is released. These unburnt fuel droplets are a source of volatile organic compounds (VOCs) and give rise to odours. ▪ As aircraft tyres get worn and burnt during take-off and (especially) landing, they release particulate matter (PM). ▪ Fuel dumping by aircraft releases unburned aircraft fuel into the air. This is a rare occurrence and usually only takes place in emergencies. In these circumstances, aircraft are expected to dump fuel over water where possible, and at an altitude where they are likely to evaporate before reaching the surface. ▪ Vehicles travelling to and from the airport, and ground service equipment (tugs for aircraft and baggage, fuel and catering lorries, buses and vans that transport passengers etc.) generate NOx, CO2,

		particulates and (indirectly) ozone through the burning of petrol and diesel fuel. • Fuel storage tanks and transfer facilities can lead to the release of VOCs. ▪ Aircraft and airfield maintenance (painting, metal cleaning, de-icing etc.), and emergency and fire training use complex chemicals which can release VOCs. ▪ Construction of airport-related projects can lead to dust, emissions from asphalt laying etc. (Kenney, 2006). ▪ Quarterly stack emission assessment of the generators and point source emissions within the airport
Noise impacts	The main social consequence of hearing impairment is the inability to understand speech in normal conditions, which is considered a severe social handicap (WHO, 2001). Noise also affects the breeding and feeding habits of birds and also encourages unnecessary expenditure of energy as the move towards or away from the sound source, thereby exposing them to predators.	▪ Putting strict regulatory constraints on the amount of noise that can be generated by aircrafts and on the flight paths to be followed. ▪ Refusing planning permission where noise levels exceed 66dB (A) Leq at daytime and 57 dB (A) Leq at night time. ▪ Making technical adjustments to thrusts, angle of flight decent/ take-off, speed of aircraft accent etc. (POSTNOTE, 2003). ▪ Incentives and penalty systems to encourage airlines to use quiet aircraft. ▪ Requirements for arriving aircraft to maintain minimum heights above the airport before starting on their descent path. ▪ Use of preferred flight routings and runways where possible, that impose less noise on local properties. ▪ Noise quotas on night flights, with the noisiest aircraft not allowed to land or take off at night. ▪ Ban on aircraft engine testing or training flights at certain times (e.g. nights, weekends) unless in an emergency. ▪ Encouragement of minimum use of auxiliary power units, and of reverse thrust by aircraft on landing consistent with safety constraints. ▪ Design of the airport so that buildings and/or bunds (long low hills made of soil) shield nearby properties from ground noise. ▪ Sound insulation grants: for high specification double-glazing in the noisiest areas, and secondary glazing across a wider area. ▪ Property relocation schemes which cover most of the costs of moving house for those people living in the areas of highest noise. ▪ Public complaint handling services. ▪ Noise monitoring systems that monitor the noise level of each aircraft
Impacts of solid waste from sources as discussed in 7.4.7	▪ Potential impact on public health and safety	A comprehensive monitoring and evaluation system should be implemented, for the airport operator to properly assess progress towards meeting the targets in the Waste Management strategy. Although the procedure may vary according to the level of details, the principles should remain consistent and compliant to other requirements applicable to the organization. Identifying common elements used in other areas of responsibility of the airport operator could help identifying the approach taken by the organization to monitor and evaluate operations. That should also be used, when appropriate to waste management. The foundation of a monitoring system could include but are not be limited to: ▪ Circular supplies: fully recyclable materials that are used, for example in drinking cartons and coffee cups, are made from recycled material and can consequently be recycled again. This way input is

		from secondary resources and output is again an input for another product, replacing the single-lifetime input and thus reducing primary material use. ▪ Dematerialization: reduce material use with new technologies, such as digital airline tickets that replace paper tickets. ▪ The use of consistent waste signage (colors, icons and terms) helps the user to quickly identify and sort their recycling, which in turn, can assist with reducing contamination and increasing recycling rates. The color and general signage should be easily identifiable by airport passengers, other stakeholders and staff. ▪ Resource recovery: food waste and other organic waste can be digested to biogas and the residue of the digestion can be used as fertilizer. ▪ Knowledge of the intrinsic properties of the material, including the physical, chemical, and leaching properties by airport Management. ▪ Solid waste to be handled managed and disposed according to the Environmental Management and Coordination (Waste Management) Regulations 2006. ▪ Proponent to contract a NEMA licensed waste collection company to be collecting all solid waste to and from the airport; ▪ Only NEMA licensed vehicles to be used to collect and transport waste from the facility. ▪ Waste to be sorted at source; ▪ There should be no scattering of waste during transportation to the disposal site;
Biodiversity loss/bird strike	▪ Extinction of some species	▪ Relocation of existing dumpsite far away from the airport. ▪ Minimising intrusion. ▪ Translocation, restoration and creation of habitats. ▪ Rescue of important species. ▪ Pond replacement and refurbishment. ▪ Hedge restoration and improvement. ▪ Mitigating the loss of mature trees as a result of height restrictions by substituting. ▪ Small trees and shrubs and hedge thickening.
Water pollution	▪ During operation, rainwater that falls on parking lots, building roofs, aprons and taxiways, and other areas with hard surfaces will run off either into drains or (if good drains are not in place) into nearby water bodies or ground water. Typically the development will not be allowed to go ahead unless it puts measures in place to treat the chemicals and other pollutants from this surface water or rainwater run-off. However during hard rains the drains and their controls can be overwhelmed, and pollution of waterbodies can occur.	▪ Minimize spillage ▪ Improve environmental management procedures ▪ Discharge and treat foul drainage and sewage ▪ Pass run off through oil interceptors ▪ Expand infiltration systems ▪ Provide attenuation to impermeable areas ▪ Ensure the maintenance of equivalent Greenfield runoff rates ▪ Carry out Flood Risk Assessment

	▪ Airport can create a range of potential pollutants including maintenance and painting chemicals, testing of fire equipment, and fuel leakage and spillage from refueling and storage. These can either be leached into ground water or can contaminate storm water run-off which can pollute nearby water sources. ▪ Wastewater from an airport's operations typically goes to a sewage treatment plant. That can be a problem if the plant is already at or near capacity. ▪ Fuel dumping from flying aircraft can cause water bodies to be polluted by kerosene.	
Operational inefficiency leading to GHG emissions	▪ Altered natural concentrations of gases leading or contributing to unnatural warming of the earth. ▪ Dilution of Climate change mitigation and adaptation effort	▪ Computerized continuous emission monitors (CEMs) for CO, O2, SOx, NOx, and HCl from aircrafts. ▪ Use of Electrofuels such as power-to-liquid that are a potential source of zero or lower carbon alternative fuels.
Occupational hazards or injuries to works, visitors and general public	▪ Complete incapacitation of the affected employee or persons ▪ loss of life ▪ Increase in Costs of litigation and compensation ▪ Disruption of the airport operational activities	▪ Aviation operators and worker training in hazardous-material management and annual refresher courses. ▪ All workers should be provided with protective gear. These include working safety boots, overalls, helmets, goggles, earmuffs, respirators/masks and gloves. ▪ A first aid kit should be provided within the site. This should be fully equipped at all times and should be managed by qualified person. ▪ The proponent should have workmen's compensation cover (WIBA). It should comply with workmen's compensation ▪ Adequate sanitary facilities should be provided and standard cleanliness maintained. ▪ Safe operation procedures/ clear instruction provided to the workers and general public to ensure that safety is maintained. ▪ Mounting of safety signage's within and outside the airport.
Storm water generation and flooding at the site from precipitation	▪ Possible transportation of bottom ash, fly ash, scrubber water, and various miscellaneous waste streams and other residues such as lime and activated carbon, themselves with condensed or absorbed contaminants to unintended natural environment. ▪ Disruption of the airport operational activities leading to economic losses.	▪ Appropriate site landscaping to be employed ▪ Vegetation cover of all open area to reduce surface run off ▪ Revegetation of all open areas to reduce surface run off. ▪ Have a proper drainage to channel the surface run off.

Increased vehicular traffic	▪ Possible traffic congestion of local road causing occasional experience of delays; ▪ Pedestrians and cyclists using local roads will have to exercise more care with increase of vehicular traffic on the said roads; and ▪ There will be an increase of exhaust emission from vehicles delivering the travellers to the airport and those on transit which will pollute local atmospheric air.	▪ All users of said roads to always observe traffic rules this will give pedestrians and cyclist their space and safety while using the road; ▪ Speed limits to be strictly observed ▪ Motorist to be sensitised to use unleaded fuel as opposed to leaded fuel
Conflict with the Community	▪ Stalled operation at the airport.	▪ Continuous public participation and engagement for improving the environmental impact assessment and increasing total welfare of different interest groups in Muvuti-Kiima-Kimwe ward and beyond ▪ Pursuing economic achievements with regard to social, public health and environmental issues that are of concern to the locals ▪ Independent Audits and strict supervision by NEMA, County Governments and other stakeholders
Landscape and visual impacts	▪ Eye pollution and reduced aesthetics. The impacts often occur on a cumulative, drip-feed basis: deaths of the landscape by a thousand cuts	▪ Light pollution can be reduced by keeping lighting (e.g. of parking lots) to the minimum levels needed for safety, and through the careful choice of light fixtures such as the use of flat-glass lanterns in car parks. Some buildings, particularly airport terminals, can be very attractive, and many people prefer the aesthetics of a well-designed and well-managed development to those of derelict, scrubby areas. In such cases, the development is a visual improvement. Other measures may include landscape engineering, tree planting and ground modelling.
AIRPORT DECOMMISSIONING PHASE		
Noise	▪ Reduced concentration among workers and people in the neighbourhood ▪ Shouting during conversation among workers on site ▪ Noise induced hearing loss among workers who are continuously exposed to high noise levels ▪ Reduction in productivity and efficiency of the workers at the workplace	▪ Demolition works and other decommissioning activities to be limited to day time. ▪ Appropriate ear protective devices to be provided to workers working in noisy environment. ▪ Engineering controls on plant and equipment used in decommissioning to reduce noise. ▪ Noise control and hearing conservation programme to be developed. ▪ Audiometric tests to be carried out to workers exposed to noise by designated medical practitioner. ▪ Post notices and signs in noisy areas. ▪ Education and training for workers on importance and proper use of PPE. ▪ Appropriate acoustic barriers around areas generating noise to be provided. ▪ Noise attenuators such as trees on site to be preserved.
Dust	▪ Skin irritation, chocking including coughing	▪ Appropriate personal protective equipment to be provided to all workers. ▪ The site to be secured with dust screens. ▪ Water sprinkling on dusty grounds to be done.
Occupational injuries	▪ Complete incapacitation of the affected employee ▪ loss of life ▪ Increase in Costs of litigation and compensation	▪ Appropriate personal protective equipment such as safety belts for workers working at height to be provided to mitigate against noise, dust and other exposures. ▪ Appropriate training of workers of ways of working safely. ▪ Appropriate supervision at workplace. ▪ Rest times to be strictly observed to reduce stress.

7.5 Impact Matrix

The matrix was designed for the assessment of impacts associated with almost any type of project. Its method of a checklist that incorporates qualitative information on cause-and-effect relationships but it is also useful for communicating results. Matrix method incorporates a list of impacting activities and their likely environmental impacts, presented in a matrix format. Combining these lists as horizontal and vertical axes in the matrix allows the identification of cause effect relationships, if any, between specific activities and impacts. The impact matrix for the actions identified in Table 6.8 along with various environmental parameters. A rating scale has been devised to give severity of impacts in the following manner.

A. **Beneficial (positive) impact – Long term**
B. **Low beneficial impact – Short term**
C. **Strong adverse (negative) impact – Long term**
D. **Low adverse impact (localized in nature) – Short term**
E. **E. No impacts on environment**

Table 0-8- Summary of risk analysis of project's impacts

SN.	Activity	Positive Impact		Negative Impact		No impact
		Short term	Long term	Short term	Long term	
Pre-Project Activity						
1	Displacement and resettlement of local people					√
2	Employment for local people		√			
3	Change in land use				√	
4	Loss of trees/vegetation					√
5	Shifting of equipment		√			
Civil works and installation Phase						
1	Pressure on infrastructure and			√		
2	Transportation system dust generation			√		
3	Noise Pollution			√		
4	Traffic					√
5	Impact on the land/soil/environment			√		
6	Impact on groundwater					√
7	Stacking and disposal of construction/installation material			√		
8	Impact on water quality			√		
9	Health and safety conditions of people			√		
10	Social impact	√				
11	Economic impact	√				
Operation Phase						
1	Increase in air pollution and noise levels					√
2	Water harvesting and recharge		√			
3	Disposal of ash waste					√
4	Quality of life		√			
5	Handling operations for hazardous waste transfer				√	
6	Community/workplace transmission from Covid 19 Pandemic			√		

7.6 Summary of Environment Impacts and Mitigation Measures

Activity	Environmental Attributes	Causes	Impact Characteristics			
			Nature	Duration	Reversibility	Significance & Mitigation measures
Transportation of installation of aviation equipment and materials	Air quality	Transportation of construction material in trucks & exhaust emission from vehicles	Direct Negative	Short term	Reversible	Medium, Regular emission checks will be performed.
	Noise levels Noise generation	Noise generation from vehicles	Direct Negative	Short term	Reversible	Insignificant, if regular vehicle maintenance is done.
	Risk	Risk of accidents during transit	Direct Negative	Short term	Irreversible	Insignificant, if safety measures are taken to prevent accidents
Civil works	Air quality (SPM & RPM)	Operation of installation machinery, welding & others	Direct Negative	Short term	Reversible	Insignificant, if regular water sprinkling can be done
	Noise levels Noise generation	Operation of installation Construction machinery, welding & others	Direct Negative	Short term	Reversible	Insignificant, if properly maintained can be used and PPEs to be provided to workers
	Land use	Setting up of project	Direct Negative	Short term	Reversible	Excavated material be stored for future use
	Ecology	Loss of vegetation	Direct Negative	Short term	Reversible	Insignificant, No cutting of trees and green belt Development is envisaged
Handling & Transportation materials	Air	Transportation of raw material to the Site. (Dust Emission)	Direct Negative	Short term	Irreversible	The covered dumper and trained transporter /driver will be engaged for the transportation of materials to the proposed airport.
	Air	The raw material is emptied to the Raw material storage yard. While unloading there is dust emission released into the atmosphere (Dust Emission).	Direct Negative	Long term	Reversible	The unloading will be done in covered area. More over there will be water sprinkling system. So that minimum dust emission will occur. The Impact will be insignificant. Besides, the management will also ensure proper usage of the personal protective equipment by the workers to avoid any exposure to dust.
	Land		Direct Negative	Long term	Reversible	

	Air quality	Dust emission from Stack, Fugitive emission	Direct Negative	Long term	Reversible	Stack will be provided with appropriate APC system so, the impact will be insignificant. If no APC system is installed there will be high impact.
Waste water discharge	water	Only Domestic waste water	Direct Negative	Long term	Reversible	There will be discharge of domestic waste water which will be taken into septic tank and soak pit so this will not cause any impact on the water environment of the area.
Green Belt	Air	Dispersion of Air emission from stationary sources along with Fugitive emission	Positive	Long term	Reversible	Very High positive Impact due to development of a proper green belt along the periphery of the premises
Rain Water Harvesting from the office structures within premise	Water	Minimization of fresh water	positive	Long term	Reversible	Because of the RWH system, requirement if fresh water can be minimized
Employment	Socio Economic	Direct & Indirect Employment	Direct positive	Long term	Reversible	Positive Impact due to hiring of manpower from the Muvuti-Kiima-Kimwe ward area. Substantial benefits in the form of contracts to local agencies for different services. Employment generation in transport sector as several local conveyance trips and trucks loadings will be handled every day.

Table 0-1: Overall matrix

Environmental Impact	No effect	Positive effect	Negative effect	Beneficial	Adverse	Problematic	Short term	Long term	Reversible	Irreversible
Environmental Area	√									
Soil characteristics									√	
Natural drainage	√									
Conformity to regional plans	√									
Air quality			√				√		√	
Ground water	√									
Surface water									√	
Noise			√				√		√	
Wild life	√									
Endangered species	√									
Natural vegetation		√						√		
Exotic vegetation		√						√		
Demography	√									
Recreation	√									
Health and safety		√		√				√		
Regional economy		√						√		
National economy		√						√		
Public facility				√						
Public services		√						√		
Transportation			√				√		√	

8 SECTION SEVEN: PROJECT ALTERNATIVES AND PROPOSED ACTION

8.1 Introduction

The IFC Performance Standards on Social and Environmental Sustainability specify the requirements for the assessment of feasible alternative configurations for a project: "For greenfield developments or large expansions with specifically identified physical elements, aspects, and facilities that are likely to generate potential significant environmental or social impacts, the client will conduct a comprehensive Environmental and Social Impact Assessment, including an examination of alternatives, where appropriate." "***For greenfield developments, the ESIA includes an examination of technically and financially feasible alternatives to the source of such impacts, and documentation of the rationale for selecting the particular course of action proposed. The purpose of the alternatives analysis is to improve decisions on project design, construction, and operation based on feasible alternatives to the proposed project. This analysis may facilitate the consideration of environmental and social criteria at the early stages of development and decision-making based on the differences between real choices. The alternatives analysis should be conducted as early as possible in the process and examine feasible alternatives; alternative project locations, designs, or operational processes; or alternative ways of dealing with environmental and social impacts***" This section explores the main alternatives considered by ESIA Experts and previously, and gives an indication of the main reasons for the selection of the current location. During the analysis of alternatives, the following topics were considered:

- Alternative modes of transportation;
- Possible alternative locations for a new airport; and
- No action alternative.

Furthermore, in accordance with **EMCA 2015**, possible alternatives should be identified and environmental attributes compared. Alternatives should cover both project location and process technologies. It must be noted that the impacts associated with the location and technical alternatives associated with the proposed Project will not be quantified as the GOM has, as defined in the following sections, identified a location for the Proposed Project. Furthermore, County Government has contracted airport engineers who has designed the Airport to international standards.

Selection of suitable site for a project is as important as selecting a technology. Factor which are taken into account for selection of site are proximity to raw materials or market and availability of manpower, water, infrastructure and ease of transportation. However a new dimension has also raised concerns in selection of site and that is environment. Factors taken into consideration while selecting the site.

- Availability of land.
- Proximity to the nearest settlement.
- Connectivity.
- Overall impact on environment.
- Availability of water and power.

- Other infrastructure.

8.2 Alternative locations

The site for the Airport was selected as the best location by a committee of technical representatives from the various ministries of the GoK, primarily based on the comparatively flat topography, suitable land area, relatively low density of inhabitants, distance from sensitive receptors and compliance with aviation requirements (including the requirement that all aircraft must remain in Kenyan airspace). After many considerations of numerous factors, this option was found to be the most suitable for the proposed development, in this particular case, the proponent determined this particular option since it would be the most appropriate for the construction of the airport within Machakos County. The option was best as compared to other options like co-location, open dumping or burning. Advantages of this option:

- Minimal disputes: Since the site would be solely operated by the proponent; there would be few or no disputes as in case with other options like co-location.

Disadvantages

- Cost and Time frame: The process is slightly longer and costly since there are many phases involved from site acquisition, construction to operations.

8.3 The Need for Machakos Airport

The development of the Proposed Project was influenced by the decision that there is existing airport within the Eastern Counties able to support the air travel needs in the near future due to rapid development within the country due to devolution. The neighbouring Airports being JKIA and Wilson does not have space for the construction of additional runways or facilities. Therefore, proposals for a new airport were put forward to replace accommodate the additional passenger traffic and emergency landing as well. The need for the Proposed Project is also influenced by Machakos County stable political systems, stable economic development, increased tourism volumes, high passenger growth rates driven by international traffic, not affected by seasonal demand and that Machakos County has available land for development, taking cognizance of international standards and best practice. The Proposed Project will target additional regions in view of commencing direct long-haul flights to other destinations. This will result in the Machakos County becoming a major hub for transit passengers, freight and cargo. The development of airport will also better position the country as a leisure and business destination as well as an information and communication technology and mining/manufacturing hub in central Eastern Africa considering its closeness to Konza technological City.

8.4 Zero option-No Action Alternative

Based on the increasing trend in air traffic passenger numbers arriving or transiting through JKIA and Wilson, the airports are currently operating beyond their limited capacity with insufficient space for expansion and therefore unable to cater for the increasing future demand. Without the Proposed Project, the people of Machakos would still need to be served by an airport. As this would limit Kenya's air-traffic potential, it was considered unfeasible to take no action to further increase airport capacity to accommodate this rising trend. Furthermore, with an increase of air traffic into the existing airports in Nairobi Counties,

the potential of ICAO and IATA safety risks will increase resulting in anticipated incidents and accidents with the current airport.

8.5 Alternative designs

8.5.1 Introduction

Details on alternative designs of the airport were not available. However, it is understood that the original design accounted for a larger airport area with more runways. This original design was discounted based on outcome of CPP involving KCAA.

9 SECTION EIGHT: OCCUPATIONAL SAFETY AND HEALTH

9.1 Introduction

Occupational Safety and Health (OSH) is of paramount importance in any industrial project. The occupational environment directly affects employees, neighbourhood, visitors, contractors, sub-contractors and the general public. County Government of Machakos is therefore responsible for the following: -

- Implementation of appropriate national and internal recognized OSH standards, codes and guidelines;
- Inclusion of meaningful participation of employees in implementation and maintenance of procedures and processes;
- Implementation of a programme to change employee culture and altitudes regarding health and safety;
- Planning, implementing and monitoring programs and systems required to ensure OHS at the workplace;
- Provide and maintain workplaces, plant, equipment, tools and machinery and organize work so as to eliminate or control hazardous ambient work factors;
- Provide appropriate occupational health and safety training for all employees;
- Provide adequate personal protective gear/ clothing to all employees at no cost to employees;
- Record and report occupational injuries and illness;
- Ensure contract specifications include demands for service providers, contractors, and sub-contractors to have or establish systems enabling them to meet the OHS requirements of the employer.

9.2 Occupational Health and Safety Management System

An Occupational Health and Safety Management System (OHSMS) must be established, managed and operated for the project. The system must contain the following features:

i. Occupational health and safety policy;
ii. Organizational framework of the OHSMS;
    - Staffing of OHSMS
    - Competence requirements;
    - Operating procedures;
    - Training programs;
    - System documentation;
    - Communication
iii. OHSMS objective (documentation)
iv. Hazard prevention
    - Risk assessment;
    - Prevention and control measures (active and negative);
- Management of changes;
- Emergency preparedness and response;

- Procurement (tools, equipment, plant, services, contractors).

v. Performance monitoring and measurements
   - Hazard prevention measures;
   - Ambient working environment;
   - Work related injuries, ill health, disease and injuries;

vi. Evaluation
   - Feedback;
   - Corrective measures;
   - Action plan.

9.3 Physical factors in the work place

Five physical factors in the work place are of importance. These are; -

- Installations, equipment, tools and substance;
- Access;
- Signage;
- First-aid;
- Personal protective equipment; and

9.3.1 Installations, equipment, tools and substances

The following must be ensured:

a) Installations, equipment, tools and substances selected to be suitable for the intended airport operation should be selected to minimize dangers to safety and health when appropriately used;
b) Equipment to be provided with adequate noise and vibration dumpers;
c) Ergonomic risks and hazards shall be minimized by selecting appropriate tools and equipment for use.

9.3.2 Access

a) Equipment and installations requiring recurrent servicing and cleaning should have permanent means of access;
b) Hand, knee and foot railings must be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays ramps;
c) Measures to prevent access to unauthorized areas must be in place.

9.3.3 Signage

i) Hazardous and risky areas, installations materials, safety measures, emergency exits shall be properly marked;
ii) Signage shall be according to national and international standards, well known to, and easily understood by workers, visitors and general public.

9.3.4 First-Aid

- Employer to ensure qualified first aid is provided to employees at all times;

- Eye-wash stations and/or emergency showers shall be provided close to the site where the recommended first-aid response is immediate flushing with water;
- First Aid stations to be equipped with gloves, gowns and masks for protection against direct contact with blood and other body fluids;
- Written emergency procedure to be in place.

9.3.5 Personal protective equipment

- County Government of Machakos to identify and provide appropriate Personal Protective Equipment (PPE) that will offer adequate protection to the worker, co-workers, and occasional visitors without incurring unnecessary inconveniences;
- County Government of Machakos to actively enforce use of PPE and ensure PPE is cleaned when dirty, properly maintained and replaced when damaged or worn out;
- Proper use of PPE to be part of recurrent training programmes for employees;

10 SECTION NINE: ENVIRONMENTAL AND SOCIAL MANAGEMENT MONITORING PLAN (ESMMP)

10.1 Introduction

This section presents a basic guideline in form of Environmental and Social Management Plan (ESMP) that includes the set of institutional and mitigation measures and monitoring targets to: a) prevent, mitigate, repair and/or compensate adverse environmental and social impacts caused by the construction and operation of the Machakos airport. The implementation of the ESMP is fundamental to assure the protection of the environment, including both the aspects that have to do with the integrity of the natural environment and those that assure a suitable quality of life for the potentially affected persons. The ESMP includes the actions necessary to put these measures into practice. The activities are scheduled for the work's lifespan, reason why the programs required for the good management of the environmental and social system will be incorporated, both in the installation stage and in operation and maintenance. The ESMP also includes a summary of criteria and environmental measures that must be included in the design of the works, whose function is to prevent and reduce potential adverse impacts on natural and anthropic ecosystems. On the other hand, it is possible to indicate that the plan and measures offered for the operation and maintenance phase of these works, will be implemented within the framework of the Environmental and Social Management Plan developed. Adequate environmental and social management contributes to the works performance and the reduction of carbon footprints, minimizing unexpected events, attenuating future conflicts and concurring to the articulation of the work and the environment and social, within the framework of a comprehensive use (integrated management). The ESMP contains information about i) the institutional framework and general guidelines for environmental and social management of the work; ii) the measures proposed to prevent, mitigate, remedy and compensate adverse impacts for complementary works; iii) monitoring plans; iv) programming and costs. In addition, it has presented a series of basic recommendations. The ESMP is generally prepared to ensure that the components of proposed airport is operated in accordance with the approved environmental design. If the environmental management strategies discussed in the ESMP is fully implemented, the adverse impact of the project would be reduced, and there will be an overall improvement in physical, chemical, biological and socio-economic environment of the Machakos County.

10.2 Environmental Inspection and monitoring

10.2.1 Inspections

The ESIA Experts have developed Construction Environmental and Social Management Plan (CESMP) Guidelines for all Contractors involved in various construction projects proposed within the Airport. The CESMP Guidance provides the over-arching framework within which environmental mitigation measures will be implemented through-out the project's construction. Each Contractor's CESMP is site specific and project specific. The purpose is to outline practical and achievable environmental management procedures for anticipated impacts from the proposed project to ensure that contractors (and sub-contractors) work methods and processes have minimal impact on the environment and are compliant with the national regulations. The Monitoring, Audit and Reporting responsibilities are outlined in the

CESMP. The proposed project will comply with the requirements of KCAA and KAA and the Contractor(s) shall develop a CESMP. The monitoring responsibilities will be guided by the Environmental Division at KAA, represented at the Machakos County Environmental Officer, will oversee the implementation of the GFT project. KAA will initiate the process of procuring the Supervision Consultant Team that will include a qualified Environmental Expert with experience in aviation environment as well as registered and licensed to practice under NEMA. The Supervising Environmentalist will support the monitoring program. The Contractor(s) Environmental Officer will be responsible for the day to day implementation of the Construction ESMP (CESMP). The Environmental Monitoring Plan (EMoP) covers the compliance with the prescribed mitigation and enhancement measures provided for the ESMP; the regular monitoring of environmental parameters; and the checking of the effectiveness of the ESMP and the overall performance of the project from the environmental point of view and the corrective measures. The EMoP shall have the following objectives: (i) Ensure that all emissions and effluents as a result of the aviation operation are all in accordance with the relevant rules and regulations. (ii) Validate the changes in the various environmental media (impact monitoring) as identified in the impact assessment; and (iii) Provide early warning information of unacceptable environmental conditions. The Environmental Monitoring Program shall include: (i) Solid (Non-Hazardous) Waste Monitoring; (ii) Hazardous Waste Monitoring; (iii) Water Consumption Monitoring; (iv) Wastewater Monitoring; (v) Air Quality Monitoring (vi) Noise Level Monitoring; (vii) Occupational Health and Safety Monitoring.

10.2.2 Source of inspection requirements

Inspections are conducted to verify that a project is being constructed in compliance with applicable regulatory requirements and contract/subcontract specifications. Sources of environmental inspection requirements include project permits and other regulatory agency approvals, environmental regulations and other project plans.

All sources of environmental compliance requirements must be reviewed to identify inspection requirements that will be included in the EIA license. Examples of project activities that may require inspection include, but are not limited to:

- Transportation, Storage and handling of hazardous/waste
- Stack emissions standards.
- Installation and maintenance of flood control structures within site.
- Risk mitigation implementation.

10.2.3 Documentation and record keeping

Environmental inspections will be documented and records retained in project files. Examples of documentation are telephone conversation logs, written correspondence, inspection logs and inspection reports. The inspector must develop an appropriate field inspection checklists, forms or other documentation. Checklists and forms generally will contain the following:

- Date and time
- Location

- Activity being inspected
- Inspector's observations and relevant data
- Need, if any, for corrective action
- Name, title and signature of inspector

Monitoring requirements are often identified in project permits or approvals, or as a component of environmental mitigation and resource protection plans that a project is required to prepare and agencies must approve.

10.2.4 Sources of monitoring requirements and parameters

Monitoring requirements are typically specified in environmental analysis documents and project permits and approvals. Agency required resource protection plans or mitigation plans could also be a source of monitoring requirements. Monitoring of resources is often required where specific development plans or resource information was not available during the permitting process, and therefore, impacts to a resource could not be determined. All sources of environmental compliance requirements must be reviewed to identify any monitoring requirements and incorporated into the EIA license. Examples of parameters that will require monitoring activity include, but are not limited to:

- Air quality or air emissions
- Ash handling and disposal
- Biological resources
- Site flooding control structures

10.2.5 Management tools

Data management tools will be developed by County Government of Machakos to address project-specific monitoring and documentation requirements. The project's monitoring requirements, such management tools will include matrices or computerized databases, schedules and maps annotated with monitoring requirements and information.

Matrices and databases-Development of a matrix that identifies all agency-specified monitoring requirements will be helpful in planning, executing, documenting and reporting monitoring activities. Identification of monitoring requirements by resource, the nature of each requirement, special technical expertise required, aviation operations activity, monitoring location, and type of documentation will provide adequate record of compliance and any agency reporting requirements can be incorporated.

10.2.6 Regulatory reporting requirements

County Government of Machakos will undertake routine regulatory reporting to KCAA, KAA, NEMA, Public Health on the progress and monitoring parameters within specified timeframes and so that appropriate documentation and information can be collected to satisfy requirements.

10.3 Significance of an EMMP

EMMP for the proposed airport is to provide a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, the EMMP assigns responsibilities of actions of various actors and provides a timeframe within which mitigation measures and monitoring can

be done. The EMMP is a vital output of an Environmental Impact Assessment as it provides a checklist for project monitoring and evaluation for sound environmental planning at entire life of the project.

There will be a need to entrench within the working operations of the proposed project a sound EMMP that will ensure no significant environmental pollution occurs as a result of the proposed activity. To achieve this, the following will need to be done: -

- County Government of Machakos to develop and document Environmental Management Policies that will guide aviation operation activities. The policies should address environmental conservation measures to be put in place, occupational and safety matters of all users;
- Availing of necessary finance for implementation of EMMP; and
- County Government of Machakos and its contractors to ensure that they carry out their work within Environmental and Occupational, Health and Safety requirements.

10.4 Monitoring Plans

Table 10-1: Summary of Environmental and Social Management Monitoring Plan.

PRE-CONSTRUCTION PLANNING PHASE						
Aspect		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**	**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Aspect**		**# Commitment / Actions Required / Key Controls**			
1	Permit Requirements	Ensure compliance with legal and other permitting requirements.	Ensure that all relevant legal requirements have been met and any permits required have been obtained.	Relevant permits obtained.	CGM/Contractors	Prior to construction
2	Finalisation of EMP	Update EMP with EIA conditions and other mitigation measures from monitoring	Incorporate additional mitigation measures specified by the regulatory authority into the EMP	EMP	CGM/Contractors	Prior to construction, or as conditions determined.
3	Notification to Regulatory Authority (KCAA)	Ensure that KCAA is notified of commencement Date.	Notify KCAA prior to commencement of construction.	Proof of communication.	CGM/Contractors	14-days in advance of commencement of construction or as required by KCAA.
		Keep KCAA informed of any aspects of non-compliance with EMP	Notify KCAA with reasons if any provisions of the EMP cannot be implemented, and provide alternative.	KCAA notification	CGM/Contractors	Prior to construction
		Provide Site Layout Plan to KCAA	Submit the detailed Site Layout Plan to the KCAA prior to construction if required.	Submission of layout plan to KCAA	CGM/Contractors	Prior to construction

4	Site Layout Plan	Ensure detailed site layout minimises environmental and social risks and complies with EMP	Prepare a detailed Site Layout Plan that demarcates the following accurately: ▪ Airport infrastructure locations ▪ Borrow pits, spoil heaps, cut and fill areas ▪ No Go areas, including sensitive features such as drainage lines / water courses, and vegetation patches, storm water drainage measures ▪ Waste disposal and storage areas ▪ Offices, works areas and ablutions ▪ Cement/concrete batching ▪ Storage of materials and equipment ▪ Chemical and fuel stores ▪ Vehicle maintenance and storage	Final Site Layout Plan	CGM/Contractors	Prior to construction
5	Subsidiary plans	Develop Subsidiary Plans to minimise environmental and social risks	The following subsidiary plans will be required prior to construction: ▪ Health and Safety Plan ▪ Waste Management Plan ▪ Traffic Management Plan ▪ Community Engagement Plan ▪ Resettlement Action Plan ▪ Community Development Plan ▪ Procurement Policy and Plan ▪ Recruitment and Employment Plan ▪ Grievance Procedure ▪ Spill Prevention Plan ▪ Incident & Accidents Plan and Register ▪ Emergency Response Plan ▪ Rehabilitation Plan ▪ Alien control plan ▪ Code of Conduct ▪ These are referred to below, where relevant	Subsidiary plans in place	CGM/Contractors / Contractor	Prior to construction
5a	Health and Safety	Ensure the health and safety of site personnel and local population during construction.	▪ A Health and Safety Plan must be developed prior to the commencement of construction to identify and avoid work related accidents. This shall include: ▪ Designation of safety zones from residences, roads, rights of way, tree felling areas; ▪ Chemical and fuel handling and storage	Health and Safety Plan and Final Site Layout Plan	CGM/Contractors	Prior to construction

			procedures ▪ Awareness and training of workers on health and safety (e.g. malaria control, HIV/AIDS awareness)			
5b	Waste Management	Waste minimisation and appropriate disposal of waste	▪ A Waste Management Plan must be developed prior to construction which shall include: ▪ An inventory of waste and waste types to be generated by the project; ▪ A description of waste disposal methods for the different waste types; ▪ Measures for the storage and handling of waste, ▪ Measures to prevent attracting problem animals (rats) to waste sites e.g. fencing, secure lidded bins, etc. ▪ Measures to be taken to minimise and recycle waste.	Waste Management Plan	CGM/Contractors	Prior to construction
5c	Traffic Management Plan	Minimise safety hazards and nuisance to residents from haulage of abnormal trucks	▪ A Traffic Management Plan must be developed to guide the safe transportation of equipment and materials from the Port of Santo Antonio and borrow pits to the airport. ▪ The Traffic Management Plan must include : ▪ Description of any permits required and if so contact persons concerned, timing, and information to be submitted. ▪ A quantification of the numbers of truck and vehicle	Traffic Management Plan	CGM/Contractors	
5d	Community Engagement Plan	Ensure affected communities are consulted in transparent manner to minimise risk of raised expectations, avoid conflicts and identify community needs	1. The appointed Community Liaison Officer should be tasked with preparing a Community Engagement Plan which should include: ▪ Purpose and objectives of the CEP ▪ A stakeholder database and profile of communities affected by different project activities; ▪ A description of the key type and level of engagement ▪ A schedule of key points of community engagement during the construction	Community Engagement Plan	CGM/Contractors	Prior to construction

			project ▪ Outline of the grievance mechanism.			
5f	Community Development Plan	Enhance benefits of the project to local community members	1. Develop a Community Development Plan for the advancement of local development needs; specifically at the local community level. 2. Projects would be identified in collaboration with the local community members to improve their general living conditions and access to services. 3. Prioritise job allocation and project benefits to members of the affected community. 4. Ensure projects are aligned with CGM/Contractors's policies.	Community Development Plan approved by CGM/Contractors and community	CGM/Contractors/ Govt / community	Prior to and during operation.
5g	Procurement Policy and Plan	Ensure that procurement of local goods and services is maximised	1. Identify and set procurement targets for the procurement of goods and services from Machakos residents/suppliers, and incorporate these into the key performance indicators of the project team and specify them in Contractor contracts. 2. Where possible, CGM/Contractors will build the capacity of the local people in order that they can access more of the semi- skilled jobs and meet the employment and procurement needs associated with future CGM/Contractors development activities.	Procurement Policy and Plan	CGM/Contractors	Prior to construction
5h	Employment and Recruitment Plan	Ensure that local labour is prioritised	1. Develop an Employment and Recruitment Plan that describes the number of job positions that need to be filled and level of skills required, and which positions may be allocated to local community members. 2. All employment procedures and practices shall be undertaken in accordance with national legislation and aligned with CGM/Contractors's policies and the International Labour Organization (ILO) conventions as ratified by the Government of Machakos. 3. Establish a recruitment policy which prioritizes the employment of people from Muvuti-Kiima-Kimwe	Procurement policy Employment & Recruitment Plan Meeting minutes / advertisements Proof of notification Proof of training	CGM/Contractors	Prior to and during construction

			ward over outsiders by setting clear criteria. Wherever possible, residents of the local villages, particularly those displaced or directly affected by the project, will be prioritized for employment. With respect to unskilled labour, after preference has been given to people directly affected by the project, these opportunities will be evenly distributed between the affected villages. Employment targets shall aim to reflect an even distribution of demographic characteristics in the villages. 4. Include the Employment and Recruitment Plan as a condition of Contractor's contracts. 5. Establish a Recruitment Committee comprising representatives from each of the villages and CGM/Contractors, with the aim of identifying and employing locals for available employment opportunities. 6. The criteria (skills and experience) for available jobs will be documented and made available to the Recruitment Committee and through local and national media, where appropriate. 7. No employment will take place at the entrance to the site (to avoid people congregating at the work site). Only formal channels for employment will be used. 8. Ensure that the appointed project contractors and suppliers have access to Health, Safety, Environmental and Quality training as required by the project. 9 CGM/Contractors and its contractors (where relevant) will implement a grievance procedure that is easily accessible to local communities, through which complaints related to contractor or employee behaviour and activities can be lodged and responded to. CGM/Contractors or their contractor would be			

			required to respond to all such complaints.			
5i	Complaints & Grievance Mechanisms	Provide opportunity for community to raise concerns to allow timeous resolution of issues	Develop and implement a grievance mechanism for the duration of the construction phase to allow community members to lodge complaints and for these to be dealt with and closed out. The grievance mechanism shall include: •Assignment of responsibility to a community liaison officer to administer a grievance register whereby community members can raise issues which are documented in the register (and circulate the contract details) •Establish a protocol for attending to the issues raised and for these to be closed out within a certain time period. •Awareness raising among local communities regarding the grievance procedure, how it works and who to contact.	Grievance mechanism in place	CGM/Contractors	At start of construction period and throughout construction
5j	Spill Prevention Plan		Compile and implement a Spill Prevention Plan that includes: ▪ Periodic inspection of hazardous materials storage area to ensure containers are properly labelled, material data sheets for all chemicals are available containers are securely covered and are stored in secondary containment (berms) and each site is equipped with spill kits and protective equipment; ▪ Training and awareness for employees on transport, storage and handling of hazardous materials; and ▪ Spill reporting and investigation procedures.			
5k	Incidents & Accidents Plan	Recording and attending to incidents	Develop and implement an Incidents and Accidents Plan and Register for the duration of construction which shall include procedures for recording and dealing with incidents that arise. The incidents plan and register shall include:	Incidents & Accidents Register in Place	CGM/Contractors / Aurecon	At start of construction. Completed for every incident that occurs. All incidents to be closed out

			• Definition and categorisation of types of incidents that may arise, and • Responsibilities and time frames for reporting and communicating incidents, and for attending to any remedial actions and investigation Information to be recorded in the incident & accidents register shall include: • Time and date of occurrence • Nature, extent and cause of the accident • Name and contact details of persons notified of the incident • Actions taken to deal with the incident and whether sufficiently deal with, Additional steps required to prevent recurrence.			
5l	Emergency Response Plan	Mechanism to ensure early response to emergencies	Develop an Emergency Response Plan that documents a procedure for communicating and dealing with emergencies that could occur on site. The response plans should include: • Contact details of emergency response operators, local doctors, clinics and hospitals, and medivac Definition of procedures for different emergencies that could arise. • Communication procedure and designated responsibilities for different emergencies	Emergency Response Plan in Place	CGM/Contractors	At start of construction
5m	Rehabilitation Plan	Ensure proper site rehabilitation to avoid erosion and sedimentation	Develop a Rehabilitation Plan for implementation as soon as construction activities in specific areas are complete. The plan should include: • A map showing rehabilitation requirements for different areas of the site (including areas for landscaping for aesthetic purposes) • Describe the rehabilitation measures that will be required to control erosion and sedimentation around the site. • Describe what plants will be used in what localities with emphasis on indigenous plants • Describe potential sources of the plants, including the possible need for nursery	Rehabilitation Plan in place	CGM/Contractors/Maintenance organization	At start of construction

			development and how this would be achieved • Avoid use of exotic and invasive grasses along the runway			
5n	Alien Control Plan	Control the risk of alien infestation into cleared or disturbed areas	An Alien Plant Control Plan shall be developed to minimise the risk of spread of alien plants. Such plan shall be aligned with the Rehabilitation Plan. The plan shall include: ▪ Description and photographs of the types of alien plants that may occur on Muvuti Kiima-Kimwe ward ▪ Measures that must be taken to minimise the spread of aliens, including via the introduction of earthmoving equipment and materials to the ward. ▪ Responsibility and frequency for monitoring spread of alien plants ▪ Procedures for alien plant control, where found to occur.	Alien Plant Control Plan in place	CGM/Contractors/ Aurecon	By start of construction for implementation throughout construction and operation
5	Code of Conduct - Managing social ills and disruption	To limit, where possible, social ills brought about by the construction and operation of the renewable energy facility	Develop an induction programme, including a Code of Conduct, for all workers. All workers will agree to the Code of Conduct and be aware that contravention of the Code could lead to dismissal. A HIV Policy and Awareness Plan must be developed and implemented (see Health and Safety Plan).	Code of Conduct Signed Code of Conduct by employees HIV Policy & Awareness Plan in Health & Safety Plan	CGM/Contractors	Prior to construction
6	Water demand and supply study	To minimise risks of reduced water availability to local communities	Undertake a Water Demand and Supply Study to determine the volume of water required for the project including investigation of a sustainable supply that minimises risks of	Water Demand and Supply Study and selection of optimal supply source	CGM/Contractors	Prior to construction
7	Disruption of access to and/ or loss of agricultural land and other resources	Minimise disruption to agricultural activities and loss of agricultural land	1. All directly affected and neighbouring residents will be able to lodge grievances with CGM/Contractors using the Grievance Procedure. 2. CGM/Contractors to design the infrastructure layout in a manner that limits the footprint of the facility and all associated infrastructure.	Code of Conduct Grievance Procedure Final Site Layout Plan	CGM/Contractors	Prior to construction

			3. CGM/Contractors to plan construction activities to minimise disruption of farming practices e.g. notifying farmers in advance of site clearance to allow prior harvesting for instance			
8	Disruption of access across airport runway	Provision of alternative access route	1. Ensure that the community of Machakos is consulted regarding the following: • The change in access route prior to the change/closure of the routes; and • Pre-construction schedule of pre-construction activities (especially site clearance, establishment of the new access road and the erection of the fence around the airport). 2. Ensure an alternative access route to and from Machakos is identified or created prior to other airport construction activities to allow people continued access to the main road. 3. A Community Engagement Plan (CEP) similar will be established by CGM/Contractors to ensure on-going identification and management of stakeholder issues and concerns. A permanent community liaison officer to interact with the communities. Implementation of a grievance procedure (as outlined in 5h above), will allow the community of Machakos to lodge complaints and have these responded to. CGM/Contractors will respond in a serious manner to any such complaints and maintain the register.	Alternative access road created Community Engagement Plan Grievance register		
9	Waste and effluent	Prevent soil and/or groundwater contamination from waste and effluent.	Site planning must select suitable areas for waste skips located away from water courses and should be demarcated on the site layout plan. Provision should be made to secure waste within a fenced area that is protected from scavengers (human and fauna)	Waste Management Plan & Site Layout Plan	CGM/Contractors	Prior to construction

9	Soil compaction and erosion	Minimise soil compaction and erosion	1. Roads should be upgraded where possible and only essential roads should be built. 2. New roads should be designed for effective drainage and to minimise ponding of water, thereby minimising deviations and road widening.	Final Site Layout Plan	CGM/Contractors	Prior to construction
10	Ecological impacts at borrow pits	Minimise vegetation impacts related to location and use of borrow pits	1. Prioritise use of existing borrow pits in preference to opening new borrow pits. 2. Borrow pit locations should be selected to minimise destruction of forest habitat and other environmental impacts such as erosion risks and sedimentation of river courses. 3. An ecologist should conduct an ecological survey of the preferred borrow pits to confirm the absence of significant ecological risks. 4. Borrow pit rehabilitation shall include sloping and contouring of slopes, and covering with top soil to facilitate plant growth.	Borrow pit selection Additional study to assess ecology of borrow pit Rehabilitation Plan	CGM/Contractors	Prior to construction
11	Loss of Endemic / Threatened Plants	Minimise loss of species	1. Endemic and interesting plant species should be saved from destruction and utilised for education, research or landscaping purposes. 2. Rehabilitation efforts must incorporate a diversity of indigenous plant species and particular emphasis should be placed on establishment of endemic and threatened plant species within rehabilitated areas. 3. Key endemic or threatened plants cleared in the project area should be cultivated in nurseries on the airport premise and used for landscaping of gardens for government buildings, lodges and other developments. Such measures would contribute towards promoting national pride as well as conservation of these species.	Search and rescue Rehabilitation of cleared or disturbed areas Cultivation of species in nurseries and use in landscaping	CGM/Contractors	Prior to construction
12	Bird impacts	Understand bird movements to minimise collision risks to birds	1. Design planning must minimise habitat loss to reduce impacts to bird habitat. 2. Liaise with biodiversity institutions and other research institutions to undertake a bird monitoring study at the airport to understand bird flight patterns during the airport construction phase. Data from this study can help to inform mitigation needs for the upgraded operation phase.	Final Site Layout Plan Appropriate contractor for monitoring	CGM/Contractors	Prior to construction

13	Forest fauna impacts	Minimise the faunal impacts during forest clearing	Undertake a search and rescue of forest fauna prior to forest clearing. This should involve the use of pitfall trapping for reptiles and amphibians in particular.	Appropriate contractor for search and rescue	CGM/Contractors	Prior to construction

CONSTRUCTION PHASE						
Activity		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**	**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Activity**		**# Commitment / Actions Required / Key Controls**			
1.	Compliance with EMP and KCAA guidelines	Confirm commitment to adherence to EMP	Ensure that the EMP and conditions for environmental authorization (if any) are available at the site throughout construction and implemented by the contactor.	Copy of signed EMP and KCAA guidelines with subcontractor	CGM/Contractors / Contractor	Prior to construction
		Auditing of compliance with EMP and Environmental Authorisation	1. A 'close out' audit report must be undertaken by the Environmental Control Officer at the end of the construction and rehabilitation phase, and shall be submitted to the Regulatory Authority. 2. The close out report shall indicate the date of the audit, name of responsible person; outcome of audit in terms of compliance with the environmental authorization and conditions of the EMP, and any other outstanding requirements that are needed to mitigate residual impacts.	Audit report and proof of submission to the Regulatory Authority	CGM/Contractors	End of Construction
2.	Unmet expectations	Minimise risk of unmet expectations	In order effectively manage the communities' expectations, proactive steps need to be taken early in the project lifespan. This will prevent from the start the development of unrealistic expectations around the project. Key steps include: • Implement the Community Engagement Plan as in • Implementation of a Grievance Mechanism • Commitment to implementation of a Procurement Policy and Employment and Recruitment Plan to maximise benefits to local workers and suppliers. • Provision of project information to local communities through recognised community leaders. • Erection of notice boards in prominent places outlining the project phasing and requirements and employment opportunities and procedures. • Clear communication to stakeholders on CGM/Contractors's roles and responsibilities on the project, especially relating to the issue of resettlement as people may regard this issue as CGM/Contractors's responsibility which may carry reputational risks. • Clear communication will be maintained throughout the project regarding the limited number of opportunities associated with the project construction and operations. Especially with regards to the number of unskilled jobs available,	Subsidiary plans in place Information distributed. Notice boards Communication & awareness on CGM/Contractors role through Interior Ministry Communication records	CGM/Contractors	Prior and during construction,

			temporary jobs as well as wages.			
3	Local employment and procurement	Maximise employment for local labour	Ensure that the Recruitment and Employment Plan and Procurement Plan is implemented with maximum employment of local labour from affected communities and sourcing of local goods and services where possible.	Employment records	CGM/Contractors / Contractor	During construction
4	Health and Safety	Ensure the health and safety of subcontractors and site users	1. A Health and Safety Plan must be developed prior to the commencement of construction to identify and avoid work related accidents and minimise safety risks to workers and the local population. This plan must be adhered to by the appointed construction contractors. 2.Potentially hazardous areas must be clearly demarcated by means of appropriate signage and demarcation 3. Appropriate Personal Protective Equipment (PPE) must be worn by all construction personnel. This shall include the use of ear protection in areas where the 8-hour ambient noise levels exceed 75dBA. General ▪ CGM/Contractors and its contractors shall ensure provision of first aid medical assistance to all workers that become ill as a result of construction activities. ▪ The first aid kit must be equipped with adequate supplies of the necessary medications to deal with cases of malaria, cholera, diarrhoea/dysentery etc. amongst workers on the project. HIV/AIDS & other STIs ▪ CGM/Contractors and its contractors to develop and implement an HIV/AIDS policy and information document for all workers directly related to the project. The information document should address factual health issues as well as behaviour change issues around the transmission and infection of HIV/AIDS. ▪ CGM/Contractors to make condoms available to employees and all contractor workers. ▪ All initiatives shall address the symptoms as well as behaviour change issues around the transmission and infection of HIV/AIDS as well as other	Health and Safety Plan (signed by contractor) Signage Evidence of PPE use	CGM/Contractors	During construction

			sexually transmitted infections. The programs will need to be developed and carried out in partnership with health services (at various levels) and will not be the sole responsibility of CGM/Contractors. ▪ The construction workers (from outside the area) shall be allowed to return home on weekends (as defined by CGM/Contractors and in accordance with the National laws) to visit their families; the contractor shall make the necessary arrangement to facilitate these visits. ▪ All contractors and CGM/Contractors employees should adhere to the Code of Conduct, and in term of health and safety, which will include a zero tolerance of illegal activities by construction personnel including: unlicensed prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling and/ fighting. Any employee or contractor found in violation of the Code shall face disciplinary hearing which may result in a dismissal. Malaria ▪ The Contractors will make sure that construction activities of the project minimize the creation of mosquito breeding areas (e.g. standing water) and apply appropriate chemical control measures where required. ▪ Ensure that all employees have access to mosquito repellent/malaria medication and mosquito nets. Should employees get sick, diagnosis should be early, accurate and effective treatment shall be provided. ▪ CGM/Contractors will sensitize local communities of the importance of Environmental Health and Safety (EHS) exclusion or safety zones. **Cholera** CGM/Contractors should encourage all contractors and workers to follow the World Health Organisation (WHO) precautionary measures against the contraction of cholera, these include: •Always drink only water that has been boiled or disinfected with chlorine, iodine or other suitable products (other products that are safe to drink include hot beverages such as tea or coffee; wine, beer and packaged fruit juices); Occupational Health and Safety			

			CGM/Contractors will adhere to public Health legal requirements, CGM/Contractors HSE policies, CGM/Contractors HSE Management System as well as ILO ratified conventions to address issues relating to the labour and working conditions. The Health and Safety Plan developed by CGM/Contractors will be adhered to by everyone on site. In line with CGM/Contractors' commitment to avoiding health and safety hazards the facilities shall meet appropriate building standards. Specifically, camp occupational health and safety should consider the following: •how many people will be on site and how long they will be staying in the accommodation; •how the presence of the workers will affect the surrounding communities and existing infrastructure; •type of accommodation that will be used e.g., temporary or permanent; •need for sanitary and toilet facilities, canteen and cooking facilities to serve nutritious and safe food, medical facility, leisure, social and telecommunication facilities; •potentially hazardous areas to be clearly demarcated (i.e., unattended foundation excavations); • stipulating appropriate Personal Protective Equipment (PPE) to be worn by all personnel; •need to appoint a Health and Safety Manager on site to ensure that health and safety controls are observed on site and at the accommodation facilities; •stipulation of rules and regulations for the workers' accommodation; consultation and grievance mechanisms to be developed and implemented. •Buffer zones around project infrastructure and any other structures will be observed.			
5	Traffic hazards and accidents	Minimize traffic hazards and risks to residents and road users and maintain roads	1. CGM/Contractors will ensure a road Traffic Management Plan is developed and the following provisions are implemented by CGM/Contractors or its contractors: •Upgrade and maintain roads should they further deteriorate as a result of CGM/Contractors's vehicles. •Define and visibly display speed limits along all routes and enforce these amongst all project-related vehicles. •All project drivers will be sensitized about potential accident risks to local users	Traffic Management Plan Regular checks on road condition and rehabilitation	CGM/Contractors and Contractors	Prior and During Construction

			and will be periodically checked for alcohol consumption. •All vehicles will be regularly checked and maintained, including tyre wear. •Schedule transport of abnormal loads outside of peak traffic hours. •Traffic calming measures will be constructed on the road sections through villages or close to schools in order to reduce speeding. •Side-walks or pavements should be constructed on road sections which are too narrow to ensure safe passing of vehicles and pedestrians. •Vehicles are correctly and safely loaded to avoid accidents, and all loads are secured and covered where they pose a risk of windblown dust or material spillage. •CGM/Contractors will work with the local schools and community leaders to implement an education and awareness programme around health and safety including a focus on traffic risks and road safety for pedestrians. • CGM/Contractors will develop a policy and procedure for assessing all damages and losses (e.g., damage to property, injury or death of people or livestock resulting from negligent project vehicle) and to determine appropriate measures to address these losses. This will be implemented in consultation with the affected parties and other relevant stakeholders, including the authorities. • CGM/Contractors and the appointed contractors will develop an induction programme, including a Code of Conduct, for all workers (CGM/Contractors and contractors including their workers) directly related to the project. A copy of the Code of Conduct shall be presented to all workers and signed by each person. The Code of Conduct must address the following with regards to road traffic management: • Respect for local residents; • Compliance with the Traffic Management Plan and all road regulations; and • Description of disciplinary measures for infringement of the Code and company rules. • Workers found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, will face disciplinary procedures	Signage and speed control measures Incident reporting Vehicle service plan Monitoring records Measures implemented		

			that could result in dismissal. • CGM/Contractors will implement a grievance procedure that is easily accessible to stakeholders, through which complaints related to contractor or employee road use infringements (e.g. speeding, accidents, etc.) can be lodged and responded to. CGM/Contractors will respond to all such complaints. Key steps of the grievance mechanism include: o Circulation of contact details of 'grievance officer' or other key contact; o Awareness raising among local communities (including all directly affected and neighbouring farmers) regarding the grievance procedure and how it works; and establishment of a grievance register to be updated by CGM/Contractors, including all responses and response times.			
6	Air Quality	Minimise risks of air emissions on human health	Fugitive Dust Control Measures: ▪ Water all active construction areas at least twice daily; ▪ Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard; ▪ Cover stockpiles of dust-generating material; ▪ Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on unpaved access roads, parking areas, and staging areas at construction sites; ▪ Sweep daily (with water sweepers) all paved access roads, parking areas, and staging areas at construction sites; ▪ Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets; ▪ Hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more); ▪ Enclose, cover, water twice daily, or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.); ▪ Limit traffic speeds on unpaved roads to 40 km per hour; ▪ Install sandbags or other erosion-control measures to prevent silt runoff to public roadways; and ▪ Replant vegetation in disturbed areas as quickly as possible. Emissions from Construction Equipment Specific measures to reduce heavy equipment exhaust during the construction of the proposed project shall include, but not limited to: ▪ Limit idling of vehicles to five minutes or less; ▪ Install oxidation catalysts, particulate traps, or other suitable particulate control devices;	Monitoring reports	CGM/Contractors	Throughout construction

			▪ Use low sulphur or other, suitable alternative diesel fuel; ▪ Tune equipment regularly; ▪ Prohibit engine tampering to increase power; and locate truck storage, maintenance and refuelling areas away from sensitive receptors.			
7	Noise pollution	Avoid disturbing surrounding land- users	1. Minimize night time construction near residential areas. Restrict high noise-generating equipment such as drills (which produce 98 dBA at 50 feet) and scrapers (which produce 89 dBA at 50 feet) to daytime hours (7:00 a.m. to 6:00 p.m.); 2. Implement proper design and maintenance of silencers on diesel-powered equipment, systematic maintenance of all forms of equipment, training of personnel to adhere to operational procedures that reduce the occurrence and magnitude of individual noisy events; 3. Where possible, earthworks and material stockpiles should be placed, so as to protect the boundaries from noise of individual operations, which for greatest effect should be placed directly behind them; and 4. If realignment of any part of the material transport road is going to be considered, the maximum possible distances from local dwellings and communities should be adhered to. 5. A grievance procedure will be established whereby complaints are recorded and responded to.	Signage on site Grievance procedure logbook	CGM/Contractors	Throughout construction
8	Loss and Fragmentation of biodiversity Habitat around the Airport	Prevent unnecessary disturbance and damage to natural vegetation and topsoil loss	1. The footprint of the development must be minimized as much as possible, particularly where this encroaches into surrounding hills. The minimum required footprint must be clearly pegged on the ground and all contractors / construction workers informed that the boundaries are not to be exceeded. 2. Areas of sensitive vegetation on the airport edges which can be avoided should be designated as No Go areas. 3. Construction camps must be established within previously disturbed areas, and preferably not adjacent to forest areas. 4. Parking of vehicles, heavy equipment and dumping of materials and waste must similarly occur in previously disturbed areas to minimise the destruction of undisturbed forest. 5. Vehicle movements must be restricted to the footprint areas and access roads to avoid unnecessary destruction of forest vegetation. 6. Natural resources from cleared areas (e.g. stones) should be made available to the local communities (coordinated by the Community Liaison Officer). 7. Roads which must traverse drainage lines should be designed to avoid disruption	Onsite observation and records Environmental monitoring records	CGM/Contractors & Contractor (ECO)	During construction

			of the natural flow of water in the drainage line to avoid bank erosion. 8. Rehabilitation and revegetation of cleared or disturbed used for construction purposes and other impacted areas is strongly recommended and should be undertaken in accordance with the Rehabilitation Plan. Revegetation must be done using only indigenous plants from Muvuti Kiima-Kimwe ward, and purchased from existing nurseries or relocated from cleared areas for replanting.	Environmental monitoring records		
9	Increased alien infestation	Minimise risk of spread of alien vegetation	1. Implement the Rehabilitation to all cleared areas as soon as possible after disturbance. 2. Landscape and rehabilitate disturbed areas using indigenous plants, and particularly endemic plants, native to the project catchment area. Many spectacularly-attractive indigenous species (e.g. Acacia) occur and provide extensive scope for landscaping. 3. Customs controls are needed to prevent both purposeful and accidental introduction of alien plants to the Muvuti Kiima-Kimwe Ward. All required controls for transferring seeds or plant material via imported equipment and machinery must be implemented.	Environmental monitoring Reports Site Observations Records of control measures implemented	Customs Authority and CGM/Contractors / Contractor	
10	Faunal Impacts	Mitigate impacts on fauna	1. Poaching or hunting should be strictly forbidden and control of poaching facilitated by banning dogs on site and enclosing worker compounds. 2. No dogs or other pets allowed at the site. 3. The construction camp and other temporary storage areas must be fenced to reduce human-wildlife interactions. 4. It should be mandatory for staff of CGM/Contractors and its contractors to attend an environmental briefing and training session with respect to the guidelines outlined in this EMP.	Environmental monitoring reports and photographic evidence Environmental monitoring Records/ Grievance Register Worker training & awareness records Grievance records	CGM/Contractors	During construction
11	Bird mortality and disturbance	Minimise loss and disturbance to birds	1. Vegetation clearance activities should be timed to avoid the primary nesting seasons of as many of the range- restricted bird species as possible – particularly **Near-Threatened species**.	Environmental monitoring reports	CGM/Contractors	Construction phase
12	Damage or Destruction of Cultural Heritage Interests	Minimise damage to cultural heritage interests	1. Any substantial excavations, such as borrow pits opened for road making, providing material for berms or any other construction, similarly need to be checked by the Environmental Control Officer (who should be trained to recognise cultural heritage remains)	Environmental monitoring reports and photographs Environmental	CGM/Contractors	Prior to and throughout construction

			2. Should any graves, human remains, or archaeological or paleontological materials (fossils, bones, artefacts etc.) be uncovered or exposed during earthworks or excavations, they must immediately be reported to the appropriate regulatory authority, and the appropriate process followed.	monitoring reports and Regulatory Authority response		
13	Visual Impacts	Minimise visual impacts	The construction camp, material stores and lay-down area should be kept in a neat and orderly manner. The extent of the construction camp and stores should be limited in area to only that which is essential; Waste should be kept behind a screened and fenced area (which will also control pests). All areas disturbed by construction activities and not required during airport operation must be rehabilitated with indigenous plants.	Environmental monitoring reports Site layout plan Site layout plan and specifications Rehabilitation plan and ECO Close Out Report	CGM/Contractors	Throughout construction
14	Soil and water contamination	Minimise risk of spillage of pollutants	Implement the Spill Prevention Plan that includes: • Periodic inspection of hazardous materials storage area to ensure containers are properly labelled, material data sheets for all chemicals are available containers are securely covered and are stored in secondary containment and in bermed areas and each site is equipped with spill kits and protective equipment; • Training and awareness for employees on transport, storage and handling of hazardous materials; and spill reporting procedures.	Spill Prevention Plan in place Environmental monitoring reporting	CGM/Contractors / Contractor	Prior to and throughout construction
15	Storm water drainage	Minimise risk of flooding	A Storm water Control Plan shall be developed based on Best Management Practices and containing design measures to minimize surface runoff and sediment entering the storm water drainage system. Specific measures that should be considered where appropriate shall include: • Diversion dykes and swales to divert runoff around disturbed areas to a stabilized outlet where water can be discharged without adversely impacting the receiving area; • Brush berm to intercept sediment-laden water from disturbed areas in order to detain sediment, and release water as sheet flow; • Installing flow-through planters or in-ground planters; • Construction of bio-retention areas and infiltration trenches. • Use of erosion blankets and silt fences and sedimentation ponds to remove suspended material from runoff; • Temporary and permanent seeding of disturbed areas and soil stockpiles; • Stabilisation of construction area entrances and exits; • Use of straw rolls, sediment fences, straw bales, and/or sediment traps to prevent sediment laden runoff from leaving the construction area; • Use of temporary dykes to re-direct or control runoff;	Storm water Control Plan in place Observation and Environmental monitoring reporting on storm water control measures.	CGM/Contractors / Contactor / ECO	Prior to and throughout construction

			• Construction scheduling, such as phasing and season avoidance, to minimize erosion and sediment; • Perimeter protection such as straw wattles and silt fences; • Check dams to prevent gully erosion and/or slow runoff flow rates to allow sediment to settle; • Wind erosion control BMP such as soil stabilizers, wetting down of dry sediment, or covering exposed surfaces; • Gravel bag berm/barriers to prevent runoff or run-on surface water flows; and • Stabilised construction entrances to prevent vehicle tracking of sediment and debris on roadways. The effectiveness of the storm water control measures should be regularly monitored, especially after significant rain events to check blockages and design capacity.			
16	Waste and effluent	Minimise impacts due to waste and effluent production	1. All waste must be separated into skips for recycling, reuse and disposal. 2. Waste which cannot be recycled or reused must be removed from site and disposed of in an appropriate waste disposal site. 3. Consideration should be given to mulching of vegetative material for soil protection from erosion, dust control and to assist with rehabilitation of disturbed areas. 4. Effluent from temporary staff facilities must be collected in tanks and emptied by a sanitary contractor at a suitable site. 5. Effluent from concrete washings from the on-site batching plant must be contained within a bunded area. 6. All solid and liquid waste materials, including any contaminated soils, must be stored in a bunded area and disposed of in an acceptable manner to enhance soil remediation. 7. Where possible, waste materials should be re-used or recycled must be placed in a skip and removed from site to a licensed municipal disposal site.	Environmental monitoring reports	CGM/Contractors	Throughout construction

OPERATIONAL PHASE						
Activity		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**	**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Activity**		**# Commitment / Actions Required / Key Controls**			
1.	Health and Safety	Maintain health and safety standards	Health and safety standards provided in the ICAO Regulations must be adhered to.	Inspection records	Airport Management body	Throughout operation
2.	Storm water management	Maintain storm water drains	Storm water drains should be monitored regularly, particularly after heavy rains, to ensure the free flow of water. Any blockages should be cleared immediately.	Inspection records	Airport Management body / CGM	Throughout operation
3.	Waste and Effluent	Prevent soil and groundwater pollution	1. General waste must be stored in a demarcated area protected from scavengers. 2. Waste bins must be regularly removed from site and disposed of in an appropriate manner by a formally contracted waste contractor. 3. Appropriate pest control measures must be implemented to control proliferation of rats in accordance with specifications of an Alien Fauna and Feral Animal Control Programme.	Photographic evidence Alien Fauna and Feral Animal Control Programme Pest control measures	Airport Management body	Throughout operation
4.	Border controls on import and export of flora and fauna	Minimise risk of introducing disease and pests, and loss of biodiversity from the locality	1. Implement relevant provisions of the Alien Plant Control Programme relating to import and export of plant material. 2. Border control regulations relating to import and export of products that can spread disease or introduce exotic plants or animals, or cause loss of the Kiima-Kimwe unique biodiversity must be heavily regulated and enforced. 3. Passengers should be regularly searched for products such as exotic pets and for import of exotic fruits or vegetables, or other restricted plant material. 4. Clear signage and posters relating to restricted products must be put up in key areas of the airport. Pamphlets with information on import and export restrictions of products should be distributed to tourism operators, tourist accommodation and at	Alien Plant Control Programme Border control policing measures Border control policing measures Signage and pamphlets	Airport Management body / Govt of STP	Throughout operation
5.	Biodiversity Protection	Minimize risks to biodiversity from airport activities	▪ Airport staff must scare birds from the runway area prior to aircraft landing and take-off to reduce collision and safety risks with birds. ▪ Implement bird monitoring measures described in ▪ Implement, where possible, other provisions relating to	Ground staff responsibility	Airport Management body	During operations

			biodiversity protection.			
6	Noise Impact	Minimize the operational noise impact on affected communities	▪ Implement when possible, low power approach (30 approach at 900 RPM) and steeper climb out gradient (12.8% at maximum power). ▪ Perform noise monitoring over two to three days on an annual or biannual basis. The monitoring point should be located at the Soweto Village. ▪ Restrict arrivals and departures to daytime hours. ▪ Ensure that future residential development maintain at least a 500 m buffer on either side of the runway and along the take-off or landing flight path of up to 2 km.	Monitoring records	Airport Management body	During operations
7	Bird strike- Can causes significant damage to the plane but can also create hazardous and unsafe flying conditions if critical damage occurs. Because of this, many airports have wildlife control initiatives in place to minimize any interaction between birds and aircraft.	Minimize risk and loss of bird life	▪ Modifying the birds' habitat, controlling the birds' behavior, and modifying aircrafts' behavior. Airports that are most successful at minimizing bird strikes have employed all three methods through various techniques. ▪ Other measures include landscaping, waste management measures, use of noise and flare guns, and use of falcons	Application of methods of control	Airport Management body	During operations
8	Air pollution	Minimize health related impacts associated with air pollution	▪ Working towards a reduction if the total number of vehicles that commute to and from the airport. ▪ A system of penalties for polluting vehicles. ▪ Introduction of charges to promote the use of lower emission aircraft ▪ Minimizing dust emissions by wheel washing, damping down and employing the use of covered vehicles for transportation. ▪ Conducting a Code of Construction Practice relating to air emission ▪ Carrying out air quality assessments periodically ▪ Use of low sulfur fuel and conduct of regular maintenance of the generators and diesel engines. ▪ Emission of air pollutant from source can also be reduced by shutting down the combustion engines when not in use.	Air quality assessments periodically	Airport Management body	During operations

DECOMMISSIONING PHASE					
CONCERN	**POTENTIAL NEGATIVE IMPACTS**	**PROPOSED MITIGATION MEASURES**	**MONITORING ASPECT**	**RESPONSIBILITY**	**COST (KSHS)**
Noise	▪ Reduced concentration of people in the neighbourhood ▪ Shouting during conversation among workers on site ▪ Noise induced hearing loss among workers who are continuously exposed to high noise levels ▪ reduction in productivity and efficiency of the workers at the workplace ▪ stressing the worker and thus reduced concentration	▪ Demolition works and other decommissioning activities to be limited to day time. ▪ Appropriate ear protective devices to be provided to workers working in noisy environment. ▪ Education and training for workers on importance and proper use of PPE. ▪ Appropriate acoustic barriers around areas generating noise to be provided. ▪ Noise attenuators such as trees on site to be preserved.	▪ Complete PPE for workers ▪ Medical examination report ▪ Audiometric tests for noise impacts ▪ Signage mounted	▪ Proponent ▪ NEMA Inspectors ▪ DOSH	200,000 for PPE supply, medical examination for workers as well as decommissioning report.
Dust	▪ skin irritation, chocking including coughing	▪ Appropriate personal protective equipment to be provided to all workers. ▪ Appropriate use of PPE provided to be enforced. ▪ The decommissioned site to be secured with dust screens. ▪ Water sprinkling on dusty grounds to be done.			
Occupational injuries	▪ Complete incapacitation of the affected employee ▪ loss of life ▪ Increase in Costs of litigation and compensation	▪ Appropriate personal protective equipment such as safety belts for workers working at height to be provided. ▪ Proper use of PPE provided. ▪ Appropriate training of workers of ways of working safely. ▪ Appropriate supervision at workplace. ▪ Rest times to be strictly observed to reduce stress.			
Solid waste	▪ May contain endocrine disrupting compounds, toxic pollutants, heavy metals, combustion products heavy metals, pathogenic microorganisms	▪ Un-recyclable material to be transported by licensed waste transporters and disposed on NEMA approved dump sites ▪ Ensure safety precautions have been observed at decommissioning especially in regard to sharp debris, heavy metals etc.	▪ Number of material recycled ▪ Records of hazardous	▪ Proponent ▪ NEMA	▪

	▪ Potential for human injuries and health risk	▪ Careful removal lined ash pit on site ▪ Use of NEMA approved waste handlers	materials disposed		
Site restoration and rehabilitation	▪ Introduction of incompatible procedures and methodologies	▪ Notify NEMA and other relevant authorities on intension to stop operations at least 3 months in advance. ▪ Carry out a decommissioning report and submit report to NEMA for review six months in advance, ▪ Re-vegetate the project site with as much indigenous trees as possible ▪ Monitor the site for one year.	▪ Observation	▪ Proponent	▪ 100,000

11 SECTION TEN: CONCLUSION AND RECOMMENDATIONS

11.1 Anticipated (potential) positive Impacts

The proposed Machakos airport has been designed based on environmental principles taking into consideration sustainable energy use, water and waste management best practices. Impacts associated with the development are generally localized within Muvuti/Kiima-Kimwe ward. The facility is located wholly on the county Government land define through local development plan for New Machakos town and will not cause displacement of people, institutions or economic activities. Livestock keepers noted herding on the airport grounds do not reside in the area. The project has no direct interaction with surface natural drainage, external air quality and noise levels. It is recommended that the Contractor shall fence off the proposed project site to keep off local intrusion by grazing livestock and wildlife in the short term. There will be limited ecological impacts on the wildlife dispersing into the airport grounds. Potential social disruption will be associated with reduced grazing area, truck movements and influx of workers into the area. The area, however, is not a sensitive habitat. However, the ESIA Experts CGM to engage KWS to undertake 3 to 6 month Wildlife Monitoring determine the grazing patterns of the Wildlife and wildlife Translocation. In the meantime, the appointed management for the Airport if for instance if under KAA will urgently consider providing a full fence on of the airport to keep out grazing animals.

11.2 Environmental statement

From the assessment, the EIA experts concludes that the proposed airport for is appropriate in relation to ICDP for Machakos County. This conclusion has been made in terms of environmental impact, site selection, public health and public participation responses/outcomes. By using a multi-criterion assessment model for economic, social, public health and environmental effects, this study indicates the proposed airport has taken much consideration of the public health and environment. This study finally offers some corresponding recommendations for improving the environmental impact assessment and enhancing the benefits of the proposed Machakos airport.

The ESIA report for the proposed airport has revealed that only **potential significant** issues maybe from;

vi. **Pollutant emissions and Air Quality Management**: Source Emissions: The operation of the electricity generators at the substations, generators inside the aviation area, and the water/fire pump diesel engines at the pumping station are potential sources of air pollutant emissions. It is very difficult to reduce the air pollution impacts from aircraft except through more efficient operations and technology. The air pollution impacts of ground traffic can be reduced by switching to less polluting forms of transport (bicycle and bus rather than private vehicles). Dust from construction can be controlled by soil damping and wheel washing. Some airports compile emissions inventories and carry out air quality assessments to help identify how air pollution can best be tackled. Some of the measures that have been proposed or carried out to mitigate the effects of air pollution include measures to control the emissions or to penalize non-compliance. Measures proposed in airport master plans and environmental statements for minimizing air pollution impacts are:

- Working towards a reduction if the total number of vehicles that commute to and from the airport.
- A system of penalties for polluting vehicles.
- Introduction of charges to promote the use of lower emission aircraft
- Minimizing dust emissions by wheel washing, damping down and employing the use of covered vehicles for transportation.
- Conducting a Code of Construction Practice relating to air emission
- Carrying out air quality assessments periodically
- Use of low sulfur fuel and conduct of regular maintenance of the generators and diesel engines.
- Emission of air pollutant from source can also be reduced by shutting down the combustion engines when not in use.

vii. **Vehicular Emissions**: The movement of vehicles serving the terminal and vehicles going to and from the airport increases the emission of air pollutant such as the particulate matter, oxides of nitrogen and carbon monoxide in the vicinity. The following methods of abatement are being employed to reduce the emission of pollutant to the ambient air: (i) Shutting down the combustion engine when not in use; (ii) Minimizing the vehicular traffic, appropriate design of access roads provided to avoid traffic jams to reduce air pollution; (iii) Provision of adequate buffer zones where pollution concentrations is highest to reduce the impact of emissions; (iv) Providing suitable green belt to reduce the impact of air pollution; and (v) Maintain the vehicles moving within the airport, routinely perform emission checks.

viii. **Noise Level Management**: The operation of compressor, electricity generators, water/fire pump engine, and the take-off and landing of aircrafts are the possible sources that increase the noise level at the aviation area in excess of those typically found in the project environs. Controlling the noise at source is an important option in noise control strategies. Appropriate noise barrier/shields, silencers, etc. are provided wherever possible. The following measures shall be implemented to mitigate the sonic impacts (noise attenuation): (i) Switching off the combustion engines when not in use; (ii) Proper maintenance of equipment to reduce the high noise levels; (iii) Use of noise absorbing material at the buildings; (iv) Electricity generators and water/fire pumps to be provided with acoustic enclosure for effective noise reduction. Also, electricity generators to be provided with exhaust muffler capable of effective noise reduction; and (v) The sources of intermittent noise generating equipment such as compressors to be provided with appropriate acoustic barriers to reduce the noise level generated from the operation of these units.

ix. **Grievance Redress Mechanism**: It will be necessary for airport management appointed agent to establish a Grievance Redress Mechanism to cater to grievances and complaints that are directly related to the project cycle in its various stages. Although the Involuntary Resettlement policy is not triggered by the project, it is likely that some environmental impacts like noise and dust pollution, among others, may trigger complaints from nearby settlements even if they are

located outside of the airport boundaries. The following benefits based on good international practice justify the need for an internal GRM for CGM. Benefits to Project include; (i) Provides information about project implementation to the public; (ii) Provides an avenue to comply with government policies and regulations; (iii) Provides a forum for resolving grievances and disputes at the lowest level; (iv) Resolves disputes relatively quickly before they escalate to an unmanageable levels; (v) Facilitates effective communication between the project and affected persons; (vi) Helps win the trust and confidence of community members in the project and creates productive relationships between the parties; (vii) Mitigates or prevents adverse impacts of the project on communities and produces appropriate corrective or preventive action and (viii) Helps avoid project delays and cost increases, and improves quality of work. Benefits of GRM to other Stakeholders and persons potentially affected by the construction; (i) Provides a cost-effective method to report their grievances and complaints; (ii) Establishes a forum and a structure to report their grievances with dignity, and access to a fair hearing and remedy; (iii) Provides access to negotiate and influence decisions of the project that might adversely affect them and (iv) Facilitates access to information. In order to address external grievances and complaints, a typical Grievance Redress Mechanism is therefore proposed to CGM, which can be modified appropriately as needed. The GRM implementing unit within CGM shall be a Grievance Redress Committee (GRC) comprising CGM Project Manager, Supervising Consultant Resident Engineer; CGM Environmental or Social Officer and Contractor representative.

x. **Bird strike during operation**: There should be a relocation of the existing dumpsite to avert bird strike. Even if the landfill is not located in the approach path of the airport's runway, it still poses a hazard because of the birds' ability to fly away from the landfill and into the path of oncoming planes.

11.3 Institutional capacity and strengthening plan

CGM has put in place elaborate plans to ensure the environment is safeguarded and that safety and health of the workers and proposed airport users within the airport grounds are protected through clear elaborate environmental, health and safety policies that are guided by local and international safeguards including ICAO. Policies and procedures must be put in place to ensure that safety and health issues are adequately taken care of especially in the aviation environment in which the proposed air will operate. Construction and operations of the Terminal will have impacts on the environment (mainly occupational) but none are anticipated to the external environment and social settings (neighbouring residential and institutional premises. It is, therefore, imperative that precautions are taken to ensure that these internal impacts are minimized through a concerted effort from the Project Management Team and the Contractor(s). The Supervision Team will review and activate the contents of the Environmental Management Plan and direct the Contractor(s) to prepare a Construction-specific Environmental and Social Management Plan that should be in line with the ESMP as well as the guidelines established by the appointed airport Management Agent. Other responsibilities will include the following; (i) Appointed airport Management Agent will be

responsible for coordination activities and liaisons, particularly in regard to the natural resources on site (relocation of the wildlife), construction, quality control and social issues during the project implementation. This may partly be achieved through the Supervision. (ii) The stakeholders will be responsible for overseeing that the implementation of the environmental management plans is undertaken. (iii) Constant consultation with the Kenya Civil Aviation Authority (KCAA) and other operators such as Kenya Airways, Ground Support Services providers, Cargo Handlers, Immigration Department, Kenya Revenue Authorities among others shall be ensured at all times. In addition, the development and implementation of the GRM is critical. In order to ensure that the provisions of the ESMP have been fully integrated into the implementation process, an ESMP Implementation Committee will need to be established. This Committee, to be chaired by the Manager, Environment at will also comprise of the Airport Engineer, Environment Officer, the Health and Safety Officer, the Airport Fire Safety Office and the House Keeping Department as well as the Security Agents around the airport. The role of this Committee will be ensure compliance with the established regulations as outlined under this report and full integration of the ESMP provisions in the implementation process.

11.4 Essential Stakeholders proposed for sustainable waste management at the airport

- Passengers passing through public areas, parking lots, garages, curbside pickup and drop off areas, restrooms, holding areas, and food courts
- Tenants such as businesses, airlines, and concessions (including taxi, hotel, rental cars, flight kitchens, and other industries that operate at the airport)
- Airline employees (including ground crew, cabin cleaning crew, catering);
- Employees of airport authorities, government offices, business agencies, etc.
- Maintenance operations and support facilities
- Contractors of the airport and its tenants, including aircraft cleaning and service, janitorial services, waste haulers, and construction contractors
- Machakos County solid waste management team.

12 SECTION ELEVEN: APPENDICES

Appendix 1: Copy of TOR approval

Appendix 2: KRA Pin for the Proponent

Appendix 3: EIA/EA expert Practicing license for consultants

Appendix 4: Minutes of the CPP and duly filled Public participation forms for Public consultation.

Appendix 5: Part development plan

Appendix 6: Airport layout plans and Engineering designs