



**AFRICAN DEVELOPMENT
BANK GROUP**

**PROJECT: JOMO KENYATTA INTERNATIONAL AIRPORT
GREENFIELD TERMINAL PROJECT**

COUNTRY: KENYA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT SUMMARY

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Project Number: P-KE-DA0-004

Country: KENYA

Department: OPSM

Division: OPSM.3

Project Category: CATEGORY 1

1. INTRODUCTION

Jomo Kenyatta International Airport (JKIA) serves as a hub for most airlines operations in the Eastern Africa region. The airport was designed and constructed in 1978 to serve about 2.5 million passengers per year but over the years, this capacity has been overshoot to over 6 million passengers per year. Kenya Airports Authority (KAA) is currently expanding the existing terminal building (Terminal 1) and plans to renovate the existing runway. However, the development and growth of air traffic in Kenya requires urgent consideration of a new Passenger Terminal and an additional runway to meet the long term capacity desires. This expansion is supported through the National Airports Master Plan Final Report prepared in 1993.

The aircraft traffic movement (ATM) at JKIA has increased to reach over 72,700 aircrafts per year currently and is predicted to reach over 195,000 aircrafts per year by the year 2030. The current cargo handling capacity is estimated at 252,000 tons having increased by over 50,000 tons over the last 7 years alone. The number of flights handled at the airport has also increased by almost 45% in 7 years.

The above scenario calls for intervention measures to meet the current demand and provide for future growth. The government of Kenya is focused on upgrading and expanding aviation infrastructure, particularly at the JKIA. Investments at JKIA, the regional aviation hub, are one of the key activities of Kenya's Vision 2030 goals. The proposed interventions at JKIA has been geared towards enhancing capacity and increasing efficiency with the expansion programme partly involving development of Phase 1 of the new **Green Field Terminal (GFT)** and in the near future, construction of a second Runway.

The proposed Greenfield Terminal (GFT) is expected to increase the capacity of JKIA from the current 6 million passengers per year to about 18.5 million passengers annually by the year 2030. The Greenfield Terminal project will encompass construction of a four level terminal building comprising a central processing area, a transit hotel, landside retail centers, arrivals and departures plaza. Ancillary facilities shall include an access road, car parking, access taxiways, Ground Service Equipment (GSE) and bus parking areas.

The Kenya Airport Authority development plan report for the Greenfield Terminal proposes various scenarios in order to meet the immediate and future traffic needs as well as being fully compliant with international standards in terms of environment, aviation safety and security.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

The Environmental Management and Coordination Act (EMCA), 1999 provides for the establishment of a legal and institutional framework for the management of the environment

and for matters connected therewith and incidental thereto. Just as in the new Kenya Constitution 2010, Part II of EMCA confers to every person the right to a clean and healthy environment and to its judicial enforcement. The new Constitution and EMCA therefore obligates the project's Executing Agency, KAA and the Contractor(s) to work in a clean environment and not to contravene the right of any person within its zone of influence, to this entitlement. EMCA has provided for the development of several subsidiary legislation and guidelines which govern environmental management and are relevant to the project implementation. These include;

- The Environmental (Impact Assessment and Audit) Regulations, 2003 Legal Notice No. 101;
- The Environmental Management and Coordination (Waste Management) Regulations, 2006 Legal Notice No. 121;
- The Environmental Management and Coordination (Water Quality) Regulations, 2006 Legal Notice No. 120;
- The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 Legal Notice No. 61;
- The Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006 Legal Notice No. 160;
- The Environmental Management and Coordination (Fossil Fuel Emission Control) Regulations, 2006 Legal Notice No. 131;
- The Environmental Management and Coordination (Controlled Substances) Regulations, 2007 Legal Notice No. 73.

Kenya's key environmental assessment and monitoring agencies include the following;

- The National Environment Council: The Council is responsible for policy formulation and directions for the purposes of developing the EMCA. The Council also sets national goals and, objectives, and determines policies, and priorities for the protection of the environment.
- The National Environment Management Authority (NEMA): NEMA is responsible for general supervision and, co-ordination of all matters relating to the environment and is the principal instrument of government in the implementation of all policies relating to the environment. The authority is also responsible for monitoring compliance with all the NEMA regulations.
- The Standards and Enforcement Review Committee (SERC): NEMA through EMCA has established standards for the various environmental parameters that require management and these include the water quality standards, noise and vibration control standards, and the waste management standards, amongst other. SERC, through the Compliance and Enforcement Department of NEMA monitors the compliance level of the project to ensure environmental control standards are implemented. The committee also follows on complaints reported by the public.
- The County Environment Committees: These committees contribute to decentralization of activities undertaken by NEMA and thus enable local communities to have access to environmental management information. The committees also conduct quick site visits and review environment related reports of the projects and on occasions could attend site meetings.

The Occupational Safety and Health Act, 2007, is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. The Act applies to all workplaces and workers associated with it; whether temporary or permanent. The main aim of the Act is to safeguard the safety, health and welfare of workers and non-workers. It is thus recommended that all Sections of the Act related to this project, such as provision of protective clothing, clean water, and insurance cover are observed so as to protect all from work related injuries or other health hazards.

There are sectoral legislation and regulations relating to various environmental aspects and that are relevant to the project that were reviewed, including international treaties and agreements that Kenya has ratified and these have been included in the ESIA Report. In addition, the African Development Bank's Integrated Safeguards Policy has been applied in the preparation of the ESIA.

Provisions of the national regulations on environmental conservation implies that the Kenya Airports Authority has a legal duty and responsibility to operate the airport sustainably and to comply with the established environment management regulations and should not compromise on the environmental health and safety requirements. This position enhances the importance of this ESIA and subsequent implementation of the ESMP developed therefrom. The key national laws that govern the management of environmental resources in the country will also be integrated throughout the construction and subsequent operations.

3. DESCRIPTION OF THE PROJECT AND JUSTIFICATION

The proposed Greenfield Terminal (GFT) is expected to increase the capacity of JKIA from the current 6 million passengers per year to about 18.5 million passengers annually by the year 2030 with Phase 1 of the GFT handling 12.7million passenger capacity per annum. This expansion is supported through the National Airports Master plan Final Report prepared in 1993.

The Green Fields Terminal will be located within the airport grounds between 0.75 – 1.5km east of the existing Terminal 1. It is situated mid-way between the existing Runway to the north and proposed corridor for the 2nd Runway to the south. The airport Control Tower stands about 300m from the site midway from Terminal 1.

The Green Fields Terminal is designed with a floor area of 178,000m² on 4No. levels such as to accommodate 50No. international check-in desks; 10 domestic check-in desks; 32 contact gates; 8No. remote gates; an apron; 45No. aircraft stands (complete with hydrants and other provisions) and parking areas. The key design principles for the New Greenfields passenger terminal encompasses environmental based concepts. The Green Field Terminal will initially be served from the existing Runway facility and be linked to the existing terminal through taxiways.

The Passenger Terminal Complex (PTC) facilities will consist of the following main structural elements: (1) The central processing building, housing various support functions and a hotel for limited accommodation of transit passengers; (2) The northern concourse; (3) The northwest and northeast piers for loading passengers and disembarking passengers, and (4) A concrete and steel structure with four levels.

Phase 1 of the GFT project will be provided with among other components; (i) The main PTC access road, which shall be a minimum of six lanes including separated grade junction with the Airport South road, and the junction to the existing terminal building; (ii) Passengers Terminal (commercial apron) for 45 Aircraft stands of area 950,000 m²; (iii) Taxiways of area 128,500 m²; (iv) Ground Service Equipment (GSE) of area: 146,200 m²; (v) Bus parking Areas (Airside) of Area 2,000 m²; (vi) Parking areas for vehicles (landside); (vii) 2 additional vehicular lanes (1 exclusive to Bus Rapid Transit System - BRT) on both sides of the main access road from toll gate; and (viii) Street lighting from main toll gate to the Greenfield PTC. Thereafter, Phase 2 PTC of the project will take a mirror image of Phase 1 PTC.

Environmental Design Principles: The Greenfield PTC design is based on environmental sustainability principles including energy and water saving. The environmental guiding principles are geared towards JKIA certification to international best practices benchmarks, among the Leadership in Energy and Environmental Design (LEED) Principles. An outline of the principles are as follows; (i) The orientation of the terminal building structures is on east – west to maximize hours of natural lighting, effectively saving energy and associated costs; (ii) The structure of the windows and vents are also oriented on a east – west direction (the direction of the prevailing winds) for natural ventilation and aeration of the terminal areas; (iii) A “Green Roofing” technology providing thermal mass has been adopted to facilitate natural condition of temperatures in the terminal; (iv) Shading materials for open spaces has been designed to complement the temperature conditioning; (v) Green points are designed to introduce limited indoor plants to complement in moderating micro-climate of the terminal; (vi) The Terminal will be provided with fixed electrical ground power points (also commonly referred to a Ground Power Units) to provide auxiliary power to the aircrafts as opposed to running engines. This is designed to reduce carbon emissions from stationary aircrafts; (vii) Fixed air conditioning links will be installed on the air bridges to supply pre-conditioned air to stationary aircrafts as opposed to the running engines. This will also control noise and emissions associated with aircraft engines.

Aircraft Related Design Concepts: The Green Fields Terminal is designed as per the ICAO Annex 14 Volume I guidelines including the buildings, aircraft pavements (the aprons and taxiways). The aircraft pavements are designed for Code E Aircrafts (Boeing 777-300ER) and Code F Aircrafts (Airbus 380-800). This, therefore, will be suitable for Boeing 747-400, Boeing 767-300ER, Boeing 737-800, Airbus A340-600, Embraer ERJ 170LR and Embraer ERJ 190AR. It is estimated that the GFT will handle up to 55% and 49% of sitting capacity and Aircraft Movements respectively of JKIA for International flights and 53% and 30% for the domestic flights respectively. The terminal will provide 78 aircraft parking bays (current parking capacity is only 37). The apron will be built of rigid pavement setting to withstand aircraft tyre pressure, ensure stability from fuel and lubricant spills, resistant to rutting and damage by Ground Support Equipment. However, taxiways will be built of flexible asphalt concrete for rideability and resistance to friction effects.

Associated or Support Infrastructure: The GFT will be provided with the basic support infrastructure such as to include; (i) Sewer connections to the trunk sewer facility to serve all terminal areas. JKIA is served with a sewer system linked to the main Dandora Sewerage facility in Ruai area; (ii) Power supply comprising of grid connection as well as power back-up generator(s); (iii) Water Supply system integrated into the existing JKIA network; (iv) Solid waste collection and transfer stations at strategic locations established in accordance with the JKIA waste management plan; (v) Drainage systems covering the paved areas including the access roads and the parking areas. The drainage network is provided with 2No. surface runoff

balancing/settlement ponds each of 15,000m³ with controlled discharge arrangement. All storm water will be linked to the trunk surface drainage channel leading to Athi River about 10km to the east of the airport.

Landscaping: Phase 1 of the GFT will set stage for landscaping of the subsequent phase. The landside of the terminal including the access road corridors will be landscaped and beautified with the local flora and indigenous plants (including acacia trees that are the basis for the architectural design). On the other hand, the airside will be landscaped by compacting the local top soil and seeding with appropriate grass for ground cover.

Project Justification: The initial design capacity of JKIA was to serve about 2.5 million passengers per year but over the years this capacity has been overshoot to over 6.5 million passengers per year. The aircraft movement (ATM) has also increased to reach over 72,700 aircrafts per year and is predicted to reach over 195,000 aircrafts per year by the year 2030. The current cargo handling capacity is estimated at 252,000 tons having increased by over 50,000 tons over the last 7 years alone. The number of flights handled at the airport has also increased by almost 45% in 7 years.

The above scenario calls for intervention measures to meet the current demand and provide for future growth. The interventions proposed are expected to increase the efficiency and capacity of the airport. The government of Kenya is focused on upgrading and expanding aviation infrastructure, particularly at the JKIA. Investments at JKIA, the regional aviation hub, are one of the key activities towards Kenya Vision 2030 goals.

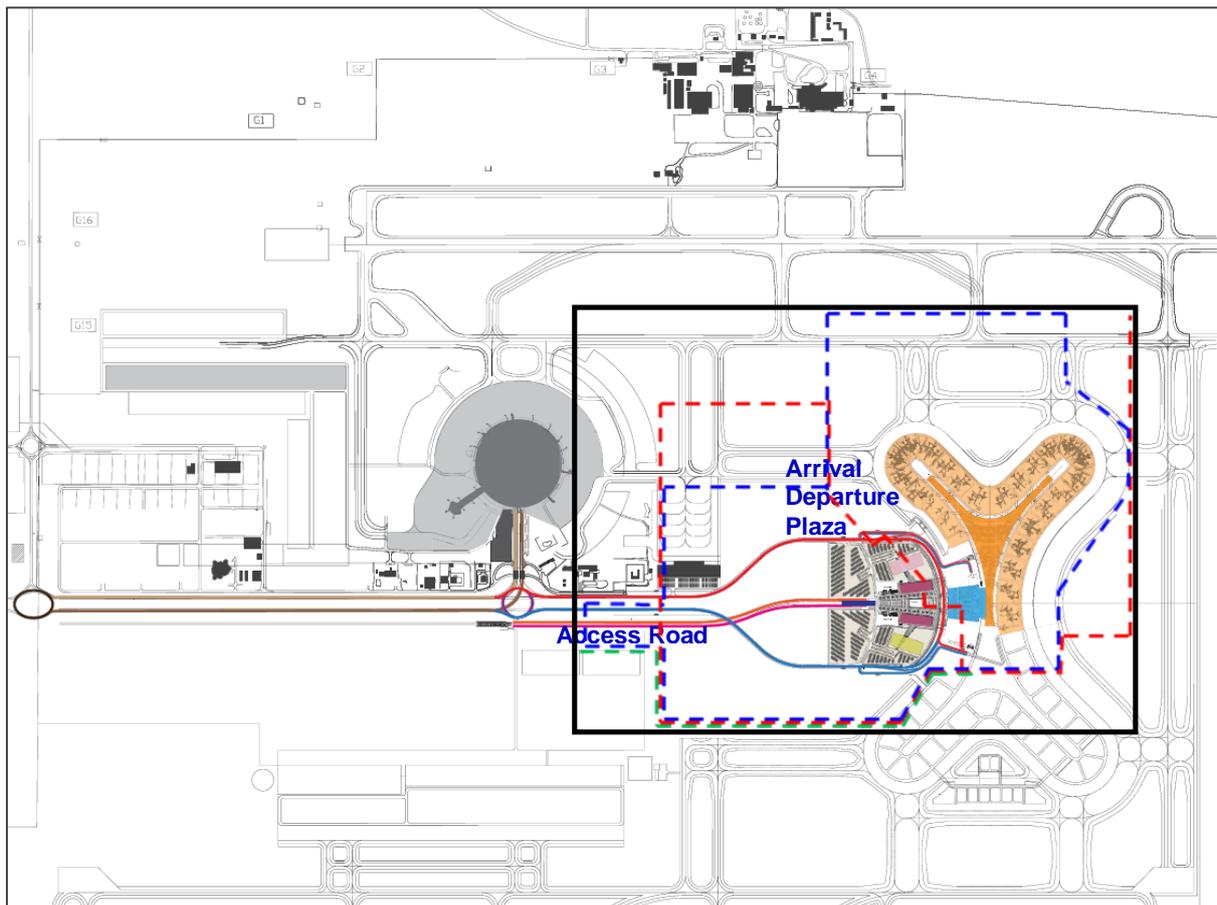


Figure 1: Proposed Phase 1 JKIA GFT boundaries

4. DESCRIPTION OF THE PROJECT ENVIRONMENT

Topography and Drainage: JKIA area and the surrounding areas is within a low lying dry plains to the southeast of Nairobi City influenced by the Athi Plains of Machakos and Kajiado areas. The Airport area is characterized by mild undulating flat terrain with a general slope towards the southeast with a general drainage pattern influenced by Athi River basin. The general altitude is about 1500m at Athi River located about 8 Km south east of the airport to about 1,800m above sea level further west in the faulted region near Ngong. There are no natural permanent surface water bodies in the immediate neighbourhoods.

Climatic Conditions: The climate within JKIA identifies with that of the greater Nairobi region; a tropical city located about 140km south of the equator and approximately 500km west of Indian Ocean coast. The area is characterized with a semi-humid climate that is highly influenced by semi-aridity on the east (towards the Machakos) and southern (towards Kajiado) directions. The rainfall is bi-modal with two rainy seasons from March to May (long rains) and from mid-October to mid-December (short rains) with an average annual mean rainfall of about 1,080mm per year. The minimum and maximum temperature ranges from 12°C to 28°C with annual mean temperature of about 19°C.

Geology and Soils: The project area is mainly underlain by volcanic rocks, tuff and metamorphic rocks. The area is characterized with the Nairobi phonolite separated from the underlying Mbagathi phonolitic trachytes by some thickness of a few feet of dark grey tuff, which belongs to the Athi Tuffs and Lake Beds Series. The soils around the JKIA airport are black clays referred to as black cotton soils described as being high to extremely high plasticity clays, silty clays or silty clays with sand.

Water Resources: With no surface water sources within the vicinity of JKIA, the airport is served water from the Nairobi Water and Sewerage Company (NW&SC) Ltd water supply and from the 7 boreholes around the airport grounds. The NW&SC domestic mains, along the Outer-ring road supply water, through a 200mm pipeline, into an 8,300m³ storage tanks. Of the 7 Boreholes around the airport, 4 have been fully operational and 3 are newly constructed and in the process of commissioning.

Vegetation: The airport is within a mixture of industrial and human settlement area and there is notable absence of natural vegetation following intensive social and economic driven land use changes. Apart from short withered grass and newly planted exotic trees, there is no significant vegetation cover on and around the existing airport side, a suitable setting for aviation operations. On the undeveloped land area earmarked for the GFT there exists sparse vegetation cover, mainly grass and acacia tree species and scattered shrubs and exotic trees introduced through settlements and economic activities in the last few years.

The proposed GFT site area is generally open grassland with presence of assorted ASAL shrubs. Other notable tree species found in the area but in low population include eucalyptus species, Senna spectabilis, Euphorbia tirucalli (milk bush), acacia species (Acacia tortilis, Acacia drepanolobium).

Ecological Setting: The Nairobi National Park is situated approximately 5km to the west of the airport and it is the influencing ecological factor. There is however, no direct linkage with the location and development of the Green Field Terminal facility. Other conservation areas to the

east of the airport include Ol Donyo Sabuk National Reserve near Kilimambogo (~50km away) and a number of ranches in Machakos County (between 10 – 20km away) that hosts various wildlife species. Among the common species in these conservation areas are mainly grazers (Buffaloes, Zebras, Giraffes, antelopes). Others include Cheetah, Serval Cats, Crocodiles, Snakes, Monkeys and baboons.

JKIA is shielded from Nairobi National Park by the Mombasa Highway corridor, the railway line and a number commercial premises, it is not so for the Ol Donyo Sabuk and ranches in Machakos Plains. The latter are open systems and the wildlife freely migrate in and out in search of fodder, water and refuge from predators including human beings. As a result, some of the species finds their way into the airport grounds (also conflicting with the massive emerging human settlements in Syokimau, Katani, Embakasi, Mihang'o, Utawala and parts of Ruiiai and Mavoko areas).

The airport grounds are not well fenced on the eastern edges and with the presence of the shrubs and grass as well as water (the dams created out of the main drainage system) as well as safety seems to attract a few migratory wild animals to the airport grounds (including a some giraffes, zebras and antelopes although the airport operations and various other construction activities and heavy social and economic development in Embakasi, Syokimau and Mlolongo has limited intrusion by the animals for a long time. The few migrating species (mainly from Ol Donyo Sabuk National Reserve and the Ranches in Machakos) are not permanent and only appear occasionally especially late in the evenings when social activities are low.

The open drainage network around the airport has resulted in the formation of a temporal wetland. The area has presence of wetland vegetation such as the cattails (*Typha ssp*) and bulrushes sedges. *Typha ssp* are common wetland plants that are long, bladelike leaves with stiff flower stalks. Wetland vegetation has attracted birds and insect species particularly where grass is dense. Wetland area has provided a habitat for many birds' species mainly for nesting and source of food. The bird's species include grey crowned crane, black headed heron, malachite kingfisher, blacksmith plover, spur winged plover, banded plover, wood ducks, black necked stilt, guinea fowl, cattle egrets, geese, blue winged teal among others, different snake species and also presence of some mud fish.

Administrative Setting: The Green Field Terminal lies within JKIA grounds in Embakasi location within Embakasi sub-county. It is sandwiched to the south by Katani and Mlolongo locations in Athi River sub-county, to the East and North by Mihang'o location in Embakasi sub-county and, Githunguri location in Athi River sub-county and to the West Embakasi and Mukuru Kwa Njenga locations Nairobi East sub-county. Politically, JKIA entirely falls within Embakasi South (Embakasi and Mukuru Kwa Njenga locations) and Embakasi East constituencies.

Population: According to the 2009 population and housing census, Nairobi City County had a total population of 3,138,369. It is estimated that 100% of Nairobi County's population is urbanized compared to 32.3% of the national population. The population of the project areas has been increasing in line with Nairobi City County's growth rate currently standing at 4.1%. In the last census report (2009), the project sub-county had about 1,144,416 persons of which about 81% (i.e. 925,775 persons) were residing in the Embakasi division.

On the other hand, the internal population within JKIA grounds consists of workers, passengers (local and international), transit service providers (mostly transporters) and passenger

escorts/receivers (relatives and friends). JKIA handled about 5,486,000 in 2010 and 6,272,000 in 2012.

Land Tenure and Use: Land is a key component of all economical activities including airports, roads construction, housing, agriculture, water and forestry among others. Land in JKIA is government owned through KAA. In the neighbourhood, land was initially owned by ranch companies (Syokimau, Katani and Githunguri among others) with minimal sections under private ownership. Thus, the neighbourhood to JKIA initially consisted of expansive tracts of rangelands mainly used for livestock ranching.

These group ranches have since been demarcated to members who have further sub-divided their shares into small plots and sold them. All these have combined and changed land use around the JKIA and specifically along the stretch of the project corridor from livestock ranching to residential settlements, industrial and commercial establishments.

Health and Safety: KAA has in place elaborate plans to ensure safety and health of the workers and airport users within the airport ground through clear elaborate environmental, health and safety policies that are guided by local and international safeguards including ICAO. Policies and procedures are in place to ensure that safety and health issues are adequately taken care of especially in the aviation environment in which JKIA operates.

The top diseases in Nairobi City County include Fever/Malaria (50%), Flu (31%), Lower (chest Lung) respiratory diseases (8%), stomach aches (5%) and Asthma (3%)¹. The common diseases in Machakos County include Malaria, URTI, Skin Diseases, Diarrheal Diseases, Intestinal Worms, Pneumonia and Eye/Ear Infections. Morbidity rates in Nairobi are 25.3% and 72% in Machakos County with females having higher morbidity rates than males.

Security: Security department works closely with the Health and Safety Department. Security issues such as bombs, viruses and dangerous goods may also affect the safety and health of workers and the general public. Consequently, an inter-departmental approach adopted by JKIA management ensures that relevant emerging issues are effectively handled and resolved. Specialized units also exist to complement efforts of the Safety and Health Department, such as the Bird and Wildlife control Unit, which ensures that the safety of aircrafts landing and taking off is assured. Interference of aviation activities by wildlife may create serious safety consequences if not appropriately handled.

The Kenya Airport Police Unit is in charge of ensuring the airport is secure from any interference and safe. Following emerging trends in security and safety of key government installations from terrorism and other forms of harm, decisions have been made in the recent past to respond to possible attacks. Consequently, the KAPU in consultation with the Cabinet Secretaries in charge of Security and Transport effected stringent security procedures that included thorough manual screening of all passengers and vehicles accessing the airport. A change in access point had also to be made that resulted in the closure of one of the main entry points to the airport.

Fire Safety: Kenya Airports Authority has an overall Safety Policy that commits the organization to develop, implement, maintain and constantly improve strategies and processes to ensure that aviation and non-aviation activities aim at achieving the highest level of safety and meet the appropriate national and international standards. The airport has a Fire Station and two remote backup posts to respond to emergencies. The design and location of these

facilities are such that the time required to respond to disasters at any point within the airport is the ICAO recommended three (3) minutes. Regular drills conducted during the course of service ensure that this response time is attainable. Currently, the Fire Station at the airport is adequately prepared to handle six different categories of emergencies; aircraft crash, full emergency, local standby, weather standby, domestic fires and Very Important Person (VIP) standby. These emergencies are governed by protocols, procedures, rules and regulations developed from local legislation and ICAO standards.

The fire station is equipped with several conventional fire trucks fitted with all the necessary equipment, and a number of foam tenders. Six (6) static tanks along the runway each with a capacity of 45,000 liters provide the necessary storage and reservoir to support firefighting. The source of the water is from the County Council of Nairobi Mains, and several boreholes sunk within the airport to provide backup. Elaborate procedures exist for testing the use of foam, backed by regular servicing of equipment.

Another important function of the Fire Station and the Fire Fighting Team is to provide oil-spill clean-up function to areas prone to such incidences including aprons and runways. Since fire may also seriously affect aerodromes operations, the location of the fuel farm is strategic along the national trunk and in close proximity to the airport to cater for the needs of the air traffic. Specialized dedicated hydrants supply fuel to user-points in such a way as to minimize the amounts stored at these locations. At the fuel uptake points located at the aprons, there is likelihood of oil spills occurring, and therefore appropriate provisions are in place to contain any washouts from these areas, which is directed through oil separators before the water is discharged.

Air Traffic Movements (ATMs): Kenya Airways takes over 50% of flight volume share at JKIA (as reported in 2012). Annual traffic forecast shows a rapid growth from 98,532ATMs in 2013, 107,506ATMs in 2015, 134,958ATMs in 2020 and 220,775ATMs in 2032. An average of monthly peak of 8,318ATMs and a day peak of 248ATMs was reported.

Vehicular Traffic: Vehicular traffic records obtained from KAPS show that an average of 8,500 cars enters the airport on a daily basis either to pick or drop passengers. This is indicative of the response from increased passenger arrivals and departures. As the number of passengers is projected to increase, so will transport requirements for pick-up and drop-off proportionately increase. Generally, trucks to the airport bring in cargo for export, or pick cargo that have arrived. Transport safety has been adequately addressed through erection of speed bumps at specific locations along the airport roads. In addition to this, appropriate signs limit the speeds into and out of the airport. Manual screening of both road traffic passengers and vehicles are done at the entries to the airport from the Mombasa Road side and that from the cargo terminal side.

Passenger Movements: Like the flight volumes, annual passenger movements will also be on the rise from 6,863,165pax in 2013, 9,104,769pax in 2017, 12,074,934pax in 2022, 15,116,865pax in 2022 and 18,805,755pax in 2032. This contrast the projected maximum passenger movements at 13,728,130pax by 2030 as reported in the Airports Systems Plan Report and 35,349,471 pax from the Master Plan report. The peak hour passenger movement rises from 1,378pax in 2013 to 3,820pax in 2032.

Goods Movement: The National Airports Systems Plan 2010 projects the cargo capacity at JKIA was 479,051 tons in 2014, 638,142 tons in 2020 and 901,295 tones for the year 2030.

The figures are in agreement with the averages projected for the years 2009 – 2015 (508,774 tons per year), 2016 – 2020 (639,614 tons per years) and 2021 – 2030 (903,050 tons per year). The expansion of the cargo terminal facilities were meant to meet this demand.

5. PROJECT ALTERNATIVES

The proposed Green Fields Terminal and associated facilities became necessary to meet the emerging capacity deficiency at JKIA. The selection of the site location was determined by among other factors, the relative orientation in respect to the existing Terminal 1, the existing runway as well as the proposed 2nd Runway. Taxiing distance from the runways to the terminals is a major consideration by the airline operators due to the associated costs.

Site Alternatives: The Greenfield Terminal location is entirely within the JKIA boundaries and no additional land will be acquired. No direct or indirect displacement of neighbouring landowners, institutions or economic facilities will arise (the nearest external premises is situated about 2km away from the site. The selected site is the most optimum in terms of accessibility and relative interaction with other facilities including the runway, Terminal 1, fire rescue and security attention.

The site is also noted to have minimal conflicts with other services and amenities and hence causing minimal disruptions to other internal facilities and neighbourhoods. There are no interactions with water supply facilities, power distribution and sanitation services as none runs along the project area.

Design Alternative: The design art concept adopted is that of an Acacia Tree to enhance the natural nature of the project location. However, the current practice is fossil and electrical energy intensive operations at Terminal 1 and associated functions with potential for carbon emissions (along with other air pollutants) for lighting and air conditioning. The GFT design has applied alternative energy saving options including enhanced natural lighting technologies, less use of fossil energy and natural aeration (green energy). Several orientations of the design was considered and the most optimum which is the butterfly option was selected.

No-Project Alternative: A No-Project Alternative implies retaining the JKIA as is. This is not preferable considering the capacity challenges facing JKIA. A no-project alternative will also deny the country the potential advantage of hosting one of the air transport hubs in Africa.

6. POTENTIAL IMPACTS AND MITIGATION

Development of the GFT will involve the construction of a new terminal building and installation of associated facilities among them passenger processing equipment, operation areas and offices, amenities (water, power, sanitation, drainage, etc.) and security. In addition, it will also provide pavements including aprons and accessing taxiways, access roads for vehicles and foot paths for pedestrians.

The terminal will be situated on a space of land on which there was no other development before. The proposed terminal structures is expected to have localized direct impacts and only limited linkage impacts to other parts of the airport and the surroundings. Development on the locations will not disrupt any of the existing activities and land use around the airport including

vehicle parking, aircraft parking, ground support operations and people movement at the respective areas.

Increase in Employment: Employment opportunities in the country are on the decline. During construction and operation phase the project will result to employment of skilled, semi-skilled and unskilled workers. More specialized professionals will also be employed during the operation stage by airlines and for ground works.

Transport Infrastructure Improvement: The expansion of JKIA will lead to the development of a modern railway transport system to serve the airport. These will facilitate the provision of an integrated public transport network for Nairobi City. Public service vehicles using the JKIA route will increase, reducing the number of people using private vehicles to the airport and providing transport services to employees. The enhanced public transport will serve current and projected population demand for road space parking, reduce traffic congestion, car exhaust emissions and prolong the life and span of the existing road facilities. Construction of more parking areas will increase income while appropriate parking policies to limit the number of spaces provided in particular for employees and increased parking prices will make public transport facilities more attractive.

Air Quality: Several air quality measurements around JKIA grounds have been undertaken. Notably the SGS Study in 2013 at four locations around the GFT site for a period of 7 days. The measurements were done to evaluate ground concentrations of the following: particulate matter PM, volatile organic compounds (VOCs), sulphur oxides SO_x, and nitrogen oxides NO_x 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 are experienced during the landing and take-off and taxiing 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, motorised ladders, passenger busses and service vehicles are negligible. The pollution indicators sampled on ground for the existing runway, generally indicated compliance with WHO limits.

There is need to undertake air quality modeling of aircrafts emission using internationally recognized modeling tools such as AERMOD (Air Quality Dispersion Model) which uses an atmospheric dispersion modeling system and inputs the internationally accepted emission factors such as UK-NAEI and/or USEPA emission factors or similar for SO₂, NO₂, PM₁₀ and PM_{2.5}; annual aircraft flight frequencies in 2015 and 2030; fuel consumption during landing and take-off and appropriate meteorological data. For GHG emissions for aircraft travelling within the operational LTO cycle, the IPCC methodologies can be used to calculate carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O).

Noise and Vibrations: The main sources of noise at JKIA is associated with aircraft operations and reaches peaks during flight events (landing, takeoff and taxiing) of different aircraft types (large and small). Other sources include ground support equipment and surface vehicles. Ambient noise levels, however, is relatively low and compares well with the conditions in the neighbouring Syokimau residential areas. The data on noise monitoring shows that the impact of the airport operations to the neighbourhood is within acceptable limits below 55dB(A) apart from the location directly below the take-off funnel which experiences occasionally slightly

higher noise levels 64.6 dB(A). This is confirmed by the trends reported from the noise map contours. This implies that aircraft operations will not have a significant impact on the residents. The GFT, however, is within the high noise zone with >75dBA levels during flight events.

Health and Safety Hazards: Construction activities within the airport have the potential to negatively impact the health and safety of both workers and passengers. Unsafe activities and improper use of tools and equipment may result to accidents. People will also be exposed to high noise, vibrations, and air pollution while construction and renovation are on-going. There is also a possibility that fire or chemical spillage may occur.

Mitigation Measures: To mitigate the impacts of these hazards, the Contractor shall comply with KAA Construction Health and Safety Plan requirements. This include (i) training to construction workers in Health and Safety applicable to their respective line of work. (ii) Provision of the necessary PPEs (Proper Protective Equipment) such as ear muffs, safety shoes, masks, and goggles. (iii) Monitoring of workplace noise and air quality regularly to determine exposure levels of pollution to workers during the construction period. (iv) Development and implementation of a Fire Safety Plan and provision of the required equipment and facilities to mitigate the hazards associated with the presence of the fuel storage area.

Ecological Impacts: The previous assessed airport improvement and development projects were established to lose about 3,312,000m³ of grass and minor vegetation. The proposed GFT will also significantly contribute to this loss of vegetation matter. This loss will need to be compensated for (green interventions around the airport and the neighbourhoods) but also disposal of the removed matter. Other improvement works at JKIA did not have significant possibility of displacing the wildlife dispersing onto the airport grounds other than forcing the animals into smaller dispersal grazing area and so is Phase 1 of the GFT. It is, however, noted that this is not a sensitive area and does not constitute a wildlife habitat.

Mitigation Measures: (i) The Contractor to fence the GFT site to prevent any wildlife or livestock from entering. (ii) KAA to consider fencing the eastern side of the airport grounds to keep off further entry by the grazing wildlife. (iii) KAA Wildlife Management Department should give leadership in the collaboration with KWS on possible translocation of the wildlife within the airport precincts to Nairobi National Park or other safe reserves. The translocation costs for wildlife to be borne by KAA.

7. CUMULATIVE IMPACTS, EXPECTED RESIDUAL EFFECTS AND ENVIRONMENTAL HAZARD MANAGEMENT

Dust: Dust emissions from earth works (excavations, spoil removals and fills) affecting mainly the health of the construction workers. Dust emissions at the material sources (borrow areas and quarry sites (will be of concern if the Contractor(s) operates their own material sites). Effects expected on the residents in the immediate neighbourhoods and depending on the wind direction. Materials preparation including storage, batching and application may have localized effects on the workers, the airport air quality. Dust emissions (particulate matter PM) will also increase proportionately with the additional magnitudes of earthworks, materials mobilization and batching as well as additional movements of trucks into and out of the airport grounds.

Mitigation Measures: (i) Water regularly the access roads within the airport used by the construction trucks to keep dust low. (ii) Identify specific routes for materials deliveries for considered dust control (note that other projects outside the airport are using the same roads from the same material source areas). (iii) Materials management and batching plants associated with the project should be designed for low dust and emissions.

Solid Waste: It is estimated that other airport improvements around the airport in will generate over 600,000m³ of spoil earth and rocks. The Green Fields Terminal construction has a potential to generate an additional volume of earth from the excavation of its land surface. Ultimately, the total excavation of the airport pavements alone is estimated to generate close to 2,919,787m³ of spoil earth. The GFT project is also generating vegetation materials (mainly Acacia ssp and grass) of biomass in addition to other ongoing and proposed JKIA improvement projects. Other sources of cumulative wastes (not quantified) would include construction camp sites, material storage and holding areas, workshops and materials batching yards. It is presumed that each Contractor operates their own yards and equipment, effectively distributing waste generation points in various locations around the airport grounds.

Mitigation Measures include: (i) Develop a comprehensive waste management plan for the construction period guided by the ESMP, JKIA Waste Management Plan and the NEMA Waste Management Guidelines. This will be part of the Contractors Environmental Management Plan. (ii) Provide a material balance schedule of construction materials to establish consumption and residuals generated. This will help determine efficiency in waste management, provided with appropriate solid waste bins and removal mechanisms defined at all times at the construction work areas and the construction camp sites. (iii) Ensure daily removal of solid waste materials from the construction sites to avoid unnecessary accumulation at the locations. (iv) Inert solid waste materials (scrap metals, plastic, polythene materials, timber, etc.) may be made available for recycling as a sustainable disposal option. The contractor should be able to establish safe accessibility in this regard without compromising the safety of the airport. (v) The adopted on-site disposal of spoil materials is appreciated so long as the disposal areas are pre-agreed and planned to be in harmony with the airport operations.

Liquid Waste: Wastewater from the construction cleaning activities around the airport grounds may contaminate drainage runoff and ultimately the receiving environments, especially during the rains. Potential pollutants include hydrocarbon residuals, silt and other solid materials. The contaminated wastewater poses risks of health and safety of communities downstream the airport grounds including Syokimau areas, Utawala areas and the upper parts of Mavoko areas. Oil, grease and chemical spills are potential contaminants of the storm water drains and associated downstream receiving aquatic environments. There will be additional generation of domestic wastewater from the workforce on the GFT project in addition to the overall workers wastes water in other airport areas. Liquid wastes generated, however, could not be quantified at this stage.

Mitigation Measures: Contain wash water residuals from the work areas in receptacles for appropriate discharge; and Provide on-site mobile toilets for the construction workers at the work areas and construction camp sites due to the long distances from the construction areas to the nearest washrooms.

Surface Drainage: There is surface runoff originating from the airport grounds (pavements, roofs and other areas) as well as that generated from the neighbourhoods (roads and building

surfaces) and runs through the airport grounds into collective internal drainage systems. Surface runoff is collected and transmitted through the external open drainage systems.

There is possible increase in ponding areas as a result of additional surface generation and disruption of surface runoff drainage channels. With the trunk drainage carrying more runoff from the ongoing works, disruption downstream by the Green Field Terminal works may lead to notable stagnation of rainwater in various parts of the lower sections of the airport grounds. The number of sources and level of pollutants from the various construction activities will increase. These include oil/grease residuals, silt, solid matter, construction debris and dry plant matter. This situation will main affect the southern trunk surface drainage system of the airport.

Mitigation Measures: Contain soils and other materials from the works such as not to interfere with the trunk drainage system to the south of the site; Construct silt traps and channel surface runoff from the site from the rains into the nearest drainage facility (in this case the main trunk drain).

Emergency Response Plan: An Emergency Action Plan will be formulated to provide for the necessary information and training which in turn will reduce reaction time in the event of an accident, thereby increasing the effectiveness of the preventative actions. The Emergency Action Plan must address the necessary responses to the following: (i) Accidents and injuries; (ii) Building evacuation; including evacuation plans and personnel accounting; (iii) Emergency communications; (iv) Emergency response teams; (v) Emergency shutdown procedures; (vi) Fire; (vii) Natural Disasters; (viii) Spills and other Releases.

The Contractor shall comply with KAA's Construction Safety Plan (CSP) that provides both general and specific information to contractors on the requirements and procedures for accident prevention, safety and security at JKIA. This includes construction, repair or services required by JKIA and its tenants. JKIA's safety objective is to achieve accident-free construction projects. KAA demands that safety must be an integral part of each job and full participation, cooperation, and support are necessary to ensure the safety and health of all persons and property involved in the project. According to the CSP, marking, barricading, and lighting airside construction areas are necessary to delineate hazardous areas and prevent unauthorized incursions into the area by personnel, vehicles, equipment, and aircraft during construction. This is done in accordance with ICAO's Annex 15 and is mandatory.

8. ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM

KAA, with Technical Assistance Support from the EU-Africa Infrastructure Trust Fund, has developed Construction Environmental and Social Management Plan (CESMP) Guidelines for all Contractors involved in various construction projects within JKIA. 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 KAA and the Contractor(s) shall develop a CESMP.

The monitoring responsibilities will be guided by the Environmental Division at KAA, represented at the JKIA by a Regional 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 terminal 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

9. PUBLIC CONSULTATION AND PUBLIC DISCLOSURE

In conforming to the current environmental legislation which emphasizes on comprehensive stakeholder engagement, consultations were held with key stakeholders including key businesses at JKIA, airport staff, KAA staff, JKIA Management, private sector institutions, Government institutions and JKIA neighbouring communities. The aim of consultation was to introduce the project, and have their reservations and views integrated in the study.

Specifically, consultations were held with the following institutions, and their views captured in the minutes appended to this report. Kenya Wildlife Service, Kenya Civil Aviation Authority, Kenya Airways, National Airport Services, Taxi Association at the airport, Business association at the airport, Representative of meters and greeters, JKIA Management, KAA – Cargo, KAA – Public Relations, KAA – Environment Department, Kenya Army – Garrison Command, National Environment Management Authority, City Council of Nairobi, Administrative police college, General Service Unit Police College.

Several focus group discussions and public meeting were held, with the people living around the airport. This exploratory research tool was used to gain deeper understanding of issues affecting specific sections of the population within the project area, get views and perceptions of the community about the project and find out the forms of assistance that the community wanted to be accorded to them by KAA including any environmental hazards related to the new terminal.

The focused groups were organized for Syokimau Community, Utawala community, Mihang'o Community, Ruai Community, Business Community around the airport, Women groups, Youth groups and Local Non-governmental Organizations. A field visit was carried out with

members of the Army Garrison Unit and the Syokimau Community, the aim of this field visit was to clarify the site of the Green Field Terminal.

Generally there was broad support for the project from the stakeholders. Concerns raised especially by the community were: (i) KAA to undertake some Corporate Social Responsibility Programs to the neighbouring communities affected by noise. (ii) Stakeholders within the JKIA and outside were concerned on the potential elevation in noise levels with the predicted growth in air traffic at JKIA. Thus, adequate mitigation measures should be put in place. (iii) The capacity of Terminal 1 is reducing and the GFT will complement in addressing the project passenger capacity towards the year 2030. (iv) Safety measures should be put in place during the construction stage of the GFT to ensure that fire and other accidents are mitigated or to allow for fast response to emergency situations. (v) The construction materials and design of the GFT should be of noise proof to shield the occupants and airport users from the effect of aircraft noise. (vi) KAA to fence off the airport land for security and to prevent potential future encroachment. (vii) Relationship between KAA and neighbouring communities is strained and measures need to be put in place to ensure good neighbourliness as the airport expands in capacity and population increasing. (viii) All stakeholders agreed that the project is an important investment for the country.

10. ESMP

Air Quality Management: *Source Emissions:* The operation of the electricity generators at the substations, generators inside the terminal and the water/fire pump diesel engines at the pumping station are the sources of air pollutant emissions. Mitigation implemented to reduce the emission of air pollutants are the 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.

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.

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 terminal 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 terminal building; (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.

Grievance Redress Mechanism: It will be necessary for KAA 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 KAA.

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 KAA, which can be modified appropriately as needed. The GRM implementing unit within KAA shall be a Grievance Redress Committee (GRC) comprising KAA Project Manager, Supervising Consultant Resident Engineer; KAA Environmental or Social Officer and Contractor representative.

11. INSTITUTIONAL CAPACITY AND STRENGTHENING PLAN

KAA has in place elaborate plans to ensure the environment is safeguarded and that safety and health of the workers and 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 are in place to ensure that safety and health issues are adequately taken care of especially in the aviation environment in which JKIA operates.

Construction and operations of the Greenfield Terminal has 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 KAA.

Other responsibilities will include the following; (i) KAA 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 KAA will also comprise of the Airport Engineer, Environment Officer at JKIA, the Health and Safety Officer at JKIA, 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.

12. CONCLUSION

The proposed Green Field Terminal has been designed based on environmental principles taking into consideration sustainable energy use, water and waste management best practices. Impacts associated with the GFT development are generally localized within the airport precincts. The facility is located wholly on the airport land 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. Phase 1 project also 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 from Oldonyo Sambu Game Reserve and Machakos Plains searching for fodder, water and refuge. This 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 as confirmed by KWS. KWS recommended that a 3 to 6 month Wildlife Monitoring be done to determine the grazing patterns of the Wildlife prior to development of a Translocation Plan. In the meantime, KAA will urgently consider providing a full fence on the eastern side of the airport to keep out grazing wildlife. Thereafter, KAA shall liaise with KWS on modalities of safe relocation of the wildlife.

Development of the Green Field Terminal is one among numerous improvement projects at JKIA. It, therefore, adds into the overall cumulative and residual impacts to the airport and its surroundings including; (i) Noise levels arising from increased air traffic activities. The impacts are, however, limited going by the indications of the noise maps projected to 2030; (ii) The overall waste generation and categories will increase with an expanded passenger volumes and

required support services; (iii) With additional hard surfaces, more storm water will be generated demanding higher drainage capacity.

It will be necessary to provide a Community Liaison Desk to continuously address social concerns associated with the GFT project and other improvement activities around JKIA. This desk will be managed by KAA.

REFERENCE

Environmental and Social Impact Assessment of Jomo Kenyatta International Airport Greenfield Terminal Phase 1, October 2014;

Kenya Airports Authority Construction Safety Plan, 2012.

Kenya Airports Authority Safety Policy Statement.

Jomo Kenyatta International Airport Safety Management System, 2013.

Jomo Kenyatta International Airport Emergency Plan, 2011.

Jomo Kenyatta International Construction Environmental Management Plan Guidance, 2011.