ENVIRONMENTAL IMPACT ASSESSMENT PROJECT REPORT FOR THE PROPOSED KIAMBU ROAD INVESTMENT LTD. (KRIL) HOSPITAL ON PLOT L.R. No. 14861/8and PLOT L.R. No. 14861/9 ALONG KIAMBU ROAD, MUTHAIGA NORTH,NAIROBI COUNTY

Figure 1: *Section of the proposed project site*

PROPONENT

Kiambu Road Investment Ltd.

CONSULTANTS

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August 2017

SUBMISSION

This Environmental Impact Assessment (EIA) Report has been prepared and is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003.This Environmental Impact Assessment project report has been prepared by Green By Choice Ltd, a NEMA certified EIA/EA firm of experts. We, the undersigned, wish to certify that the particulars in this report are correct and true to the best of our knowledge.

PROPONENT: Kiambu Road Investment Ltd.

Designation: .....

Name: .....

Signature: .....

Date: .....

EIA/EA LEAD EXPERT

Elizabeth Nzani Wachira

NEMA Reg. No.: 0848

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NEMA Reg. No.: 9083

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ACRONYMS

EA	Environmental Audit
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
L.R. No.	Land Registration Number
NWSC	Nairobi Water and Sewerage Company
MML	Mentor Management Limited
NEAP	National Environmental Action Plan
NEMA	National Environment Management Authority
NLC	National Lands Commission
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Act
PAYE	Pay As You Earn
PPE	Personal Protective Equipment
VAT	Value Added Tax
KRIL	Kiambu Road Investments Ltd.

EXECUTIVE SUMMARY

There are numerous challenges to the Kenyan environment today. This has occurred as a result of unsustainable development projects, many of which have led to environmental degradation.

In an effort to address this problem the Kenya Government came up with legislation enshrined in the Environmental Management and Coordination Act (EMCA), 1999. EMCA's main role is to advocate, oversee and enforce environmental management. Under EMCA, it is a mandatory requirement that all projects are economically viable, socially acceptable and environmentally sound. For this reason, all new development projects are required to undergo an Environmental Impact Assessment (EIA). EIA assesses the ecological and socio-economic impacts of a project before it is implemented.

According to section 58 of the Environmental Management and Coordination Act (EMCA) No. 8 of 1999 Second Schedule 9 (1), and Environmental (Impact Assessment and Audit) Regulations (2003), new projects are required to undergo an EIA. The report of the same must be submitted to National Environment Management Authority (NEMA) for approval and issuance of a license. This is necessary as many forms of development activities cause damage to the environment. It is in accordance with this piece of legislation that the Project Proponent(s) - the developers- undertook to prepare this EIA project report.

The proposed development site for which this report has been conducted is located in Muthaiga North, along Kiambu Road at the Coffee Garden Drive junction, Nairobi County. The area enjoys a mix of suburban setting with diversity in developments ranging from commercial, residential to recreation facilities. The site is approximately 6.8kms from the Nairobi CBD and is located on a plot on Kiambu Road. The project being proposed will sit on a piece of land that measures approximately 3 acres. The L. R. Nos. for the plots to be developed are **14861/8** and **14861/9**. The Proponent applied for and has obtained approval for amalgamation of the two plots. The Proponent would like to develop a hospital which shall consist of well equipped operational theatres, an antenantal clinic, accident and emergency centres, laboratory and vaccination services, doctors plaza with different consultation and advisory services like dental, gynaelogical and a car park. KRIL Hospital will have a maximum capacity of 100 beds for patients.

Scope, Objective and Criteria of the Environmental Impact Assessment

Green By Choice Ltd - an environmental consultancy firm- was engaged by Pharos Architects on behalf of the Proponent(s) to conduct the EIA of the proposed project. The scope of the assessment covered construction works of the proposed development which included ground preparation, masonry and installation of service lines, as well as the utilities required for the proposed project. The output of this work is this comprehensive EIA project report for the purposes of applying for an EIA licence.

The general objective of the project report is to ensure that the Proponent(s) observes environmental concerns in all development activities in order to contribute to sustainable development.

Specific Objectives

- To determine the compatibility of the proposed development with the local environmental setting.
- To identify and evaluate the significant environmental impacts of the proposed project.
- To assess the environmental costs and benefits of the proposed project to the local and national economy.
- To propose mitigation measures for any negative environmental impacts.
- To incorporate Environmental Management Plans (EMP) and monitoring mechanisms during implementation, operation and decommissioning phases of the project.
- To inform the public about the proposed project and get their views (public participation).

The EIA Consultant, on behalf of the Proponent(s), conducted this EIA project report that had the following **Terms of Reference**: -

- To provide a detailed description of the proposed development project in terms of location, objectives, design, activities, material inputs, outputs, products and waste.
- To provide a detailed description of the baseline environmental and socio-economic conditions of the project site.
- To review the relevant legal, policy and institutional framework applicable in the implementation of the proposed project.
- To provide a detailed description of the potentially affected environment.
- To identify, predict and analyse the environmental and social impacts of the project, including seeking neighbours' and public views and concerns.
- To provide an analysis of project alternatives in terms of site, design and implementation technologies and provide reasons for preferred options.
- To provide a detailed EMP proposing measures for mitigating negative environmental impacts, including the cost, timeframe, responsibility and monitoring indicators to implement the measures.
- To provide an action plan for management of health, safety, security and prevention of accidents and emergencies and hazardous activities.

Methodology Outline

The general steps followed during the assessment were as follows: -

- Environmental screening, during which the project was identified as among those requiring EIA under Schedule 2 of EMCA (1999).
- A site reconnaissance and visual survey to determine the baseline information of the project area.
- Comparative study of the project with existing land uses in the neighbourhood.
- Discussion with the Project Proponent(s) and his consultants.
- Seeking public views via the use of questionnaires.
- Proposal of mitigation measures to minimize any negative impacts.
- Preparation and submission of the report to NEMA for purposes of seeking an EIA approval and license.

Potential Positive Impacts of the proposed project

The positive benefits associated with the proposed project include the following: -

- Creation of a readily available market for the raw materials used during construction.
- Economic investment hence increases in wealth for the project Proponent(s).
- Provision of employment opportunities during construction of the proposed project.
- To contribute towards the improvement of health infrastructure, health services and opportunities in Kenya and the East African region.

Potential Negative Impacts Associated with the proposed project

The potential negative impacts associated with the proposed project include the following: -

- Increase in solid waste
- Impact during transportation of construction materials and products and traffic implications along the roads leading into the area
- Impacts on human health and safety. The health and safety of workers may be an issue during the construction phase
- Air pollution as a result of dust particles emanating from excavation and construction activities

In order to alleviate the negative impacts associated with the project, the Proponent(s) shall take several measures, as indicated in the summarized EMP (Table 1).

Environmental Management Plan (EMP)

Table 1: *Summarized EMP for the proposed development*

Possible Environmental Impacts	**Suggested Mitigation Measures**
Air pollution, dust generation and noise pollution	❖ Sprinkle water during construction work ❖ Control of speed and movement of construction vehicles ❖ Use of low-sulphur diesel for diesel-operated machinery ❖ Use of ear protection aids by construction workers ❖ Construction to take place only during the day ❖ Use of attenuated equipment ❖ No unnecessary hooting by project vehicles ❖ Installation of sound barriers ❖ Temporarily fencing off of noisy machinery such as vibrators ❖ Switch off machines when necessary
Clearing of vegetation	❖ Planting grass to cover open/bare grounds ❖ Maintaining trees in areas not affected ❖ Proper landscaping ❖ Use specialized equipment to minimize damage to tree roots ❖ If possible, plant new trees on approved public land to replace the trees cut down at the project site ❖ Establishment of flower gardens and lawns around project site
Disturbance of soil structure	❖ Put soil traps around perimeter fence and on steep areas ❖ Landscaping with trees, shrubs and grass ❖ Maintaining specified routes for construction vehicles ❖ Control earthworks ❖ Use of light machinery and equipment
Destruction of habitat	❖ Maintaining trees and plants in areas not affected ❖ Avoid off-road driving ❖ Control of earthworks
Generation of solid waste	❖ Provision of waste collection bins ❖ Re-use of soil, construction debris and other reusable waste ❖ Proper containment and disposal of solid waste ❖ Contracting a licensed waste collection and disposal company ❖ Creation of awareness on proper solid waste disposal

	methods ❖ Re-use of timber off-cuts and wooden support for fuel or in other construction projects
Generation of Bio-medical waste	❖ Provision of waste collection bins designed to hold bio-medical waste and hazardous waste. ❖ Contracting a licensed waste collection and disposal company specialised in handling bio-medical and hazardous waste ❖ Proper containment and disposal of the bio-medical waste. ❖ Creation of awareness on proper bio-medical waste collection and disposal methods to the staff.
Increased demand for water and electricity	❖ Conservative use of water and electricity ❖ Provision of adequate water storage facilities ❖ Installation of waste water recycling systems ❖ Installation of rainwater harvesting structures ❖ Re-use of water where possible, especially during the construction phase ❖ Explore additional sources of water such as boreholes ❖ Utilize alternative and renewable sources of energy such as installation of solar panels ❖ Use of energy saving and efficient appliances
Occupational health and safety risks	❖ Use of suitable personal protective equipment (PPE) ❖ Site to be sprinkled with water to minimize dust ❖ Use of stable ladders and other climbing/support structures ❖ Sensitize workers on construction safety measures ❖ Cleanliness and organization at the construction site ❖ Fencing or covering of risky areas such as deep pits ❖ Safety signage ❖ Use of permit-to-work authorizer for risky jobs ❖ Engagement of skilled labourers ❖ Insurance for workers if possible
Fire hazards and accidents	❖ Acquire fire-fighting facilities/equipment ❖ Sensitize workers in fire safety ❖ Avoid storage of flammable substances on the project site ❖ Keep well stocked first aid kits ❖ Proper handling and use of tools and machinery
Security	❖ Guarding of site by a reputable security firm ❖ Constant site patrol ❖ Adequate screening of visitors to the site ❖ Collaboration with existing security machinery

	❖ Partnership with neighbours and police in community policing
Generation of waste water	❖ Proper connection of waste water and sewerage system to existing city council system as per approved design ❖ Provision of storm water drains ❖ Proper decommissioning of waste water and sewerage system ❖ Proper maintenance of the drainage system
Public health and safety	❖ Proper handling and disposal of solid waste ❖ Operation of noisy machinery in daytime only ❖ Control of visitors to the site ❖ Installation of adequate water supply ❖ Controlled developments around the facility
Increase in traffic flow	❖ Adequate road warning signs to traffic regulations ❖ Set driving speed limits and erection of speed bumps ❖ Put acceleration and deceleration lanes to and from the main road ❖ Choice of access routes during construction phase should ensure minimum disturbance to the neighbours ❖ Develop a traffic plan to minimize traffic flow interference from construction activities e.g. schedule transport activities affecting traffic for off-peak hours
Storm water run off	❖ Establish a storm water drainage system ❖ Proper maintenance of the drainage system ❖ Surface run-off and discharge should be controlled to prevent soil erosion

Conclusion and Recommendations

It is worth noting that the construction and operation of the proposed development will bring positive impacts in the project area, as well as negative impacts as outlined above. However, the positive impacts outweigh the negative impacts.

It is our recommendation that the Proponent and the Contractor adhere to the mitigation measures outlined in this report and that the EMP is implemented as prescribed. The Proponent needs to continue complying with the relevant legal and policy requirements that affect this project. It will be in the interest of all stakeholders if NEMA issues an EIA license to the Project Proponent to ensure the full realization of benefits accruing from this project.

1. INTRODUCTION

1.1 Background and rationale for Environment Impact Assessment

The proponent has proposed to construct a modern hospital to facilitate easy access to quality health care which has been elusive to the less priviledged in society in most African countries. The proposed project is intended to enhance medical services offered in Kenya by providing highly specialised care, modern treatments for patients and a more spacious and comfortable environment. This will be in line with meeting the goals and deadline for the U.N Charter Millenium Development Goals. The proposed hospital is to be constructed in Muthaiga North along Kiambu Road, on an approximately 3-acre piece of land comprising two plots joined together. An application for Amalgamation of the plots has been approved. The Registration Numbers for the plots are **14861/8** and **14861/9.**

For a long time, many development projects worldwide have not taken into account their effects on the environment. This has led to many environmental problems some of which have been irreversible and costly. In Kenya for instance, policies and strategies that were pursued to achieve development since independence were not only disjointed, but hardly addressed environmental problems. A comprehensive environmental policy was therefore needed to address the environment in a holistic way. This was achieved through the passing of the Environmental Management and Coordination Bill into Law (EMCA, 1999). EMCA stipulates that EIAs be carried out on all development projects likely to cause significant impacts on the environment. This environmental legislation has led to significant achievements in environmental conservation and protection in the recent past. It is in this response that this project report has been prepared.

1.2 Data Collection Procedures

The Consultant undertook environmental screening and scoping to avoid collecting unnecessary data. Data collection was carried out through questionnaires, visual observation, photography, site visits and desktop environmental studies, where necessary in the manner specified in Part V (Section 31-41) of the Environmental (Impact Assessment and Audit) Regulations (2003).

1.3 Reporting and Documentation

This EIA project report was compiled and prepared in accordance with the guidelines issued by NEMA for such works. The report is to be submitted by the Proponent for consideration of approval and licensing. The Consultant ensured constant briefing of the client during the exercise. Description plans and sketches showing various activities are part of the Appendices.

1.4 Responsibilities and Undertaking

The Consultant undertook to meet all logistical costs relating to the assignment, including those of production of the report and any other relevant material. The consultant arranged for own transport and travel during the exercise. On the site of the proposed project, the Proponent provided a contact person to provide information required by the consultant. The Proponent also provided site plans showing buildings layout, a list of raw materials that will go into the project, operation permits and land ownership documents. The output of the process is this detailed EIA project report.

1.5 Methodology Outline

- Environmental screening, during which the project was identified as among those requiring EIA under Schedule 2 of EMCA (1999).
- Environmental scoping that provided the key environmental issues.
- A site reconnaissance and visual survey to determine the baseline information of the project area.
- Comparative study of the project with existing land uses in the neighbourhood.
- Discussion with the Project Proponent.
- Desktop studies.
- Seeking public views via the use of questionnaires.
- Preparation and submission of the EIA report to NEMA for purposes of seeking an EIA approval and license.

Environmental screening was applied to determine whether an EIA was required and what level of assessment was necessary. This was done in reference to requirements of EMCA, (1999). Issues considered included the physical location, sensitive issues and nature of anticipated impacts.

Environmental scoping process helped focus the project report towards the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, natural/ecological, social, economic and cultural aspects.

Site visits were meant for physical inspection of the location of the project, and to gain a better understanding of the characteristics and the environmental status of the surrounding areas to determine the anticipated impacts. To ensure adequate public participation in the EIA process, questionnaires were administered to the neighbours within a one kilometre radius and the information gathered was subsequently synthesized and incorporated into the EIA project report.

Desktop studies included documentary review of the nature of the proposed activities, project documents, designs, policy and legislative framework as well as the environmental setting of the area, among others.

In addition to constant briefing of the client, this report was prepared. The contents were presented to the Proponent for submission to NEMA as required by law.

2. LOCATION AND SIZE OF THE PROPOSED PROJECT

The proposed project will sit on a plot that is approximately 3 acres whose L.R. No. is **14861/8** and **14861/9**, off Kiambu Road near Coffee Garden drive junction, Nairobi County. The proposed site is about 6.8 km from Nairobi's Central Business District (CBD). GPS coordinate values for the site are **Lat: -1.23765, Long: 36.84498.** The elevation of the site is **5449** ft.

Figure 2: *Location of the proposed project site*

2.1Objectives of the Proposed Project

The main objective of the project is to develop a 3-acre plot into a modern hospital that will offer quality and affordable healthcare services to people within Nairobi County as well as the country at large, while maintaining the highest environmental standards in accordance with International Standards Organisation (ISO).

Specific Objectives

- To put the land at the project site to optimal use
- Boost the economy by providing a market for suppliers of goods for construction and related services
- Maximize return on investment for the Proponent while taking due consideration of policy, legal and administrative procedures governing the operations of a facility of this nature
- To ensure that the fears and hopes of the neighbouring community in this serene environment are captured and addressed in all stages of the project cycle
- Ensure that implementation of the project does not in any way interfere with the environmental sustainability of the area in question giving due consideration to: -
    - Neighbouring population and land uses
    - Facilities and infrastructure within the project area
- Put in place mitigation measures that will ensure that any potential negative impacts resulting from project activities are taken care of at the earliest opportunity to obviate any harmful effect to the neighbouring populations and the environment.

2.2 Key Findings

The proposed site has decrepit structures that were once part of Rock City – a popular childrens' entertainment park. The piece of land being developed comprises two plots being amalgamated. The plot to be developed is grassy, bushy and has a few trees such as *Araucaria cunninghamii*, *Grevillea robusta*, *Eucalyptus saligna*, *E. globule*, *Cupressus torulosa* and *Cupressus lusitanica*. Additionally, a number of shrubs are also found on the site such as *Strychnos henningsii* (Muteta), *Erythrococca bongensis* (Muharangware), *Vangueria madagascariensis* (Mubiro), *Rhamnus prinoides* (Mukarakinga), *Caesalpinia volkensii* (Mubuthi), *Solanum incanum* (Mutongu, Sodom Apple), *Elaeodendron buchananii* (Mutanga) and *Rhus natalensis* (Muthigio).The site is home to a number of exotic plant species, mostly coral trees and palm trees. It is highly recommended that trees in the area that will not be affected be left intact.

Access to the site is via Kiambu Road at Coffee Garden junction. The site is bordered by residential houses to the East and Karura forest to the West. The area is supplied by electricity from the national grid and can be routed to the project site from a 3 phase power line passing close to the site. Commodities grown on the farms surrounding the site area are mostly for commercial and domestic purposes, specifically, large scale coffee farming.

Figure 3: Existing Site Conditions

2.3 Project design

The proposed development which is estimated to cost **Kshs.**890,700,000.00million entails the construction and operation of a hospital with a capacity to hold 100 beds. The actual proposed project design will have the following facilities:-

- Doctor's Plaza
- Outpatient Department
- Radiology
- Laboratory
- Accident & Emergency Department
- Theatres & Surgery Department
- Critical Care Department
- Pediatrics Department
- Main Wards Department
- Maternity and Labour Department
- Holding Room (a cooling plant for temporary holding of dead bodies for transfer to other mortuaries)
- Kitchen, servery and auditorium**.**

- Parking slots.
- Construction of Basement, Lower ground floor, Upper ground floor and First floor.
- Roofing tiles (curved roof with slope to drain)
- Perimeter wall and associated pavements including ramps for disabled persons
- Public and patient lifts and fire escapes.
- Development utilities, such as water, drainage, energy etc.

Some of the facilities that will be provided include waiting rooms, staff lounge, manager's office, private rooms, toilets, changing rooms and recreation rooms. Other social amenities include a gym coupled with a therapy pool, aerobics centre and also a conference centre. The entrance and gate-way shall be articulated using plants and trees such as royal palm trees, colorful shrubs and ground cover. The courtyards will be well landscaped to provide good views for quick healing.

The development will be constructed with a facade design to enhance aesthetics. In general, the project will essentially optimize the use of the best available technology to prevent or minimize potentially significant environmental impacts associated with the project. The proposed development will highly consider maximum use of natural light and best use of natural ventilation. Water efficiency, conservation, harvesting and storage will also be considered.

Fig 4: A diagram showing a Perspective of the proposed KRIL Hospital

2.4 Electricity/Power supply

The site will be connected to the electricity main Kenya Power line, which will be used in all phases of the project. Necessary guidelines and precautionary measures relating to the use of electricity shall be adhered to.

2.5 Water supply

Water supply for consumption will be supplied by the Nairobi Water and Sewerage Company (NWSC). Other supplies will include harvested rain water and recycled water. Water storage tanks will be installed to increase water capacity at the project site to the required amount. During the operation phase of the project, rain water will be harvested and stored.

2.6 Waste water and sewerage

The proponent intends to use septic tanks for waste water and sewerage disposal that will be connected to an on-site sewerage treatment system (to be constructed) which will treat the waste water to suitable standards to allow re-use and recycling of water.

A waste water treatment plant will be installed by a specialist. Wastewater treated using this technology will meet the set water quality standards outlined below.

Table 2: *Guideline values for discharge of treated effluent into the environment*

Parameter	**Guide value**
Ph.	6.5 – 8.5
Biological Oxygen Demand (5 days at 20 ° C)	30 (mg/L) max
Chemical Oxygen Demand	50 (mg/L) max
Suspended solids	30 (mg/L) max
Ammonia $–NH_4^+$ Nitrate-NO_3^+ Nitrite-NO_2	100 (mg/L) max
Total Dissolved Solids	1200 (mg/L) max

Source: Environmental Management and Co-ordination (water quality) regulations, 2006. Sixth schedule

Table 3*: Microbiological quality guidelines for wastewater use in irrigation*

Re-use Conditions	**Exposed group**	**Intestinal nematodes (MPN/L)***	**Coliforms (MPN/100 ml)**
Unrestricted irrigation (crops likely to be eaten uncooked, sports field, public parks)	Workers, consumers, public	< 1	< 1000 **
Restricted irrigation (cereal crops, industrial crops, fodder crops, pastures and trees)***	Workers	< 1	No standards recommended

Source: Environmental Management and Co-ordination (water quality) regulations, 2006. Eighth schedule

**Ascaris lumbricoides, Trichuris trichiula* and human hookworms
** A more stringent guideline (< 200 coliform group of bacteria per 100 ml) is appropriate for public lawns, such as hotel lawns, with which the public may come into direct contact
*** In the case of fruit trees, irrigation should cease two weeks before fruit is picked and fruit should be picked off the ground. Overhead irrigation should not be used.

Table 4*: Standards for Irrigation water*

Parameters	**Permissible Level**
Ph.	6.5-8.5
Aluminium	5 (mg/L)
Arsenic	0.1 (mg/L)
Boron	0.1 (mg/L)
Cadmium	0.5 (mg/L)
Chloride	0.01 (mg/L)
Chromium	1.5(mg/L)
Cobalt	0.1 (mg/L)
Copper	0.05 (mg/L)
E-coli	Nil/100 ml
Fluoride	1.0 (mg/L)
Iron	1 (mg/L)
Lead	5 (mg/L)
Selenium	0.19 (mg/L)
Sodium Absorption Ration (SAR)	6 (mg/L)
Total Dissolved Solids	1200 (mg/L)
Zink	2 (mg/L)

Source: Environmental Management and Co-ordination (water quality) regulations, 2006. Ninth schedule

Table 5*: Quality standards for recreational water*

PARAMETER	**MAXIMUM PERMISSIBLE LEVEL**

Arsenic (mg/l)	0.05
Faecal coliform (Counts/100 ml)	Nil
Total coliform (Counts/100 ml)	500
Cadmium	0.01
Chromium	0.1
Colour (True Colour Units)	100
Light Penetration (meters)	1.2
Mercury (mg/L)	0.001
Odour (Threshold Odour Number, TON)	16
Oil and Grease (mg/L)	5
Ph.	6 – 9
Radiation, Total (Bq/L)	0.37
Surfactant, MBAs (mg/L)	2
Temperature (° C)	30
Turbidity (NTU)	50

Source: Environmental Management and Co-ordination (water quality) regulations, 2006. Tenth schedule

2.7 Storm water/run off

Storm water from a construction site can be a major cause of water pollution. Pollution in storm water can include:

- Soil
- Sand
- Construction debris: (cement, woodchips, metal scraps etc.)
- Natural debris: (leaves, grass etc.)
- Chemicals: (paints, fuel, lubricants and oils etc.)

Storm water drainage system will be put in place to collect all the storm water and to make sure that there is no stagnant water at the site.

2.8 Solid and Bio-medical waste

Solid waste management will consist of dustbins stored in enclosed area to be protected from rain. The waste will then be collected by a reputable NEMA approved waste collection and disposal company. Bio-medical waste will also be disposed of in specially designed bins stored in an enclosed area. The waste will then be collected by a reputable NEMA approved bio-medical waste collection and disposal company. It is recommended that the proponent separate different types of solid waste to make recycling and re-use easier. Waste containers for example can be provided for glass, plastics, tins/metal, paper, biodegradables etc. and the colour of the containers for each type of waste can be different to encourage and make recycling easier and efficient.

2.9 Project Activities

2.9.1 Description of the project construction activities

Construction activities include site preparation by clearing the vegetation, excavations work, foundation works and building of floors and walls. The construction will be carried out by a registered NCA class A contractor.

2.9.1.1 Excavation and foundation work

Excavation will be carried out to prepare the site for construction of foundations, pavements and the drainage system.

2.9.1.2 Material handling and storage

Building materials will be stored on site. Bulky materials such as rough stones, ballast, sand and steel will be carefully piled on site. Sand, soil and any other dusty material should be covered to prevent and reduce air pollution and fugitive dust at the site and its surroundings.
Construction materials and equipment if not handled with care can cause hazard to the environment and injuries to the workers. For a safe working environment during the construction phase, it is recommended that:

- Stockpiles be removed as soon as practicable and materials placed in a way so as not to obstruct waterways.
- Stockpiles of soils, pre-mixed aggregate and asphalt binder should be covered especially during rainy and windy events.
- Potential water pollutants e.g. chemicals, solvents, paint, etc., should be stored in an isolated place where they will not cause run-off pollution. They should be stored according to manufacturers' guidelines.
- Great care should be taken to prevent spillage.
- Containers should not be washed in or near streams or storm water drainage systems.
- A plastic mat, tar paper or other impervious materials should be placed on any areas where toxic liquids are to be opened and stored to protect soil and groundwater pollution.
- Construction workers must take appropriate precautions by use of protective clothing during construction activities.
- No materials are to be stored in unstable or high-risk areas.
- Material stockpiles must be stable and well secured to avoid collapse and possible injury to workers or visitors at the site.
- Deliveries should be planned to keep the amount of materials on site to a minimum.

2.9.1.3 Masonry, concrete work and related activities

The construction of the building walls, foundations, floors, drainage systems and perimeter fence, among other components of the project, involves a lot of masonry work and related activities. General masonry and related activities include stone shaping, concrete mixing, plastering, slab construction, construction of pavilions, and erection of building walls and curing of fresh concrete surfaces. If concrete and cement will be mixed at the construction site, it is recommended that the mixing be done in an enclosed place.

2.9.1.4 Structural steel work

The building will be reinforced with structural steel for stability. Structural steel works involve steel cutting, welding and erection. The workers carrying out this activity must wear appropriate protective clothing/equipment.

2.9.1.5 Roofing works

Roofing activities will include raising the roofing materials such as Decra or Armatile roof tiles and structural timber to the roof and fastening the roofing materials to the roof. Reinforced concrete slabs and steel structures are to be used as per the Engineers' detail while the waterproofing is to be laid to follow manufacturers' specifications.

2.9.1.6 Electrical works

Electrical work during construction of the premises will include installation of electrical gadgets and appliances including electrical cables, lighting apparatus and sockets.

2.9.1.7 Plumbing and drainage

Installation of pipe-work for water supply and distribution will be carried out in the development and associated facilities. In addition, pipe-work will be done for wastewater and for storm water. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling, among others.

2.9.1.8 Landscaping

The site is to be landscaped to plan. Well-landscaped lawns will be established at the site. The project designs make provision for landscaping at the proposed site.

2.9.2 Description of the project operational activities

Once the proposed development is complete, the building will be used for different activities and purposes from wards, doctor's rooms, and dining rooms to offices. There will be office waste (waste paper, cartons, and containers), biodegradable waste and waste water generated from the proposed development.

2.9.2.1 Solid waste and waste water management

The completion of the project will lead to generation of assorted solid waste including office waste e.g. waste paper, empty cartons, biodegradable waste and waste water. The solid waste generated within the facility will be put in containers within the premises temporarily before the hired/contracted licensed solid waste disposal company collects the waste for final disposal.

Care must be taken to ensure that waste water is handled well to avoid contamination of any water body. Sewage generated will be collected and channelled into the drainage/ sewage system at the site.

2.9.2.2 General repairs and maintenance

The proposed development and associated facilities will be repaired and maintained regularly during the operational phase of the project. Such activities will include repair of walls and floors, repair and maintenance of electrical gadgets and equipment, repair of leaking water pipes, painting and replacement of worn out materials, among others.

2.9.2.3 Final Inspection and Occupancy

The final inspection is undertaken to ensure that the project is properly undertaken in accordance to the laid down contract. The inspection team will include the contractor, the structural engineer, and the project architect. This inspection entails checking in detail the construction and its installed utilities. The team will ensure that everything is functioning as expected and the quality of the materials used are up to standard. If they are satisfied with the job, the job shall be declared officially completed and a certificate of occupancy will subsequently be issued. The certificate will be issued based on the health and safety requirements stipulated in legislations such as the Public Health Act. If satisfied, the contractor and the proponent will file a formal notice of completion marking the handing over of the project to the proponent. All required kinds of works will be done and supervised by skilled and registered experts in conformity with established standards.

2.9.3 Description of the project decommissioning activities

Should there be need for eventual decommissioning of the proposed project, in which case the development would have to be demolished and land put to alternative use, different measures will be taken into account.

Decommissioning will produce a lot of solid waste, which will be reused for other construction works or if not reusable, disposed of appropriately by a licensed waste disposal company.

All equipment including electrical installations, furniture, finishing fixtures, partitions, pipe-work and sinks, among others, will be dismantled and removed from the site on decommissioning of the project. If the equipment is in good state priority will be given to reuse of this equipment in other projects. This will be achieved through resale of the equipment to other building owners or contractors or donation to schools, churches and charitable institutions.

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the top soil and re-vegetation using indigenous plant species. It is recommended that a separate EIA report be carried out in case of decommissioning of the proposed project.

2.10 Material inputs, products, by-products and waste

2.10.1 Material Inputs

Material inputs to be used in the construction and implementation of this project are listed below.

- Construction stones
- Construction sand
- Ballast
- Cement
- Timber
- Steel
- Reinforced concrete slabs
- Nails
- Damp proof membrane
- Glass
- Paint
- Aluminium

- PVC pipes
- Galvanized wires
- Galvanized iron sheets
- Ceramic tiles
- Electrical wires, among others.

2.10.2 Utilities

- Water
- Electricity

2.10.3 Tools and Machinery

The following tools and machinery are to be used:

- Hammers and mattocks
- Wheelbarrows
- Spades, trowels and other masonry tools
- Concrete mixer etc.

2.10.4 Outputs

The outputs of this proposed development will be hospital wards, private rooms, a sick room, administration rooms, auditorium, science laboratories, staff quarters, a dining room, recreational facilities etc. and their associated facilities.

2.10.5 Waste and by-products

The waste and by-products arising from this project include:

- Construction debris (from concrete and broken stones)
- Excavated soil
- Wooden pieces, timber cut-offs and left-over timber
- Waste water
- Waste metal cuttings from wires, rods and metal sheets

All the waste and by-products from the proposed development should be reused or recycled if possible to avoid waste for disposal.

3. BASELINE INFORMATION

This section describes the area where the proposed project is to be established. It will describe in detail the biological, physical and socio-economic environment of the project area.

3.1 Site Location

The site is situated along Kiambu Road off Coffee Gardens Drive in Nairobi County. Both Kiambu Road and Coffee Gardens Drive are tarmacked. The site borders Karura Forest, to the west (along Kiambu Road).

Fig 5: Panoramic view of the KRIL project site

3.2 Physical Environment

Nairobi experiences long rains between mid-March to May followed by a cold season usually with drizzles and frost from June to August, and short rains between mid-October to December. The average rainfall received by the county in general is 1,000 mm.

The mean temperature in Nairobi is 26°C with temperatures ranging from 7°C in the upper highlands to 34°C in the lower midlands. July and August are the months during which the lowest temperatures are experienced whereas January to March are the hottest months.

3.2.1 Climate

Climatic conditions in this area compare favourably to that of the wider Nairobi City. The area has an annual rainfall of between 600-1000 mm annually. The area has a bimodal rainfall pattern in which the maxima occur in March-May (long rains) and November-December (short rains). The simple rainfall regime is complicated by the uncertainty of rainfall from year to year. Temperature ranges to $20 – 27^0$ C.

Table 6: *Temperature graph of Nairobi*

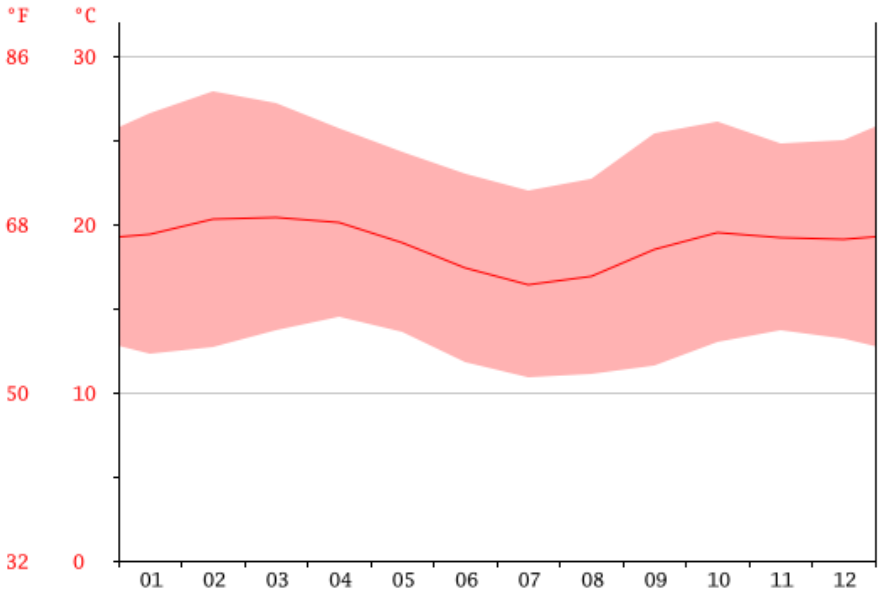
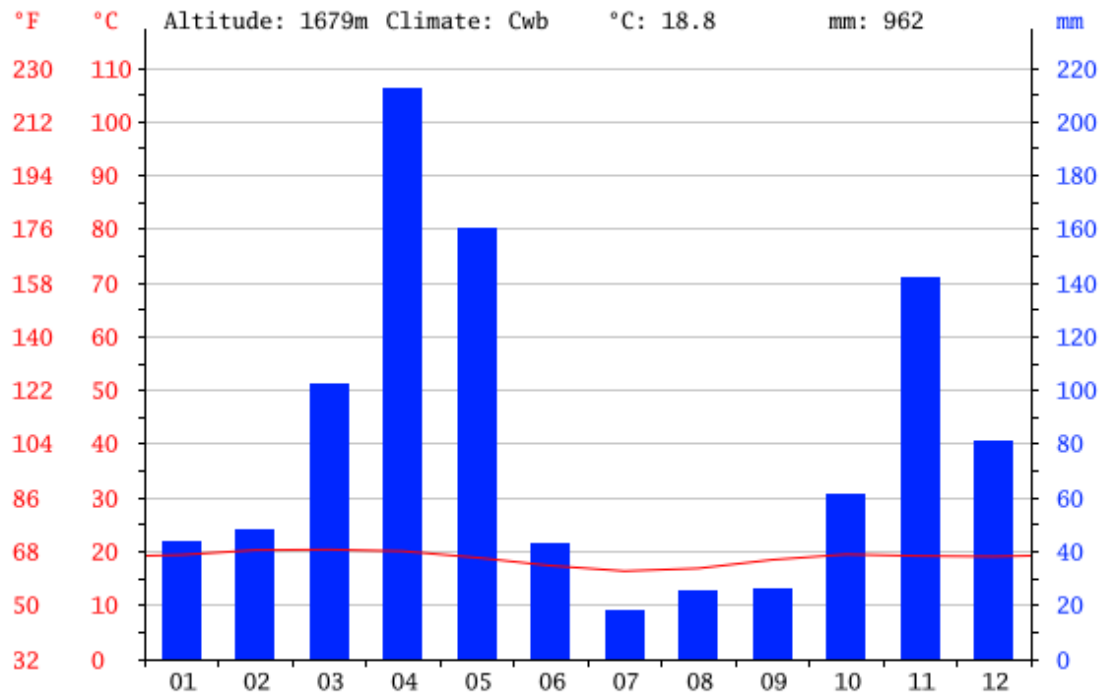


Table 7*: Climate graph of Nairobi*



The general climate in Nairobi is warm and temperate.

Table 8: Climate table of Nairobi

month	1	2	3	4	5	6	7	8	9	10	11	12
mm	44	48	102	212	160	43	18	25	26	61	142	81
°C	19.4	20.3	20.4	20.1	18.9	17.4	16.4	16.9	18.5	19.5	19.2	19.1
°C (min)	12.3	12.7	13.7	14.5	13.6	11.8	10.9	11.1	11.6	13.0	13.7	13.2
°C (max)	26.6	27.9	27.2	25.7	24.3	23.0	22.0	22.7	25.4	26.1	24.8	25.0
°F	66.9	68.5	68.7	68.2	66.0	63.3	61.5	62.4	65.3	67.1	66.6	66.4
°F (min)	54.1	54.9	56.7	58.1	56.5	53.2	51.6	52.0	52.9	55.4	56.7	55.8
°F (max)	79.9	82.2	81.0	78.3	75.7	73.4	71.6	72.9	77.7	79.0	76.6	77.0

Source: www.nairobicity.go.ke and www.worldtravels.com

3.3 Topography

The surrounding area has a gated community which comprises homes of higher than average net worth individuals. Karura Forest is across Kiambu Road from the site. The area landscape rolls gently between and through shallow valleys. Drainage is generally south-easterly. Depressions throughout the area impede drainage and cause formation of small edaphic grassy swards and swamps. Proper landscaping and drainage will be installed.

3.4 Soils and Geology

The site area sits on million-year-old Late Tertiary volcanic rocks. Geologically, the area is covered by rocks of the upper Athi series which formed from successive lava flows in the post rift valley formation. The common rock forms are volcanic tuffs with intercalated flows of basaltic sponge cake. Overlain by this clay stratum is the wet laterite. This laterite (rocky) stratum may offer the best foundation depth for the proposed structures. The soils near and within the project site comprise the red loamy soils and are very fertile. The fertility is conducive for livestock keeping and growth of various cash crops, food crops and horticultural crops.

3.6 Biological Environment

3.6.1 Flora and Fauna

The site is covered by various types of vegetation, all of which is secondary vegetation due to human disturbance. These include grass, shrubs, and a few trees. Some of the tree, shrub and grass species found on site include *Araucaria cunninghamii*, *E. globule*, *Cupressus torulosa* and *Cupressus lusitanica*, *Strychnos henningsii* (Muteta), *Erythrococca bongensis* (Muharangware), *Vangueria madagascariensis* (Mubiro), *Rhamnus prinoides* (Mukarakinga), *Caesalpinia volkensii* (Mubuthi), and *Solanum incanum* (Mutongu, Sodom Apple). Resident fauna on site include small mammals such as rodents and various bird species, herperto-fauna such as snakes, frogs and lizards.

Figure 6*: Flora on site; this will only be cleared when necessary*

3.7 Infrastructure

Nairobi County is generally well served by infrastructure such as roads and other services such as electricity, schools and health centres. Piped water supply is also connected to several parts of the county. Medical care in Kenya is unfortunately still the preserve of the higher socio-economic income bracket. A percentage of the population is fortunate to have employers who are legally obliged to provide some form of medical cover. However, an even larger percentage have no medical cover and access medical care from the public hospitals or seek traditional healers, whilst a number resort to being treated by unqualified or unlicensed practitioners. Generally, the proposed project area is secure with easy access to public transportation networks.

3.7.1 Roads

The main Kiambu Road is tarmacked. Access to the site is easy as the site is along Kiambu Road – on the right when approaching Kiambu.

3.7.2 Water

Nairobi Water and Sewerage Co Ltd will supply the proposed project site with water. Water harvesting shall be implemented during the operational phase of the project to reduce water stress in the area. The climatic and physical conditions of the area compare favourably to that of the wider Nairobi area. A combination of one or more of these factors directly influence urban development, and are a prerequisite to site analysis and planning.

3.7.3 Electricity

The area is served by 3-phase electric power from the Kenya Power main line. The area is adequately served with telecommunication facilities.

3.7.4 Traffic

The Proponent has commissioned a traffic study to forecast traffic flows on existing and future road networks. The study is on-going.

3.7.5 Security

Security in the area is generally good. The proposed development will be secured by use of CCTVs, screening of individuals and cars, a perimeter fence and by hiring a reputable security firm.

3.7.6 Refuse disposal

There was no dumping site identified in the area and therefore it is assumed that neighbouring establishments manage their own waste or engage the services of private waste handlers. The proponent shall use the services of a private registered solid waste collection company to collect and dump all solid waste generated from the proposed site. Temporal solid waste handling containers shall be provided on site where residents will dispose of their waste before it is collected for disposal at the council's designated dumpsite.

3.7.7 Sewerage

The area has no public sewer system. Most of the neighbouring establishments rely on septic tanks. The proposed development proposes to construct septic tanks.

3.8 Socio-economic Environment

3.8.1 Demography

The City of Nairobi is among the key urban areas in Kenya that has continued to experience high rates of demographic transition over time. Nairobi has experienced one of the highest population growth rates of any city in Africa. This is mainly due to the rural-urban migration as well as a natural population increase. Since its beginnings in 1899, Nairobi has grown to become the largest city in East Africa, despite being the youngest city in the region. The growth rate of Nairobi is currently 4.1%.

The project site is adjacent to multiple residential developments on one side and Karura Forest on the other. The area is a low density residential area. The population in the area has increased in the recent past owing to the increase in physical development.

3.8.2 Income levels

Muthaiga North is generally occupied by individuals from a high socio-economic income bracket. Proximity to the city centre, decentralisation from the city centre and well-developed infrastructure makes the area a good residential and business area. Generally, the area is secure with easy access to public transportation networks.

3.8.3 Demography

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The project site is adjacent to multiple developments both to the East and to the West. The population in the area has increased in the recent past owing to the increase in physical development.

The table below shows the projected population for Nairobi from 1999 to 2020.

Table 9: Projected Population for Nairobi (1999-2020)

Year	**1999**	**2005**	**2010**	**2015**	**2020**
Total Population	2,143,254	2,855,792	3,627,472	4,607,671	5,852.736

Source: *1999 Census Survey used as a basis of projection*

4 LEGISLATIVE AND REGULATORY FRAMEWORK

In this section, institutional and legal frameworks that govern the development of this kind of project in Kenya and some of the international legislations that may apply will be discussed.

Every anthropogenic activity has an impact on the environment. More often than not, this impact is harmful. However, mankind cannot live without taking up these activities for his food, security and other needs. Consequently, there is need to harmonize development activities with environmental concerns. EIA is a useful tool for protection of the environment from the negative effects of development activities.

According to section 58 of the Environmental Management and Coordination Act (EMCA) No. 8 of 1999 and section 3 of the Environmental (Impact Assessment and Audit) Regulations 2003, all new projects are required to undergo an Environmental Impact Assessment. The report of the same must be submitted to National Environment Management Authority (NEMA) for approval and issuance of a license before the development begins. This is necessary as many forms of development activities cause harm to the environment.

4.1 Environmental policy framework

EIA critically examines the effects of a project on the environment. An EIA identifies both positive and negative impacts of any development activity or project, how it affects people, their property and the environment. EIA also identifies measures to mitigate the negative impacts, while maximizing positive ones. EIA is basically a preventive process. It seeks to minimize adverse impacts on the environment and reduce risks. If a proper EIA is carried out, then the safety of the environment can be properly managed at all stages of project planning, design, construction, operation, monitoring and evaluation as well as decommissioning. The assessment is required at all stages of project development with a view to ensuring environmentally sustainable development for both existing and proposed public and private sector development ventures. The National EIA regulations were issued in accordance with the provisions of EMCA 1999. The EIA regulations must be adhered to, taking into account the provisions of EMCA 1999 and other relevant national laws.

4.2 Institutional framework

Environmental Management and Coordination Act No. 8 of 1999 provides a legal and institutional framework for the management of environment related matters in Kenya. It is the framework law on environment, which was enacted on the 14th January 1999 and which commenced in January 2002. Topmost in the administration of EMCA is the National Environment Council, which formulates policies, sets goals, and promotes environmental protection programs. The implementing organ is the National Environment Management Authority (NEMA). EMCA comprises of sections covering all aspects of the environment.

Relevance of the legislations as well as policy papers (national and international) and institutional framework related to the proposed development are discussed in the following sections. The EIA for the proposed development is bound to be influenced by the operational interests of several lead agencies, whether exclusively or concurrently. These include, but are not limited to, the following key institutions:

4.2.1 National Environmental Management Authority (NEMA)

In 2002 the Government created the NEMA as the supreme regulatory and advisory body on environmental management in Kenya. NEMA coordinates and supervises the various environmental management activities being undertaken by statutory organs with a view to promoting their integration into development policies, programmes, plans and projects that provide sustainable development and a safe and healthy environment for all Kenyans.

The key functions of NEMA through the National Environment Council include responsibility for policy formulation and direction for the purposes of the Act, setting national goals and objectives and determining policies and priorities for the protection of the environment, promotion of cooperation among public departments, local authorities, private sector, non-Governmental organizations and such other organizations engaged in environmental protection programmes, and performing such other functions as are assigned by the Act.

NEMA will remain in charge of coordinating all activities related to environmental management in the project area, such as enforcement of EIA, as well as environmental audits (EA).

4.2.2Director of Physical Planning

The Physical Planning Act (Cap 286) established the office of the Director of Physical Planning. The duties of the Director of Physical Planning shall include the following:-

- Formulation of national, regional and local physical development policies, guidelines and strategies;
- Responsibility for the preparation of all regional, local and national physical development plans;
- From time to time, he/she shall be required to initiate, undertake or direct studies and research into matters concerning physical planning;
- Advising the Commissioner of Lands and local authorities on the most appropriate use of land including management such as change of user, extension of user, extension of leases, subdivision of land, and amalgamation of land, and
- Requiring local authorities to ensure proper execution of physical development control and preservation orders.

4.2.3 Neighbourhood Associations and/or General Public

The proposed construction of KRIL Hospital is likely to attract the interests of the area's neighbourhood association(s)/general public. An extensive public participation process will hence form a major component of the study. From the foregoing, particular reference is made to Section 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003, which states that:-

".....The Proponent shall in consultation with the authority seek the views of persons who may be affected by the project....."

The above expression clearly underscores the concept of participatory environmental planning and management in the context of urban development. Questionnaires were distributed to members of public/neighbours for public participation and the feedback is appended to this report.

4.3 Legal and Policy Framework

4.3.1 The Public Health Act (Cap. 242)

Environmental degradation may pose a health hazard to the general public. This is one of the factors the Public Health Act deems a nuisance. For the interpretation of the Act, Section 15 (IX) indicates that any noxious matter, or wastewater discharged from any premises, such as a building, constitutes nuisance. Any premises not kept clean and free from offensive smells such as gases which are injurious to health such as those from hospitals or commercial establishments shall therefore generate nuisance. The act therefore stresses that no person shall cause a nuisance to exist on any land or premises occupied by him. Because of the above, the Act acknowledges that it shall be the duty of all local authorities to take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to health.

To achieve this, systems on the management of both solid and liquid waste (effluent) will be adopted as proposed in the report. For instance, the effluent will be discharged into public sewer line if one exists. The solid waste shall be handled by a professional garbage collector on a regular basis and disposed of appropriately as per the waste regulations. Sanitary facilities shall be in conformity with Ministry of Health standards and installation of standard fittings.

4.3.2 The Health Act (No. 21 of 2017)

The Health Act, Section 88 (XIII) indicates that The Cabinet Secretary shall pursue strategies that are conducive to the development and regulation of private health services and their atonement to the needs of the population. Furthermore, the act stresses that the public and private health services and facilities shall complement each other in the provision of comprehensive and accessible health care to the people. It is therefore law that private entities shall be permitted to operate licensing of private hospitals, clinics, laboratories and other institutions in the health sector, subject to licensing by the appropriate regulatory bodies. The first schedule of the act states that a quality health centre should provide out-patient care, provision of limited emergency care, maternity for normal deliveries, laboratories, oral health and referral services, provision of preventive and promotive services and in-patient

observations. To achieve the requirements of the heath act, the proposed project architectural plans have been designed to be in line with the requirements of the health act as they cover all the provisions of a health centre as stated in the Act.

4.3.3 Medical Examination Rules (Legal Notice No. 24 of 2005)

This is a subsidiary legislation to the Factories and Other Places of Work Act, CAP 514 of the Laws of Kenya. These rules were made in early 2005 by the Minister for Labour and Human Resource Development. These rules apply to factories and other workplaces where workers are exposed to hazardous substances and processes. The categories of workers who require medical examinations is given in section 45 (B) of the Factories and Other Places of Work Act of 1990. The category of workers to be examined is also given in the first schedule of Legal Notice No. 24.

According to this Legal Notice, the type of examination required for workers is dependent on the hazards that one is exposed to. Examples of work deemed hazardous include spray painting, sanding, and handling used oil or grease. Such workers must also undergo skin tests in accordance with these regulations.

4.3.4The Food, Drugs and Chemical Substances Act (Cap 254)

This act relates to any representation by any means whatsoever for the purpose of promoting directly or indirectly the sale or disposal of any food, drug, cosmetic, device or chemical substance. The act also states that any person who labels, packages, treats, processes, sells or advertises any drug in contravention of any regulations made under this Act, or in a manner that is false, misleading or deceptive as regards its character, constitution, value, potency, quality, composition, merit or safety, shall be guilty of an offence.Additionally, any person who sells, prepares, preserves, packages, stores or conveys for sale any drug under insanitary conditions shall be guilty of an offence. It is therefore recommended that the proponent shall adhere to the law in the process of providing treatment and medication in form of drugs to patients. This will be achieved through the proponent employing quality medical staff and ensuring that drugs and medical equipment are kept as per the heath laws and policies.

4.3.5 The Bio Safety Act (No 2 of 2009)

It is of paramount importance to ensure avoidance of risk to human health and safety, and the conservation of the environment, as a result of the use of genetically modified organisms and tissues more so in hospitals. This includes ensuring that the physical factors of the surroundings of human beings, including land, water, atmosphere, soil, vegetation, climate, sound, odour, aesthetics, fish and wildlife are not infected from harmful genetically modified organisms or tissues. The objective of the bio safety Act is to facilitate responsible research into, and minimize the risks that may be posed by genetically modified organisms, to ensure an adequate level of protection for the safe transfer, handling and use of genetically modified organisms that may have an adverse effect on the health of people and the environment; and to establish a transparent, science-based and predictable process for reviewing and making decisions on the transfer, handling and use of genetically modified organisms and related activities. The project proponent will therefore have to procure quality services from a NEMA approved bio-medical

waste handling company that will be responsible for disposing all the waste tissues and other genetically modified waste that may be generated.

4.3.6Environmental Management and Coordination (Water Quality) Regulations 2006

The Water Quality Regulations provide for the protection of lakes, rivers, streams, springs, wells, and other water sources. The Regulations provide that no person shall discharge or apply any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permit any person to dump or discharge such matter into the aquatic environment unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards set out in the regulations.

These regulations set the standards of domestic water and waste water. The regulations are meant for pollution control and prevention, and provide for protection of water sources. The proposed project will connect to the NWSC supply, while waste water shall be directed to the waste water treatment system which will be installed. The proponent shall take appropriate measures as provided in the regulations. However, there is great need for the proponent to strictly adhere to all the provisions of the regulations for the purposes of enhancing the environment. The waste water treatment plant in particular must be sound to prevent leaks and blockages and the efficiency and adequacy of the treatment system must always be monitored.

4.3.7Environmental Management and Coordination (Waste Management) Regulations 2006

The Waste Management Regulations set out standards for handling, transportation and disposal of various types of waste. The regulations stipulate the need for facilities to undertake, in order of preference, waste minimisation or cleaner production, waste segregation, recycling or composting. These regulations provide guidelines on how to store, transport and dispose any waste generated during the construction and operation phases of the proposed project. Some of the waste to be generated such as used oils and bio-medical waste may fall under the hazardous waste category and thus require particular disposal arrangements. The proponent shall adhere to the regulations and proposes to contract a NEMA registered waste handler and transporter.

Requirement for Environmental Impact Assessment from bio-medical waste generator

No person shall own or operate any institution that generates bio-medical waste without a valid EIA licence issued by the Authority under the provisions of the Act.

Approval of biomedical waste generating facility

Any person who generates biomedical waste shall ensure that the generating facility has been approved by the appropriate lead agency and Local Authority.

Segregation of biomedical waste

Any person who generates biomedical waste shall at the point of generation and at all stages thereafter segregate the waste in accordance with the categories provided under the Seventh Schedule to these Regulations.

Securing and packaging of bio-medical waste.

All biomedical waste shall be securely packaged in biohazard containers which shall be labelled with the symbols set out in Part I and II of the Eighth Schedule to these Regulations.

Treatment of biomedical waste

Any person who generates waste shall treat or cause to be treated all biomedical waste in the manner set out in the Ninth Schedule to these Regulations, before such biomedical waste is stored or disposed of.

Storage of biomedical waste.

No person shall store biomedical waste above 0º C for more than seven days without the written approval of the relevant lead agency, provided that untreated pathological waste shall be disposed of within 48 hours.

4.3.8Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009

These regulations provide for the protection of all wetlands on both private and public land. The regulations provide for sustainable exploitation of wetlands and are aimed at maintaining both the wetlands and hydrological, ecological, social and economic functions and services.

4.3.9Environmental Management and Coordination (Conservation of Biological Diversity) Regulations, 2006

These Regulations apply to conservation of biodiversity which includes conservation of threatened species, inventory and monitoring of biodiversity and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties. These regulations will guide the identification and protection of any endangered/threatened species found on the development site. Proper environmental management will be required to conserve the biological diversity within the affected areas.

4.3.10The Physical Planning Act (Cap 286)

The Physical Planning Act (Cap 286), which commenced on 29th October 1998, aimed at developing a sound spatial framework for co-existence, through plan proposals that enhance and promote integrated spatial/physical development of socio-economic activities. Because building/construction of a health institution constitutes making material change to land, the activity constitutes development. It hence needs to be controlled by local authorities/County Governments. From the foregoing, the Physical Planning Act (Cap. 286) has made specific provisions in respect to the mandate of local authorities in the need for physical planning. As concerned city, municipal, town and urban councils:-

- Section 24 (1) the Director may prepare with reference to any Government land, trust land or private land within the area of authority of a city, municipality, town or urban council or with reference to any trading or marketing centre, a local physical development plan.
- Section 24 (3) the Director may prepare a local physical development plan for the general purpose of guiding and coordinating development of infrastructure facilities and services for an area referred to in subsection (1), and for the specific control of the

use and development of land or for the provision of any land in such area for public purpose.

- Section 25 (b) a local physical development plan shall consist of such maps and description as may be necessary to indicate the manner in which the land in the area may be used.

According to Section 33 of the Physical Planning Regulations (Building and Development Control), the Director of Physical Planning shall refuse to recommend any new building or proposed development, or alteration or addition to any existing building if:-

- The proposal is not in conformity with approved development plans
- Such plans disclose a contravention of the physical planning (Building and Development) rules
- The plans are not correctly drawn or fail to show information required
- On such being required, a separate application accompanied by sets of plans has not been lodged in respect of buildings on separate plots or subplots
- The land or the proposed building or structure is not used for any purpose which might be calculated to depreciate the value of neighbouring property or interfere with convenience or comfort of neighbouring occupants
- The proposed building or land use is unsuitable, injurious to amenities or detrimental in respect of appearance or dignity or fails to comply with physical planning requirements in regard to sitting, design, height, elevation, size, shape, structure or appearance
- The building is likely to become objectionable on environmental grounds
- Roads of access, parking bays, vehicular and pedestrian circulation space or other services to the plot or premises are inadequate
- The building is not sited in a satisfactory position
- The system of drainage, including soil, waste and surface water of the plot, or subplot upon which the building is to stand, is not satisfactory
- Provision has not been made for adequate natural light and ventilation, or
- Any other physical planning issue.

Section 36 of the Act (Cap. 286) further compels that if in connection with a development application, a local authority is of the opinion that proposals for location, or any other development activity will have injurious impact on the environment, the applicant will be required to submit together with application an environmental impact assessment report. The above provision compares well to Section 2(a), which confers upon local authorities the powers to prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area.

4.3.11The Environmental Management and Coordination Act No. 8 of 1999

The Environmental Management and Coordination Act (EMCA) of 1999, and its attendant Environmental (Impact Assessment and Audit) Regulations of 2003 provides for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya. The Act introduces two important aspects of urban environmental

management, which are directly related to the proposed project. Section 58(1) has underscored that any person being a Proponent of a project, shall, before financing, commencing or proceeding, submit an EIA report to NEMA Kenya. Section 68(1) gives NEMA the mandate for carrying out all environmental audits of all activities that are likely to have significant impacts on the environment. It authorizes environmental inspectors, as appointed by NEMA, to enter any premises and determine how far the activities carried out conform to statements in the EIA study. In compliance, the proponent appointed experts to conduct the EIA project report to seek approval before implementation of the proposed project.

4.3.12The Building Code

In recognition of the role of County Governments as lead planning agencies, the adoptive by-law compels any potential developer to submit their development application to the relevant County office for approval. The County office is empowered to disapprove any plan submitted if it is not correctly drawn or does not provide sufficient information that complies with the by-law. Any developer who intends to erect a building must give the concerned County office a notice of inspection, before the erection of the structure.

All approvals will be sought before commencement of the work and regular monitoring will follow to ensure compliance with set standards and conditions. All buildings are expected to utilize natural lighting and solar energy.

After erecting the building, a notice of completion shall be issued to the County office to facilitate final inspection/approval. No person shall therefore occupy a building whose certificate of completion has not been issued by the relevant County office. As a precaution against fire breakout, the by-law states that the walls of any premises shall be non-combustible throughout. Similarly, every building, other than a small house which comprises more than one storey, shall have fire resistance. The by-law, in Section 214 indicates that in any public building where the floor is more than 2feet above the ground level, the council may recommend the provision of fire-fighting equipment that may include one or more of the following: hydrants, hose reels and fire appliances, external conations, portable fire appliances, water storage tanks, dry risers, sprinklers, drencher and water spray spring protector systems.

4.3.13Energy Act, 2006

The Act prescribes the manner with which licenses shall be obtained for generating, transmitting and distributing electricity. The provisions of this Act apply to every person or body of persons importing, exporting, generating, transmitting, distributing, supplying or using electrical energy; importing, exporting, transporting, refining, storing and selling petroleum or petroleum products; producing, transporting, distributing and supplying of any other form of energy, and to all works or apparatus for any or all of these purposes. The Act provides for monitoring of energy consumption by each unit through installation of a meter, and Conservation of energy, auditing and analysis of energy consumption in a building. The Act establishes an energy commission, which is expected to become the main policy maker and enforcer in the energy sector.

It is expected that the proponent shall conserve energy, audit and analyse energy consumption

in their building in accordance with the standards, criteria and procedures prescribed by the set regulations.

4.3.14Environmental Management and Coordination (Air Quality) Regulations, 2008

These regulations provide for the safeguarding of ambient air quality and give guidelines to prevent and control air pollution. The first and seventh schedules of the regulations provide a list with associated emission limits of prohibited, controlled, and un-controlled air pollutants. The regulations also give ambient air quality tolerance limits. The regulations will be particularly relevant to the construction works (including transportation) and also to operational facilities.

4.3.15The Water Act, 2002

The Water Act (2002) provides for management, conservation, use and control of water resources. The sections of the Water Act (2002) that are relevant to development of hospital projects are:-

Section 2(1) that defines pollution in relation to water resources to mean any direct or indirect alteration of the water resources so as to make it less fit for any beneficial purpose for which it is or may reasonably be expected to be used, or harmful or potentially harmful to:

- The welfare, health and safety of human beings
- Any aquatic or non-aquatic life or property or
- The environment.

Section 94 (1) that states that no person shall, without authority under the Act:

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

Section 94 (2) underscores that a person who contravenes the above section shall be guilty of an offence.

4.3.16The Penal Code (Cap. 63)

The chapter on “Offences against Health and Conveniences” contained in the Penal Code enacted in 1930 strictly prohibits the release of foul air into the environment, which affects the health of other persons. Any person who voluntarily violates the atmosphere at any place, to make it noxious to health of persons in general dwelling or carrying out business in the neighbourhood or passing along public ways is guilty of misdemeanour, i.e. imprisonment not exceeding two years with no option of fine. Under this code, any person who for the purpose of trade or otherwise makes loud noise or offensive awful smell in such places and circumstances as to annoy any considerable number of persons in the exercise of their rights,

commits an offence, and is liable to be punished for a common nuisance, i.e. imprisonment not exceeding one year with no option of a fine.

4.3.17The World Commission on Environment and Development

The Commission commonly referred to as the Brundtland Commission focused on the environmental aspects of development, in particular the emphasis on sustainable development that produces no lasting damage to the biosphere, and to particular ecosystems. In addition, environmental sustainability is economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. Social sustainable development maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition and shelter, cultural expression and political involvement.

The proponent is committed to adhere to the proposed EMP to ensure environmental enhancement and this would first be monitored through the initial environmental audit.

4.3.18The Occupational Safety and Health Act (OSHA), 2007

The OSHA Act came into law in October 2007 and replaced the Factories and Other Places of Work Act, Cap.514. The two laws are basically the same except that the scope of the former has been extended to cover all work places where persons are employed. The Act makes it mandatory for occupiers or employers to provide Personal Protective Equipment and all practicable means to prevent injury to health of workers who are exposed to any potentially harmful substances or condition.

Section 9 (1) of the Act states that the occupier should establish a safety and health committee at the workplace in accordance with regulations prescribed by the Minister if:

- There are twenty or more persons employed at the workplace; or
- The Director directs the establishment of such a committee at any other workplace.

Section 11 states that the occupier of a workplace shall cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a safety and health advisor, who shall issue a report of such an audit containing the prescribed particulars to the occupier on payment of a prescribed fee and shall send a copy of the report to the Director. The audit report shall be preserved and be kept available for inspection by the occupational safety and health officer.

In section 21 of the Act, an employer or self-employed person is obliged to notify the area occupational safety and health officer of any accidents, dangerous occurrence, or occupational poisoning which has occurred at a workplace.

Section 47 states that every workplace should be kept in a clean state, and free from effluvia arising from any drain, sanitary convenience or nuisance, and, without prejudice to the generality of subsection (1).

Construction workers will be provided with appropriate PPE and they will use them throughout the construction phase. The proposed development will be kept clean and safe throughout the project cycle.

The provisions of the Act are also relevant to the management of hazardous and non-hazardous waste, which may arise at a project site. The Act provides all necessary safety precautions to ensure the health and safety of workers. The proponent will appoint a reputable contractor who will be responsible in enforcing the requirements during construction and subsequent repairs and maintenance after project completion.

4.3.19The Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009

Part II, Section 3 of the regulations states that except as otherwise provided in these Regulations, no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. Section 4 states that except as otherwise provided in the Regulations, no person shall (a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment;

Part III, Section 11 states that any person wishing to operate or repair any machinery, motor vehicle, construction equipment or other equipment, pump, fan, air-conditioning apparatus or similar mechanical devices, or engage in any commercial or industrial activity, which is likely to emit noise or excessive vibrations shall carry out the activities within the relevant levels prescribed in the First Schedule of these Regulations.

Section 13 of these regulations prohibits construction at night, operation of any construction equipment, any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to the Regulations.

These rules have spelt out permissible noise levels as follows:

a) **90 dB (A)** exposure for a maximum of 8 hours per 24 hours in very noisy environments
b) **140 dB (A)** peak sound level at any given time
c) Maximum of **50 dB (A)** noise transmissible from an establishment to the neighbourhood during the day and **45 dB (A)** at night.

These rules require employers to carry out noise measurements periodically. The Proponents and the contractor will abide by these regulations by ensuring that noise levels do not exceed the set limit, and that no construction activities go on during the night. The mitigation measures indicated in the EMP will be keenly observed.

4.3.20The National Environmental Action Plan (NEAP)

The first NEAP for Kenya was prepared in 1994. The NEAP 2009-2013 succeeds the first NEAP. It is a deliberate policy to integrate environmental considerations into the country's social and economic development process. Integration was achieved through a multi-sectorial approach to develop a comprehensive framework to ensure that environmental management

and conservation of natural resources is an integral part of societal decision-making processes. It proposes a strategy for achieving sustainable development in line with Kenya's quest to meet the Millennium Development Goals and Vision 2030. Under the NEAP process EIA was introduced.

4.3.21The Land Act, No. 6 of 2012

The Land Act of 2012 is a new legislation (commenced on 2nd May 2012) that consolidates and harmonizes all land related laws into one legislation for ease of administration and management of land in Kenya. The Act repealed The Way leaves Act, Cap 292 and The Land Acquisition Act (295) and amended a number of laws that previously provided legal framework for compulsory land acquisition for public infrastructure projects. Part VIII of The Land Act No. 6 of 2012 supplements the constitutional basis of compulsory land acquisition, setting the procedures and regulations that explain how the compulsory purchase power may be exercised for the purposes of "public interest".

A variety of bodies performing public functions can request that compulsory purchase powers be exercised on their behalf, including government ministries, county governments and parastatal organisations supplying necessary utilities. The relevant authority in the case of compulsory purchase is the Cabinet Secretary in charge of Lands and the executing office charged with the procedural issues is that of the National Lands Commission (NLC). Every person having an interest or right in or over property which is compulsorily taken possession of or whose interest in or right over any property is compulsorily acquired has a right of direct access to the Land and Environment Court for the determination of his interest or right, the legality of the taking of possession or acquisition of the property, and the amount of any compensation to which he is entitled.

4.3.22Land Registration Act No. 3 of 2012 (replacing Registered Land Act, Cap 300)

The Land Registration Act, No. 3 of 2012 is now the only legislation for registration of all land interests in Kenya. The new Act has repealed previous legislations such as the Indian Transfer of Property Act, The Government Land Act, The Registration of Titles Act, The Land Titles Act and The Registered Land Act. Section 7 provides for the established and maintenance of a land register and a community land register for each registration unit containing the cadastral maps, parcel files, geo-referenced plans, presentation book, names of proprietors and a register of all powers of attorney.

Sections 24, 25, and 26 provide that the details of the register and the issued certificate of title or lease are the prima facie and conclusive evidence of absolute ownership of any property. The rights conferred by the registration cannot be challenged except on grounds of fraud and misrepresentation or the title was acquired illegally, un-procedurally or through a corrupt scheme.

Sections 37, 40, 42 and 49 allows a registered owner to voluntarily transfer the rights, in whole or partially, to any other party, either with consideration or without consideration and the transferee shall possess all the rights same as the original owner. To aid in identification of the location of land in each registration district, the Act has provided for the preparation of

cadastral map for every registration unit. The Act further requires boundaries of the various parcels to be geo-referenced, suggesting a shift to fixed or easily identifiable boundaries. The alteration of the boundaries can only occur with the concurrence of the office responsible for survey of land and the Registrar. It is now an offence under Section 21 to interfere with marks indicating boundaries.

5 CONSULTATION AND PUBLIC PARTICIPATION

While conducting the EIA, the Consultants widely consulted and involved various project stakeholders and members of the public. The aim was to inform stakeholders about the proposed project, gain local views and concerns and take account of public inputs. The process of consultation and public participation was also aimed at obtaining local knowledge, increasing public confidence and reducing conflicts.

5.1 Opinion forms

Public participation during the EIA process took the form of questionnaires and interviews with randomly selected neighbours around the project site. This was done to seek the neighbours' views and opinions regarding the proposed development. In each case, the issuance of the forms was preceded by an explanatory discussion between the neighbour and the EIA consultant. The neighbours were left with the forms to fill independently and at their own time. They were later collected by the EIA Consultant. The forms are appended at the back of this document.

5.2 Issues raised by the affected community

While carrying out the public participation exercise, neighbours expressed a variety of concerns with regard to the proposed project. Some of the concerns raised were as follows:-

- Proper measures should be taken to minimize air pollution
- Re-planting of any trees and/or vegetation that has been cut down
- Appropriate measures should be taken to reduce pressure on the existing water and sewerage system
- When employment opportunities arise, locals should be given the first priority
- Proper measures should be taken to deal with solid waste disposal
- Proper measures should be taken to counter any gas emissions

The Proponent is putting sustainable development into practice as much as possible to ensure minimal air pollution and conservative use of energy.

6 POTENTIAL IMPACTS AND MITIGATION MEASURES

This section highlights the potential impacts that the proposed project may cause to the environment and their necessary mitigation measures for the expected negative impacts of the proposed project. The potential impacts and the possible mitigation measures have herein been analysed under the Construction Phase, Operation Phase and the Decommissioning Phase.

6.1 Construction phase

6.1.1 Employment opportunities and Income generation

One of the main positive impacts during the project construction phase is the gains in local and national economy. Employment opportunities, especially for casual workers and several other specialized workers, are of benefit both economically and in a social sense. In the economic sense it means abundant unskilled labour will be used in construction hence economic production. Several workers including casual labourers, masons, carpenters, joiners, electricians and plumbers are expected to work on the site from start to end. Apart from casual labour, semi-skilled and unskilled labour and formal employees are also expected to obtain gainful employment during the construction period.

Through the use of locally available materials from the immediate surrounding areas during the construction phase of the project including cement, concrete and tiles, timber, sand, ballast and electrical cables, the project will contribute towards growth of the economy by contributing to the gross domestic product. The consumption of these materials, fuel oil and others will attract taxes including VAT which will be payable to the Government hence increasing Government revenue while the cost of these raw materials will be payable directly to the producers/suppliers.

6.1.2 Economic returns and promotion of secondary business

Economic-investment by the proponent shall increase wealth. The project shall also create market for goods and services and especially construction inputs which include raw materials, construction machinery and labour. There are usually several informal businesses which come up during the construction period of such projects. These include activities such as food vending which benefit directly from the construction workers who buy food and other commodities from the vendors. This will promote the informal sector as it will help them to earn a livelihood. Other businesses will also come up in the proposed health facility when the project is complete that will serve the institution, especially medical supplies such as medication, hospital equipment, food supply, sanitary services and recyclable products, among others.

6.1.3 Optimal utilization of the land

The proposed site was at the time of study an empty, unutilised space. The proposed project shall accommodate 100 inpatients.

6.1.4 Noise pollution

Noise is unwanted sound that can affect job performance, safety and health. The construction work on site will most likely be noisy due to moving machines (mixers and tippers), communicating workers, incoming vehicles delivering construction materials and workers to site, and other normal construction activities. This may prove to be a potential source of disturbance to the surrounding neighbours and a health hazard to the workers themselves. According to NEMA Noise regulations as stipulated in the second schedule the maximum permissible noise levels for construction sites in residential areas is 60 dB(A) during the day and 35 dB(A) at night.

Therefore, such noise emissions should be minimized as much as possible from the point of source while workers should be provided with appropriate personal protective wear. It will also affect small animals and bird life. Psychological effects of noise include annoyance and disruption of concentration. Physical effects include loss of hearing, pain, nausea, and interference with communications when the exposure is severe. During operation, noise will come from vehicles, and other operations within the site. Production machines generate/produce a lot of noise. Hearing protection is thus essential when noise exposure cannot be controlled at its source.

Mitigation Measures:

- Use of suppressors or silencers on equipment.
- Construction works should be carried out only during day light hours i.e. from 0800 hrs to 1700 hrs; when most of the neighbours will be at work.
- Machinery should be maintained regularly to reduce noise resulting from friction.
- There should be no unnecessary hooting of the involved machinery and vehicles.
- Provision of bill boards at the construction sites gates notifying of the construction activity and timings.
- Workers should be provided with relevant personal protective equipment/materials such as earmuffs and earplugs when operating noisy machinery and when in noisy environments. These provide a physical barrier that reduces inner ear noise levels and prevents hearing loss from occurring.

6.1.5 Oil Leaks and Spills

It is important to note that oil/grease spills are prevalent on construction sites and in most areas that make use of petroleum products. Such products contain detrimental elements to the environment. They contain such heavy metals as mercury, lead, and sulphur, among others. Though this may not be common at the site, it is wise to control and observe what could occur especially during maintenance of the involved machinery.

Mitigation Measures:

- All machinery must be keenly observed not to leak oil on the ground. This can be done through regular maintenance of the machinery.
- Maintenance must be carried out in a designated area (protected service bays) and

where oils are completely restrained from reaching the ground. Such areas should be covered to prevent storm water from carrying away oils into the soil or water systems. Waste water/wash water from these areas should be properly disposed of.

- All oil products and materials should be stored in site stores or in the contractor's yard. They should be handled appropriately to avoid spills and leaks.

6.1.6 Air pollution (Dust and exhaust emissions)

Construction activities on the site will result in increased dust and gas emissions. Particulate matter pollution is likely to occur during site clearance, excavation and loading and transportation of the construction materials.

Exhaust emissions will be generated during the construction period by the various construction machinery and equipment. Construction machinery and trucks (including small vehicles) generate hazardous exhaust fumes such as Carbon Oxides (COx), Sulphur Oxides (SOx) and Nitrogen Oxides (NOx). However, such exhaust gases are emitted at intervals, are limited to the construction phase, and are unlikely to affect the neighbours.

Mitigation Measures:

- Provide PPE such as nose masks for the workers on site.
- Regular and prompt maintenance of construction machinery and equipment. This will minimize generation of noxious gases and other suspended particulate matter.
- Control over areas generating dust particles. Such areas should be regularly cleaned or sprinkled with water to reduce dust. The areas can be enclosed to mitigate effects of wind on them.
- Training of the workers on the hazards that may be generated in such work environments.
- Regular health check-ups for the workers to ascertain their health standards.
- Enclose the site with dust-proof net during the construction.

6.1.7 Increased water demand

Both workers and the construction work will create an increased demand for water. Water will be mostly used in the creation of aggregates for construction work and for wetting surfaces for softening or hardening after creating formwork.

Waste water from the proposed project during the construction phase mainly includes cleaning water for the equipment, and water from concrete maintenance/wetting. The quality of this water is insignificant, and poses a small impact on the environment. If necessary, a simplified sedimentation tank can be installed on the construction site where the construction wastewater can be collected and settled. This water can be re-used for site sprinkling to reduce fugitive dust at the construction site.

Mitigation Measures:

- Avoid excessive use of the water
- Roof catchments should be provided with gutters to facilitate collection of the run-off. This water should be stored for general use i.e. cleaning, fire-fighting, gardening etc.
- Sufficient storage water tanks should be provided.
- Install water conserving taps that turn-off automatically when water is not in use.
- Encourage water reuse/recycling mostly during construction and occupation phases.

6.1.8 Increased pressure on materials and energy

Several building materials will be required for construction of the proposed development and associated facilities. These will include sand, ballast, hard core, timber, cement, clay tiles, metal sheets, electrical gadgets, steel, plumbing materials, glass and paint among others. Most of these materials will be obtained from the surrounding areas.

The main sources of energy that will be required for construction work will include mainly electricity and fossil fuels (especially diesel). Electricity will be used for welding, metal cutting/grinding and provision of light. Diesel will run material transport vehicles and building equipment/machinery. The Proponent should promote efficient use of building materials and energy through proper planning to reduce economic and environmental costs of construction activities.

Mitigation Measures:

- Construction materials should be sourced from licensed dealers and suppliers
- Quality should be thoroughly controlled through regular tests.
- Procurement of the materials should follow specifications by the structural and architectural engineers

6.1.9 Waste generation

Large amounts of solid waste will be generated during the construction phase. These will include scrap metal, rejected materials, surplus materials, excavated materials, paper bags, empty cartons, empty paint and solvent containers and broken glass, among others.

Solid waste, if not well managed, has the potential of causing disease outbreaks due to suitable breeding conditions for vectors of cholera and typhoid. Malaria outbreak could also be exacerbated by the presence of open water ditches for breeding of anopheles mosquitoes. The major vulnerable groups are children who could be exposed to these conditions. The proposed project site will be enclosed and only the Proponent, Project Consultants and the construction workers will be able to access it easily.

Mitigation Measures:

- The construction workers will need to have proper sanitation facilities on site; portable toilets are recommended rather than pit latrines as these can be carted away after construction. They are also easier to maintain.

- The contractor or proponent should work hand in hand with NEMA approved private refuse handlers to facilitate sound waste handling, and disposal from the site. All waste must be taken to approved dumpsites.
- Segregation and recycling of waste on site is encouraged i.e. some excavated stone can be used to backfill.
- There should be several bins – the bins should have a close fitting cover. The receptacle(s) must be kept in a good condition, and sanitarily clean by frequent washing and disinfecting.
- Train or educate the involved stakeholders on the importance and means of waste (garbage) management and handling especially during operation.
- Explore installation of an incinerator on the site to enhance disposal relevant material through burning. It is not advisable to burn waste material in open areas.

6.1.10 Increased run-off from new impervious areas

Construction activities could result in additional run-off through creation of impervious areas and compaction of soils. Impervious areas and compacted soils generally have higher run-off coefficients than natural areas, and increased flood peaks are a common occurrence in developed areas.

Mitigation Measures:

- Storm water generated from roof catchments should be harvested, stored and made use of in various activities i.e. general cleaning. This will minimize resultant soil erosion and other associated impacts.

6.1.11 Traffic and Transportation

The transportation of sand to the site during the construction phase may lead to dust and road spillage. These potential impacts are of a temporary nature. During the operational phase, there will be increased traffic from both the residential and non-residential areas.

Mitigation Measures:

- Ensure that material transported to the site during the construction phase is properly covered and the trucks fitted with tailgates.

6.1.12 Workers accidents and hazards during construction

During construction of the proposed project, it is expected that construction workers are likely to have accidental injuries as a result of poor handling of construction equipment and materials, and lack or neglect of the use of protective wear. All necessary health and safety guidelines should be adhered to so as to avoid such circumstances.

There is also a chance, though slight, that workers may be exposed to disease from contact with potentially harmful building materials. It is therefore recommended that before construction

activities, there is need for the materials to be well inspected and harmonized to the occupational health and safety standards.

Mitigation measures:

- Provide properly fitting PPE depending on tasks being performed to avoid injuries and illness including working boots, overalls, helmets, goggles, earmuffs, masks, gloves etc.
- Adapt effective emergency response plans especially during the construction phase. Safety awareness may be gained through regular safety meetings, safety training or personal interest in safety and health. This awareness will increase ability to respond if, some day in future, one is a bystander in an emergency.
- The contractor should have workmen's compensation cover. It should comply with workmen's compensation Act, as well as other ordinances, Regulations and Union Agreements.

6.1.13 Loss of vegetation

The construction of buildings, recreational facilities and road paths can result in some vegetation loss. However, this can be mitigated as indicated below. The re-grown areas where thickets and small stands of trees are to be found coincide with proposed recreational areas where the existing vegetation would be conserved. If trees have to be selectively felled there would be no loss of rare, threatened or endangered plant species. There would be some loss of habitat for epiphytes, which require larger species for support.

The proponent intends to leave the indigenous flora untouched and will take proper measures to ensure minimal disturbance of the flora. In areas that will be cleared, the proponent intends to re-plant those areas with indigenous tree species.

Mitigation measures:

- Minimal disturbance of vegetation cover in areas designated for the gardens.
- Selective cutting in other areas.
- For areas of significant loss of vegetation, the developer has the option to replant similar vegetation at other sections of the property
- Conserve any indigenous trees within the premises;
- Avoid unnecessary clearing of vegetation by conserving vegetation not in the sections being built
- Re-vegetate cleared areas with indigenous vegetation as much as possible

6.1.14 Visual Impact

This includes introduction of construction equipment during the construction period and earthworks associated with construction activities at the project site. This impact will be noticeable to the immediate neighbours. However, such an impact is unavoidable in any construction site. This will be temporary, only during the construction period.

Mitigation Measures:

- Ensure compliance with the planning policy and zoning.
- On completing the earthworks, the worked area should be restored through backfilling, levelling and planting of vegetation.
- All solid waste and debris from construction site must be cleared on completion
- The scheme should be blended in a way to merge with existing environment. It should in fact upgrade the aesthetics of the surrounding area. Landscaping and planting of vegetation especially trees shall go a long way in mitigating the visual intrusion.

6.2 Operation Phase Impacts

6.2.1 Promotion of social cohesion

The development will bring together people from diverse backgrounds. It will lead to promotion of cultural interaction especially when the hospital becomes operational.

6.2.3 Promotion of Development

The proposed project has the potential to influence health facilities and commercial trends in the area in various ways and in the long run the multiplier effect will lead to development and reduction of poverty. The proposed project shall contribute in overcoming the challenges of today's life including strategies for offering affordable healthcare, while promoting sustainable development through a healthier population. The proposed project shall generate various tax revenues (PAYE, VAT from purchases of building materials and through an increase of employees) for the government directly and indirectly. Similarly, there will be creation of market for goods and services and secondary businesses.

The proposed project shall consume various materials during construction such as stones, cement, sand, glass, steel products, wood products, PVC products, ceramic products etc. various professionals have and shall continue giving their services during both the commercial activities in the neighbourhood shall also have their market widened by the occupants and workers.

6.2.4 Operational waste

The Proponent will be responsible for efficient management of all types of waste generated by the project during its operation. In this regard, the Proponent will provide waste handling facilities such as waste bins and skips for temporarily holding waste generated at the site. In addition, the Proponent will ensure that waste is disposed of regularly and appropriately. It is recommended that the Proponent put in place measures to ensure that the waste is efficiently managed through reducing, recycling, re-use and proper disposal procedures. It is recommended that the Proponent segregate solid waste for example glass, paper and biodegradable waste to make recycling and re-use possible.

Mitigation Measures:

- The proponent should provide a number of dustbins strategically on the footpaths of the driveway for incoming patients and visitors to throw away their rubbish. These bins

should be fixed to posts one or two feet above the ground.

- The collection should be made at least once in 24 hours, and it should be done in such a way as to minimize nuisance of smell and dust during filling into carts or vans or any employed (suitable) collection method. All the refuse collected from the hospital, especially from the kitchen and the operating theatre, must be carried away from the storage site to a safe place where it can be suitably disposed of.
- Lastly, a suitable and effective method of disposal should be applied.

6.2.5 Increased energy demand

The Proponent shall plan and install an energy-efficient lighting system in the hospital and maximize on natural lighting. This will contribute immensely to energy conservation during the operational phase of the project. To complement these measures, it will be important to monitor energy use during the operation of the hospital and set targets for efficient energy use. The Proponent should also utilize other renewable sources of energy.

Mitigation Measures:

- Educate all personnel on the importance of efficient use of energy
- Use of alternate sources of energy

6.2.6 Increased water demand

The Proponent will install water-conserving automatic taps and flush-wise toilets which are specifically designed to reduce the amount of water used in washing and flushing. They are eco-friendly and the technology reduces water usage up to 60%. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. In addition, the Proponent is advised to use water efficiently and to install rain water harvesting facilities. All waste water will be treated using the waste-water treatment plant and will be recycled.

The project design should incorporate measures to reduce water consumption, increase water efficiency, re-use water and rain water capture.

6.3 Decommissioning Phase Impacts

6.3.1 Ecological Restoration

Upon Decommissioning of the proposed project, rehabilitation of the project site will be carried out to restore the site to its original status or to a better state than it was in originally. This will include replacement of topsoil and re-vegetation which will lead to improved aesthetics of the area.

6.3.2 Employment Opportunities

The decommissioning process will require substantial workforce (manpower) for successful and timely completion. This translates to substantial job opportunities for the unemployed.

6.3.1 Decommissioning phase waste

Demolition of the buildings and related infrastructure would result in large quantities of construction rubble. The waste would contain materials used in construction including

concrete, metal, wood, glass, paint, adhesives, sealants and fasteners. Although demolition waste is generally considered less harmful to the environment since it is composed of inert materials. There is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment.

All waste should be handled with care and a licensed company should be contracted for solid waste disposal. Re-use and recycling should be given priority before disposal.

6.3.2 Air pollution (Dust and exhaust emissions)

Large amounts of dust would be generated during demolition works. This would affect demolition staff as well as the neighbours.

Machinery and vehicles that would be used during decommissioning would emit exhaust fumes which would affect the ambient air quality. Demolition staff should wear protective clothes and masks during demolition.

6.3.3 Noise and vibration

Demolition works would lead to significant deterioration of the environment within the project site and the surrounding area. This would be as a result of the noise and vibrations that would be experienced. In the case of demolition, all activities should be carried out during the day and the demolition staff should minimize noise and vibrations as much as possible.

7 ANALYSIS OF PROJECT ALTERNATIVES

This section analyses the project alternatives in terms of socio-economic implications, technology, location and environmental implications.

7.1 No Project alternative

The 'No Project' Alternative in respect to the proposed project implies that the status quo be maintained. This means the Proponent would not invest in the proposed project. In general, the No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:-

- The economic status of Kenyans and the local people would remain unchanged.
- No employment opportunities would be created for Kenyans who would work in the proposed project area.
- Discouragement for investors.
- Less access to quality healthcare in the region.

From the analysis above, it becomes apparent that the No Project alternative is no alternative to the Proponent, the local people and the Government of Kenya.

7.2 The proposed development alternative

Under the proposed development alternative, the Proponent would commission EIA Consultants to conduct an EIA study for the proposed project. The EIA report would be submitted to NEMA for review and approval. In issuing a license, NEMA would approve the Proponent's proposed project, provided all environmental measures are complied with during the construction period and operation phases. This alternative consists of the applicant's final proposal with the inclusion of mitigation of environmental impacts as stipulated in the EIA regulations to the maximum extent practicable.

This alternative has the following advantages:-

- Creation of jobs to a proportionately large number of Kenyan citizens
- Health care development in Kenya
- Optimal use of land which is a highly valuable but scarce resource in Kenya

7.3 Alternative project

This will see the Proponent adopting another project idea other than the one currently proposed.

There are a number of alternative options that would be available to the Proponent for this piece of property. Possible alternatives include apartment blocks, office blocks etc. After considering all the possible alternatives, though, the Proponent has settled for the construction of KRIL Hospital.

7.4 Alternative site/location

This would involve relocation of the proposed project to another site other than the present proposed site. Such a move would have several implications both to the Proponent and the recipient environment.

Some of the implications may include:-

- Cost of purchasing land/leasing new premises
- Destruction of the new environment should the alternative site be pristine

7.5 Analysis of alternative materials and technology

The proposed project will employ the use of locally and internationally accepted materials and equipment to achieve public health, safety, security and environmentally aesthetic requirements. Equipment that saves energy and water will be given first priority without compromising on cost or availability factors.

7.6 Solid waste management alternatives

The Proponent will give priority to reduction at source of solid waste, followed by recycling, re-use and disposal. This will call for putting in place a source separation programme. Recyclable material will be sold to waste buyers within the surrounding area.

8 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

In order to mitigate negative environmental and social impacts arising from the project, and to integrate environmental management into all stages of the project cycle, an EMP is given below. The EMP also provides a framework for monitoring mitigation of negative environmental impacts.

While specifying mitigation measures for negative environmental impacts, the EMP assigns responsibilities, gives cost estimates for mitigation options and gives monitoring indicators. The EMP also specifies time frames within which mitigation measures are to be monitored.

It is important to observe that various measures have already been integrated by the project Proponent at the design stage of the project cycle.

The EMP given in **Table 10** contains mitigation measures for project impacts at the construction, operation and decommissioning phases.

Table 10: *Environmental Management Plan for the construction of KRIL Hospital in Muthaiga North, Nairobi County*

Possible Environmental Impacts	**Suggested Mitigation Measures**	**Responsibility**	**Monitoring Indicator(s)**	**Cost estimate (Kshs)**	**Time Plan**
Air pollution and noise pollution	• Avoid unnecessary hooting of vehicles • Avoid burning waste materials at the site • Use of ear muffs by workers working in noisy environment/operating noisy equipment if any • Use of attenuated equipment • Frequent testing of any gas or fumes emitted • Scrubbing of any fumes that may be emitted	• Proponent • Contractor	• Minimal noise generation • No complaints from workers and neighbours	900,000	• Continuous throughout construction stage
Generation of solid waste	• Minimize generation of waste • Re-use of packaging materials • Provision of solid waste collection bins • Engaging the services of a NEMA licensed waste collection and disposal company at operation stage • Sensitizing workers and staff on proper waste disposal and material re-use	• Proponent • Contractor	• Solid waste receptacles at site • Minimal incidences of solid waste occurrence at the project site	200,000	• Continuous throughout construction stage

Generation of bio-medical waste	• Provision of waste collection bins designed to hold bio-medical waste and hazardous waste. • Contracting a licensed waste collection and disposal company specialised in handling bio-medical and hazardous waste • Proper containment and disposal of the bio-medical waste.	• Project Proponent and staff. • Contracted bio-medical waste firm.	• No complaints from workers and neighbours • Minimal incidences of bio-medical waste occurrence at the hospital during operation.	350, 000	• Continuous throughout the operation.
Increased demand for water and electricity	• Conservation of water and electricity • Use of energy conserving electrical appliances • Switching off appliances when not in use • Considering sources and use of renewable energy e.g. solar energy for heating water, solar powered fans, solar powered pumps etc. • Maximize on natural lighting where possible	• Proponent and staff	• No wastage of water • Adequate water storage facilities • Water re-use • Use of energy saving bulbs, equipment and material • Reliance on natural lighting as long as it is practical • Usage of manual and pneumatic tools	200,000	• Continuous throughout construction stage
Storm water/run off	• Establish a storm water drainage system	• Proponent	• A well-maintained storm water drainage	100,000	• Continuous throughout

	• Proper maintenance of the drainage system		system		construction stage
Oil leaks and spills	• Regular maintenance of all the machinery. • Proper storage of all oil products and materials should be stored in stores or in the contractor's yard.	• Proponent • Contractor	• No used oil storage tanks to have direct contact with bare ground/soil • Minimal incidences of oil spill on site. • Proper drainage	200,000	• Continuous throughout construction and decommissioning stage
Public health and safety	• Ensure use of provided pit latrines by construction staff • Proper handling and disposal of solid waste • Fencing off of construction site and placing of warning signs • Operation of noisy machinery at daytime only • Control of visitors to the site • Traffic control • Installation of adequate water supply • Enhanced site security • Controlled developments around the facility	• Project Proponent • Construction workers	• Proper solid waste disposal • Minimal incidences of disease outbreaks or accidents at the site	150,000	• Throughout the project cycle
Generation of sewage	• Proper connection of waste water and sewerage system to the waste water treatment system	• Proponent	• No sewerage leakages	150,000	• Once at construction stage for connection and often during

					project operation phase for maintenance
Occupational health and safety risks	• Provision of appropriate PPE for construction workers • Sensitize workers on environmental health and safety measures • Maintain cleanliness and organization at the working area • Engagement of skilled labourers • Insurance of workers • Availability of a well-stocked first aid kit at the site	• Proponent • Workers	• 100% use of appropriate PPE by workers • Minimal accidents at the site • Insurance cover for construction workers • Clean, organized workplace • Number of workers trained in safety	200,000	• Daily throughout construction and at decommissioning phase
Fire hazards and accidents	• Acquire fire-fighting facilities • Sensitize workers on fire safety • No storage of inflammables on site • Keep well stocked first aid box • Proper handling and use of tools and machinery • Use of correct PPE • Initiate fire safety drills	• Proponent • Grounds manager	• Presence of fire-fighting facilities at the site • First aid box at site • Absence of inflammables at site • Presence of clearly marked warning signs	150,000	• Daily throughout construction and at decommissioning phase
Security	• Ensure that the site is always guarded by a reputable security firm • Constant site patrol • Collaboration with existing security machinery	• Proponent • Contracted security firm	• Zero cases of burglary or vandalism at the site	100,000	• 24-hours a day throughout the project cycle

	• Partnership with neighbours and police in community policing • CCTV system				
Biodiversity Loss	• Selective cutting of vegetation in areas that will require removal of vegetation. • Clear demarcation (for example using flagging tape) of the areas to be cut	• Proponent • Contractor • Supervisor	• Replanting exercises • Ensure minimal clearance of vegetation during construction • Re-vegetate cleared areas with indigenous vegetation as much as possible	150,000	• At all stages of project cycle

9 HEALTH, SAFETY AND ACCIDENT PREVENTION ACTION PLAN

In order to ensure public health and safety, and to prevent accidents or emergency situations at construction, operation or decommissioning phases, the following action plan shall be incorporated in the project cycle.

Table 11*: Health, Safety and Accident Prevention Plan for the construction of KRIL Hospital*

Issue	Specific measures	Responsibility
Project design	• Incorporation of environmental, health and safety (EHS) measures in the process	• Project manager • Proponent
Organization and cleanliness at the work station	• Keep materials in correct place • Maintain cleanliness at the work station	• Project manager
Fire safety	• No storage of inflammables at the site • Fire safety awareness • Keep fire-fighting facilities at the site • Safe handling of fire • No burning of waste at the site	• Facility manager
Accident prevention	• Safe handling of tools and machinery • Use of appropriate PPE • Engagement of qualified personnel	• Workers • Facility manager
Waste disposal	• Provision of adequate waste disposal facilities at the facility • Engagement of NEMA licensed waste disposal company • Separation, re-use and recycling of packaging materials • Proper maintenance and connection of sewerage/drainage system to ensure that there are no leakages	• Contracted waste disposal company • Facility manager
Tools and machinery safety	• Use of tools and machines for designated job • Regular servicing of machinery • Proper storage and handling of tools	• Facility manager
Emergency preparedness	• Keeping passages clear • Marking emergency exits • Training staff in emergency preparedness and response • Keeping a well-equipped first aid kit on site	• Facility manager
Site security	• 24-hour security at site • Control of visitor entry into the hospital grounds	• Security company

10 CONCLUSIONS AND RECOMMENDATIONS

The proposed project will have numerous positive impacts including the growth of the health sector, creation of employment, increased revenue, and industrial growth, among others.

The negative environmental impacts that will result from the proposed project include increased pressure on infrastructure, biodiversity loss, air pollution, and waste generation, among others. Most of these, however, can be mitigated.

The Proponent of the proposed project shall be committed to putting in place several measures to mitigate the negative EHS and social impacts associated with the life cycle of the project. It is recommended that in addition to this commitment, all relevant national and international EHS standards, policies and regulations should govern establishment and operation of such projects.

It is also recommended that the positive impacts that emanate from such activities shall be enhanced as much as possible. It is expected that these measures will go a long way in ensuring the best possible environmental compliance and performance standards.

From the detailed environmental and socio-economic analysis of this development, the EIA Consultant is of the opinion that this is a viable project, and hence recommends that NEMA approves it and issues it with an EIA license.

NEMA and other relevant authorities need to continue raising public awareness on EIA requirements and the importance of public participation.

11 REFERENCES

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APPENDICES

Appendix 1: Project Budget

The total estimated budget for the proposed development project is Kshs890,700,000.00

Appendix 2: A Copy of Transfer Title Deed

Appendix 3: Architectural Plans for the proposed KRIL Hospital

Appendix 4: Waste Water Treatment Plant specifications

Appendix 5: Public Participation and Neighbours' Consultation Questionnaires

Appendix 6: Amalgamation Approval