ENVIRONMENTAL IMPACT STUDY REPORT
FOR THE PROPOSED REALE HOSPITAL ON PLOT NO.NANDI/KAMOBO 6840 ALONG KAPSABET-KISUMU ROAD,APPROXIMATELY 1.5 KM FROM KAPSABET TOWN, NANDI COUNTY

COORDINATES: LATITUDE: 0.200423° LONGITUDE: 35.083834°.
PLOT No. NANDI/KAMOBO/6840
LOCATED AT KAPSABET TOWN

PROJECT PROPONENT
REALE HOSPITAL LTD
P.O BOX 4694
ELDORET

FEBRUARY, 2019

SUBMISSION AND DOCUMENTATION

LEAD EXPERT

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

AGUI DENIS KIPTANUI

Signed…….. **Date: 12/03/2019**

Contacts: 0724763181

Lead Expert No 9126

PARTICIPATING EIA/EA EXPERTS

NAME	**NEMA REG NO.**
RAPHAEL RUTO	5010
BEN TANUI	7609
S.K ROTICH.	8136

PROPONENT

The Environmental Impact Assessment study Report was commissioned by **Reale Hospital Ltd** herein referred to as project Proponent.

Signed …… **Date……**

ABBREVIATIONS

EIA- Environmental Impact Assessment

EA- Environmental Audit.

NEMA- National Environmental Management Authority

EMCA- Environmental Management Coordination Act.

NGO- Non-Governmental Organization

CBO- Community based Organization

OHS- Occupational Health and Safety

KM- Kilometers

TOR- Terms of Reference

PPE- Personal Protective Equipment

TABLE OF CONTENTS

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 study report.

The proposed development site for which this report has been conducted is located at Kapsabet town, along Kapsabet-Kisumu road, Nandi County.

The area enjoys a mix of suburban setting with diversity in developments ranging from commercial, residential to recreation facilities.

The project being proposed will sit on a piece of land that is approximately 0.48 HA. The L. R. No. for the plots to be developed is Nandi/Kamobo/6840.

The Proponent would like to develop a hospital which shall consist of well-equipped operational theatres, accident and emergency centres, laboratory, cold room and vaccination services and a car park.

Scope, Objective and Criteria of the Environmental Impact Assessment

A team of experts were engaged by Proponent to conduct the EIA study report. 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 license.

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

1. To determine the compatibility of the proposed development with the local environmental setting.

2. To identify and evaluate the significant environmental impacts of the proposed project.
3. To assess the environmental costs and benefits of the proposed project to the local and national economy.
4. To propose mitigation measures for the negative environmental impacts.
5. To incorporate Environmental Management Plans (EMP) and monitoring mechanisms during implementation, operation and decommissioning phases of the project.
6. 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 who's **Terms of Reference** were as follows: -

1. To provide a detailed description of the proposed development project in terms of location, objectives, design, activities, material inputs, outputs, products and waste.
2. To provide a detailed description of the baseline environmental and socioeconomic conditions of the project site.
3. To review the relevant legal, policy and institutional framework applicable in the implementation of the proposed project.
4. To provide a detailed description of the potentially affected environment.
5. To identify, predict and analyze the environmental and social impacts of the project, including seeking neighbors' and public views and concerns.
6. To provide an analysis of project alternatives in terms of site, design and implementation technologies and provide reasons for preferred options.
7. To provide a detailed EMP proposing measures for mitigating negative environmental impacts, including the cost, timeframe, responsibility and monitoring indicators to implement the measures.
8. 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: -

1. Environmental screening, during which the project was identified as among those requiring EIA under Schedule 2 of EMCA (1999).
2. A site reconnaissance and visual survey to determine the baseline information of the project area.
3. Comparative study of the project with existing land uses in the neighborhood.
4. Discussion with the Project Proponent(s) and his consultants.
5. Seeking public views via the use of questionnaires.
6. Proposal of mitigation measures to minimize any negative impacts.
7. 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: -

1. Creation of a readily available market for the raw materials used during construction.
2. Economic investment hence increases in wealth for the project Proponent(s).
3. Provision of employment opportunities during construction of the proposed project.
4. 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: -

1. Increase in solid waste load
2. Impact during transportation of construction materials and products and traffic implications along the roads leading into the area
3. Impacts on human health and safety. The health and safety of workers may be an issue during the construction phase
4. 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.

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	Put soil traps around perimeter fence and on steep areas

structure	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
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 specialized 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	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	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 firefighting 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 neighbors 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 maintenance of the drainage system 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 road 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

The success of the proposed development project will impact positively in regard to provision of quality health care which is accessible and accommodative to all citizens of Kenya and beyond.

From the socioeconomic angle, the project comes with positive impacts. These include job creation, improvement of the local economy and as a source of revenue to the local and national governments. However, at this stage of project development, there are a number of areas that

need attention to ensure that the project will meet acceptable environmental performance and acceptability. Most of the issues have been discussed in the earlier sections of this report and should be followed up and implemented.

A comprehensive Environmental and Social Management and Monitoring Plan (ESMMP) has been formulated and sufficient mitigation measures for the predicted negative environmental and social impacts during construction, operation, and decommissioning phases have been proposed therein. It is in this regard that the Lead experts recommend that the project proponent fully implement the ESMMP and that NEMA considers issuing the proponent with an EIA License under condition that the outlined mitigation measures shall be strictly adhered to.

Recommendations

-Adhere to the formulated Environmental and Social Management and Monitoring Plan (ESMMP) to mitigate the predicted negative environmental and social impacts during construction, operation, and decommissioning phases.

- Conduct statutory Environmental audits, Fire risk assessments and Occupational Safety and Health audits annually through licensed advisors during construction and operations phase.
- Waste, including excavated soil and debris should be properly disposed of by backfilling and landscaping. During decommissioning of existing buildings, the contractor should adopt the method of selective demolition as far as practicable. This will enable the demolition and removal of wastes of the same category one at a time thus facilitate recycling of wastes for beneficial reuse, and minimizing the burden on dumpsites.

INTRODUCTION

1.1 Background and Rationale for an Environmental Impact Assessment

The proponent has proposed to construct a modern based hospital to facilitate easy access to quality health care which has been elusive to the less privileged in society in most African countries. The proposed project is intended to enhance medical services offered in Kenya by highly specialized 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 Millennium Development Goals.

The proposed hospital is to be constructed in Kapsabet along Kapsabet-Kisumu road on an approximately 0.48 Ha piece of land. The Registration Number for the plots Nandi/Kamobo 6840**.**

For a long time, many development projects worldwide did not take into account the effects of the projects on the environment. This led to many environmental problems some of which have been irreversible and costly. In Kenya for instance, the 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 EIA 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 study 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

The 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(s) 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 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 area.
- Comparative study of the project with existing land uses in the neighborhood.
- Discussion with the Project Proponent(s).
- 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 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 neighbors within a one kilometer radius and the information gathered was subsequently synthesized and incorporated in to 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(s) 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 0.48 Ha whose L.R. No. Nandi/Kamobo 6840, Nandi County. The coordinates of the proposed location are Latitude: 0.200423° Longitude: 35.083834°.The proposed site is about 1.5 km from Kapsabet town along Kapsabet-Kisumu road

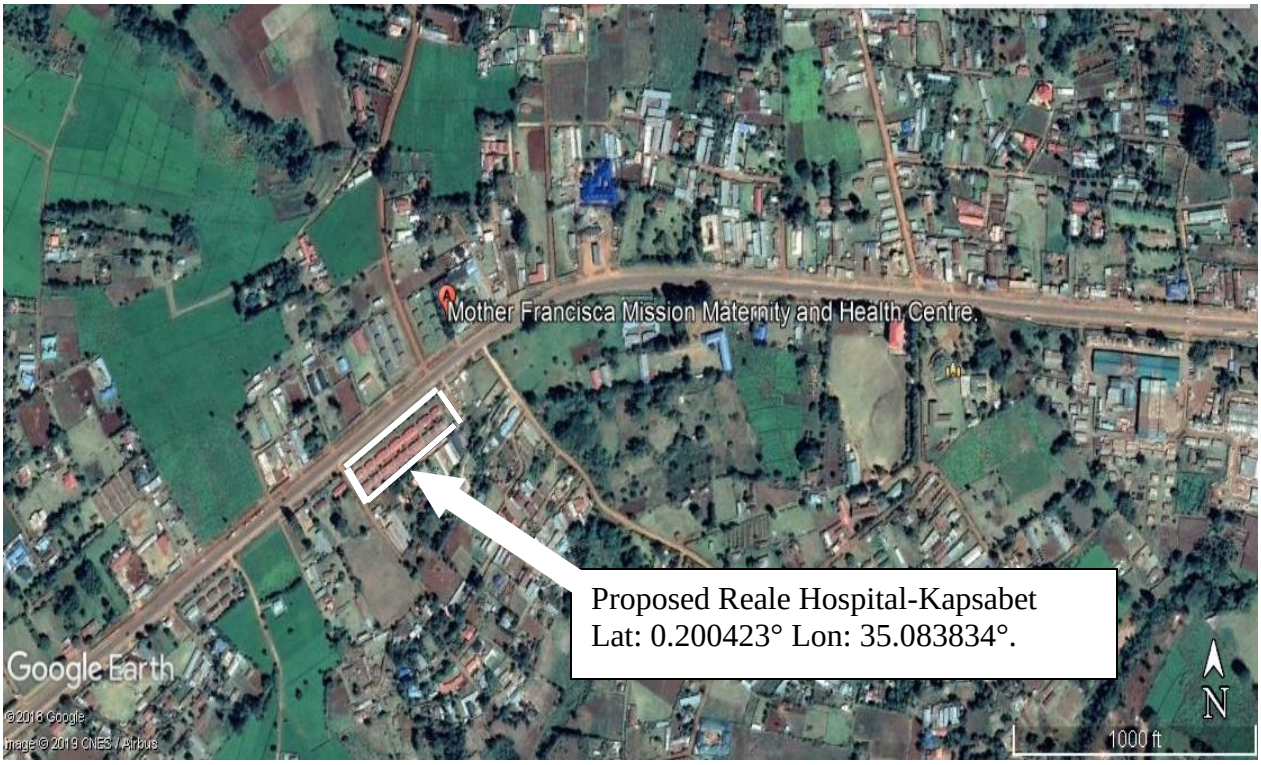

Plate 1: Location of the proposed site

2.1 Project design

The proposed development which is estimated to cost **Kshs. 250**,000,000.00 million entails the construction and operation of a hospital Centre. The actual proposed project design will have the following facilities:-

- Outpatient Department
- Radiology
- Laboratory
- Theatres & Surgery Department
- Critical Care Department
- Pediatrics Department
- Main Wards Department
- Maternity and labor Department
- Holding Room (A cooling plant for temporary holding of dead bodies for transfer to other mortuaries)

- Parking slots.
- Construction of ground floor, first, second and third floors.
- Roofing
- Perimeter wall and associated pavements including ramps for disabled persons
- Public and patient lifts and fire escape stairs.
- Development utilities, such as water, drainage, energy etc.

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.

2.2 Electricity/Power supply

The site is 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.

2.3 Water supply

The site is supplied by Kapsabet Nandi water and Sewerage Company. 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.

2.4 Waste water and sewerage

The site is connected to sewer line and therefore the proponent will connect the facility to the sewer line.

2.5 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.

2.6 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. The bio-medical waste management will also be collected special 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 color of the containers for each type of waste can be different to encourage and make recycling easier and efficient.

2.7 Project Activities

2.7.1 Description of the project construction activities

Construction activities include site preparation by demolishing the existing structures; clearing the vegetation, excavations work, foundations work and building of floors and walls. The construction will be carried out by a registered NCA class "A" contractor.

2.7.1.1 Excavation and foundation work

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

2.7.1.2 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 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, paints, etc., should be stored in 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 system.
- 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.

2.7.1.3 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.

2.7.1.4 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.

2.7.1.5 Roofing works

Roofing activities will include raising the roofing materials 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' specification.

2.7.1.6 Electrical works

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

2.7.1.7 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 waste water and for storm water. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling, among others.

2.7.1.8 Landscaping

The site is to be landscaped to plan. Well-landscaped grass and garden lawns will be established at the site. The project designs greatly put in place a lot of landscaping at the proposed site.

2.7.1.9 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 the checking in detail the construction and its installed utilities. The team will ensure that everything is functioning as expected and the qualities of the materials used are up to standard. If they are however 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 to in conformity with established standard.

2.7.2 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, to offices. There will be office waste (waste papers, cartons, and containers), biodegradable waste and waste water generated from the proposed development.

2.7.2.1 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 papers, 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 has collected 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 channeled into the drainage/ sewage system at the site.

2.7.2.2 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.

2.7.3 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 appropriately by a licensed waste disposal company.

All equipment including electrical installations, furniture, finishing fixtures partitions, pipework 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.

2.8 Material inputs, products, by-products and waste

2.8.1 Material Inputs

Material inputs to be used in the construction and implementation of this project are: Construction stones, Construction Timber, Steel, PVC pipes, Galvanized wires, Galvanized iron sheetson sand, Ballast, Cement, Reinforced concrete slabs, Nails, Damp proof membrane, Glass, Paint, Aluminium, Ceramic tiles, Electrical wires, among others.

2.8.2 Utilities

- Water
- Electricity

2.8.3 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.

2.8.4 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
- Hospital waste

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

2.8.5 Hospital waste

Hospitals are important sites for the generation of waste. Every department in the hospital generates waste and the overall product is waste of different kinds; healthcare, household and administrative waste. Healthcare waste includes infectious, chemical, expired pharmaceutical and radioactive items and sharps. These items can be pathogenic and environmentally adverse. Other waste items generated through healthcare but not hazardous include medication boxes, the packaging of medical items and food, remains of food, and waste from offices.

The management of hospital generated waste is not only the responsibility of the hospital administration but also of every department and every healthcare providing personnel in the hospital. It is a process that should begin at the site of generation where medical waste has to be properly collected and segregated from other non-hazardous waste in specific color-coded receptacles. Transportation of hazardous healthcare waste should be well mapped in the hospital and conveyed by special carts. Storage should be carried out in utility rooms specially prepared for this purpose.

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. The site has structures that were initially used as residential buildings see (Plate: 1).The vegetation is mainly grass and planted trees.

3.1 Site Location

The site is situated along Kapsabet-Kisumu road at Kapsabet town, Nandi County.

Plate 1: Current site characteristics

3.2 physical Environment

3.2.1 Topography and Climate

The hilly and undulating topographical features of Nandi County overlap with a spatial distribution of ecological zones that define agricultural and overall economic development potential of the regions. The Northern parts receive rainfall ranging from 1,300mm to 1,600mm per annum. The Southern half is affected by the Lake Basin atmospheric conditions, thus receiving as high as 2,000mm per annum. Generally the County receives an average rainfall of about 1200mm to 2000mm per annum. The long rains start in early March and continue up to end of June while short rains start in mid-September and end in November. In Nandi it is rare for a month to pass without some rainfall. The dry spell is usually experienced from end of December to mid-March. The lowest rainfall is experienced in the Eastern and North eastern

parts of the county, while the highest is recorded in the Kobujoi-Tindinyo area in Aldai Division. Across Nandi, the highest rains are experienced in Kaptumo in Nandi South, Nandi Hills, Kapsabet and Kobujoi.

3.3 Biological Environment

The site is dominantly covered by grass, planted trees. Fauna on site include small mammals such as rodents and various bird species, herperto-fauna such as snakes, frogs, and lizards.

3.4 Infrastructure

Nandi 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 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.

3.5. Electricity

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

3.6 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 Socio-economic Environment

3.7.1 Demography and health facilities

Kapsabet is among the urban areas in Kenya that has continued to experience high rates of demographic transition over time. This is mainly due to the rural-urban migration as well as a natural population increase. Kapsabet municipality has a total population of 86,803 (2009 census). The majority of residents belong to the Nandi section of the Kalenjin ethnic group. The county has a number of health facilities but the major Hospitals are Kapsabet District Hospital and St Francisca Hospital.

3.7.2 Economic Activities in Kapsabet Town

Kapsabet is an agricultural town. Within its environs are large tea and maize farms as well as a number of horticulture and dairy concerns. The town has a milk depot operated by New Kenya Cooperative Creameries (New KCC) and the KTDA Chebut Tea Factor

4.0 POLICY, LEGAL AND LEGISLATIVE FRAMEWORK.

4.1 Environmental Impact Assessment (EIA)

The Environmental Management Coordination Act, 1999 (EMCA) describes it as follows:- Section 2 "Environmental Impact Assessment" means a systematic examination conducted to determine whether or not a program, activity or project will have any adverse impacts on the environment; "Section 58(5), 1999. The Environmental Impact Assessment (EIA) consists of a multidisciplinary approach combining the evaluation of the economic aspects of a project, based on cost-benefit ratios, with the environmental consequences of undertaking the project.

EIA is a tool for better planning by permitting the integration of environmental concerns with the policy and project planning process at the earliest possible development planning stages. EIA process is also concerned with identifying, predicting and eradicating the foreseeable adverse environmental impacts, of public and private development policies and projects with a view of eliminating where possible, or minimizing the negative impacts while optimizing the positive impacts. EIA is conducted to ensure that important environmental resources are recognized and protected early in the planning and decision making process.

EIA generally is used to accomplish the following-

- Identification of whether or not the proposed project is likely to have significant impacts (both adverse and beneficial);
- Determine whether the adverse impacts can be mitigated
- To recommend preventive and/ or mitigation measures;
- Identify and assess any other alternative to the proposed policy, project or activity and associated activities;
- Recommend whether or not the proposed project should be implemented or modified.

4.2 Physical Planning Act.

The local Authorities are empowered under Section 29 of the Act reserved and maintain all land planned for open space, parks urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of the area.

Section 30 states that any person who carries out development without permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local authority.

The owner has already obtained the necessary authorization from Nandi County for use of land for this purpose.

4.3 The Occupational Safety and Health Act, 2007

The main theme of this Act is that the Occupier shall ensure safety, health and welfare at work of all persons while working in his workplace.
The Act, which repeals the Factories Act, has provisions to ensure the health and safety of persons. It provides that the premises should be kept in a clean state and free from effluent arising from any drain or sanitary convenience. It requires that every workroom has adequate ventilation, sufficient and suitable lighting. It also states that effective measure should be undertaken to maintain floors from being wet.
The Act requires for the general safety of employees. It requires that warning signs indicating the degree of danger should be in a form readily understood by the employees. It should be marked on, attached to, or posted nearby any risk area.
Hazardous areas should be confined and conditions for access to these areas should be posted.
The Act provides for the prevention of fires. It requires that the premises be readily accessible, have adequate and suitable means of extinguishing fire and it should have adequate means of escape in case of fire. It requires that highly inflammable substance be kept either in a fire-resisting store or in a safe place outside any occupied building.

The Act provides for the provision of first aid facilities and for protective clothing and appliances for employees in any process involving exposure to wet or to any other injuries or offensive substance.
The act also brings in new aspects of Safety & Health Policy statement and Annual audits.
The act also requires that adequate supply of both quantity and quality of wholesome drinking water must be provided. Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. Sitting facilities should be provided to enable the workers take advantage of any opportunity for resting.

The hospital management will ensure that workers and occupants safety and health is upheld in line with the Kenya Government OHS Policy by conducting annual OHS Environmental audits.

4.4 Electricity Power Act No. 11 of 1997

The Electricity Power Act No. 11 of 1997 deals with the generation, transmission, distribution supply and use of electric energy as well as the legal basis for establishing the systems associated with this purpose. Under schedule 3 of the Electric Power (licensing) Regulation 2003, it is mandatory to comply with all the safety, health and environmental laws.
The proposed project will ensure that all electrical operations and equipment are operated in a manner designed to protect the health and safety of the project employees.

The proponent shall ensure compliance to all health and safety measures and only approved electrical contractors are appointed.

4.5 Occupier's Liability Act Cap 34

The act regulates the duty that an occupier of premises owes to his visitors in respect to the dangers due to the state of the premises or to things done or omitted to be done on them.
It requires that the occupier warns the visitors of the likelihood of dangers within his premise to enable the visitors take reasonable care of themselves.
The proponent shall have an insurance policy to cover this liability.
It shall also ensure proper signage is placed as necessary. This will cover aspects e.g. slippery floors and other hazardous areas.

4.6 Water Act Cap. 372

The act requires that any effluent discharge in any water body should contain no poisonous matter or substances that are likely to be injurious directly to public health, to livestock crops orchards, gardens irrigated with such water.
It prohibits disposal of effluent or drainage from factory in a manner likely to contaminate groundwater.
The proponent has will connect to the sewerage for effluent as per engineers and public health officer's designs and direction.

4.7 Public Health Act Cap. 242

The act prohibits any accumulation or deposition of refuse or other matter, which is offensive or injurious or dangerous to health. The proponent would ensure that proper refuse disposal is practiced.
It makes it an offence to emit or release any noxious matter or waste water into any place, land, or watercourse not approved for the reception of such substances.
It also prohibits the release of any gases, vapors, dust or other impurities generated that are deemed to be injurious or dangerous to the health of employees.
It provides for the prevention of pools of standing water and for the repair and cleansing of open channels and drains.
The Act also requires workers to undergo periodical medical examinations.

4.8 The Brundtland Commission of (1987)

The Brundtland Commission addresses the environmental aspects of development. It has emphasized on sustainable development that produces no lasting damage to the biosphere and to particular ecosystems. In addition to environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resource.

4.9 Policy Guidelines on Environment and Development

Among the key objectives of the Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999) are to ensure that from the onset, all development policies, programs and projects take environmental considerations into account and to ensure that an immediate environmental impact assessment (EIA) report is prepared for any construction venture or other development before implementation among others. Under this paper, broad categories of development issues have been covered that require sustainable approach. The policy recommends the need for enhanced reuse/ recycle of waste including wastewater, use of low non-waste technologies, increased public awareness and appreciation of clean environment. It also encourages participation of stakeholders in the management of wastes within their localities.

4.10 Environmental Management and Coordination (Waste Management) Regulations 2006

The Waste Management Regulations sets 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 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.

4.11 The Building Code

In recognition of the role of local authorities as lead planning agencies, the adoptive by-law compels any potential developer to submit their development application to the relevant local authority for approval. The local authorities are 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 local authority 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 building are expected to utilize natural lightings, water heaters to heat water for students.

After erecting the building, a notice of completion shall be issued to the local authority to facilitate final inspection/approval. No person shall therefore occupy a building whose certificate of completion has not been issued by the local authority. 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 2 feet 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.

4.12 The 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 factories

b. **140 dB (A)** peak sound level at any given time

c. Maximum of **50 dB (A)** noise transmissible from the factory to the neighborhood during the day and **45 dB (A)** at night time.

These rules require employers to carry out noise measurements at least once in every year. 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.

5.0 CONSULTATION AND PUBLIC PARTICIPATION

This chapter describes the process of the public consultation that was followed to identify the key issues and impacts of the proposed development of Reale hospital in Kapsabet,Nandi County. Views from the general public, and neighbours, who in one way or the other would be affected by the proposed project, were sought through oral interviews and administering of questionnaires as stipulated in the Environment Management and Coordination Act, 1999.

A number of site visits were made to the site to interview the residents. One of the key information sources used during the Environmental Impact Assessment exercise was a public participation exercise. The exercise was conducted by a team of experienced registered environmental experts and associates via administration of pre-designed questionnaires and by interviewing neighbours surrounding the proposed project site. 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 to the end of this document).

The purpose for such interviews was to identify the positive and negative impacts and subsequently promote and mitigate them respectively. It also helped in identifying any other issues which may bring conflicts in the event that project implementation proceeds as planned. The residents participated freely by giving some of their views and concerns.

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 Public Meeting

Public participation during the EIA process took the form of an open public meeting with community members of Kamobo and neighbours around the project site, the project proponent, the project architect and the environmental consultant.

An open public meeting was carried out on 09/03/2019 at the site. This was done to

Seek the neighbors' views and opinions regarding the proposed development.

There was good representation among those who attended the meeting, with residential neighbors, business neighbours, project proponents and the majority of project consultants all represented.

Issues raised

The main negative issues raised by the respondents were as follows:

- Increase in biomedical waste generation
- Noise and air pollution during construction and operation.
- Accidents.
- Obstruction of traffic.
- They refused establishment of a mortuary instead a cold room for temporary body holding is fine with them

6.0 POTENTIAL IMPACTS AND MITIGATION MEASURES

This section identifies both negative and positive impacts associated with the proposed Hospital construction. These are identified according to the proposed project phases namely: Construction Phase, Operational Phase and the Decommissioning Phase.

6.1 CONSTRUCTION PHASE

Positive Impacts

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 facility when the project is complete that will be serving the institution.

6.1.3 Optimal utilization of the land

The proposed site was at the time of study occupied by structures that were initially used as residential buildings. The proposed use is perceived to be better and suited than the previous use.

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, noise from students and other operations within the site. Production machines generate/produce a lot of noise. Hearing protection is thus essential when noise exposures cannot be controlled at their source.

Mitigation Measures:

- Use of suppressors or silencers on equipment.
- Construction works should be carried out only during day light hours i.e. from0800 hrs to 1700 hrs; when most of the neighbors will be at work.
- Machineries 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.
- During celebrations, fireworks should be avoided late into the night to safeguard the interests of the neighbours. The neighbours should also be informed in advance. Also seek a license from NEMA (particularly during the operational phase).
- Workers should be provided with relevant personal protective equipment/materials such as earmuffs and earplugs when operating noisy machinery and when in noisy environment. These provide a physical barrier that reduces inner ear noise levels and prevent hearing loss from occurring.

6.1.5 Oil Leaks and Spills

It is important to note that oil/grease spills are prevalent in 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 avoid storm from carrying away oils into the soil or water systems. Waste water/wash water from these areas should be properly disposed.
- All oil products and materials should be stored in site stores or in the contractor's yard. They should be handled approximately to avoid spills and leaks.

6.1.6 Air pollution (Dust and exhaust emissions)

The construction activities on the site will result to 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 to 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 Environment.
- 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
- 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, metal sheets, electrical gadgets, and 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 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 the approved dumpsites.
- Segregation and recycling of waste on site is encouraged i.e. some excavated stone materials can be used as backfills.
- 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 just burn waste material on 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 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 earth material 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.
- Factories Act abstract should be posted at a strategic point on site. The requirements of the Factories and other places of work Act should be strictly adhered to, the Building code and other relevant regulations. Only specialized machine operators should operate machinery and specialized equipment and all moving parts should be provided within the site. This should be fully equipped at all times and should be managed by qualified persons.
- Adapt effective emergency response plans especially during 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 picnic, nature reserve, nature trails and orchard.
- Selective cutting in other areas inclusive of the area designated for the project.
- For areas of significant loss of vegetation, the developer has the option to replant
- 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 quality of the surroundings. Landscaping and planting of vegetation especially trees shall go a long way in mitigating the visual intrusion.

6.1.15 Loss of plant species and communities

Direct impact results from disturbances that cause changes in temperature, light, moisture and nutrient levels; removal activities (e.g. clear-cutting, bulldozing); impacts resulting from air and water pollution (e.g. turbidity, eutrophication). Indirect impacts result from changes in natural community processes or invasion of non-native plant species. Loss of plant communities also results in decreased water quality, increased erosion as a result of unstable soil, nutrient imbalances in the soil, and/or compaction of soil.

6.2 Operation Phase Impacts

6.2.1 Promotion of social cohesion

The development will bring together people with diverse traditions and culture. It will lead to promotion of cultural interaction especially when the hospital becomes operational.

6.2.2 Increase Kenya's economic value

During operation, the hospital will employ workers who will contribute positively to the Kenyan economy through taxation. It will also help in reducing unemployment problem in Kenya.

6.2.3 Promotion of Development

The proposed project has the potential to influence commercial trends in the area in various ways and in the long run the multiplier effect will lead to development and reduction of poverty. 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 neighborhood 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.

Mitigation Measures:

- The proponent should provide a number of dustbins strategically on the footpaths of the driveways for the hospital users to throw whatever rubbish instead of scattering them on the operational phase of the project. These bins should better 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.

- Incinerators should be provided for medical was

6.2.5 Increased energy demand

The Proponent shall plan and install an energy-efficient lighting system in the building and maximize on natural lighting. This will contribute immensely to energy conservation. Monitor energy use during the operation of the building 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.

6.2.7 Increased population without commensurate services and facilities

This will increase the density of resident population in the area and if this population is not provided with the appropriate services and facilities then pressure on existing facilities is bound to increase.

6.2.8 Increased pressure on infrastructure

Housing projects of this magnitude have a potential of increasing pressure on existing infrastructure such as roads, water supply system, hospitals, schools, waste handling facilities, electricity etc. This would be due to increased volumes on human and vehicle traffic along the access road.

6.2.9 Insecurity/social crime

The project will introduce permanent residents on the proposed site. This implies increased operations that may make it more difficult to monitor and control. The project may encourage development of informal settlements in the vicinity.

However, measures have already been taken to deal with insecurity in the area. The developer will put measures to ensure there is security by engaging a reputable security firm to guard the area, erecting a perimeter wall, undertake lighting and install security lights that will benefit the surrounding areas.

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 solid waste. The waste would contain the 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)

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

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 to eliminate hazards and accidents at the site.

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. TYPICAL WASTE GENERATED IN HOSPITAL DEPARTMENTS

7.1 Waste generated from Administration and Purchasing Department

Many administrative services such as billing services, record keeping and documentation, printing and copying, and shipping and receiving generate large amounts of municipal solid waste. Recycling items such as paper, glass, aluminum cans, cardboard, plastics, computer equipment, printer and copier cartridges, wood waste and scrap metals will drastically reduce your solid waste output. Improving waste segregation systems can increase recycling and reduce solid waste.

Mitigation measures

- Buy and use durable products and materials instead of "use-once, throw-away" items. Recycle and purchase products with recycled content.
- Avoid excessive and/or unnecessary packaging. Insist that manufacturers reduce, collect, and/or re-use packaging (containers, foam peanuts, inserts). Use reusable packaging and totes instead of corrugated shipping containers.
- Collect and recycle fluorescent bulbs (keep intact), thermostats, mattresses, furniture, and equipment. Keep furniture, carpet, and equipment out of the dump. Consider having a reprocessing durable goods center. Sell or donate excess durables to clinics, shelters, and foreign medical aid.
- Demand that your vendors start take-/buy-back programs for computers and peripherals, printer and copier cartridges, etc. Recycle computer equipment and toner cartridges.
- Use energy efficient computer equipment, lights, and appliances (Green Star/Lights Programs).
- Keep batteries out of the trash. Use non-mercury, rechargeable batteries and implement a battery collection program.
- Place mercury spill kits in mercury use areas.
- Start a mercury elimination program. Buy mercury-free products and equipment (digital sphygmomanometers and thermometers, tilt and float switches, reed or displacement relays, thermostat probes and plungers).
- Choose less- or least-toxic products and materials. Eliminate carcinogenic chemicals, and use CFC/Freon management systems to avoid releasing CFC's.
- Dangerous waste is generated hospital-wide. Know your dangerous waste generator status and do hospital-wide dangerous waste generation counts monthly.

Alternatives to and Management of Hazardous Substances found in Hospital Administration & Purchasing Departments

Hazardous wastes and substances often found in this department	**Use or Source**	**Available Alternatives**
Mercury	Light bulbs, lamps, and older microwaves.	Low-mercury or energy efficient lamps Newer microwaves Digital thermostats Non-mercury-containing novelty items
Batteries: Mercury, lead, acid, cadmium, nickel	Hearing aids and pacemakers; PDAs and digital cameras; Communication devices	Rechargeable batteries; Lithium or alkaline ;Zinc air
Toner cartridges	Copiers, Printers	Recycle; Use vendor take-back programs
Cleaning chemicals	Janitorial supplies	Use least toxic chemicals
Electronic waste	Computers, Cathode Ray Tubes (CRTs)	Recycle, Send for re-use, Use vendor take-back programs

7.2 Anesthesia Services

Anesthesia services generate dangerous wastes such as nitrous oxide, halogenated agents: halothane (fluothane), enflurane (ethrane), isoflurane (forane), and other inhalation anesthetics. Waste anesthetic gases are generally removed from the site of application by either a scavenging unit attached to the anesthesia unit which may capture halogenated waste gases with a charcoal filter or by vacuum lines which vent to the outside. Charcoal filters will not trap nitrous oxide. Spent charcoal filters and Soda Sorb must be handled as dangerous waste.

All wastes must be evaluated to determine if they are dangerous wastes, biomedical wastes wastewater discharges, permitted air polluting emissions, or municipal solid waste. Keep municipal solid, dangerous and biomedical wastes separate

Mitigation measures

- Consider replacing hazardous substances, including mercury-containing devices, with lesstoxic alternatives.
- Educate staff to ensure sharps containers are used solely for sharps—not batteries, broken glass, broken thermometers, or anything other than syringe needles, lancets, etc. Purchase reusable, leak-proof, puncture-resistant, cadmium-free sharps containers.
- Inform staff about proper segregation and disposal of red bag and biomedical waste containers.
- Use scavenging systems for anesthesia unit gas emissions. Restrict waste gases to anesthesia units-stop any flow into other work areas inside the hospital or outside. Use low-leakage equipment. Check anesthesia unit daily for possible leaks (e.g., loose tubing, etc.). Do regular maintenance checks on anesthetic units and scavenging systems especially on equipment that is more than 10 years old. Perform quarterly monitoring of anesthetic levels in rooms that dispense anesthetics.
- Eliminate gas cylinders/cartridges/cans not currently being used or lacking a specific purpose. Return empty containers, cartridges or cylinders to supplier. Determine if they are dangerous waste.
- Keep pharmaceuticals, spent charcoal filters, halogenated anesthetic bottles, and other dangerous or biomedical waste out of the trash.
- Dangerous waste is generated hospital-wide. Know your dangerous waste generator status and do hospital-wide dangerous waste generation counts monthly.
- Maintain all disposal records on-site for five years.

Alternatives to and Management of Hazardous Substances found in Hospital Anesthesia Services Departments

Hazardous wastes and substances often found in this department	**Use or Source**	**Available Alternatives**
Liquid and gas halogenated wastes	Anesthetic gases; Containers	Return unused portions and/or containers back to vendor or dispose of properly. Filters and Soda Sorb are dangerous waste
Waste anesthesia gases	Air emissions; Filters; Soda Sorb	Use low-leak equipment; Use scavenging units. Routinely check equipment and maintain against leaks; avoid liquid anesthetic spills. Fit patient mask properly; turn gas supply off before disconnecting. Check wall piping and connections routinely. Do leak tests daily and monitor anesthetic levels in operating and recovery rooms, emergency

		dental and adjacent/other rooms receiving gases quarterly.
Compressed gas cylinders		Eliminate gas cylinders not in use or lacking specific purpose. Return to vendor for recycling when possible.
Dangerous waste air emissions	Air pollutants, Halogenated gases	Capture fugitive gases and pollutants.
Biomedical wastes	Body fluids, Saturated materials	Separate solid from biomedical waste

7.3 Autopsy Services

Autopsy services generate biomedical, dangerous, and solid wastes. Determine the proper disposal methods for all wastes generated. Bio-hazardous wastes include sharps, blood, or any material saturated with blood or bodily fluids. Store and dispose in a labeled biomedical waste red bag or in a leak proof, puncture resistant, cadmium-free, hard bio-hazardous waste container. Sharps need to be stored separately in a rigid, secure container. When containers are full, use a permitted biomedical waste hauler.

High level disinfectants and preservatives such as formalin/formaldehyde and glutaraldehyde wastes need to be neutralized, recycled, or disposed of as dangerous waste. Ecology encourages hospitals to use a central sterile department to reduce the use of cold sterilants. Less-toxic high level disinfectants are available including those containing acetic acid, peracetic acid, hydrogen peroxide, alcohols, or ketones.

Mitigation measures

- Recycle plastics, paper, cardboard, unopened surgical devices, and other items. Don't throw away items that can be reused or recycled. Distill and reuse alcohols, solvents and xylene.
- Instead of using high-level disinfectants like glutaraldehyde, formaldehyde, Bouin's solution, or formalin, investigate and use less-toxic alternatives.
- Never dispose of still bottoms or other dangerous, pathological, and/or biological wastes down the drain, sink, or into the air, garbage, sewer, or septic tank.
- Properly collect, segregate, store, label and dispose of all wastes. Inform staff on proper separation and disposal of biomedical red bags, dangerous and municipal solid wastes.
- Use reusable, leak-proof, puncture resistant, cadmium-free sharps containers for needles, syringes, lancets, etc. only – not for batteries, broken glass, broken thermometers or other non-sharps.
- Neutralize disinfectants before discharging into drain/sewer. Keep high-level disinfectants, even if neutralized, out of sewerage systems.

- Decant formalin/formaldehyde from pathological specimens prior to packaging for disposal or reuse.
- Use digital or other mercury-free devices and instruments whenever possible. Manage mercury containing devices (thermometers, fluorescent bulbs, etc.) dangerous waste or universal waste.
- Don't dispose of mercury down the drain or in the trash. Always wear gloves when handling mercury and mercury-containing products. Have mercury spill cleanup kits readily available—don't allow spills to be cleaned up without proper materials, equipment, and disposal methods.
- Maintain all disposal records on-site for five years.

Alternatives to and Management of Hazardous Substances found in Hospital Autopsy Services

Hazardous wastes and substances often found in this department	Use or Source	Available Alternatives
Bio-medical waste	Body fluid, Saturated materials, Blood, Sharps	Make sure waste meets standards to reduce total volume; store in bio-medical waste "red bags;" separate sharps into a puncture-resistant container labeled "Bio-medical Wast;." keep bio-medical and solid waste separate to reduce costs
Glutaraldehyde, formaldehyde, xylene and alcohols	Chemiclaves;Tissue ;preservation; Embalming	Use autoclaves or sonic sterilization Waste aldehydes are hazardous and therefore Use glycine, glutarex or formalex to detoxify them. Never discharge into a septic tank; use proper ventilation and medical monitoring of staff.
Mercury	Thermometers, Barometers, Chemicals, Fluorescent bulbs ,Mercury switches, Batteries	Alcohol thermometers, Digital equipment,Non-mercury chemicals,Low-mercury bulbs,Mercury-free switches and batteries
Dangerous waste discharges	Wastewater	Don't pour untreated dangerous or bio-medical waste into the sewer system.

7.4 Biomedical engineering services

Biomedical Engineering services provide support to the maintenance and supply of equipment and devices used in patient care. Wastes generated include batteries, used equipment and devices which contain mercury, degreasers and other dangerous wastes. Determine the proper disposal methods for all wastes generated.

Mitigation measures

- Improve segregation systems for recycling and disposal; never mix different types of wastes. Recycle whenever possible.
- Recycle or dispose of mercury-containing devices (batteries, barometers, etc.) intact, not broken, as universal or dangerous waste. Keep batteries, switches, thermometers, manometers, barometers, and other mercury-containing items out of the trash.
- Handle mercury-containing lamps (fluorescent, mercury vapor, metal halide, high-pressure sodium vapor, or neon) with care: don't crush them.
- Remove the entire flame sensor unit that contains mercury from the appliance that is going to be disposed. Remove mercury switches using screwdrivers or wire cutters. Store in an airtight container that is properly labeled "Mercury Devices for Recycling or Disposal."
- Have a mercury spill kit available at all times and clean up spills only with proper materials and equipment. Use gloves to handle spilled mercury and dispose of properly.
- Collect and store waste electronic equipment and devices in a safe, dry place until properly disposed – don't mix them with regular garbage.
- Store each kind of solvent and waste separately. Store flammables in a specially-marked storage cabinet. Determine if the solvents are dangerous waste and dispose properly.
- Don't dispose dangerous chemicals and their wastes down the drain or into the garbage.
- Label all containers of dangerous waste legibly and clearly.
- Maintain all disposal records on-site for five years.

Alternatives to and Management of Hazardous Substances found in Hospital Biomedical Engineering Services

Hazardous wastes and substances often found in this department	Use or Source	Available Alternatives
Municipal solid waste	Packaging	Request less packaging, Segregate wastes, Minimize by purchasing in bulk Recycle; minimize use of hard-to-recycle plastics and glass.
Electronic/computer waste	Cathode ray tubes, Monitors,	store in a dry, secure storage

(lead, mercury containing waste)	Televisions, Hard drives	area prior to hazardous waste service disposal or recycle with a reputable reclaimer
Mercury	Thermometers, Barometers, Chemicals, Fluorescent bulbs ,Mercury switches, Batteries	Alcohol thermometers, Digital equipment, on-mercury chemicals, Low-mercury bulbs, Mercury-free switches and batteries
Solvents (alcohols, ketones and chlorinated compounds)	Equipment maintenance	Aqueous-based cleaners, Collect, recycle or dispose as dangerous waste.
Used batteries	NiCad, lithium and others	Use rechargeable batteries, Use mercury-free batteries Create a battery collection area and recycle when full; separate by type.

7.5 Construction and Renovation

Construction, renovation, and demolition waste in hospitals mainly consists of solid waste. Hospitals must identify which materials are dangerous waste including lead shielding, lead paint peelings, asbestos (contained in some ceiling tiles, floor tiles or heating systems/boilers), demolished equipment containing lead, mercury, silver and/or cadmium (residuals in drain traps, gauges, switches, batteries, fluorescent light bulbs, and computer monitors). Light ballasts may contain PCB's.

To reduce disposal costs, identify and separate wastes that are recyclable. Some debris is municipal solid waste, but the volume may warrant separate disposal in an approved construction and debris landfill.

Mitigation measures

- Use recycled materials and energy-efficient design principles.
- Prevent saw-cut slurries, dirt, leftover paints (including rinse water), solvents, or toxic chemicals from getting into storm drains, sewer, or septic tanks, or run-off into streets, alleys, or parking lots.
- Ensure wastewater meets discharge standards before discharging to any drain. Don't store chemicals and other hazardous substances or wastes, above or near any drain.
- Install separate piping for laboratory and sanitary waste when installing new plumbing.
- Use an asbestos abatement contractor when removing or disturbing asbestos. Don't use any asbestos containing materials when constructing or renovating a facility, or burn any material containing asbestos. Dispose of asbestos waste properly.

- Have spill clean-up kits, materials, and neutralizing agents readily available. Train employees in spill preparedness. Clean up spills of hazardous substances immediately and dispose as dangerous waste. Never handle spilled mercury with bare hands.
- Manage waste lead paint & debris, asbestos ceiling or floor tiles, materials/equipment containing lead, mercury, silver or cadmium, batteries, computer monitors, lighting ballasts and thermostats properly – never put into trash or sewer.
- Identify and properly manage all demolition debris. Manage municipal wastes separately. Separate dangerous wastes from wastes like metal and wood wastes, used mattresses, carpeting, solid waste from construction debris, and furniture. Sort and recycle, don't mix wastes.
- Manage mercury-containing lamps (fluorescent, mercury vapor, metal halide, high-pressure sodium vapor, and neon) correctly; don't put into the regular trash. Switch to mercury-free thermostats, fluorescent lamps, switches, floats, temperature control devices, and cleaning products.
- Improve segregation systems for all wastes to aid with proper disposal and recycling.
- Replace all plastic tubing/piping containing DEHP (PVC) with tubes that are DEHP-free.

7.6 Emergency Dental Services

Dentistry generates a variety of dangerous (hazardous), universal, biomedical, and municipal solid waste. This page provides information on proper waste management and possible alternatives for using less-toxic products and reducing the generation of certain wastes.

Mitigation measures

- Segregate dangerous, biomedical, and municipal solid wastes and recyclables.
- Properly manage and dispose of dangerous waste generated by the dental department (e.g., fixer, or lead foils and aprons, sterilants, and amalgam, etc.).
- Mercury is toxic and bio accumulative. Dental amalgam is a concern if discharged into the sewer. Collect and manage amalgam for recycling or disposal as dangerous waste. Do not disinfect with bleach.
- Other dangerous wastes of concern in emergency dentistry include fixer (silver), lead shields and packaging, high-level disinfectants and sterilizers, waste pharmaceuticals, and mercury-containing devices.
- Use precapsulated amalgam alloys, not bulk mercury. Recycle used amalgam capsules, salvage, store, and recycle non-contact scrap amalgam and recycle salvage contact amalgam pieces from restorations after removal.
- Disinfect extracted teeth that contain amalgam restorations. Check with your recycler to see if they will accept extracted teeth with amalgam restorations. Don't dispose of used amalgam capsules, non-contact or contact amalgam waste, nor extracted teeth that contain amalgam in bio-medical containers into municipal solid waste. Never flush

amalgam waste down the drain, or rinse vacuum pump filters, chairside traps, or other amalgam collection devices into drains or sinks.

- Collect and recycle amalgam from separators, chair-side traps, vacuum pump filters or other amalgam collection devices.
- Never place uncovered hands directly into cold sterilants—use nitrile gloves and aprons. Sterilants which contain glutaraldehyde are an inhalation hazard. Use products with ortho-phthalaldehyde that are glutaraldehyde-free.
- Keep cold sterilant containers covered. Neutralize cold sterilants with an appropriate neutralizer before discharging into drain/sewer

8 ANALYSIS OF PROJECT ALTERNATIVES

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

8.1 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 industrial development in the region.
- Status quo maintained

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.

8.2 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
- Industrial development in Kenya
- Optimal use of land which is a highly valuable but scarce resource in Kenya

8.3 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 a Hospital.

8.4 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/lending new premises
- Destruction of the new environment should the alternative site be pristine

8.5 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.

8.6 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 of separation programme. Recyclable material will be sold to waste buyers within the surrounding area.

9.0 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

9.1. Introduction

The proponent of the proposed project acknowledge the fact that the proposed project activities will have some impacts on the biophysical environment, health and safety of its employees and members of the public, and socio economic well-being of the local residents. Thus, the main focus will be on reducing the negative impacts and maximizing the positive impacts associated with the project activities through a program of continuous improvement.

An environmental management/monitoring plan has been developed to assist the proponent in mitigating and managing environmental impacts associated with the life cycle of the project. The EMP has been developed to provide a basis for an Environmental Management System (EMS; ISO 14001 principles) for the project. It is noteworthy that key factors and processes may change through the life of the project and considerable provisions have been made for dynamism and flexibility of the EMP. As such, the EMP will be subject to a regular regime of periodic review.

Tables below form the core of this EMP for the construction, operational and decommissioning phases of the proposed project respectively. In general, the tables outline the potential safety, health and environmental risks associated with the project and detail all the necessary mitigation measures, their financial costs, as well as the persons responsible for their implementation and monitoring. The EMP will be used as checklist in future environmental audits.

Environmental/ social impact	proposed mitigation measures	Responsibility for monitoring	Monitoring frequency	cost
	PRE- CONSTRUCTION PHASE			
Vegetation disturbance	Ensure proper demarcation and delineation of the project area to be affected by construction works. Specify locations for trailers and equipment, and areas of the site which should be kept free of traffic, equipment, and storage Designate access routes and parking within the site	Proponent	Throughout the operation phase	As per budget
Increased storm water, runoff and soil erosion	A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structure will be designed	Proponent	continuous	As per budget
Land and site preparation	Develop early warning mechanisms	Proponent	continuous	As per budget
Dredging and re-excavation	Liaise with the County Government of Nandi and other stakeholders to consider prior underground developments.	Proponent	continuous	As per budget

Environmental/ Social impact	Proposed Mitigation measures	Responsibility for monitoring	Monitoring Frequency	Cost
CONSTRUCTION PHASE				
Soil erosion	-Control earthworks -Rehabilitate degraded environmental to avoid siltation and wash offs. - Compact loose soils. -Landscaping -Ensure management of excavation activities. -Control activities especially during rainy conditions. -Provide soil erosion control and conservation structures where necessary. -Proper disposal of excavated loose soil.	Contactor/ proponent	Daily soil control measures during construction and on completion of each measure. Once a month for each measure during operation phase.	As per budget
Noise and vibration	-Use modern equipment, which produces the least noise. Any unavoidably noisy equipment should be identified and located in an area where it has least impact; -Noise shielding screens should be used and the operation of such machinery restricted to when required; -For mobile equipment, fit efficient silencers and enclose engine compartments in plant vehicles; -For fixed plants, isolate source by enclosure in acoustic structure; -Raise barriers around noisy equipment;	Contractor/ engineer in charge	Throughout operation phase	As per budget

	-Notify the public of construction activities that may be perceived as noisy and intrusive prior to starting construction; -Establish means for the public to contact the engineers-in-charge (i.e., provide telephone number, email, etc.) and provide methods to handle complaints; -The use of hearing protection gears by workers when exposed to noise levels above 85 dB(A); -Ensure that noise & excessive vibration from construction activities are within permissible levels as per the provision of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. This includes among others adhering to permissible noise and vibration level; -Sensitize construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used. -Provide personal protective equipment's to workers onsite.			
Air pollution through dust and gaseous emissions	-Prohibit idling of vehicles at site during construction. -Water should be sprayed during the construction phase of excavated areas. -Regular maintenance of construction equipment -All bare areas should be landscaped after construction -Workers should be provided with dust masks if working in sensitive areas -Work only on designated areas -Construction equipment will be maintained in good operating condition to reduce exhaust emissions; -Haulage trucks must be covered or the aggregates sprayed with water before loading the haulage trucks; -All diesel fuel in use should be ultra-low sulphur diesel; -The project area will be cordoned off to minimize dust migration to nearby facilities by wind; -Speed controls by temporary speed bumps on diversions where necessary within the construction site; -Staff working in dust generating activities e.g. site preparation,	Contractor	Daily	As per budget

	excavation, concrete mixing, stone dressing should be provided with personal protective equipment (PPE) the use of PPE shall be enforced; -Avoiding open burning of solid wastes.			
Noise pollution	-The measures to reduce noise pollution should include. -Construction activities to be restricted to daytime. -Workers in the vicinity of or involved in high level noise to wear respectively safety & protective gear i.e. earplugs & earmuffs. -Low noise selection of machinery. -Enclose the site -Use low noise equipment.		At random during construction phase	As per budget
Soil and water pollution	-Open stockpiles of construction materials on site should be covered with tarpaulin or similar fabric during rainy season; -Prevent the washing away of construction materials, soil, silt or debris into any drainage system; -All machinery and equipment should be regularly maintained and serviced to avoid leak oils; -Maintenance and servicing of vehicle, machinery and equipment must be carried out in a designated area (protected service bays) and where oil is completely restrained from reaching the ground; -Oil products and materials should be stored in site stores or in the contractor's yard; -There should be no flooding within the site at all to prevent seepage of contaminated water into underground water sources; -All applicable national laws, regulations and standards for the safe use, handling, storage and disposal of hazardous waste to be followed; -Storage sites for petroleum products should be secured and signage posted, which include hazard warnings, who to contact in case of a release (spill), access restrictions and under whose authority the access is restricted will be posted	Contractor/ Engineer	Regularly during construction	As per budget
Increased Safety and	-Regular drills shall be undertaken to test the response of the involved stakeholders;	Contractor	Regularly	As per budget

Health Risks	-Use signage to warn staff and/ or visitors that are not involved in construction activities of areas that pose risk; -Strict instructions shall be given for drivers of heavy equipment; -Supervision of works shall be done regularly to ensure that safety conditions are met while any deviation from safety regulations is immediately reclaimed following the best practices regarding safety at work; -Develop evacuation procedures to handle emergency situations; -Truck drivers should maintain a speed limit of not more than 20Km/hr.; -Speed controls by temporary speed bumps where necessary shall be undertaken within the construction site; -Compliance to all international, national and local health and safety standards that may exist; -Clear marking of work site hazards and training in recognition of hazard symbols; -Training of all personnel in fire prevention and protection; -Regular inspection, testing and maintenance of equipment and machinery; -Provide full first aid kits at the construction yard; -Use of water sprays to arrest dust; -Containment of hazardous materials; and -Provide adequate protective gear to construction workers			
Increased solid waste	-Adopt the method of selective demolition (for existing buildings) to the extent possible; -Waste (such as metal scrap or wood waste) that can be reused/ recycled may be donated to local people; -Segregate waste onsite; -Ensure that waste is disposed of according to EMCA (Waste Management) Regulations, 2006 and the Nandi County Government by-laws; -Contracted waste handlers should be licensed to transport and dispose waste at approved dumpsites only -During transportation of waste, it should be covered to avert dispersion	Contractor	Continuously during construction	

	along the way; and -Hazardous waste will not be mixed with other solid waste generated and should be managed by way of incineration or land-filling.			
Traffic snarl up along Kapsabet-Kisumu road	-Construction activities that might substantially disrupt traffic e.g. delivery of materials should not be performed during peak travel periods -Warning signs should be used as appropriate to provide notice of road hazards and other pertinent information to motorists and the general public; -Signage and barricades should be used as part of the typical construction traffic controls; -Temporary manual traffic control should be used when construction vehicles are entering and leaving the site	Contractor, engineer		As per budget
Gender Inequality	-Equal employment opportunities will be provided for both men and women; -Expose and involve women in construction and maintenance activities in an effort to transfer required skills to them; -Involve women groups in activities that they are good at such as landscaping; and -Enhance gender sensitivity and reduce gender discrimination in construction activities.	Contractor	During construction	As per budget
Road safety	-Enforce speed limits for construction vehicles especially along road links leading to the site. Construct accelerating and deceleration lane	contractor	During construction and operation phases	As per budget
OPERATION PHASE EMP				
Water resource/water quality	-Ensure integrity of pipes before operation	Contractor and Proponent	At random during operation phases.	As per budget

Waste water generation	-Process waste water must be treated with chemical disinfectants, neutralized and then flushed into the sewage system; -Chemical waste should first be neutralized with appropriate reagents and then flushed into the sewer system; -The treated effluent being discharged to the sewer line should conform to the limits as provided for under Environmental Management Co-ordination (Water Quality) Regulations, 2006; Standards for effluent discharge into public sewers-Schedule five; -Sewage from health care facilities should never be used for agricultural, aqua-cultural, drinking water, or recreational purposes; -Minimize entry of solid waste into the waste water stream by collecting separately urine, faeces, blood, and vomit from patients treated with genotoxic drugs to avoid their entry into the wastewater stream; and -Ensure that sewerage discharge pipes are not blocked or damaged.	Management	Continuous during operation	As per budget
Solid Waste Generation	-Consider waste minimization practices; - Segregate waste at the point of generation; -All waste to be handled and managed in accordance with the EMCA (Waste management) Regulations of 2006; -All waste containers to be labelled/ color-coded depending on waste category; -Waste storage areas to have the following design consideration: Hard, impermeable floor with drainage, and designed for cleaning / disinfection with available water supply, secured by locks with restricted access, designed for access and regular cleaning by authorized cleaning staff and vehicle, protected from sun, and inaccessible to animals / rodents, equipped with appropriate lighting and ventilation, segregated from food supplies and preparation areas; equipped with supplies of protective clothing, and spare bags / containers; -Appoint a waste handler who is licensed by NEMA and permitted by the local government to handle, transport and treat biomedical wastes at	Management	Continuous during operation	As per budget

	approved treatment sites using recommended treatment procedures laid down by the legal framework and respective government agencies; -Waste destined for off-site treatment facilities should be transported according to the guidelines for transport of hazardous wastes / biomedical wastes in EMCA(Waste Management) Regulations, 2006; -Package for infectious waste should include an inner, watertight layer of metal or plastic with a leak-proof seal. Outer packaging should be of adequate strength and capacity for the specific type and volume of waste; -Packaging containers for sharps should be puncture-proof; -Waste should be labeled appropriately, noting the substance class, packaging symbol (e.g. infectious waste, radioactive waste), waste category, mass / volume, place of origin within hospital, and final destination; and -Transport vehicles should be dedicated to waste and the vehicle Compartments carrying waste sealed.			
Public health and occupational safety.	-Ensure proper collection and solid waste disposal facilities. -Ensure effective wastewater management. -Design of disposal system should be as provided in the plans. -Provide first Aid kits on the site. -Sensitize Residents/Workers on environmental management. -Workers should be trained on occupational health & safety and first Aid administration	contactor	During operation phase weekly disposal of solid waste. Annually for workers training.	As per budget
Increased Water demand	-Monitor water use; -Implement water saving devices for domestic water use e.g. dual flush toilets, automatic shut-off taps, etc.; -Cleaning methods utilized for the cleaning of vehicles, floors, containers, yards etc. must aim to minimize water use; -Maintenance of proper pressure within fire water systems to limit water use; -Practice rain water harvesting;	Management	Continuously during operation	As per budget

	-Conducting of regular audits of water systems to identify and rectify any possible water leakages; and -Implementing a system for the proper metering and measurement of water use to enable proper performance review and management			
Increased Surface/Storm Runoff Generation	-Ensure that no surface wastewater is directed into the sewer system to avoid overloading the sewerage system; -Monitor effluent quality regularly to ensure that the stipulated discharge rules and standards are not violated; and -Harvest rainwater from roof for non-portable uses e.g. cleaning and watering plants	Contractor	Continuous during construction and operation	As per budget
Increase in consumption of electricity	-Building design that allows the use of natural light during the day. -Use energy saving bulbs -Switch off appliances when not in use.	Contractor	Continuous during operation	As per budget
Record keeping	-Collection and analysis of relevant environment data at the site. -Staff Training records. -Environmental impact assessment reports done onsite.	Contractor and proponent	Weekly during Operation	As per budget
Theft of materials	-Provide security guards and facilities during construction period. -Provide flood lights for security at night. Security men should always be available to alleviate cases of robbery.	contactor	On daily basis during construction and operation phases	As per budget
Occupational Health and Safety Incidences	-Conduct basic occupational training programs and specialty courses as needed -Ensure that workers are oriented to the specific hazards of individual work assignments. Training should generally be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards; -Conduct statutory assessments i.e. risk assessments, fire safety audits and Occupational Safety and Health audits annually through licensed advisors and auditors by the directorate of occupational safety and health services (DOSHS); -Conduct statutory trainings under OSHA, 2007 and Rules under it. i.e.	Management	Throughout operation phase	As per budget

	basic first aid, fire safety training, and Occupational Safety and Health committee training through approved training institutions by the Directorate of Occupational Safety and Health Services (DOSHS); -Provide adequate lighting in all workrooms; -Passageways for pedestrians and vehicles within and outside buildings should be segregated and should provide for easy, safe, and appropriate access; -Provision of firefighting equipment in strategic and well labelled sites; -Conduct drills at reasonable intervals to test the disaster preparedness level at the workplace, using the results to improve the response mechanisms; -Provide eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response; -Materials handling operations should follow the instructions of use given by the manufacturer-The "Material Safety Data Sheets)"; -Train workers on safe work practices, and provide appropriate PPE; -Enforcement of use of PPE such as gloves, dustcoats, nose masks in all workrooms requiring use; -Restriction of access to high risk areas to authorised personnel only i.e. radiation rooms, surgery rooms; -Operate places with radiations in accordance with in accordance with the radiation protection Act Cap 243 Radiation Protection (Standards) Regulations, 1986 and recognized international safety standards and guidelines on radiation; -Orient all staff on safe work practices and guidelines and ensure that they adhere to them; -Training staff on how to prevent and manage incidences. This should involve proper handling of electricity, water etc. and sensitization on various modes of escape, conduct and responsibility during such incidences; -Use signage to warn staff and/ or visitors of dangerous places. The			

	signage must be visible and placed strategically; -Set up (fire) assembly points; and Develop evacuation procedures to handle emergency situations.			
Fire safety	Training on the fire safety Provide firefighting equipment and emergency response plan Potable firefighting equipment are located at strategic points A fully equipped first aid kit is provided Provide emergency numbers at strategic points	Proponent	Daily reporting of occurrences	As per budget

Decommissioning phase for the proposed hospital development

In case the hospital construction is complete, operational and has reached a level where a proponent needs to demolish the hospital after using it, a decommissioning EMP is applied. The proposed site (currently) has structures/buildings that will need to be decommissioned and some of the mitigations and recommendations on this decommissioning EMP will apply.

Expected Negative Impacts	**Recommended mitigation measures**	**Responsibility party**	**Time Frame**	**Cost (Kshs)**
1. Construction machinery/structures & wastes				
Scraps and other debris on site	-Use of an integrated solid waste management system i.e. through a hierarchy of options. -Wastes generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures. Disposal locations will be selected by the contractor based on the properties of the particular waste stream.	Proponent & Contractor.	One-off	As per budget

	-All machinery, equipment, structures and tools that will not be used for other purposes should be removed and recycled/reused say in other projects.	Proponent &Contractor	One-off	As per budget
	-Where recycling/reuse of the machinery, equipment, implements, structures, tools and other waste is not possible, the materials should be taken to approved dumpsites.	Proponent &Contractor	One-off	
2. Rehabilitation of project site				
Vegetation disturbance. Land deformation: Soil erosion, drainage problems.	- Soil analysis to assess contamination status. - Soil remediation if necessary -Implement an appropriate re-vegetation program to restore the site to its original status. -During the re-vegetation period, appropriate surface water runoff controls will be taken to prevent.	Proponent & Contractor	One-off	As per budget

10:0 EMERGENCY RESPONSE PLAN (ERP)

Emergencies and disasters can occur any time without warning. More so construction sites are prone to such, thus it is important for the proponent to prepare for them, and be in a good position to act to minimize panic and confusion when they occur. Emergency Response Plans (ERP) will have to be instituted throughout the project cycle.

The following elements of a conventional emergency response plan are recommended as summarized bellow

Emergency Response Plan Components	**Actions/Requirements**	**Responsibility**
Potential Emergency	Identification of all potential emergencies associated with the proposed project at the project site, Include, Fires, Accidents & Incidents, Security, and Terrorism etc.	-Contractor during construction and Decommissioning phases. -Proponent during operation phase.
Emergency Operations Coordinator (EOC)	-Designate a primary and secondary contact person.	-Contractor during construction and Decommissioning phases. -Proponent during operation phase.
Emergency contact Numbers	-Give & display contact for Fire station, Ambulance, police, Hospitals, and others	-Contractor during construction and decommissioning phases -Proponent during operation phase.
Installation of emergency equipment	-Fire sensors, -Fire alarms, -Fire extinguishers, -Fire hose, -Panic alarm button, -Provision and enforcement of use of PPEs, -Emergency Communication equipment, such as Phone & alarm bells	-Contractor during construction and Decommissioning phases. -Proponent during operation phase.
Training for emergency response	Regular training for emergency response	-Contractor during construction and decommissioning phases. -Proponent ,during operation

		phase
Trained in the use of emergency equipment	Employees training in the use of emergency equipment	-Contractor during construction and decommissioning phases. -Proponent during operation phase.
First Aid	-Provision of first aid kits, -First aid management training	-Contractor during construction and decommissioning phases. -Proponent during operation phase.
Signage	-Fire sensors -Signage, action poster, alarm bell/ panic button	-Contractor during construction and decommissioning phases. -Proponent during operation phase.
Procedure for rescue and evacuation	-Evacuation plan, -Warning system, -Assembly site -Shelter in place plan.	-Contractor during construction and decommissioning phases. -Proponent during operation phase.
Occupants emergency contact information	-List of all occupants, residents & their activities	Proponent during operation phase.
ERP review	Annual ERP review	-Contractor during construction and decommissioning phases. -Proponent during operation phase.

11.0 CONCLUSION AND RECOMENDATION

The success of the proposed development project will impact positively in regard to provision of quality health care which is accessible and accommodative to all citizens of Kenya and beyond.
From the socioeconomic angle, the project comes with positive impacts. These include job creation, improvement of the local economy and as a source of revenue to the local and national governments. However, at this stage of project development, there are a number of areas that need attention to ensure that the project will meet acceptable environmental performance and acceptability. Most of the issues have been discussed in the earlier sections of this report and should be followed up and implemented.

A comprehensive Environmental and Social Management and Monitoring Plan (ESMMP) has been formulated and sufficient mitigation measures for the predicted negative environmental and social impacts during construction, operation, and decommissioning phases have been proposed therein. It is in this regard that the Lead experts recommend that the project proponent fully implement the ESMMP and that NEMA considers issuing the proponent with an EIA License under condition that the outlined mitigation measures shall be strictly adhered to.

Recommendations
-Adhere to the formulated Environmental and Social Management and Monitoring Plan (ESMMP) to mitigate the predicted negative environmental and social impacts during construction, operation, and decommissioning phases.

- Conduct statutory Environmental audits, Fire risk assessments and Occupational Safety and Health audits annually through licensed advisors during construction and operations phase.
- Waste, including excavated soil and debris should be properly disposed of by backfilling and landscaping. During decommissioning of existing buildings, the contractor should adopt the method of selective demolition as far as practicable. This will enable the demolition and removal of wastes of the same category one at a time thus facilitate recycling of wastes for beneficial reuse, and minimizing the burden on dumpsites.

REFERENCES

Barnes, J., O'Hanlon, B., Feeley, F., McKeon, K and Gitonga, N., and Decker C (2010) Private Health Sector Assessment in Kenya. World Bank: Washington D.C

GOK (Government of Kenya) (2015) Environmental Management and Coordination (Amendment) Act. Nairobi: Government printers.

GOK. (Government of Kenya) (2003). the Environmental (Impact Assessment and Audit). Nairobi: Government printers.

GOK. (Government of Kenya) (1999). Environment Management and Coordination Act. Nairobi: Government printers.

GOK. (Government of Kenya) (2009). Government of Kenya, 2009.Kenya Vision 2030: Nairobi: Government printer.

GOK. (Government of Kenya) (1998). Local Government Act (Cap 265). Nairobi: Government Printer. GOK. (Government of Kenya) (1994). National Environmental Action Plan. Nairobi: Government Printer.

GOK (Government of Kenya) (1999) Sessional paper No 6 of 1999 on Environmental and Development. Government Printers

NEMA (National Environment Management Authority) (2009). Environmental Management and Coordination

Noise and Excessive Vibrations Pollution) (Control) Regulations. Nairobi: government printer.

NEMA (National Environment Management Authority) (2006). Environmental Management and Coordination (Waste Management) Regulations. Nairobi: Government printer.

NEMA (National Environment Management Authority) (2006). The Environmental Management and Coordination (Water quality) Regulations. Nairobi: Government printer.

World Bank (2007). Environmental, Health, and Safety General Guidelines.

GOK (Government of Kenya) (2010) Ministry of Public Health and Sanitation and Ministry of Medical Services,

Republic of Kenya. National Infection Prevention and Control Guidelines for Health Care Services in Kenya. Nairobi: Kenya

UNEP (United Nations Environment Programme), Secretariat of the Basel Convention (SBC) and World Health Organization (WHO) (2000-2004) (Preparation of National Health-Care Waste Management Plans in Sub- Saharan Countries; Guidance manual.

United Nations (2000), The World Commission On Environment And Development.