ENVIRONMENTAL IMPACT ASSESSMENT

STUDY REPORT

FOR THE
PROPOSED KENYATTA UNIVERSITY CHILDREN, RESEARCH AND REFERRAL HOSPITAL AT KENYATTA UNIVERSITY, NAIROBI COUNTY

PREPARED FOR: (PROPONENT)

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ACRONYMS AND ABBREVIATIONS

Cap	**:**	Chapter
EIA	**:**	Environmental Impact Assessment
EMCA	**:**	Environmental Management and Coordination Act
EMP	**:**	Environmental Management Plan
MP	**:**	Monitoring Plan
NEMA	**:**	National Environment Management Authority
WHO	**:**	World Health Organization
CMW	**:**	Christ Ministries Worldwide

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EXECUTIVE SUMMARY

The Kenya Government policy on all new projects requires that an environmental impact assessment (EIA) study be carried out at the project planning stages to ensure that significant impacts on the environment are taken into consideration at the planning and implementation stages. The proposed Kenyatta University children, research and referral Hospital located at Kenyatta University grounds, Nairobi County is one of the development listed under the second schedule of EMCA, (1999).

The proposed development is located in Kenyatta University grounds, Nairobi County, a distance of approximately 23km from Nairobi city center.

The objective of this EIA is to ensure that the proposed development takes into consideration appropriate measures to mitigate any adverse impacts to the environment. It will also ensure that the related operations will be in full compliance with the EMCA (1999).

The EIA was carried out with a view to achieve the following goals;

Provide a description of the proposed ***children, research and referral hospital*** development,

Carry out an investigation on environmental baseline status of the area,

Produce an environmental impact assessment report with recommended mitigation measures and an environmental management plan outline,

The proposed Children, research and referral Hospital facility site and the surroundings have many other educational facilities, and near complete Teaching Hospital facility. The land on which the site stands is owned by the proponent, and has a clear title deed as proof to the ownership of this land. Kenyatta University land measures around 1000 acres from Thika road in Kasarani division to Kamae sub-location in Kiambu County. Initially the project was be put up on the Kamae side of Kenyatta University which is in Kiambu County, but the plans changed after consultations. Therefore, this proposed Children's Hospital will be put up next to the Kenyatta University Teaching, Research and Referral Hospital and on Kenyatta university grounds, within Ka*sarani Division, Nairobi County*. The proposed facility will be in character with the surrounding which has similar facilities – and which is within the core mandates for which the University was set. It is anticipated that no

significant effects will occur in the physical environment as a result of this development if prior measures are taken into consideration.

The project proponents, however, have a responsibility to ensure that appropriate measures are taken during the construction and operations to eliminate or minimize any of the negative effects anticipated at the proposed site and immediate neighbourhood.

To address the negative impacts, this study presents the objectives of the EIA, an overview of the legislative framework, a baseline situation, anticipated impacts and related mitigation measures under the following headings;

(i) EIA Objectives and scope,
(ii) Methodology,
(iii) Policy and legal issues,
(iv) Baseline Conditions of the project area,
(v) Anticipated environmental impacts,
(vi) Recommended mitigation measures,
(vii) Environmental management plan outline,
(viii) Conclusions
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CHAPTER ONE: OBJECTIVES AND SCOPE OF WORK

1.1 Introduction

In recent year's population growth, urbanization and industrial development in Kenya and equally in many developing countries in general, poses formidable environmental challenges. The major environmental problems from rapid population growth are pollution due to the concentrated discharge of residuals (gaseous, liquid and solid wastes) into the environment, and destruction of ecosystems for urban and rural development in environmentally sensitive areas.

In the past, environmental management has been based on reactive policies of the waste generation which led to belated measures that did not necessarily save ecosystems from damage. Waste management, for instance, concentrated on end-of-pipe waste treatment. In above context, it is the government policy to ask every developer of the project to carry out Environmental Impact Assessment to gauge the degree of potential environmental degradation. This assessment will also provide environmental management plan to mitigate negative impacts of the development.

Kenyatta University is proposing to put up a Children, research and referral Hospital at Kasarani Division, Nairobi County which will cover about 15 acres of Kenyatta University Land. The plot is currently an open area with grass and shrub vegetation. The proposed site is currently unoccupied and planned for this facility. The neighboring area is mainly occupied by human settlement. Majority of people in this area are ordinary workers residing in this area and engaged in employment, formal and informal businesses, or local commercial activities. The proposed site has enough space for the proposed development, while the existing service infrastructure (water supply, power supply and solid waste management) are adequate to accommodate uses of the intended facility. The main activities during the construction of the proposed facility will include masonry work and installation of service lines as well as utilities relevant to a health facility. It is expected that materials to be used during construction are the typical ones (mainly cement, metal, stones and timber) used in the county and the area in particular. Ordinarily, and from screening efforts, the

scope and size of this project may not require an EIA, but being a public utility, it was necessary.

It is recognized that any such project as proposed is likely to impart certain effects on the site and the surrounding environment. Appropriate measures are, therefore, necessary to ensure coexistence of the proposed development with the other social and economic activities in the area. Besides, the project proponents are aware that an Environmental Impact Assessment (EIA) is a statutory requirement for all new projects in Kenya under section 58 sub-section of 1 the Environmental Management and Coordination Act (EMCA 1999). It is for this reason that this EIA exercise was commissioned.

1.2 Project Objectives

The objective of this EIA is to ensure that the proposed hospital development takes into consideration appropriate measures to mitigate any adverse impacts to the environment. It will also ensure that the related operations will be in full compliance with the EMCA, 1999.

1.3 Terms of Reference

Scope

The Kenya Government policy on all new projects, programmes or activities requires that an EIA is carried out at the planning stages of the proposed undertaking to ensure that significant impacts on the environment are taken into consideration during the design. The scope of this EIA, therefore, covered.

i. The baseline environmental conditions of the area,
ii. Description of the proposed project,
iii. Provisions of the relevant environmental laws,
iv. Identification and discuss on possible adverse impacts to the environment anticipated from the proposed project,
v. Appropriate mitigation measures,
vi. Provision of an environmental management plan outline

EIA outputs

EIA outputs will include:

i. Provide a description of the proposed project with a focus on potential impacts to the surrounding environment,
ii. Carry out a systematic environmental assessment following the gazetted regulations,

iii. Produce an EIA report that should contain among other issues identification of key environmental aspects, recommendations on appropriate mitigation measure to minimize or prevent and adverse impacts,

iv. Develop an environmental management plan outline.

Responsibilities

While the environmental assessor provided the technical understanding on the baseline environmental status, projected impacts, management options and legal framework, the client was expected to provide the following;

i. Site map(s) /sketch showing roads, service lines, buildings' layout and the actual size of the site,

ii. Indication of the proposed location of the project,

iii. Full details of raw materials, proposed process outline and anticipated by-products,

iv. Proposed measures for handling wastes on site,

v. Land ownership documents and site history,

vi. Project budget outline.

The output from the Assessor include the following;

i. An EIA report comprising of an executive summary, study approach, baseline conditions, anticipated impacts and proposed mitigation measures,

ii. An environmental management plan outline also form part of the report recommendations.

1.4 Methodology Outline

The proposed site is in conformity with existing land use , namely, development of educational infrastructure. However, for EIA purposes, methodology that was used involved scientific assessment of the proposed site for significant physical (eg soils) and biological (e g current biodiversity status)properties, and modeling possible changes that may arise as a result of the proposed development. Equally, community consultation were done in accordance with NEMA's (Environmental Impact Assessment: review guide for communities (2014).

1.4.1 Biophysical Assessment

The objectives of this assessment were to:

(a) To take an inventory of the existing biophysical conditions at the proposed site; and to;
(b) Evaluate or model the possible environmental impacts and change that may arise as a result of the project.
(c) Determine environmental restoration actions needed

The proposed site is undeveloped with grassland which is located in Kenyatta university grounds, Kasarani division, Nairobi County. The study will be accomplished through a series of steps which include:

Preliminary assessment of the general and existing land use and biophysical conditions . Through this, development was identified as being among those that need environmental impact assessment; as provided under Environmental Management and Coordination Act (EMCA), 1999. During the field investigations, and scooping, information on biophysical and socio-economic environment of the proposed development area and its environs were collected, and discussed in the initial report. These were then given further considerations in the study. Measurements included measurements and analysis of the existing physical (e.g soil characteristics, site elevation, etc. and biological entities; such as of the plant and animal species occurring at the site. Land use aspects of the surrounding were also taken into account. Impacts evaluation and proposing mitigation measures to be implemented were outlined in the project report, and have been elaborated further in this study. To ensure comprehensiveness on the assessment, desktop studies and interviews were held. This involved the proponent and the consultants. Relevant studies and reports on the construction including design works and other related sources of information were critically reviewed, described in the report and have be interrogated further in this study.

1.4.2 Community Participation

Human well-being is dependent upon healthy environments that are able to sustain ecosystems, which in turn provide the much needed food, goods and ecosystem services. It is against this background that when putting up development projects, well developed community involvement programs in the EIA process is important for bringing people

/stakeholders together and allow them to share issues and ideas. Since their introduction in the 1970s, participatory methods and techniques have become central tools for community development. Participatory methods may be applied in a variety of contexts and sectors, including environmental management, urban sanitation provision, impact assessments, among others. When applied, they all stakeholders to participate in decision making on projects that may affect them in one way or another and to arrive at a consensus on what is best for both the community and the project developer.

The main objective of the Community involvement was to provide an opportunity to get "grassroots"/stakeholders participation in the development of the Children's referral hospital at Kenyatta University:

Specific objectives of community participation were to:

(i) Provide a forum for Kenyatta University Community members and local stakeholders to share information on the proposed Children's Referral hospital.

(ii) Encourage a more democratic process in discussing environmental matter pertaining to the project.

(iii) Provide dialogue between the community and decision makers thus help steer the project towards goal achievement.

(iv) Generate creative alternatives and solutions an help reach consensus on solving issues and problems in the community may identify and building on collective strengths of parties involved.

(v) Facilitating partnership and capacity building throughout the process

(vi) Disseminate pertinent information, data and other findings to all participants

In the community based participatory aspects of EIA, it was found important to important to engage the most trusted members of the community, "gatekeepers," right from the beginning of the project to ensure effective dissemination of pertinent information, pertaining to

the project, to all participants.

Once stakeholders have been identified, they were provided with a forum for expressing their concerns and suggestions. Efforts were made to ensure that the stakeholders represented the diversity of the community within and around Kenyatta University. Once the stakeholders are in place group discussions, use of questionnaires, and site visit and observations were instruments applied in order to produce the best outcomes.

CHAPTER TWO: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 General Overview

Environmental impact Assessment (EIA) is a tool for environmental conservation has been identified as a key component in new project implementation. At the national level, Kenya has put into place necessary legislation that requires EIA be carried out on every new project, activity or programme. (EMCA, 1999.), and a report submitted to the National Environmental Management Authority (NEMA) for approval and issuance of relevant certificates.

To facilitate this process, regulations on EIA and environmental audits have been established under the Kenya Gazette Supplement No. 56 of 13th June 2003. Besides, a number of other national policies and legal states have been reviewed to enhance environmental sustainability in national development projects across all sectors.

Some of the policy and legal provisions are briefly presented in the following sub-sections

2.2 Policies

National Environmental Action Plan (NEAP)

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from industrial, economic and social development programmes that disregarded environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP process EIA was introduced and among the key participants identified were the industrialists, communities and local authorities.

National Policy on Water Resources Management and Development

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors for promotion of the

country's socio-economic progress, it also recognizes the by-products of this process as waste water. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution.

Development projects, therefore, should be accompanied by corresponding waste management systems to handle the waste water and other waste emanating there from. The same policy requires that such projects should also undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and peoples' health in the immediate neighborhood and further downstream are not negatively impacted by the emissions.

In addition, the policy provides for charging levies on waste water on quantity and quality (similar to polluter-pays-principle) in which those contaminating water are required to meet the appropriate cost on remediation, though the necessary mechanisms for the implementation of this principle have not been fully established under the relevant Acts. However, the policy provides for establishment of standards to protect water bodies receiving waste water, a process that is ongoing.

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: -

(i) To ensure that from the onset, all development policies, programmes and projects take environmental considerations into account,

(ii) To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation,

(iii) To come up with effluent treatment standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that require sustainable approach. These issues include the waste management and human settlement sectors. The policy recommends the need for enhanced re-use/recycling of residues including wastewater, use of low non-waste technologies, increased public awareness raising and appreciation of clean environment. It also encourages participation of

stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others.

2.3 Legal Aspects

Applications of national statutes and regulations on environmental conservation suggest that the owner of any project has a legal duty and responsibility to discharge wastes of acceptable quality to the receiving environment without compromising public health and safety. This position enhances the importance of an EIA for the proposed extension project to provide a benchmark for its sustainable operation when it is finally commissioned. The key national laws that govern the management of environmental resources in the country have been briefly discussed in the following paragraphs. Note that wherever any of the laws contradict each other, the Environmental Management and Coordination Act 1999 prevails.

2.3.1 The Environment Management and Coordination Act, 1999

Part II of the Environment Management & Coordination Act, 1999 states that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. In order to ensure this is achieved, part VI of the same Act directs that any proponent of a new project should undertake EIA study and prepare an appropriate report for submission to the National Environmental Management Authority (NEMA), who in turn may issue a license as appropriate. The second schedule of the same Act lists proposed project among the key urban developments that must undergo EIA prior to implementation.

Part VIII section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. Section 73 require that operators of projects which discharges effluent or other pollutants to submit to NEMA accurate information about the quantity and quality of the effluent. Section 74 demands that all effluent generated from point sources are discharged only into the existing sewerage system upon issuance of prescribed permit from the local authorities.

2.3.2 The Water Act 2002

Part II section 18 of this Act provides for national monitoring and information systems on water resources. Following on this, sub-section 3 allows the Water Resources Management Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a owner of the project and the information thereof furnished to the authority.

Section 73 of the Act of the Act allows a person with license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75 and sub-section 1 allows the licensee to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction.

Section 76 states that no person shall discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of the effluent, maximum quantity anticipated, flow rate of the effluent and any other information deemed necessary. The consent shall be issued on conditions including payment of rates for the discharge as may be provided under section 77 of the same Act.

2.3.3 The Public Health Act (Cap. 242)

Part IX section 115 of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires Local Authorities to take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable for injurious or dangerous to human health.

Such nuisance or conditions are defined under section 118 waste pipes, sewers, drains or refuse pits in such a state, situated or constructed as in the opinion of the medical officers of health to be offensive or injurious to health. Any noxious matter or waste water flowing or discharged from any premises into a public street or into the gutter or side channel or watercourse, irrigation channel or bed not approved for discharge is also deemed as a

nuisance. Other nuisances are accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbour rats or other vermin.

On the responsibility of local authorities, Part XI section 129 of the Act states in part "It shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes…".

Section 130 provides for making and imposing regulations by the local authorities and others the duty of enforcing rules in respect of prohibiting use of water supply or erection of structures draining filth or noxious matter into water supply as mentioned in section 129. This provision is supplemented by Section 126A that requires local authorities to develop by-laws for controlling and regulating among others private sewers, communication between drains and sewers and between sewers as well as regulating sanitary conveniences in connection to buildings, drainage, cesspools, etc. for reception or disposal of foul matter.

Part XII Section 136 states that all collections of water, sewage, rubbish, refuse and other fluids which permits or facilitate the breeding or multiplication of pests shall be deemed nuisances and are liable to be dealt with in the manner provided by this Act.

2.3.4 The Local Government Act (Cap. 265)

Section 160 helps local authorities ensure effective utilization of the sewerage systems. It states in part that municipal authorities have powers to establish and maintain sanitary services for the removal and destruction of, or otherwise deal with all kinds of refuse and effluent and where such service is established, compel its use by persons to whom the service is available. However, to protect against illegal connections, section 173 states that any person who, without prior consent in writing from the council, erects a building on; excavate or opens-up; or injures or destroys on sewers, drains or pipes shall be guilty of an offence. Any demolitions and repairs thereof shall be carried out at the expense of the offender.

Section 170, allows the right of access to private property at all times by local authorities, its health officers and servants for purposes of inspection, maintenance and alteration or repairs

of sewers. To ensure sustainability in this regard, the local authority is empowered to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and wellbeing of the inhabitants of its area as provided for under section 201 of the Act.

The Act under section 176 gives power to the local authority to regulate sewerage and drainage, fix charges for use of sewers and drains and require connecting premises to meet the related costs. According to section 174, any charges so collected shall be deemed to be charges for sanitary services and will be recoverable from the premise owner connected to the facility. Section 264 also requires that all charges due for sewerage, sanitary and refuse removal shall be recovered jointly and severally from the owner and occupier of the premises in respect of which the services were rendered. This in part allows for application of the "polluter-pays-principle".

2.4.5 The Physical Planning Act, 1999

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

Section 30 states that any person who carry out development without development permission will be required to restore the land to it 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.

Finally, section 36 states that if in connection with a development application, local authority is of the opinion that the proposed development activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an environmental impact assessment (EIA) report. EMCA, 1999 echoes the same by requiring that such an EIA is approved by the National Environmental Management Authority (NEMA).

2.3.6 The Land Planning Act (Cap. 303)

Section 9 of the subsidiary legislation (The development and use of land regulations 1961) under this Act, requires that before the local authorities submit any plans to the Minister for approval, steps should be taken as may be necessary to acquaint the owners of any land affected by such plans. Particulars of comments and objections made by the landowners should also be submitted. This is intended to reduce conflict with other interests such as settlement and other social and economic activities.

2.3.7 The Building Code 2000

Section 194 requires that where a sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer line and that all wastewater must be discharged into the sewers. The code also prohibits construction of structures or buildings on sewer lines.

2.3.8 The Penal Code (Cap. 63)

Section 191 of the Penal Code states that any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons/institution in dwellings or business premises in the neighbourhood or those passing along public way, commit an offence.

2.3.9 Wastewater guidelines

Part of the study involves a review of the environmental standards that provides a basis for monitoring and future audits. The table below presents recommended guidelines on wastewater quality for discharge into the public sewers and open water bodies.

Kenya discharge Guidelines for Waste water

Parameter	**Discharge in public sewers (mg/l)**	**Discharge into water bodies (mg/l) – Assuming 10% dilution**
PH	6.0 – 9.0	6.0 – 9.0
BOD_5 (20^oC)	500	20

COD	1000	50
Suspended Solids	500	30
Detergents	30	Nil
Heavy metals (combined)	1	0.1
Oils/Grease	50	Nil
Nitrates (TN)	20	10
Phosphates (TP)	30	5
Conductivity	-	1500 uS/cm
4hr PV Value	No limits	20
Faecal Coliforms	No limits	1000/100ml for large water bodies, otherwise <10/ml)
Sulphates	-	500
Dissolved Oxygen	No limits	2
Phenols	-	2
Cyanides	-	0.1
Chlorides	-	1000
PCB	-	0.003
Colour	No limits	5 Hazen Units
Odour	No limits	Not objectionable

Sources: Department of Water Development

2.4 EIA Guidelines

The EIA guidelines require that EIA be conducted in accordance with the issues and general guidelines spelt out in the second and third schedules of the regulations. These include coverage of the issues on schedule 2 (ecological, social, landscape, land use and water considerations) and general guidelines on schedule 3 (impacts and their sources, project details, national legislation, mitigation measures, a management plan and environmental auditing schedules and procedures.

CHAPTER THREE: PROJECT DESCRIPTION

3.1 Physical Location

The proposed Kenyatta University children, research and referral hospital facility is to be at Kamiti location and Kiambu *County*, and on plot no; and about 23 km North East of Nairobi. The proposed site is vacant and surrounded by few other buildings as well as undeveloped land. The proposed hospital block will be compatible with the surrounding land use, which has similar buildings. It is envisaged the proposed block will contribute towards alleviating children health problems for Kenyatta University children and referral hospital. It will also greatly empower the country's financial management efforts through taxes, and also strengthen the areas socio-economics through a myriad of activities of the occupants.

The proposed site is within Kamiti location of kiambu county an which has been specifically earmarked for the hospital building facility. According to regulations, the buildings shall not cover more than 30 Percent of the area of the land or such lesser area as may be laid down by the local authority in its by-laws. The proposed facility is in conformity to those requirements.

Table 3.1: Salient Features of the Project Influence Area.

Criteria	**Details**
Topography	Flat
Climate conditions	Moderate to dry; semi arid grassland/woodland
Land availability	>300
Surrounding land use	Residential and commercial
Nearest airport	Thika raod super highway
Surrounding towns	Nairobi City, Kiambu, Ruiru, And Thika
National parks	None
Forests	Karura forest
Water bodies	Ruiru river
Universities	Kenyatta University and Jomo Kenyatta University of Agriculture And Technology
Local advantage	High population around the of the hospital facility, availability

	of proper infrastructure necessary for the proposed hospital facility.
Locality	23km northeast of Nairobi

3.2 Project Design

According to the designs and drawings, the hospital building facility will comprise of rooms with large windows and well landscaped exterior and interior areas in order to enhance environmental protection and social well-being of the occupants. All the necessary sanitary facilities and all necessary waste disposal facilities and ample parking space, will be put in place. In addition, there will be tarmac road access with gate and guard facilities for security and a life boundary fence.

This development may be divided into two phases namely construction and operation. The topography of the proposed site is flat which do not require leveling and/or landscaping. The construction phase will include soil excavation, earth moving and backfilling with suitable materials (mainly hardcore stones). This phase will also require suitable management for materials brought for the work. Other involvement will be construction machineries (delivery trucks, earth movers, concrete mixtures, compacters, etc.), building material storage and disposal of construction debris.

3.3 Size and magnitude of the Project

As indicated earlier, the hospital block will be essential facilities including sanitary and waste disposal facilities. There is also ample space outside for parking access/ waiting areas and relaxation compound. The site is currently undeveloped as NEMA approvals are awaited. During construction, negative impacts may arise and which could become a nuisance to the neighbouring communities. Trucks delivering construction materials also have potential safety hazards to the surrounding communities. Suitable measures would have to be undertaken.

Among the issues that will arise from a development such as this will be solid wastes (food remains, papers, polythene materials, plastics, etc.), waste water (wash water, sewage and surface run-off). Increased volumes of each category of waste demands expanded handling

capacity both on site and the final destinations. The project proposes to connect to an exsiting; sewage line. Water harvesting is planned as part of the development.

3.4 The Project Schedule

The proposed development is expected to start as soon as necessary approvals have been obtained. From the start date the construction and commissioning is estimated to take approximately 18 months. This is however, subject to design conditions.

3.5 Estimated Project Cost

The project is a small facility estimated to cost Kenya shillings 300 million (KES 3000, 000,000) only. The cost will cover the construction, provision of services, as well as related consultancies (feasibility studies, architectural/designs among others.

3.6 Project Alternatives

The following alternative projects to the proposed hospital facility was considered and outlined below:

3.6.1 No Project option

This alternative would mean that the project does not proceed

Advantages

- Air pollution from dust as a result of the construction process will not occur
- There would not be soil compaction as a result of heavy machinery use
- There will be a reduction of soil erosion due to less loosening for soil on the surface
- There would be no soil or water contamination

Disadvantage

- Housing in the area will continue being a challenge and as the population grows, this may give way to slums.
- The intended money for development will be diverted to somewhere else, hence failure to alleviate housing problem.
- There will be no secondary development as a result of the project
- The improvement in infrastructure as a result of the project would not be realized
- The value of land might improve but it will remain underdevelopment

- Provision and supply of construction materials will not improve, hence slow economy and employment.
- There will be a slow-down of local socio-economics.

3.6.2 Relocation alternative

Relocation option to a different site is an option available for the project implementation. At the moment, there are no alternative sites for the proposed development (i.e. the project proponent do not have an alternative site). The hospital block is needed as there is a shortage of health centers more so for children at Kenyatta University and the surrounding area. Relocation would mean that the proponent has to look for land elsewhere or dampen hopes of contributing to the economy. Looking for the land away is not a viable option for the proponent. Furthermore, completing official transaction on it may take a long period. In addition, it is not guaranteed that such land would be available.

3.6.3 Comparison of alternatives

Under the NO Action alternatives, no development would be allowed on the site. Therefore, this would contradict the proponents and also the National development goals and there would neither be benefits from the project nor the insignificant affects.

Under the proposed development alternatives, the proposed development would create temporary employment for contractors.

Provided the mitigation measures are implemented, including construction and best management practices, insignificant impacts on soils and water quality are anticipated. Commitments associated with this alternative would ensure that potential impacts are avoided or reduced to levels of insignificance.

CHAPTER FOUR: BASELINE INFORMATION AND DATA

4.1 Baseline Data/Information gathering procedure

Project information was gathered through discussions with the project owners and the neighboring community. The site was also visited for investigation of the physical environmental status and that of the immediate surroundings. A questionnaire (completed copy annexed to this report) was used to record information gathered during the discussions and site visit with the key stakeholders, including neighboring community and other interested parties.

Physical investigation additionally took into consideration among other issues the hydrology and surface geology, drainage system, water availability and sanitation status in the area as well as typical socio-economic activities around the proposed site. Also investigated were the public services provided in the area including the drainage systems, water supply/abstractions, power supply and access roads.

4.2 Environmental Setting

4.2.1 Temperature

The minimum and maximum temperature ranges from of 15.5 $^{o^{\circ}}$C to 30 $^{o^{\circ}}$C with annual mean of about 19^{o}C. The humidity level ranges from 56% in the month of February to 71% with no significant diurnal variation.

4.2.2 Rainfall

The climate within the site identifies with that of the larger Nairobi North County. The annual rainfall totals are generally around 600mm - 750mm p.a. for most sites. The proposed site is a flat area and with a gentle slope nearby. Most of the land surface and related landforms have been interfered with by human economic and settlement activities, though the main vegetation is semi-arid grass and woody shrubs.

4.2.3 Structural Geology and Soils

The geology of the area, like most other parts of Nairobi North is dominated by volcanic rocks and mixed red loams, and mixed murrum and shallow black cotton soils with a rocky

bedrock in different patches or sites. As a result, rocks of the area mainly comprise a succession of lavas, sandstones and pyroclatics of Cainozoic age overlaying the folded schist and gneiss of the Precambrian basement system. The soils of the area are mainly fertile loams.

4.2.4 Water sources.

There are several but largely fragmented streams and other surface waters in the project area. Piped water is readily available at the site.

4.2.5 Biodiversity

Biodiversity comprising plant species (indigenous and exotic trees mainly arid-land shrubs such as acacia *sp., commiphora spp*, among others, grasses etc) and animal species (small grassland mammals and birds) is to be found. Like most other highly settled peri-urban areas, natural biodiversity is highly fragmented due to intense human activities. This aspect has been looked in narrow sense of Macro fauna and flora. It is apparent that most animals save for pets and livestock have little room left by human habitation and economic land use.

4.3 Environmental Quality

4.3.1 Sanitation and Water Quality

The area surrounding the proposed site is characterized by human settlement, and scattered small farms on plots that await further development. The proposed block will have provision for future connection to a biodigestor instead of the conventional septic tanks and soaks pits (see attached plan). This is a modern way of dealing with sewerage while providing an alternative source of energy (biogas) to be used by the University community. The project has a waste water treatment facility as well as water harvesting provision to conserve water.

4.3.2 Green Area/Landscaping

Within the proposed project site, approximately 90 percent will currently an open space. About 30% of the total space will be designated for green areas. This will achieve a blend between modern buildings and various plant species, aquatic attractions as well as shrubs mainly to create a clean, healthy and aesthetic environment that provides a visual retreat and relaxation to the occupants of this building. A combination of an evergreen trees and ornament flowering trees, shrubs and palms will be used.

4.4 Human and Economic Development

The facility is basically surrounded with activities such as educational, business as well as other small health centers. The project is hoped to expand health welfare of mainly children and economic opportunities, and promote the philanthropic activities of hospital, opportunities which are imperative in a university setting. The proposed development will also through enhance socio-economic undertakings around the university's environs.

CHAPTER FIVE: ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

5.1 General Overview

The proposed hospital block development though being within an educational setting may not have significant impacts on the physical environment (unlike industries) but there is need to have proper mitigation measures.

In view of the above, the environmental aspects identified are listed below.

Environmental Issue	**Relative Impacts**	**Remarks**
Water Quality and Quantity	Low	▪ Minimum effects to the surrounding community during construction through poor drainage and stagnant waters, ▪ Waste water emanating from the building upon occupation and, ▪ Wastage of water from uncontrolled pipes and leakages, ▪ Storm water from open surface run-off. ▪
Soil Quality	Low	▪ Loosening of soils during land preparation for construction,
Air Quality	Low	• Dust and smoke from the construction materials and smoke from trucks delivery materials respectively
Drainage	Low	▪ The facility will have connections to the Kenyatta University sewer lineGeneral land surface will not be affected.
Land use and settlement	High	▪ Land use trends may not be determined now.

Vegetation	Low	• No major effect since the area is under minor grassland
Topography	None	-
Health and safety	Medium	• Contingency measures on health and safety measures will be taken into consideration

5.2 Environmental Impacts

It has already been indicated severally that the proposed hospital block facility is within a surrounding which has a high population density, (university community) and who will therefore contribute the bulk of the facility users.

Effluent wastes from the proposed project will enter into a properly constructed drainage channels. On the other hand solid wastes will be collected using on-site bins, and be removed through contracted services, use of either for off-site recycling or further management in authorized grounds. Anticipated impacts resulting from the project will be predicted through process description and aspect checklists.

Some details on the anticipated impacts have been presented under the following paragraphs.

5.2.1 Impacts on Water Quality

Water quality may be compromised during operational phase if proper supervision is not taken. The proposed block when completed will have full-time occupants, most who are health workers and visitors to the facility. The water use is expected to be low during the day save for mornings, evenings and week-ends, and used in general domestic purposes which include cooking, cleaning, sanitation, and general washing among others. Out of this consumption, though minimal in amounts, it is expected that 80% will go out as sewage and will be directed to the waste treatment facility. This will be waste water rich in the following pollutants;

(i) Bacterial populations,

(ii) Biomedical waste

(iii) Organic matter,

(iv) Detergent residuals,

(v) Suspended and settle-able matter,

(vi) Oils and fats

The impacts are likely to originate as follows:

(i) Soil erosion as a result of the construction activities. This may have negative effects to water bodies which are very far from the construction site. This will introduce pollutants suspended solids (turbidity), certain heavy metals (e.g. iron, manganese) and humic matter,

(ii) Surface run-off for hard surfaces (roofs, floors and pavements) and other sections of the site that will not be covered with either vegetation or buildings. The effects will be increased suspended soils, biological contamination and other pollutants such as oils/grease and chemicals,

(iii) The location of septic tank will be within the main compound area.

Solid wastes will also comprise of contaminants with serious effects both on surface water sources and ground water. There is no surface water near the proposed site. On the site solid waste holding may cause pollutants to infiltrate into the ground water. Suitable waste management measures and installation of suitable handling infrastructure will require to be incorporated into the project.

5.2.2 Impacts on Topography and Hydrology

The development does not have significant effects on the hydrology of the area. The surroundings are not likely to be directly affected.

5.2.3 Impacts on Soil and Land

Whereas there are no critical impacts anticipated on the soil quality, it is expected that any pollution problems will be felt through water quality either at the river or groundwater abstraction that may be undertaken. Change in the capacity of the soil to retain water and other soil structural characteristics are also likely to occur. Contamination of soil may result from the following;

(i) Excavations during the construction that will bring poorer sub-surface soils to the surface,

(ii) Storage of building materials that may introduce "foreign" components to the local soils,

(iii) Dumping of wastes such as oils/grease, food wastes and other solid wastes without due consideration of nature and potential dangers,

(iv) Due to the gentle sloppy terrain of the site, the land is susceptible to water and wind erosion after the vegetation is removed unless suitable measures are undertaken before the heavy rains.

5.2.4 Impacts on Air Quality

Significant effects on air quality are only anticipated during the construction phase. This will result from dust from slight excavation when leveling, stone cutting and building material handling including cement and sand.

5.2.5 Impacts on Bio-diversity

At the moment there are no signs of biological entities (plants and animals) at the proposed site. This implies there will be no direct impact on bio-diversity.

5.2.6 Noise pollution

Noise is unwanted/undesirable sound that can affect job performance; safety, and health, 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.

The construction activities will involve use of light machinery and other miscellaneous sources of noise for construction site (concrete mixers, workers, trucks). This is not likely to cause any significant degradation of local environment, as it will be mainly limited to the construction site. In addition, the noise levels produced are not likely to exceed the background levels which will be for a short time.

5.2.7 Impacts on Public Health and Safety

Health

Main health effects during the construction could result from building materials' dust, and particularly so cement. Others may originate from lack of proper protective equipment during finishing such as paint solvents and glues/adhesives. This is a responsibility of the building contractor to ensure potential cases are reduced. After commissioning, wastes originating from the building (sewage and solids) may be a health hazard to the residents and the surrounding community if not properly handled.

Safety

Construction work is generally a threat to the workers in terms of accidents such as falling from raised levels, body injury by equipment and accidents (on-site and off-site) by material delivery trucks. Again, the contractor is responsible on reducing related cases by providing the workers with gloves, helmets, overalls and other protective gears. Construction machines should be inspected thoroughly to avoid accidents. A first aid box should be provided. One person who is well trained should be available to administer first aid in case of an accident.
After commissioning, the key safety issues to address will include risks of fire to the property, the facility users and the surrounding community.

5.2.8 Impacts on Income Generation Opportunities

Development of the facility will contribute to creation of job opportunities for construction workers and care-takers, and also generate revenue to the government through taxes.

5.2.9 Social Issues

The proposed development has very limited potential to exert negative pressure on the physical environment or certain aspects on social amenities. However the anticipated impacts are as follows;

Water Supply

If water will be drawn from public supply system, the additional demand may require a similar expansion to be incorporated in the supply infrastructure. The effect of additional

demand from the existing facility is a likely issue of social complaint from the surrounding community. In the other hand, abstraction from a local source of water, say a borehole may have minimum effects on the neighbouring community if properly executed. The proposed hospital facility is planned to draw water from already existing public supply system and has water harvesting incorporated.

Waste Water

Waste water management systems, and more so the surface run-off drains, will carry additional flow from the washrooms and hard surfaces created respectively. Surface run-off has the potential for carrying solid materials into the water bodies and may reduce the river depth and eventually cause flooding of the homesteads downstream. Inappropriate treatment system has the potential to generate undesirable odours affecting the comfort of the neighbourhood depending on the wind direction. The facility usage is expected to generate insignificant amounts of wastewater which will nevertheless be recycled on site..

Solid Wastes

Solid wastes, including papers, plastics and polythene materials, food remains among others, will be generated from the proposed building. Dumping around the site interferes with aesthetic status of the area. Other effects could be breeding of pests (rats, snakes, insects etc.) or invasion by scavenging birds. This has direct effects to the surrounding community.

Disposal of the same solid wastes off-site could also be a social inconvenience if done on the wrong places. The off-site effects could be aesthetic, pest breeding, pollution of physical environment, invasion of scavengers and informal recycling communities. Related effects could be disease outbreaks in addition to other inconveniencies. Appropriate measures to deal with waste generated will be instituted.

Community Participation

As part of the assessment, a sample of the workers and neighbouring community was interviewed in regard to the proposed development. Majority felt the facility is highly needed as they regard Kenyatta University as their main employer, and its expansion do enhance their day to day socio-economics. A summary of their views is annexed;

CHAPTER SIX: RECOMMENDED MITIGATION MEASURES

6.1 General Overview

The proposed project is generally a positive development in terms of good facilities that will contribute to serving the people better. However, while the beneficial aspects are quickly realized, negative impacts from the development should also be appreciated and necessary measures incorporated in the project design, construction and eventually throughout its operation. The duty of achieving this, therefore, lies with proponent, the Project Designers, Architects and Engineers, the Contractor as well as the Operators and their Supervisors upon commissioning.

In view of the above, it is suggested that;

(i) Appropriate environmental, health and safety guidelines are developed at the initial planning stages of the project to guide the entire project implementation process,

(ii) Other ongoing activities at and around the site be evaluated with respect to the environment, health and safety with a view to incorporating the proposed project and improvement of the related infrastructure,

(iii) The project implementation does not cause unnecessary disruption to public utilities (e.g. water supply, power supply, waste water treatment systems, water resources, road network, etc.) and other land users in the area,

(iv) That safety and security of the surrounding communities will not be compromised,

(v) Necessary technological considerations are taken into account to provide an acceptable waste quality and disposal procedures to safe guard natural resources such as peoples health and ground water sources,

Below are specific mitigation measures recommended for the significant environmental aspects.

6.2 Planning Design and Construction

6.2.1 Planning

While planning for this development it will be necessary to consider the following basic aspects (some already addressed in the project document) of environment;

(i) The health of the workers and the neighbouring communities is of key importance and necessary mechanisms should be provided for this purpose at the project planning phase (see health and safety below),

(ii) Safety for on-site installations and people as well as those in the neighbouring communities should also be considered in the project plans. This includes fire safety measures (see health and safety below),

6.2.2 Design

The layout and operation of the proposed flat is expected to;

(i) Integrate within the existing environmental infrastructure at site to facilitate sharing of services and amenities (e.g. power, water, solid refuse collection and roads), safety arrangements and waste management systems among others. This has already been catered as per the designs annexed.

(ii) Minimize risks to health and impacts to external environment. Suitable anti-pollution facilities (solid waste containment and organized removals, waste water purification) should be part of the design. This has been incorporated in the preliminary designs.

(iii) Take into account changing environmental practices, market demands and availability of technology for flexibility on alternatives that do not have significant effects to the environment,

The proposed hospital block is expected to produce waste from use activities, food, equipments. Management of such wastes will be dealt with by the hospital waste disposal facilities and programs.

6.3 Waste Disposal Facilities

Medical waste pose a growing problem worldwide, jeopardizing the health of staff, patients, disposal workers and anyone else coming into contact with the often hazardous materials

discarded by hospitals and other healthcare sites. As such, Health-care waste needs sound management, including alternatives to incineration. Wastes emanating from the hospital are in different categories, ranging to those of medical nature, materials such as plastics, food, and human waste.

Products that we all use every day have a finite lifespan. Even with initiatives to re-use and recycle lots of waste still ends up in landfill sites where the chemicals in these products will decompose and can do extensive environmental harm as they break down. Plastics are not all biodegradable and there are still millions of plastic bags being manufactured, used and ending up in landfill so the damage is still being done.

6.2.1 Incineration of medical wastes

Some 20 to 25 percent of the total waste generated by healthcare establishments is regarded as hazardous and may create a variety of health and environmental risks if not managed and destroyed in an appropriate manner. Incineration is the only method providing complete destruction and neutralization of the medical waste ideally at the source. Modern hospital waste incinerators that lead to substantial reductions in the formation, emission and exposure to toxic substances from waste incineration, are currently available from global manufacturers such as Incinerate8 among others.

Such modern medical wastes incinerators are easy to operate are designed (specifically designed for medical/pharmaceutical, hazardous and hospital waste management and are even capable of disposing of type IV pathological waste and any other medical waste) to provide efficient waste destruction, utilizing best available technologies and environmentally friendly processes. Kenyatta University Teaching Research and Referral Hospital will acquire such modern and environmental compliant incinerators, and which will also be used to serve the incineration needs of the proposed children's hospital. Exact specifications of incinerator will be dealt with by University Medical/health and environmental experts for specifications, and tender committees and at the time of purchase and as per requirements of the Procurement Authority to avoid specification that may lead to tender biases. However, the university will purchase an incinerator with over 150 - 300 Kg capacity and very high Combustion Efficiency among other feature as agreed and which

will have Kenya Bureau of Standards and NEMA certification, and which can serve the needs of other hospitals (private and public) around

6.2.2 Waste water

The process waste water resulting from the hospital may contain a wide variety of polluting components. The amounts of waste water and concentrations depend on the composition of the wastes. Various methods are applied, for treatment of the waste water from the hospital will undergo treatments such as : (i) physico-chemical treatment - based on pH-correction, sedimentation and neutralization (ii) evaporation in the waste incineration process line --by means of a spray drier, into a semi- or other system that uses a bag filter. In this case there is no emission of waste water, other than that evaporated with the flue-gases or (iii) separate evaporation of waste water. In this case, the evaporated water is condensed, but as it is generally very clean can often be discharged (or re-used) without special measures.

6.2.3 Human wastes

Human wastes from toilets will be disposed using the main Kenyatta university sewer line. However, chemical sterilization of such wastes will be made since they will be emanating from a hospital facility.

6.2.4 Other Solid Wastes

In this hospital, there will be a system of separating solid wastes into various categories, including food wastes, papers, plastics, obsolete equipments and metal parts etc, with each category being managed appropriately. Some solid wastes such as plastic bottles may require recycling while others may require land-filling related actions

6.2.4.1 Disposal of plastic waste

Disposal of plastic waste has emerged as an important environmental challenge and its recycling is facing roadblocks due to non-degradable nature. Because plastic does not decompose biologically, the amount of plastic waste in our surroundings is steadily increasing. Plastic waste is often the most objectionable kind of litter and will be visible for months in landfill sites without degrading. Plastic is a durable substance and resists easy disposal. It is hard to recycle, noxious to burn, and bulky to transport. Once placed in a

landfill, the actions of sun, wind, water, and time can pry it loose to enter the environment again as pollution. As such plastic wastes will be sterilized stored and collected by licensed plastic disposal and recycling companies.

6.2.4.2 Awareness of Bio-medical Waste

Awareness of Bio-medical Waste Management among the Children hospital staff and public and private medical practitioners in the surrounding area will be part of hospital waste management programme of the University.

6.2.4.3 Other waste management actions

Office kitchen/tea area waste (e.g. food remains) may be isolated from ordinary materials (paper, plastics, textiles and wooden refuse).

Storm drains and waste water collection systems including sewers and open drains should be clearly shown on the designs. Monitoring points should also be fitted on the drains/sewers, NB. Waste water recycling system is included as well as biodigestor for biogas production.

Solid wastes (including garbage, papers, packaging materials, plastics and packaging materials, fats/oils) will be generated. The design should therefore, provide for suitable solid waste collection receptacles at strategic locations at the premises. An accessible area with a concrete slab should also be provided for collection and storage of the various solid waste categories awaiting disposal.

Surface run-off from open surfaces should NOT mix with the waste water. In this regard, storm water drains should be provided to pass at safe distances from the proposed wastewater treatment system. Systems of rain water harvesting will be put in place in order to address this problem.

6.3 Construction management

Though the construction phase will normally involve mobilization of construction materials, excavations and earth moving, effects from the proposed site are not expected to be significant in the neighbouring areas. However, to mitigate any impacts to the surrounding communities, the construction equipment require to be maintained at the best possible mechanical conditions to minimize aerial emissions (carbon dioxide, hydrocarbons, particulate matter etc.). The contractor will also therefore be expected to advise materials

delivery trucks to observe utmost care on road safety, define specific safe roads to be used and maintain trucks in good condition to reduce exhaust emissions.

Common construction materials are generally harmless to the natural environment, but related debris could become an aesthetic nuisance. All wastes emanating from the construction activities are expected to be disposed off into designated grounds by the Local Authorities. Such debris includes excavated soils, concrete wastes, building blocks, packaging materials and timber wastes.

Dust is one major environmental problem expected from construction sites. In order to reduce dust from the site, delivery trucks will always be covered, while the open stocks of sand and ballast will be constantly sprinkled with water to keep it moist. Care will be taken at all times when handling cement to minimize cement dust. In this connection, construction workers will be expected to be provided with personal protective equipment (dust masks, gloves, overalls/dust coats, boots and helmets) while at the construction site. Application of the same will be enforced.

6.4 Operations and Maintenance upon commissioning

i. Provide bins at the entrance of the proposed facility for waste paper, waste plastics and polythene materials and general organic wastes,
ii. The waste collected to be picked by a refuse handler and delivered to designated garbage dumping sites,
iii. Waste water generated including domestic sewage and wash water to be channeled into an existing sewer system. Options for water recycling will be researched on by the University, as part of its mandate
iv. Installation of water saving sanitary facilities in the structure reduces waste water generation. Water harvesting is also included in the designs.
v. Installation of energy saving technologies, and security systems.
vi. Ensuring Regular maintenance, Occupational safety measures are in place, and carrying out yearly Environmental Audits.

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6.4 ENVIRONMENTAL MANAGEMENT ACTION PLAN

The action plan outlined below addresses the prevention and management of possible accidents and risks to health/safety.

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
Changes in hydrology and drainage	Construction	▪ Harmonize site drainage design with the neighbouring premises, ▪ Direct storm water and surface runoff to the public drainage system, ▪ Incorporate a storm water collection reservoir as part of the site plan,	Proponent, Architect and Site Engineer Supervising Foreman and Contractor	Install structures on works commence ment then regular monitoring throughout construction period	▪ Free flow of surface runoff and storm water, ▪ NO ponding noted around the site.

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
	Occupation	▪ Ensure close supervision of drainage maintenance, ▪ Utilize storm water for irrigation of lawns and flower beds, ▪ Minimize hard surfaces around the premises, ▪ Ensure sewage and foul water do NOT enter into the drainage system, ▪ Ensure close supervision of wastewater septic tank and maintenance	Proponent, The Care Taker or Property Manager	Daily inspection of drains	

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
	Decommissioning	▪ Indicate intentions to decommission on years in advance, ▪ Undertake a decommissioning audit six months in advance ▪ Rehabilitate site	Proponent	Building designed for a lifespan of 50 years.	No impacts to the immediate neighbourhood **No Costs Estimate (to be worked out during the decommissioning audit**)

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
Soil Erosion	Construction	▪ Control the earthworks, ▪ Landscaping to create contours towards the drainage systems, ▪ Create embankments around the premises with excavated earth to prevent loss.	Landscaper, Supervising Foreman and Contractor	Continuous throughout construction phase	Silt loading in the drainage systems during rains
	Occupation	▪ Maintain internal and immediate external drainage systems clear at all times, ▪ Compact loose soils and apply binding materials.	Care Taker or Property Manager	Continuous activity	
	Decommissioning	As per the decommissioning report	Proponent	In 50 years	

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
Air Pollution (dust, emissions and particulate matter)	Construction	▪ Delivery trucks to be covered. ▪ Dusty building materials to be kept moist.	Supervising Foreman and Contractor	Continuous throughout the construction phase	▪ Complaints from the neighbours, ▪ Physical appearance in the immediate air space, ▪ Depositions on surfaces (buildings, plants and stationary vehicles) **No direct costs estimates**
	Occupation	▪ Control ALL points sources of emissions in the premises, ▪ No (emitting) operations in the building.	Care Taker or Property Manager	Continuous	
	Decommissioning	As per the decommissioning report	Proponent	After 50 years	

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
Noise pollution	Construction	▪ Construction machinery and equipment be maintained at highest level of working conditions. ▪ Construction time scheduling to suit the neigbourhood, ▪ Provide construction workers with plugs/muffs as part of PPE.	Architectural designer, Supervising Foreman and Contractor	A continuous observance throughout the construction Spot checks of noise levels every month	▪ Complaints from the neighbours, ▪ Audible noise levels at the nearest home not to exceed 55 dBA during the day and 45dBA during he night,

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
	Occupation	▪ Maintain monitoring of noise levels on annual basis ▪ Control points, events or other sources of noise.	Care Taker		
	Decommissioning	As per the decommissioning report	Proponent	After 50 years	No complaints from the residents
Water Pollution (Oil spills, silt, leachate from solid wastes, suspended matter, infiltration into water supply pipes, sewage discharge, etc.)	Construction	▪ Proper storage, handling and disposal of oil and oil wastes from machinery, ▪ Discourage servicing of machinery and vehicles on site, ▪ Minimize soil/silt wash-down into open drains.	Supervising Foreman and Contractor	Continuous through the construction period	Nature of surface runoff from the site **No cost estimates (Part of the earthworks and landscaping)**

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
	Occupation	▪ Avoid unnecessary wastage and spillage of water, ▪ Sewer pipes not to discharge into drainage systems, ▪ Solid waste holding bin be connected to the sewer lines for leachate discharge.	Residents, Care Taker	Continuous monitoring	Nature of surface runoff from the site **No specific cost estimates (part of the sanitary and plumbing installations)**

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
Waste Management, Sanitation and Hygiene	Construction	▪ Special attention on the sanitary facilities, ▪ Earth excavate be dumped on pre-identified and approved land fill sites, ▪ Construction debris and other inert materials (wood, steel bars, nails, papers, glass, etc. be recycled off site OR approved dumpsites, ▪ Provide segregated waste holding units at strategic locations, ▪ Some of the debris could be re-used elsewhere for covering earth roads,	The Proponent, The Architect Contractor, Supervising Foreman	Wastes expected throughout the construction phase	Compatibility of the waste types with the recipient physical and social environment. Value of the wastes types to the generation points and the recycling agents. **No direct costs estimates**

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
	Occupation	▪ Solid waste holding bins (segregated into different compartments), ▪ Engage approved refuse handling operators for the various waste, ▪ Carry out annual waste audits, ▪ Identify with the existing solid waste management mechanisms to adopt or otherwise,	Care Taker	Facilities and mechanisms to be in place upon commissioning	
	Decommissioning	▪ Ensure safe disposal of the waste generated during the	Proponent	After 50 years	**No cost estimates at present**

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
		decommissioning process, ▪ Everything is done in accordance to the decommissioning audit provision.			
Health and Safety	Construction	▪ Provide appropriate sanitation facilities for the construction workers, ▪ Ensure no stagnant water at any given time (mosquitoes could breed), ▪ The contractor not to allow proliferation of pests and nuisance situation,	Contractor, Supervising Foreman	Observance will be an all time requirement	▪ Complaints from the residents, ▪ Compliance level of the construction workers. **No direct costs estimates**

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
		▪ Provide and enforce application of personal protective equipment, ▪ Isolate the construction site for rest of the community for their safety, ▪ Consult the neighbourhood on regular basis for enhanced safety. ▪ Truck drivers be instructed to observe utmost care for the safety of the residents during the			

Environmental and Social Impact Aspect	**Project Stage**	**Mitigation Action Plans**	**Responsibility**	**Timeframe**	**Monitorable Indicators Cost Estimates (KShs.)**
		construction,			
Health and Safety	Occupation	▪ Liaise with existing neighbourhood security arrangement for integration in the design and construction. ▪ Drainage from the site, water supply network and power conduits should be made as safe as possible,	Care Taker Occupants of every floor also have a responsibility of their health and safety.	An all time requirement. Annual health and safety would be necessary.	▪ Cases reported on health and safety, ▪ Compliance levels with health and safety requirements, ▪ Level of awareness of the residents.

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATION

7.1 Conclusion

The proposed development, therefore, is compatible with the current land use trends in the University. The proponent wishes that the proposed hospital structure will take all measures to ensure that no activities with potential to compromise the comfort and safety of the neighbouring land users will be undertaken in the premises.

The project design has been scrutinized and has been found to integrate appropriate mitigation measures with a view to ensuring compliance with all the applicable laws and procedures as well as coexistence with the neighbouring communities. No physical environmental feature is likely to suffer adverse impacts from the activities of this project.

A comprehensive environmental management programme has also been presented under this report with appropriate measures and action plans through the project construction, occupancy and decommissioning of the proposed development. Relevant documentation has also been annexed to this report for ease of reference.

7.2 Recommendations

Following on the above conclusions, the following recommendations have been listed to ensure the prevention and mitigation of adverse impacts that may emanate from the proposed project;

(i) Open spaces with loose soils will require to be well compacted to prevent any erosion by wind and water,

(ii) Excavated earth and other constructed debris will require to be removed safely and dumped in approved sites or reused elsewhere as road gravelling land fills materials,

(iii) Workers will require to be provided with appropriate personal protective gear and the application enforced at all times while at place of work,

(iv) Dry construction materials and excavated earth will be kept moist to prevent excessive dust and particulate matter emissions into the air, during construction phase, and site clean up on completion.

(v) All equipment will be properly maintained and in good operating condition,

(vi) Ensure compliance with all relevant laws and regulations throughout the project cycle,

(vii) File completion report to NEMA.

(viii) Give the proponent a copy of the report.

(ix) Undertake regular audits during occupational phase.

The local community had **NO OBJECTION** to this project, and actually welcomes it, since Kenyatta university activities largely drive the socio-economics of this local community. They noted that the facility will ease children's health problems as there only one Children's in the whole country today, yet the population has expanded many-folds. The facility will provide both direct and indirect employment opportunities, attract taxable revenue to the government once it is occupied; and also attract more people who would in turn open small businesses. In particular stakeholders noted that the facility would provide employment and construction skills to the local youths during the construction phase. They were positive that the right environmental impact mitigation measures will be put in place at all stages. It is therefore important that the proponent be issued with an approval license so that this Land mark project for the University specifically, and the government/public on overall can commence.

Existing condition at the proposed development site

AREA STAKEHOLDERS QUESTIONAIRE ON PROPOSAL TO PUT UP A CHILDREN'S HOSPITAL ON KENYATTA UNIVERSITY GROUNDS

Name:…….

ID No:……

Tel. contact:……

1. Do you reside in this area?----------
2. How long have lived in this area? ----------
3. What is your occupation?----------
4. Are YOU (i) a home owner (ii) tenant or (iii) a worker in this neighborhood (iv) visitor?----------
5. Is access to a children's hospital a major problem here?----------
6. Is Water shortage a major problem here?----------
7. Are solid wastes or liquid effluents a major problem here?----------
8. Is security an issue here? ----------
9. An health facility is to be put at the nearby Kenyatta University and specifically on plot LR No 11026/2. Do you have any objection? YES/NO

If YES, Explain.----------

10. In what ways do think this facility will be (i) Advantageous to this area……..

(ii)Disadvantageous. ……..

11. What would you like the proponent to do (i) During construction phase……. (ii) Upon completion and during occupation phase……

……..

12 . Would you like this project to proceed? YES/NO