ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED APARTMENT COMPLEX ON PLOTS L.R. NO. 9509/49, 9509/50 & 9509/51 IN MARURUI AREA OFF USIU ROAD, ROYSAMBU SUB-COUNTY, NAIROBI COUNTY.(TOR 348)

This Environmental Impact Assessment (ESIA) Study Report is submitted to National Environmental Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003

GPS CO-ORDINATES Latitude -1.21861, 36.880855

PROJECT PROPONENT

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DOCUMENT AUTHENTICATION

This Environmental Impact Assessment Study report has been prepared by Clamson Ogutu in accordance with the Environmental Management and Coordination Act (EMCA) 1999 and the Environmental Impact Assessment and Audit regulations 2003 which requires that every development project must have an EIA report prepared for submission to the National Environmental Management Authority (NEMA). We the undersigned, certify that the particulars in this report are correct and righteous to the best of our knowledge.

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PROPONENT:

SYRICH CHATEUA LTD

Name……**Position**……..

Signature ……**Stamp**……

Date ……

EXECUTIVE SUMMARY

The proponent (Syrich Chateau Ltd) has entered into a joint venture with Tofina Futures Ltd to develop a one and half-acre plot off USIU Road, opposite Safari Business Arcade next to USIU University, Nairobi County.

Pursuant to section 58 of the Environmental Management and Coordination Act, (EMCA) 1999 revised 2015, the National Environment Management Authority (NEMA) requires project proponents to carry out Environmental Impact Assessments (EIA) and prepare related reports for developments that have the potential of resulting in negative Social and Environmental Impacts. It is against this background that the project proponent commissioned the EIA/Audit experts to undertake EIA for the proposed project. The EIA was undertaken using a combination of methods including; ground surveys, review of existing literature pertinent to the proposed project, focus group meetings and administration of structured questionnaires to some sampled stakeholders. The ESIA Study report was prepared to conform to the requirements of EMCA, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

The methods adopted for preparing the ESIA study report were guided by the Third Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. Site visits were undertaken in September 2021 for purposes of area reconnaissance, assessing the baseline and environmental risks associated with the proposed project as well as the applicable environmental safeguards and standards. An Environmental screening criterion was informed by the Second Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. A second site visit was conducted on 14th September 2021 for public participation with the PAPS. As per this Schedule the issues considered by the experts included; ecological and socio-economic issues, landscape changes, land use character and water. Data collection methods included literature review of relevant documents, observations during site visits and photography.

The policies of relevance to the proposed project and the environmental policies in place for ensuring clean and health environment for all were reviewed. The primary objective of the environmental policies is to ensure that economic development is sustainable and does not destroy the natural resources on which it depends. Kenya has environmental legislations which seek to make developments sustainable; The Environmental Management and Co-ordination Act of 1999 revised 2015.

The proposed project is considered important and beneficial to the economic growth of Kenya and is coherent with the Kenya's Vision 2030. This ESIA proposes a comprehensive environmental management and a monitoring plan for the entire project cycle to address negative environmental impacts and improve the environmental performance of the project.

Overview of the Project

The project comprises an apartment complex that will boast 288 beautifully finished units with studios of plinth area 35 SQM, 1 bedroom of 60 SQM, and 2-bedroom apartments of 95 SQM.

Property Features:

- Studio Apartments; 128 units (35 SQM)
- 1 Bedroom Apartments; 96 units (60 SQM)
- 2 Bedroom Apartments; 64 units (95 SQM)
- Roof Top View Deck
- Massive Ground Floor Swimming Pool
- Basketball Court
- Expansive Children's Play Area
- State-of-the-art high-speed Elevators
- Hardwood & Ceramic Floors
- On-Site 196 Vehicle Basement Parking
- Hi-tech solar system

Positive impacts

Demand for housing units in Nairobi far exceeds supply. The project will mainly increase the number of affordable, standardized, safe and convenient residences. Other positive impacts include employment opportunities, revenue generation to the county and national government, optimal use of land, economic benefit to the proponent.

Potential negative environmental impacts

Anticipated Impacts

The anticipated impacts during the project`s entire cycle namely, construction, operation and decommissioning phase include;

- Change in land use
- Land degradation and contamination;
- Noise pollution and vibrations
- Air pollution
- Social economic and cultural impacts
- Contamination of water resources;
- Solid and liquid waste generation;
- Dust nuisance;
- Vegetation loss;
- Increase in vehicular traffic in the area
- Increased demand for water and electricity supply to the area;
- Occupational health and safety risks

Summary of negative impacts & mitigation measures

The study identified negative impacts related to the project. These can be mitigated by the implementation of the proposed EMP. The potential negative environmental impacts of the proposed project and possible mitigation measures are summarized below: -

Potential Impacts	Mitigation Measures
1. Soil erosion	✓ Control earthworks; Install drainage structures to control the flow of stormwater; Ensure management of excavation activities
2. Air pollution	✓ Avoid excavation works in extremely dry weather ✓ Provide 2.4-meter-high hoarding along the site boundary ✓ Provide effective dust screen, sheeting or netting where scaffolding is erected around the perimeter of a building under construction, from the ground floor level of the building up to the highest level of the scaffolding; ✓ Water all active construction areas when necessary; ✓ Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard; ✓ Down wash of trucks (especially tyres) before departure from the site ✓ Vehicle idling time shall be minimized ✓ Comply with the Air Quality Regulations,2014
3. Excessive noise and vibrations generation	✓ Prescribe noise reduction measures if appropriate e.g., restricted working hours and transport hours and noise buffering; ✓ Install portable barriers to shield compressors and other small stationary equipment where necessary and locate stationary noise sources as far from existing sensitive receptors as possible; ✓ Use quiet equipment (i.e., equipment designed with noise control elements such as mufflers); ✓ Ensure use of well serviced and maintained vehicles and equipment. ✓ Limit trucks and other small equipment to minimize idling time and switch off idle engines whenever possible ✓ Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement works.

	✓ Comply with the Noise and Excessive Vibration Pollution (Control) Regulations, 2009. ✓ Workers operating equipment that generates high noise levels noise should be equipped with noise protection gear including ear muffs and plugs. Workers operating equipment generating noise levels greater than 80 dBA continuously for 8 hours or more should use ear protectors.
4. Waste generation	✓ Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time; ✓ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements; ✓ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste; ✓ Use of construction materials containing recycled content when possible and following accepted standards; and ✓ Adequate collection and storage of waste on-site and safe transportation to licensed disposal sites and disposal methods at designated area shall be provided.
5. Health and safety hazards	✓ Security shall be enhanced by ensuring security guards are posted around the project site and the strategic placement of security lights around the site. ✓ A roster of all construction workers shall be kept ✓ Unattended public access to the construction site shall be restricted and only one entry/exit point shall be used ✓ Appropriate health and safety measures shall be implemented. ✓ Warnings and signs should be placed in appropriate places. ✓ Ensure safety education and training of the construction workers ✓ Appropriate Personal Protective Equipment shall be worn at all times by all within the construction site including visitors ✓ Install proper fire management equipment and emergency response systems/strategies.

6. Road traffic disruption	✓ Ensure that the Entry/Exit to the project site is located where it will cause minimal traffic along adjacent roads ✓ Ensure all construction vehicles to and from the construction site use the designated Entry/Exit to the project site ✓ All transportation of construction raw materials and excavated materials are to be conducted at traffic off-peak hours only ✓ Sensitize truck drivers to avoid unnecessary road obstruction ✓ Cover all trucks hauling soil, sand and other loose materials to avoid spillage and dust emissions that may interfere with smooth motoring
7. High demand for water and effluent generation	✓ Install water meters where applicable ✓ Install water-saving devices in the appropriate places (flow regulators, water flow sensors, self-closing taps, low flush toilets ✓ Regularly maintain plumbing fixtures and piping in order to avoid losses ✓ Replace defective seals and repair damage to water pipes ✓ Waste water to be connected to the sewer line. ✓ Adhering to the water quality regulations 2006
8. High demand for electricity	✓ Switch off electrical appliances and lights when not in use ✓ Install energy saving fluorescent tubes ✓ Monitor energy use during the operation of the project and set targets for efficient use ✓ Sensitize workers to use energy efficiently ✓ Use alternative energy sources such as solar power for water heating

Recommendations

1. The proponent to implement the measures outlined in the Environment Management Plan (EMP) as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern the establishment and operation of such projects.
2. Maximize positive impacts as much as possible as exhaustively outlined within the report. This will ensure the best possible environmental compliance and performance standards.
3. Additionally, use solar PV especially for lighting streets and pavements/walkway lighting

Conclusion

Considering the positive socio-economic and environmental benefits to accrue as a result of the development, the EIA has found no major impacts to arise from the development, we recommend that the project be allowed to proceed on the understanding that the proponent will adhere to the recommended mitigation measures and will further implement the proposed EMP.

ACRONYMS AND ABBREVIATIONS

CCTVs	Closed Circuit Televisions
CPP	Consultation and Public Participation
EA	Environmental Audit
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management Coordination Act
EMP	Environmental Management/Monitoring Plan
EMS	Environmental Management System
ICT	Information Communication Technology
KBS	Kenya Bureau of Standards
KPLC	Kenya Power and Lighting Company
KURA	Kenya Urban Roads Authority
MDGs	Millennium Development Goals
NCG	Nairobi County Government
NEMA	National Environment Management Authority
NPEP	National Poverty Eradication Plan
NW&SC0	Nairobi Water & Sewerage Company
OSHA	Occupational Safety and Health Act
PPE	Personal Protective Equipment
WIBA	Work Injury Benefic Act
WRA	Water Resources Authority

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CHAPTER ONE: INTRODUCTION

1.1 Background and Rationale for the EIA

Currently, the rate of urbanization and population growth worldwide is increasing fast and with it comes the need for improvement in service provision especially in our urban areas. Kenya's rates of urbanization are escalating and being a developing country; most of its urban population is forced to live in slums. Increased population due to rural-urban migration in search of job opportunities and or higher education in major towns of Kenya has increased demand for buildings, especially residential houses. Due to this imbalance in the demand and availability of residential houses within Nairobi City and its neighborhoods, the client identified an investment gap that calls for the development of residential apartments which is in line with the surrounding population from USIU University and the needs of the area.

The principal measure of sustainable development is that all activities which are carried out to achieve development must take into account the needs of environmental conservation. The sustainability of the ecosystem requires the balance between human settlement development and the natural ecosystem, which is a symbiotic relationship. This can be achieved through careful planning and the establishment of appropriate management systems. In modern times, the need to plan activities has become an essential component of the development process. Consequently, several planning mechanisms have been put in place to ensure that minimum damage is caused to the environment. Environmental planning is also integrated with other planning processes such as physical planning, economic planning, and development planning. Environmental Impact Assessment (EIA) is considered part of environmental planning. EIAs are undertaken for activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority. In Kenya, the competent authority is the National Environment Management Authority (NEMA).

As part of the EIA process, it is necessary to devise alternatives to avoid undesirable impacts. Besides the alternative, identification of impacts may also lead to the development of mitigation measures i.e., means of reducing the impacts. As a tool of environmental planning, EIA is therefore precautionary. EIA is neither antidevelopment nor does it stop actions that impact the environment. It only requires that those impacts be considered. Most development activities impact the environment hence a "no impact" interpretation of Environmental Impact Assessment could lead to no development. But a "considerable impact" interpretation of EIA will lead to better development. If environmental impacts are ignored, the project may not be sustainable in the long run, in which case the money invested in it will have been wasted.

Environmental Impact Assessment studies were carried out as per the provisions of Environmental (Impact Assessment and Audit) Regulations, 2003. This report is a product of the entire study and will be used in various decision-making platforms including consideration for issuance of an EIA license by the National Environment Management Authority (NEMA). It is well known that there is a significant urban housing facilities deficit in Kenya with an estimated 150,000 housing units being required per annum just to meet the current demand over the next 10 years. Therefore, this development shall be a welcome idea to help address the limitations of living space and shelter in the city and its suburbs.

1.1 Need for the project

Rapid urbanization is a trend seen across the developing world, with the fastest rates of growth seen in Sub-Saharan Africa. Much of this is due to rural-urban migration of people in search of jobs and or higher education or higher standards of living. Urbanization rates in Kenya have mirrored those seen in other Africa countries and just like in other areas, the housing sector is not growing in tandem with the rates of urbanization.

It must be appreciated that there is a scarcity of residential premises in our urban areas. This has seen more and more residential buildings coming up to cater for the increased demand. The result of this has seen more and more agricultural land being converted to residential use and most urban areas set aside/ low rise residential developments convert to high raise multi-family dwelling developments.

There is a glaring gap between the demand and availability of affordable residential facilities in various sections of Nairobi and the large metro region. This has been largely so because most of the more recent large-scale developments in areas near the major towns have tended to focus more on commercial and office use developments.

The conceived project is designed to be within the character of the current housing trend for the area, where this survey revealed that apartments are allowed and are guaranteed of attracting the desired clientele. A survey sponsored by the proponent has established that demand exists for such development and that the target clientele would cherish an environment that meets the following criterion:

- A residence within reasonable distances to Nairobi CBD
- An environment that will allow occupants to interact but with strict rules regarding
  - Individual Privacy
  - Security of residents

The need, therefore, exists for providing flexible, modern and cost-effective housing establishment

1.2 National Housing Policy and Housing Needs in Kenya

In August 2003, the government of Kenya through a Sessional Paper spelt out a Housing Policy whose overall goal was to facilitate the provision of adequate shelter and a healthy living environment at an affordable cost to all socio-economic groups in Kenya to foster sustainable human settlements. The aim is to minimize the number of citizens living in shelters that are below the habitable living conditions.

Among other things, the policy aims at facilitating increased investment by the formal and informal private sector, in the provision of housing units for low and middle-income dwellers. The estimated current urban needs are 150,000 units per year, which can be achieved if the existing resources are fully utilized by the private sector with the enabling hand of the government. It is estimated that the current production of new housing in urban areas is only 20,000-30,000 units annually, giving a short fall of over 120,000 units per annum. The shortfall in housing has been met through the proliferation of squatter and informal settlements and overcrowding.

To alleviate the huge shortfall of urban housing mentioned above and to curb the mushrooming of informal settlements/slums, various interventions and strategies have to be adopted. In the Policy Paper, the government correctly accepts the fact that it cannot meet the housing shortfall on its own and that the best policy is to encourage the private sector (like the proponent) to chip in while the government provides an enabling environment for development. The government will provide an enabling environment by doing the following:

- Facilitating the supply of serviced land at affordable prices in suitable locations
- Expanding and improving infrastructure facilities and services
- Using research findings as well as innovative but cheap conventional building materials and technologies to improve the production of housing units.
- Harmonizing the Banking Act, the Building Society Act, the Insurance Act and the various Acts that have so far proved to be a hindrance to the sourcing of housing finance.
- Generally easing the path of funds from the private investor/government to the development project.
- Issuing workable guidelines on Estate Management and maintenance.

The promotion of this development is therefore well within the government current and long-term policies of ensuring housing for all by 2030 (Vision 2030). The housing policy does not address the demand for affordable residential houses, which are addressed by this report.

1.3 Scope of the Project

The principle policy on all new projects, programmes or activities requires that an EIA be undertaken at the planning stages. This guarantees that significant impacts on the environment are taken into consideration throughout the project lifecycle. Thus, the scope of the EIA entailed:

- The baseline environmental conditions of the area,
- Description of the proposed project,
- Provisions of the relevant environmental laws,
- Identification and discussion of any adverse impacts to the environment anticipated from the proposed project,
- Appropriate mitigation measures,
- Provision of an environmental management plan outline.

1.5 Overall objective of the project

The proposed project has the overall objective of developing an apartment complex, 9 floors high. The blocks will have a total of Two hundred and eighty-eight (288) units.

1.6 Terms of Reference (TOR)

The TOR for this assessment is based on the Environmental (Impact Assessment and Audit) Regulations 2003. According to the Regulations, the Study Report should where possible, contain a description of the following: -

- A description of the nature of the proposed project;
- The proposed location of the project;
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- The objectives of the project;
- The technology, procedures and processes to be used, in the implementation of the project;
- The materials to be used in the construction and implementation of the project;
- The products, by-products and waste generated by the project;
- A description of the potentially affected environment;
- The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative irreversible, short-term and long-term effects anticipated;
- Alternative technologies and processes available and reasons for preferring the chosen technology and processes;
- Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies.

- An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures;
- Provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the cause of carrying out activities of the development project;
- The measures to prevent health hazards and to ensure security in the working environment for the employees and the management of emergencies;
- Identification of gaps in knowledge and uncertainties which were encountered in compiling the information;
- An economic and social analysis of the project;

1.7 Methodology

1.7.1 Environmental Screening.

The environmental screening was carried out to determine whether an EIA study is necessary for this project and at what level of evaluation. This took into consideration the requirements of the Environmental Management and Coordination Act (EMCA), 1999, and specifically the second schedule of the same act. From the screening process, it was understood that this project will cause significant impacts on the environment.

1.7.2 Environmental Scoping.

In scoping, the focus was on environmental impacts of great concern. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects. Impacts were also classified as immediate and long-term impacts. This will include assessment of the proposed project in respect of but not limited to:

- Project Background: this will give the brief history of the proposed project site, the parties involved and justification of the project in terms of demand or lack of the same, the project area, relevant policy and legislation, identification of any associated project, or any planned projects including products within the region which may compete for the same resources; the project including products, by-products, processes both at implementation and operational level, resources required for successful implementation and operation of the project and the different options considered.
- The proposed project objectives; both in the short and long run; and how they are linked to the overall objectives.
- Present environmental conditions; description of the project site, ecological zoning as well as the state of the environment and its surroundings. Attempts will state if it is already suffering from degradation, causes of the original degradation if any established.

- Identification of Environmental Impacts; the report will distinguish between significant positive and negative impacts, direct and indirect impacts and immediate and long-term impacts which are unavoidable and/or irreversible,
- Community/ Stakeholder Consultations: these will be undertaken to determine how the project will affect the local people / various stakeholders.
- Cost-Benefit Analysis; to evaluate the economics of the project and establish its viability in terms of the expected environmental concerns and measures.
- Development of an Environmental Management Plan (EMP); to mitigate negative impacts, recommending feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels,
- Development of a Monitoring Plan; this will be used in monitoring the implementation of the mitigation measures and the impacts of the project during construction and operational phases, including an estimate of capital and operational costs, and making necessary recommendations about the proposed development.

1.7.3 Desktop Study.

This included a documentary review on the nature of the proposed activities, project documents, Nairobi County Development Plan, and relevant legislative and regulatory frameworks among others. It also included discussions with the developer, project managers, architects and design engineers

1.7.4 Site Visits and Public Participation.

Field visits were meant for physical inspections of the project site to gather information on the state of the environment. Several photos of the project site were taken for inclusion in this report. Due to the Covid 19 global crisis and subsequent government directives, the holding of public meetings was not conducted. The appendices contain random sample copies of the completed questionnaires that were administered to the public.

1.7.5 Reporting.

The EIA Study Report from the findings was compiled following the guidelines issued by NEMA such works and was prepared for submission by the proponent for consideration and approval. The consultant ensured constant briefing of the client during the exercise.

CHAPTER TWO: POLICY, LEGAL AND LEGISLATIVE FRAMEWORK

Environmental Impact Assessment is an instrument for environmental management and development control. It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound. It is a condition of the Kenya Government for developers to conduct Environmental Impact Assessment (EIA) on the Development Projects. According to Sections 58 and 138 of the Environmental Management and Coordination Act (EMCA) No. 8 of 1999 and Section 3 of the Environmental (Impact Assessment and Audit) Regulations, 2003 (Legal Notice No.101), construction of buildings require an Environmental Impact Assessment study report prepared and submitted to the National Environment Management Authority (NEMA) for review and eventual licensing before the development commences. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.

2.1 Policy Framework.

Environmental policies cut across all sectors and government departments. As such policy formulation should be consultative steered by interdisciplinary committees. Recent policies which the government is working on include; Draft Wildlife Policy; Draft National Land Policy; and Wetlands Management and Conservation Policy among others.

2.1.1 National Environmental Action Plan (NEAP).

National Environmental Action Plan was a deliberate policy effort to integrate environmental concerns into the country's development initiatives/plans. This assumed a consultative and multi-sectoral approach. Such an approach ensured that environmental management and conservation becomes integral in various decision-making platforms.

As a result of its adoption and implementation, the 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, Environmental Impact Assessments were introduced targeting the industrialists, business community and local authorities.

2.1.2 National Shelter Strategy to the Year 2000.

Kenya adopted this strategy following the International Year of Shelter for the Homeless in 1987. This advocates for the involvement of various actors to come in and assist the government in providing housing. This took cognizance of the governments' inability to provide sufficient shelter for all its citizens. The government was to simply facilitate other actors such as developers to invest in a shelter.

2.1.3 The National Poverty Eradication Plan (NPEP).

The objective of NPEP is to alleviate poverty in rural and urban areas by 50 per cent by the year 2015; as well as the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow gender and geographical disparities and a healthy, better educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for the Sustainable Development (WSSD) of 1995. Since poor housing is among the indicators of poor societies, pursuits to address it build individuals capacity to relieve poverty.

2.1.4 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 the promotion of the country's socio-economic progress, it also recognizes the by-products of this process as wastewater. It, therefore, calls for the development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. This implies that Industrial and business development activities should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating there. The same policy also requires that such projects undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighbourhood and further downstream are not negatively impacted by the emissions. As a follow-up to this, EMCA, 1999 requires annual environmental audits to be conducted to ensure that mitigation measures and other improvements identified during EIAs are implemented. In addition, the policy provides for charging levies on wastewater based on quantity and quality.

The "polluter-pays-principle" applies in which case parties contaminating water is required to meet the appropriate cost of remediation. Consequently, to ensure water quality, the policy provides for the establishment of standards to protect water bodies receiving wastewater, an ongoing process. The standards and measures to prevent pollution to water resources are provided for in the Environmental Management and Coordination (Water Quality) Regulations, 2006 which is supplementary legislation to EMCA, 1999.

2.1.5 Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999):

The key objectives of the Policy include: -

(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 a "sustainable development" approach. These issues relate to waste management and human settlement. The policy recommends the need for enhanced re-use/recycling of residues including wastewater, use of low or non-waste technologies, increased public awareness-raising and appreciation of a clean environment. It also encourages the 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 the provision of basic needs such as water, drainage and waste disposal facilities among others.

2.2 Legal and Legislative Framework

2.2.1 Environmental Management and Coordination Act chapter387

The Environmental Management and Coordination Act (EMCA) chapter 387, and its Attendant Environmental (Impact Assessment and Audit) Regulations of 2003 Provide for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya. The Act introduces two important aspects of urban environmental management, which are directly related to the proposed project: environmental impact assessment (EIA) and environmental audit (EA).

Section 58 (1) has underscored that any person being a proponent of a project Shall before financing, commencing or proceeding with submit an EIA report to the National Environmental Management Authority (NEMA) of Kenya.

Section 68 (1) gives NEMA the mandate for carrying out all environmental audits of all activities that are likely to have significant impacts on the environment. It authorizes environmental inspectors, as appointed by NEMA to enter in any premise and determine how far the activities carried out to conform to statements in the EIA study.

Compliance with EMCA

- The proponent has undertaken an EIA as per the requirements of Section 58 (1) of EMCA chapter 387 awaiting approval before the commencement of the project.
- The proponent will implement the proposed EMP and adhere to the conditions set in the license of the proposed project.
- The proponent will adhere to subsequent EMCA legislations such as the noise and waste regulations throughout the cycle of the project.
- The proponent shall undertake Environmental audits for the project and submit the reports to NEMA as per the EIA/EA guidelines

2.2.2 The Environmental Management and Co-ordination (Waste Management Regulations 2006)

Legal Notice No. 121: Section 4-6

Part II of the Environmental Management and Co-ordination (Waste Management) Regulations, 2006 states that: - 4. (1) No person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.

(2) Any person whose activities generate waste shall collect, segregate and dispose or cause to be disposed off such waste in the manner provided for under these Regulations.

(3) Without prejudice to the foregoing, any person whose activities generates waste should ensure that such waste is transferred to a person who is licensed to transport and dispose off such waste in a designated waste disposal facility. In addition, the Regulations state that:

5. (1) a waste generator shall minimize the waste generated by adopting the following cleaner production methods

a). Improvement of the production process through: -

i. Conserving raw materials and energy;

ii. Eliminating the use of toxic raw materials; and

iii. Reducing toxic emissions and wastes

b). monitoring the production cycle from beginning to end by: -

i. Identifying and eliminating potential negative impacts of the product;

ii. Enabling the recovery and re-use of the product where possible;

iii. Reclamation and recycling

c). Incorporating environmental concerns in the design and disposal of a product.

A waste generator shall segregate waste by separating hazardous wastes from non-hazardous waste and shall dispose of such wastes in such facility as shall be provided by the relevant local authority.

(23) No person shall engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by the Authority under the provisions of the Act.

Compliance

- The proponent will ensure that all waste is segregated before being transported to a designated waste treatment facility by a contracted NEMA licensed waste transporter
- A contracted waste handler licensed by NEMA will be responsible for the safe disposal of solid wastes from the residence

2.2.3 Wastewater Management;

Legal Notice No. 120; Part II – Protection of Sources of Water for Domestic Use.

4. (1) every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of these Regulations

(2) No person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution

5. All sources of water for domestic uses shall comply with the standards set out in the First Schedule of these Regulations.

The proponent and project Architect, as well as engineer, are urged to ensure that drainage channels are well designed during the construction phase of the project, and upon completion, the entire project is supposed to be connected to the NCC sewer line for proper management of liquid waste.

2.2.4 Public Health Act Cap 242

15 (1x) –Nuisance

Any noxious matter or wastewater discharged from any premise, such as a building constitutes a nuisance. Any premise not kept in a clean and free from offensive smell such as gases which are injurious to health such as those from commercial establishments shall therefore generate nuisance. The Act, therefore, stresses that no person shall cause a nuisance to exist on any land or premise occupied by him. The Act acknowledge that it shall be the duty of all local authorities to take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to health. To safeguard against this, part X of the Public Health Act states that wherein the opinion of the Medical Officer of Health that foodstuffs within a warehouse or a building are insufficiently protected, the owner shall be compelled to observe the required regulations, else he shall be guilty of an offence.

Compliance

- The proponent will ensure solid waste shall be handled by a professional NEMA approved garbage collector on regular basis and disposed of appropriately as per the waste regulations.
- Sanitary facilities shall conform with MOH standards and the installation of standard fittings.

2.2.5 Physical planning and Land-use Planning Act, 2019

An ACT of Parliament to make provision for the planning, use, regulation and development of land and connected purposes.

Section 57 (1) A person shall not carry out development within a county without development permission granted by the respective county executive committee member.

(2) A person who commences any development without obtaining development permission commits an offence and is liable on conviction to a fine not exceeding five hundred thousand shillings or to imprisonment for a term not exceeding two months or to both.

(3) A county executive committee member shall require a person who has commenced a development without obtaining development permission to restore the land on which the development is taking place to its original condition or as near to its original condition as is possible and that such restoration shall take place within ninety days.

Section 59 (1) A person applying for development permission shall ensure that any documents, plans and particulars that are provided to the respective county executive committee member while applying for development permission have been prepared by the relevant qualified, registered and licensed professionals.

Section 65 A county executive committee member may impose conditions or impose a fine to be prescribed in regulations on an applicant for development permission for building works where that applicant fails to complete the building works within five years.

According to the Third Schedule Development Control,

Section 4. Planning authorities shall require applications for major developments to be subjected to environmental and social impact assessment.

Compliance with this legislation

- The architectural plans of the proposed development have been submitted to the county government of Nairobi for approval upon which the project shall commence.
- The proposed project has been subjected to the requisite EIA and a report submitted to NEMA for licensing to acquire the EIA license.
- The proponent will ensure that the land is utilized in an ecofriendly manner and is restored to its original condition once the project is decommissioned.
- Ensure the development does not in away have an injurious impact on the environment and that a developmental footprint of less than 50% is maintained.

2.2.6 Water Act 2016

The water act No. 8 of 2016 provides for the management, conservation, use and control of water resources and for acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services. Section 18 of this Act provides for national monitoring and information systems on water resources. Following on this, sub-Section 3 mandates 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 site operator and the information thereof furnished to the authority. Section 73 of the Act provides that a person who is licensed to supply water has a responsibility of safeguarding the water sources against degradation. According to section 75 (1), such a person is required to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon the land for preventing pollution of water sources within his/her jurisdiction.

On the other hand, section 76 makes it an offence for any person to discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee which should be sought by making an 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 provided under Section 77 of the same Act.

Section 94 of the Act also makes it an offence to throw or convey or cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive or unwholesome matter or thing into or near to water resource in such a manner as to cause, or be likely to cause, pollution of the water resource

The main contractor will be required to implement necessary measures to ensure water conservation and also to prevent potential for water contamination during the construction phase to comply with this the developer will use a channel to direct water to the main channel just like the houses in the surrounding neighbourhood.

2.2.7 County Government Act (2012).

The County Government act was formed after the promulgation of the new constitution of Kenya (2010). The constitution calls for devolution of duties in the counties for effective results. These county governments may manage and let land besides regulating and licensing trade activities including construction in their areas of jurisdiction besides provision and maintenance of roads, footways, street lighting and sewerage in their areas.

Section 160 of the act empowers counties 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.

Similarly, section 163 (e) empowers the local Authorities to prohibit businesses which by reason of smoke, fumes, chemicals, gases, dust, smell, noise, vibration or other cause, may be or become a source of danger, discomfort or annoyance to the neighbourhood, and to prescribe conditions subject to which such business shall be carried on.

In order to discharge its duties effectively, section 170 of the act allows the right of access to private property at all times by local authorities, its officers and servants for purposes of inspection, maintenance and alteration or repairs of sewers. According to section 173, any person who, without prior consent in writing from the council, erects a building on; excavate or opens-up; or injures or destroys a sewer, drains or pipes shall be guilty of an offence. Any demolitions and repairs thereof shall be carried out at the expense of the offender. The Act, by virtue of section 176 also empowers the local authority to regulate sewerage and drainage, fix charges for use of sewers and drains and ensure that connecting premises meets the related costs.

2.2.8 The Electricity Power Act, 2005

Section 55 (1) in the execution of works in connection with the construction, modification, maintenance or operation of an electric supply line or apparatus or conductor connected thereto, every licensee shall:

In no way injure the works, conveniences or property belonging to any such other such authority, company or person, nor obstruct or interfere with public traffic, except with the previous consent of the board. Take adequate precautions to protect from danger any person engaged upon such works by the provision and maintenance in safe and efficient conditions of the necessary safety appliances for the use of such persons and by ensuring their proper use, or by other means approved by the board.

2.2.9 The Penal Code (Cap. 63)

Section 191 of the Penal Code makes it an offence for any person or institution that voluntarily corrupts, or foils water for public springs or reservoirs rendering it less fit for its ordinary use. Similarly, section 192 of the same act prohibits making or vitiating the atmosphere in any place to make it noxious to health of persons/institution in dwellings or business premises in the neighborhood or those passing along a public way.

The proponent will be required to ensure strict adherence to the Environmental Management Plan throughout the project cycle in order to mitigate against any possible negative impact.

2.3 Other relevant Provisions

The following are the relevant environmental treaties to which Kenya is signatory in order of ratification:

- Montreal Protocol on Substances that Deplete the Ozone Layer (1987) ratified 9 November 1988
- United Nations Convention to Combat Desertification (1994), ratified 12 June 1994
- United Nations Framework Convention on Climate Change (1992), ratified 30 August 1994
- Convention on Biological Diversity (1992), ratified 11 September 1994
- Bamako Convention (1991), ratified 17 December 2003

- Kyoto Protocol (2004), ratified 25 February 2005

2.4 Institutional Framework

At present, there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environmental Management Authority (NEMA), the Forestry Department, Kenya Wildlife Services (KWS) and others. There are also local and international NGOs involved in environmental activities that impact the environment in one way or the other in the country.

2.4.1 National Environmental Management Authority (NEMA).

The object and purpose for which NEMA is established is to exercise general supervision and coordination over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. A Director General appointed by the president heads NEMA. The Authority shall, among others:

- Co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects with a view to ensuring the proper management and rational utilization of the natural resources environment on a sustainable yield basis for the improvement of the quality of human life in Kenya.
- Take stock of the natural resources in Kenya and their utilization and consultation, with the relevant lead agencies, and develop land use guidelines.
- Examine land use patterns to determine their impact on the quality and quantity of the natural resources among others. Moreover, NEMA mandate is designated to the following committees:

2.4.2 Public Complaints Committee.

The Committee is charged with the following functions:

Investigating allegations/ complaints against any person or against the Authority (NEMA) in relation to the condition of the environment and its management, Prepare and submit to the Council periodic reports of its activities which shall form part of the annual report on the state of the environment, and to perform such other functions and excise such powers as may be assigned to it by the Council.

2.4.3 National Environment Action Plan Committee.

This Committee is responsible for the development of a 5-year Environment Action plan among other things. The National Environment Action Plan shall contain:
Analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time, and Analytical profile of the various

uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity among other duties as the EMCA specifies.

2.4.4 Standards and Enforcement Review Committee.

This is a technical Committee responsible for environmental standards formulation methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures. Standards and Enforcement Review Committee consists of the members set out in the third schedule to the Environmental Management and Co-ordination Act.

2.4.5 National Environmental Tribunal.

This tribunal guides the handling of cases related to environmental offences in the Republic of Kenya. The Tribunal hears appeals against the decisions of the Authority. Any person who feels aggrieved may challenge the tribunal in the High Court.

2.4.6 The Occupational Safety and Health Act, 2007.

This is an act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. The Act was published in the Kenya Gazette Supplement No. 111 (Acts No.15). It received presidential assent on 22nd October, 2007 and became operational on 26th October, 2007. The key areas addressed by the Act include:

a. General duties including duties of occupiers, self-employed persons and employees
b. Enforcement of the act including powers of an occupational safety and health officer. Registration of workplaces.
d. Health General Provisions including cleanliness, ventilation, lighting and sanitary conveniences
e. Machinery safety including safe handling of transmission machinery, hand held and portable power tools, self-acting machines, hoists and lifts, chains, ropes & lifting tackle, cranes and other lifting machines, steam boilers, air receivers, refrigeration plants and compressed air receiver
f. Safety General Provisions including safe storage of dangerous liquids, fire safety, evacuation procedures, precautions with respect to explosives or inflammable dust or gas
g. Chemical safety including the use of material safety data sheets, control of air pollution, noise and vibration, the handling, transportation and disposal of chemicals and other hazardous substances materials
h. Welfare general provisions including supply of drinking water, washing facilities, and first aid
i. Offences, penalties and legal proceedings.

Under section 6 of this act, every occupier is obliged to ensure safety, health and welfare of all persons working in his workplace. The occupier shall achieve this objective by preparing and as often as may be appropriate, revising a written statement of his general policy with respect to the safety and health at work of his employees and the organization and arrangements for the time being in force for carrying out that policy (Section 7).

He is also required to establish a safety and health committee at the workplace in a situation where the number of employees exceeds twenty (section 9) and to cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a registered safety and health Advisor (Section 11). In addition, any accident, dangerous occurrence, or occupational poisoning which has occurred at the workplace needs to be reported to the occupational safety and health officer of the respective area by an employer or self-employed person (section 21). According to section 44, potential occupiers are required to obtain a registration certificate from the Director for all premises intended for use as workplaces. Such places shall be maintained in a clean state during the operation phase (section 47).

To ensure machinery safety, every hoist or lift – section 63 and/or all chains, ropes and lifting tackles – section 64 (1d), shall be thoroughly examined at least once in every period of six months by a person approved by the Director of Occupational Health and Safety Services. Similarly, every steam boiler - section 67 (8) and/or steam receiver - section 68 (4) and all their fittings and/or attachments shall be thoroughly examined by an approved person at least once in every period of twelve months whereas every air receiver shall be thoroughly cleaned and examined at least once in every period of twenty-four months or after any extensive repairs - section 69 (5). According to section 71 (3), every refrigeration plant capable of being entered by an employee also needs to be examined, tested and certified at least once in every period of twelve months by an approved person.
In relation to fire safety, section 78 (3) requires spillage or leaks of any flammable liquid to be contained or immediately drained off to a suitable container or to a safe place, or otherwise treated to make it safe. Furthermore, a clear and bold notice indicating that smoking is prohibited should be conspicuously displayed in any place in which explosive, highly flammable or highly combustible substances, are manufactured, used, handled or stored-section 78 (5). In addition, necessary precautions for dealing with fire incidents should be implemented including provision of means for extinguishing fire and means for escape, in case of fire, for the persons employed in any workplace or workroom – section 81. As far as disaster preparedness and emergency response program is concerned, section 82 (1) makes it a mandatory requirement for every occupier of a workplace to design evacuation procedures to be used during any emergency situation and to have them tested at regular intervals.

To promote health and safety of employees who are at risk of being exposed to chemical substances, section 84 (3) and 85 (4) requires every employer to maintain at the workplace material safety data sheets and chemical safety data sheets respectively for all chemicals and other hazardous substances in use and ensure that they are easily available to the employees.
The employers' positive contribution towards the welfare of the employees include provision and maintenance of adequate supply of wholesome drinking water - section 91 and a first aid box or cupboard of the prescribed standard – section 95 at suitable point (s) conveniently accessible to all employees.

Other precautionary measures include: issuance of a permit to work to any employee, likely to be exposed to hazardous work processes or hazardous working environment, including such work processes as the maintenance and repair of boilers, dock work, confined spaces, and the maintenance of machinery and equipment, electrical energy installations, indicating the necessary precautions to be taken – section 96 (1); provision and maintenance for the use of employees, adequate, effective and suitable protective clothing including suitable gloves, footwear, goggle and head coverings in any workplace where employees are likely to be exposed to wet, injurious or offensive substance – section 101 (1). The proponent will be required to ensure that the main contractor includes in the contract document, adequate measures to promote safety and health of workers.

2.4.7 Trade Licensing Act (Cap 497)

Section 5 of the Act makes it mandatory for all businesses to obtain trading licenses.

2.4.8 Environmental Vibration Pollution (Control) Regulations, 2009

These regulations were published as legal Notice No. 61 being a subsidiary legislation to the Environmental Management and Co-ordination Act, 1999. The regulations provide information on the following:

i. Prohibition of excessive noise and vibration

ii. Provisions relating to noise from certain sources

iii. Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations and

iv. Noise and excessive vibrations mapping.

According to regulation 3 (1), 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. Regulation 4 prohibits any person to (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; or (b) cause to be made excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 metres from any moving source.

Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property.
Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which- (a) produces any loud and unusual sound; and (b) exceeds 84 dB(A) when accelerating. According to sub regulation 2 of this regulation, No person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident.
Regulation 13 (1) provides that except for the purposes specified in sub-Regulation (2) there under, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform 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 these Regulations.

Regulation 16 (1) stipulates that where a sound source is planned, installed or intended to be installed or modified by any person in such a manner that such source shall create or is likely to emit noise or excessive vibrations, or otherwise fail to comply with the provisions of these Regulations, such person shall apply for a License to the Authority. According to regulation 18 (6) the license shall be valid for a period not exceeding seven (7) days. Regulation 19 (1) prohibits any person to carry out activities relating to fireworks, demolitions, firing ranges or specific heavy industry without a valid permit issued by the Authority. According to sub regulation 4, such permit shall be valid for a period not exceeding three months. The project proponent will be required to comply with the above mentioned regulations in order to promote a healthy and safe working environment.

CHAPTER THREE: DESCRIPTION OF THE PROJECT

3.1 Introduction

This chapter provides a detailed description of the project development assessed within this EIA. The overall objective of this project is to develop and avail a modern apartment block with associated amenities on plot L.R NO 9509/49, 9509/50 & 9509/51 in Nairobi County.

The increasing rate of urbanization in recent decades has seen an accelerated trend in the construction of high-rise and tall buildings worldwide, particularly in the growing economies of the world. A fundamental economic driver for the growth of tall (particularly residential) buildings is the scarcity of land in the densely urbanized parts of the world.

The decisions made by the developer and his team have a profound impact on the cost, amenity, constructability, and sustainability of high-rise buildings. The structural materials used in high-rise buildings are typically one or a combination of (reinforced or pre-stressed) concrete, structural steel and composite systems. Structural material systems for the proposed apartment building shall be chosen by carefully considering architectural, economical and site factors.

In general, the design of the project will essentially optimize the use of the best available technology to prevent or minimize potentially significant environmental impacts associated with the project and to incorporate efficient operational controls together with trained staff, to ensure high-level utility and environmental performances.
Specific details of the proposed development are outlined in the proposed project architectural drawings containing the site plan, layouts, sections, elevation and other plans that illustrate the development in more detail attached within the appendices.

Design components of the project

The project comprises an apartment complex that will boast 288 beautifully finished units with studios of plinth area 35 SQM, 1 bedroom of 60 SQM, and 2-bedroom apartments of 95 SQM.

Property Features:

- Studio Apartments; 128 units (35 SQM)
- 1 Bedroom Apartments; 96 units (60 SQM)
- 2 Bedroom Apartments; 64 units (95 SQM)
- Roof Top View Deck
- Massive Ground Floor Swimming Pool
- Basketball Court
- Expansive Children's Play Area
- State-of-the-art high-speed Elevators

- Hardwood & Ceramic Floors
- On-Site 196 Vehicle Basement Parking
- Hi-tech Solar System

Figure 1: An artistic impression of the proposed project

3.2 Project location

The proposed project is located in Plots L.R. No. **9509/49, 9509/50 & 9509/51** off USIU Road in Marurui area Nairobi County. The site falls within a residential area with several flats and apartments and associated developments including a road network, electricity supply and other infrastructure. Notable neighbours include USIU University, Safari Business Arcade and QWETU Student Residences

Satellite map showing the project area and the surrounding developments.

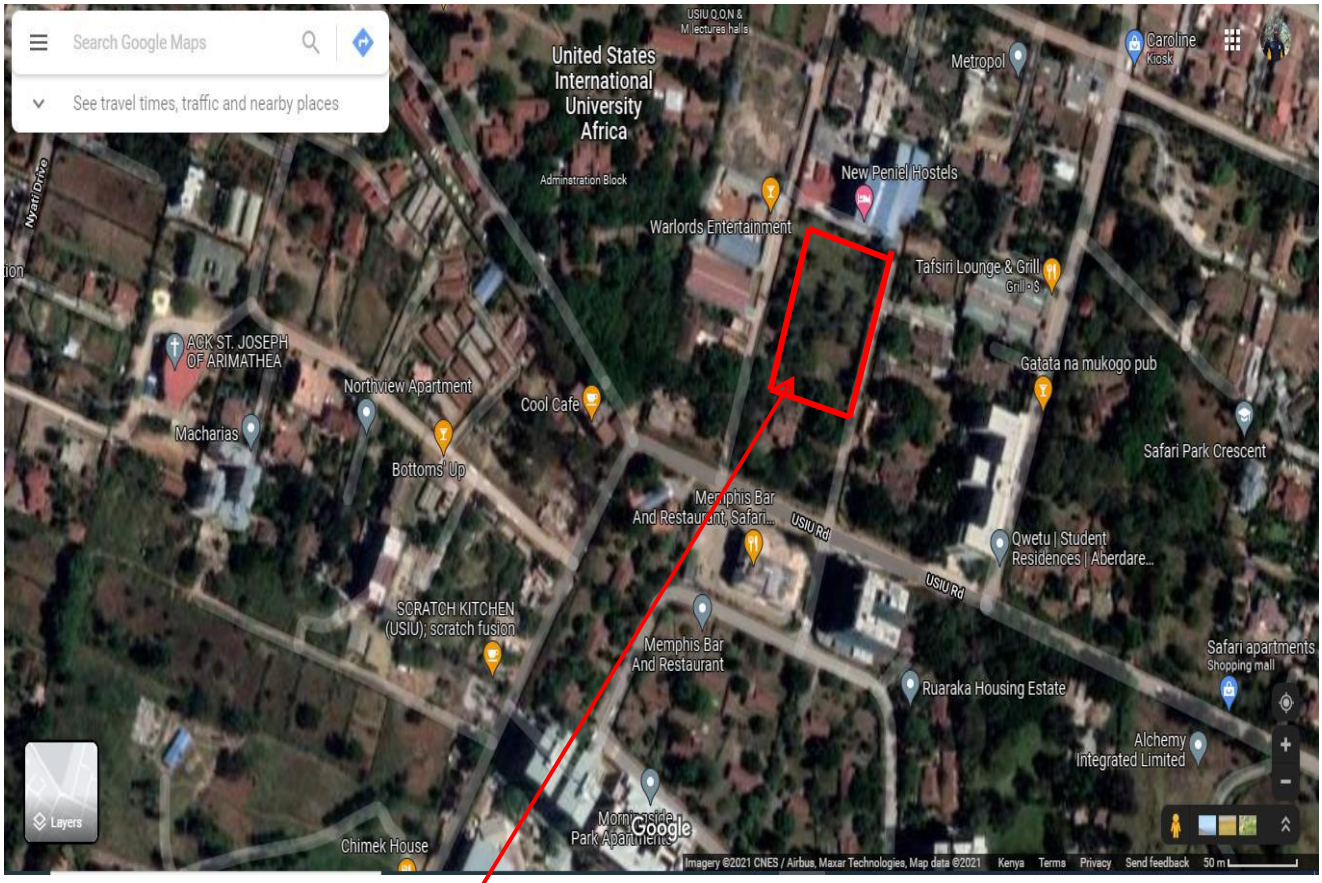

Figure 2: The proposed project site that sits on one and half acre site that is served by two roads

Figure 3: A photo of the proposed 1 ½ acre site

Figure 4: Neighboring developments

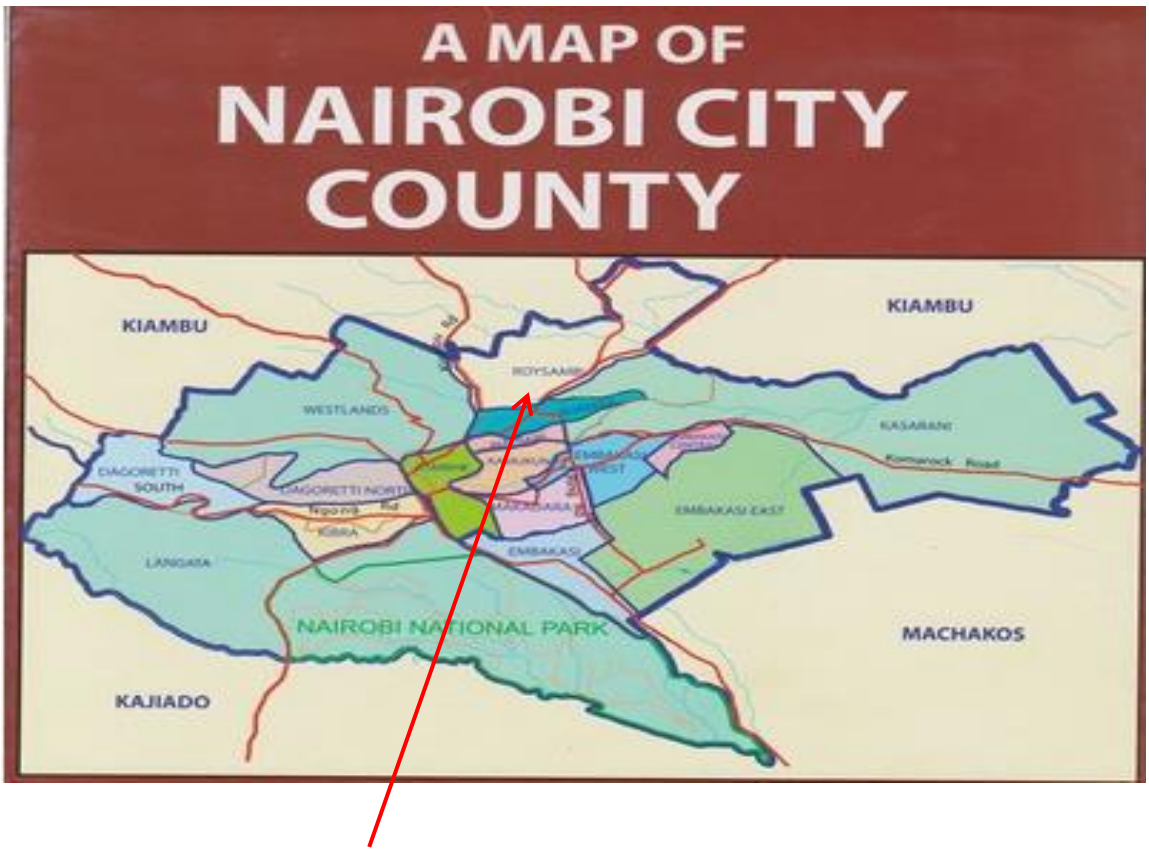

Figure 5: Nairobi County Map with Roysambu the project site.

3.3 Site Ownership

The following conditions apply to the land;

- That the proponent provides adequate measures against environmental degradation.
- That the proponent is bound by any other conditions that may be imposed by the county government in its by-laws.
- Plus, all the special conditions are outlined in the copy of the attached ownership documents. The development drawings have been submitted for approval by the relevant departments in the County Government with the following conditions in mind:
- That the proponent shall adhere to the drawing specification as they will be approved plus all conditions included in the approval letter.

The land ownership documents are registered under Syrich Chateau Ltd

3.4 Infrastructure

The development will have a comprehensive and robust infrastructure including access roads, parking areas, water storage, electricity distribution and waste disposal mechanism.

3.4.1 Electrical system

Construction power will be from the Kenya Power and Lighting Company (KPLC). The project will utilize permanent power supplied by the Kenya power company limited. The various components of the electrical system shall comprise a single and twin socket outlet, lockable meter board with glass view panel, gate lights and security alarm panel outlet and CCTV connection system and lifts. The necessary guidelines and precautionary measures relating to the use of electricity shall be adhered to. There shall be backup generators at the facility that automatically come on in case of power blackouts to ensure all facilities including lifts are operations at all times.

3.4.2 Water Reticulation system

Water for construction will be from the NCWSC. There will be water storage tanks to increase water capacity at the project site to the required amount.

3.4.3 Sewerage

The area has a conventional sewer line and wastewater is disposed of through this sewer line.

3.4.4 Solid Waste

Solid waste management will consist of dustbins stored in cubicles protected from rain and animals. The solid wastes from each block will be assembled in the garbage collection point ready for disposal by a NEMA licensed waste disposal handler. The waste will then be collected by a NEMA licensed private waste management company and be composited, palletized or re-cycled depending on the waste management strategy to be adopted in line with the Environmental Management and Co-ordination (Waste Management) Regulations, 2006.

3.4.5 Security

Security within and around the project during construction and operational phases will be enhanced by security guards posted at the site and the installation of security lighting around the project site. During operation, 24 hours security will be incorporated by having security guards on-site, CCTV and security lighting around and within the premises.

3.4.6 Fire safety

The development provides for firefighting facilities such as fire extinguishers in the form of hydrants and hose reels and portable extinguishers. Fire breaks have also been provided for.

3.4.7 Parking area

The driveway and parking area, which will be paved, will be spacious accommodating 196 cars

3.4.8 Perimeter Fence

A concrete perimeter will be erected around the project site to offer tenants maximum security.

3.4.9 Landscaping

Green areas provided for on the ground floor shall be landscaped after construction, using plant and grass species available locally. This will include the establishment of lawns and flower gardens to improve the aesthetic quality of the site.

3.4.10 Buildings Construction

Health and safety components will be incorporated into the project design to boost the emergency response and preparedness index of the building. Emergency staircases shall be incorporated from the topmost floor to the ground floor on both ends of the building while hose reels shall be located at several strategic points of each floor. Once complete, portable fire extinguishers shall be incorporated at strategic points on all floors. Emergency response and "Emergency Exit" notices will also be posted where applicable and appropriate.

3.5 Description of the Project's Construction Activities

3.5.1 Pre-construction Investigations

The implementation of the proposed Project's design and construction phase will start with investigation and studies of the site's biological, physical and socio-economic factors to minimize any unforeseen adverse impacts during the project cycle. Infrastructure assessment studies shall also be conducted to harmonize the proposed project with existing infrastructure and amenities.

3.5.2 Site set up and management

This involves activities such as screening, fencing the project site, setting up temporary stores, demarcation of temporary roads, car parks, storage areas etc.

3.5.3 Clearance of Vegetation.

The site has several mature trees to be cleared from the site.

The proponent shall ensure as many indigenous trees as possible are used for re-vegetation as well as conserving the mature trees where possible

3.5.4 Groundworks, foundations and structural works

Groundworks such as excavation and deep trenching, filling, and the construction of earth structures e.g., embankments, bunds and cuttings; will be carried out to prepare the site for the construction of foundations and drainage systems. This will involve the use of machinery such as excavators, bulldozers, backhoes and also manual labour.

The construction of the buildings foundations, walls, floors, pavements, drainage systems and parking area among other components of the proposed project will involve a lot of masonry work and related activities. General masonry and related activities will include concrete mixing, plastering, slab construction, construction of foundations, construction of the envelope of the building, the external facings, cladding, erection of building walls and curing of fresh concrete

surfaces. These activities are known to be labour intensive and will be supplemented by machinery such as concrete mixers, tower hoists, pavers, concrete vibrators amongst others.

3.5.5 Mechanical and electrical installations and associated trades

The soil cover in the proposed area has a thin layer of black cotton soil about 4 inches deep. However, this shall be excavated and disposed off in approved sites (preferably exhausted quarries). Electrical work during construction of the buildings will include installation of electrical gadgets and appliances including transformers, meters, electrical cables, lighting apparatus, sockets etc. In addition, there will be other construction activities involving the use of electricity such as welding, metal cutting, running electrical gadgets etc.

Plumbing will entail the installation of pipe-work for water supply and distribution will be carried out within the building and associated facilities. In addition, pipe-work will be done to connect the building into the existing sewer system and for drainage of storm water from the rooftops and driveways into the peripheral storm water drainage system. Other associated trades include as joinery, painting, window placement and plastering. These activities will include metal, wood, glass, plastic and ceramic tiles cutting, the use of adhesives, metal grinding and wall drilling among other activities.

3.5.6 Site reinstatement, removal of site offices and final clear away

This includes site reinstatement, removal of temporary building structures such as cranes, scaffolds and props, removal of fittings machinery and equipment and final away of surplus spoil.

3.5.7 Structural Steel Works

The building will be reinforced with structural steel for stability. Structural steel works will involve steel cutting, welding and erection.

3.5.8 Roofing and Sheet Metal Works

Roofing activities will include sheet metal cutting, raising the roofing materials such as clay roofing tiles and structural timber to the roof and fastening the roofing materials to the roof.

3.5.9 Construction inputs (Materials and Equipment)

Construction inputs/ raw materials shall include but not limited to sand, cement, machine cut stones, crushed rock (gravel/ ballast), steel metal bars, paint/painting materials, ceramic tiles, plastic and metal plumbing, marble

counters, wood doors, skirting among others. Construction machines shall include machinery such as tower crane, batch plants, trucks, excavators, concrete mixers, masonry tools, hoists and other relevant construction equipment. Both skilled and non-skilled workers will be required at all phases of the project. The labour force will require services such as energy, water supply and sanitation facilities. Large volumes of water will also be required during the civil works.

3.5.10 Landscaping

To improve the aesthetic value or visual quality of the site once construction ceases, the proponent will carry out landscaping. This will include establishment of a theme garden and lush grass lawns where applicable and will involve replenishment of the topsoil. It is noteworthy that the proponent will use plant species that are available locally preferably indigenous ones for landscaping.

3.6 Description of the Project's Operational Activities

3.6.1 Residence

A total of 288 households (about 128 students) will reside within apartment blocks while another 156 families will occupy the one and two bedroom units. Several domestic activities such as cooking, washing, use of vehicles, and leisure and recreational activities will thus accompany residence. In addition, there will be production of domestic and sanitary wastes.

3.6.2 Solid Waste

The proponent will provide facilities for handling solid waste generated within the facility. These will include dust bins/skips for temporarily holding waste within the premises before final disposal at the designated dumping site. The solid wastes from each block will be assembled in the garbage collection point ready for disposal by a NEMA licensed waste disposal company. Private waste disposal companies that are approved by NEMA and County Government will be responsible for solid waste disposal.

3.6.3 Waste Water and storm water Management

Sewage generated from each house/unit will be discharged into the existing sewer lines and then to the NCC mains sewer line available on the site/area. Storm water will be properly channeled to improve drainage within the development.

3.6.4 Cleaning

The proponent will be responsible for regular washing and cleaning of the pavements and communal areas. Individual tenants will be responsible for washing and cleaning their own premises/ residences. Cleaning operations will involve the use of substantial amounts of water, disinfectants and detergents.

3.6.5 General Repairs and Maintenance

The Houses and associated facilities will be repaired and maintained regularly during the operational phase of the project. Such activities will include repair of building walls and floors, repairs and maintenance of electrical gadgets and equipment, repairs of refrigeration equipment, repairs of leaking water pipes, painting, maintenance of flower gardens and grass lawns, and replacement of worn-out materials among others.

3.7 Description of the Project's Decommissioning Activities

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. If such a stage is reached, the proponent needs to remove all materials resulting from the demolition/ decommissioning from the site. The following should be undertaken to restore the environment.

- Remove all underground facilities from the site
- The site should be well landscaped by flattening the mounds of soil and
- Planting indigenous trees and flowers
- All the equipment should be removed from the site
- Fence and signpost unsafe areas until natural stabilization occur
- Backfill surface openings if practical

3.7.1 Dismantling of Equipment and Fixtures

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

3.7.2 Site Restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the topsoil and re-vegetation using indigenous plant species.

3.8 Public participation

3.8.1 Sources of information

One of the key information sources used during the Environmental Impact Assessment exercise was public participation. Views from the would be affected people were sought from the public through the following means: -

1. The administration of pre-designed questionnaires 14th September 2021 during the project study exercise
2. Direct interviews with stakeholders and members of the public.

The objective of the consultation and public participation was to: -

- Disseminate and inform the stakeholders about the project with special reference to its key components and location
- Gather comments, suggestions and concerns of the interested and affected parties
- Propose and discuss solutions and mitigation measures to the potential negative impacts and various concerns
- Incorporate the information collected in the EIA study report

In addition, the Environmental Impact Assessment public consultation exercise enabled: -

- The establishment of a communication channel between the general public and the team of consultants, the project proponents and the Government.
- The concerns of the stakeholders be known to the decision-making bodies at an early phase of project development

The exercise was conducted by a team experienced registered environmental expert. The
Consultation and Public Participation (CPP) Process is a policy requirement by the Government of
Kenya and a mandatory procedure as stipulated by EMCA section 58, however due to the ongoing
Covid 19 pandemic and subsequent government directives, the holding of public meetings was not possible.

3.8.2 Issues raised and comments

This Sub-Section covers the views and opinions of the key stake holders (local leaders, surrounding, neighbours/institutions/organizations, interested persons or groups). It highlights both positive and negative socio-economic and environmental impacts anticipated during the construction and operational phases of the project. This is followed by suggested mitigation measures that the developer should incorporate to minimize environmental degradation and promote sustainable
development.

3.8.2.1 Dilapidation of existing infrastructure

Heavy trucks transporting excavated materials and raw materials to and from the project site may lead to dilapidation of existing roads and also cause spillage of these materials on roads hence interfering with smooth motoring. Construction works may also interfere with existing peripheral drainage which runs along the project boundary, spillage of materials being transported and poor construction of site access roads/culvert can lead to this.

3.8.2.2 Overstretching of infrastructure and zoning

It was feared by some that the conversion of the site to a high-rise apartment building may lead to the overstretching of public utilities and infrastructure such as sewer lines, water mains supply and roads. The height of the building was also indicated to be too high by some neighbours.

The Nairobi County Government planning department authorizes projects in accordance with their infrastructure (sewer, water supply) capability as per their own infrastructure assessments. Zoning and building plans authorization is also done by the Nairobi County Government. Of note is that the proposed building is also in character with several buildings around the neighbourhood (See Section 3.4).

3.8.2.3 Obstruction and traffic

Obstruction by construction transport vehicles during the construction phase and increased number of vehicles coming to and from the project during the operational phase will lead to increase in traffic along the access roads.

3.8.2.4 Noise and Dust emissions

Noise and Dust emissions will be generated at the project site during construction which if unmitigated can interfere with neighbours comfort and health.

3.8.3 Positive comments

- The proposed project will create temporary employment for both skilled and unskilled labour both directly and indirectly

- The proposed project once complete will improve the type of housing in the area by introducing modern and quality housing units

3.8.4 Suggestions

- Ensure repair and maintenance of drainage facilities within and around the project site
- The developer should ensure that once the project is complete, post construction clean up should be carried out thoroughly especially the peripheral drainage and the access road
- Ensure the building envelope is surrounded with dust nets during the construction phase to reduce dust emissions and construction debris
- Plant trees on the property to add aesthetic value and improve local environment
- Do not carry out construction works at night to control the noise
- Provide for adequate parking for the units so that they do not park on the side of the
- road making movement a challenge and increasing traffic unnecessarily
- Consult all relevant service providers and relevant authorities (i.e. KPLC, NCG, NW&SCo, NEMA amongst others) so as to harmonize the projects infrastructural and socioeconomic developments with existing facilities
- Adhere to all relevant construction, occupational, health and safety regulations and any other relevant law.

*****Questionnaires are hereby attached within the appendices

3.9 Project cost

The estimated project completion cost of the apartment complex is estimated to be one billion Kenya shillings (**1,000,000,000).**

CHAPTER FOUR: BASELINE INFORMATION OF THE STUDY AREA

4.1 Introduction

This chapter has information on the location, bio- physical, socio and economic aspects of the project area. These are elaborately discussed in order to identify areas likely to be affected as a result of project activities. This study therefore considered the physical location, climatic data, geology, drainage, infrastructure, demography and socioeconomic information.

4.2 Climatic Conditions

At 1,795 meters (5,889 ft) above sea level, Nairobi enjoys a moderate climate. Under the Koppen climate classification, Nairobi has a Subtropical highland climate. The altitude makes for some chilly evenings, especially in the June/July season when the temperature can drop to 10 °C (50 °F). There are two rainy seasons but rainfall can be moderate. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with drizzle. Temperature fluctuates between 15°C and 32°C in most areas

4.2.1 Temperatures

The sunniest and warmest part of the year is from December to March, when temperatures average the mid-twenties during the day. The mean maximum temperature for this period is 24 °C (75 °F). The minimum temperature also remains low during cloudy nights, usually hovering around 8 °C and at times reaching 6°C. Clear skies in January and February also bring colder nights. The highest temperature ever registered in Nairobi was 32.8 degrees Celsius and the lowest was 3.9 degrees Celsius. The mean maximum temperature for this period is 24 °C (75 °F).

4.2.2 Rainfall

There are two rainy seasons but rainfall can be moderate. The cloudiest part of the year is just after the first rainy season, when, until September, conditions are usually overcast with drizzle. Mean annual rainfall range is 500-1000mm/year. Relative humidity means values range from 70 to 80%.

Wind Flows

The lower winds throughout the year are of the easterly type. Between October and April, they shift to the northeast while as from May to September they move to the southeast. Prior to the "Long Rain" season strong winds prevail with an average speed of 22.5 Miles/hour. The rest of the year has wind speed varying from 10 to 15 Miles/hour. However, during night, the winds are usually calm.

4.2.3 Sunshine.

Early mornings in Nairobi in general are often cloudy, but the sun peeks through by midmorning. Throughout the year, there is an average of seven hours of sunshine per day. Thirty percent more sunlight reaches the ground during the afternoon than in the morning. Of course, there is more sun shine during the summer months, when the sun is more overhead in the southern hemisphere. Infrequently during the rainy season the sun never show through the clouds. Even in August, the cloudiest month, there is an average of four hours of sunshine.

4.3 Topography and Drainage

Nairobi main drainage follows the regional slope of the volcanic rocks towards the east, while subsidiary internal drainage into the Rift region is confined to the western part. The lava plains east of the line Ruiru-Nairobi-Ngong are underlain by a succession of lava flows alternating with
Lakebeds, streams deposits, tuffs and volcanic ash. These plains, comprising mainly the Athi plains and the northern section of the Kapiti plain, extend westwards, rising from 4900 feet (1493 m) at the Athi River to 6000 feet (1829 m) in the faulted region near Ngong. The lava plains are crisscrossed with steep-walled gullies and canyon-like gorges, such as those along the Mbagathi valley. Further east this valley widens slightly where soft material is being actively eroded (Saggerson, 1991)

4.4 Hydrogeology and Soils

In general groundwater in volcanic rocks is limited to fractures and erosion levels within the volcanic succession. Fresh lavas are usually not water bearing because of their massive and impervious nature. The most significant aquifer system west of the project area is the Upper Athi Series aquifer system. This is the main aquifer for boreholes in Nairobi and Kiambu areas and is composed of tuffs, lakebeds and sediments. Other aquifers in this area are found in the weathered inter-lava layers and in fractured zones.

The rocks in the Nairobi area mainly comprise a succession of lavas and Pyroclastic of the Cainozoic age and overlying the foundation of folded Precambrian schist's and gneisses of the Mozambique belt (Saggerson, 1991). The crystalline rocks are rarely exposed but occasionally fragments are found as agglomerates derived from former Ngong volcano. The soils of the Nairobi area are products of weathering of mainly volcanic rocks. Weathering has produced red soils that reach more than 50 feet (15m) in thickness (Saggerson, 1991). Slopes and other categories have been introduced for lithosols and regosols.

4.5 Biological Environment

This section describes key biological elements, including the identification and distribution of dominant, rare and unique flora and faunal species within the region of concern (proposed project site and other potentially affected areas).

4.5.1 Flora

Natural vegetation in Nairobi has been cleared to pave way for the establishment of both residential and commercial developments. The natural vegetation in the area has thus been greatly modified. The remnants of the natural vegetation of the site and its environs are few scattered trees and shrubs as well as grass.

4.5.2 Fauna

This will look at the aquatic and wetland faunal species as well as terrestrial species. The site is situated within a commercial/ residential zone where human activities have altered the natural habitat for animals over the years. The principal source of water for this region is surface water from the Athi drainage basin.

The project's effect may seem insignificant to such lives but it is of great concern to the environment at large. It is expected that the area will be populated by small mammals such as mice, rats, moles and other members of the Rodent Family. Bird species were also observed at the site. None of the faunal species observed are rare or endangered.

4.6 Socio-economic Environment

Kenya's real gross domestic product (GDP) grew by 5 .8per cent in 2005 against a revised growth of 4 .9 percent in 2004 (CBS 2006). The major growth sectors were agriculture and forestry; transport and communications; manufacturing; and wholesale and retail trade. Economic growth is expected to be sustained in 2006. Nairobi is a major contributor to Kenya's economy: it generates over 45 per cent of GDP; employs 25 per cent of Kenyans and 43 per cent of the country's urban workers (UN-Habitat 2006). The paradox is that the financial capacity of the Nairobi County is extremely limited, largely because of poor resource management and a weak revenue collection system. As a result, there is a 200 per cent shortfall between the revenue collected per capita ($7 on average) and per capita expenditure ($21) (UN Habitat 2006)

4.6.1 Land use:

Urban land use refers to spatial distribution of social and economic activities. Accordingly, an up-to date land use inventory is frequently required to facilitate urban planning and growth patterns as well as monitoring of urban expansion. A study by the Department of Resource Surveys and Remote Sensing (DRSRS 1994) identified eight major land-use classes in Nairobi. These include Residential Use Industrial, commercial and service centres, Infrastructure land use, Recreational areas, urban agriculture as well as Water bodies and riverine areas.

4.6.2 Economic Activity:

The economy and the environment are closely linked, as natural resources are the basis of production, manufacturing and waste disposal. Environmental resources such as forests, water and land have a vital role to play in boosting economic growth and reducing poverty. While it may be argued that economic growth brings many benefits to people, the attendant pollution loading and resource depletion poses great risks to human health and the environment. If not Managed properly this may even jeopardize the viability of the economic activities being supported.

Nairobi is a major contributor to Kenya's economy: it generates over 45 per cent of GDP; employs 25 per cent of Kenyans and 43 per cent of the country's urban workers (UN-Habitat 2006). The paradox is that the financial capacity of the Nairobi County is extremely limited, largely because of poor resource management and a weak revenue collection system. As a result, there is a 200 per cent shortfall between the revenue collected per capita ($7 on average) and per capita expenditure ($21) (UN Habitat 2006).

4.6.3 Population

Population is a major driver of environmental change in Nairobi and as such is a determinant of other parameters such as solid-waste-generation rates, land-use patterns and settlement, and water consumption. The population of Nairobi grew from 8,000 in 1901 to 118,579 in 1948 (Rakodi 1997). By 1962, the city had a population of 343,500 people, although some of this could be attributed to extension of the city's boundaries. Between the 1948 and 1962 censuses, the population grew at an average rate of 5 .9 per cent per annum, compared with 7 .6 per cent in the previous 12-year period. Taking the 1999 census figures as a baseline, it is projected that the city's population by the next census in 2009 will be about 3 .1 million, and 3 .8 million by 2015 (CBS 2001).

4.6.4 Employment Trend

As Nairobi's population increases, so does the demand for jobs. Currently, 56 .6 per cent of women and 68 .6 per cent of men aged between 15 and 50 are economically active (CBS et al. 2004). Between 1989 and 1997, the combined formal and informal sector employment growth was 2 .3 per cent per annum, less than half that of the rate of population growth (Post Buckley International Inc.1998). It is estimated that about 500,000 people join the labour force annually. Most of these are unable to secure employment and thus remain unemployed or end up in traditional agriculture and in the informal sector (Odhiambo and Manda 2003). The 1997–1998 labour force survey showed that 9 per cent of people in Nairobi were employed and 24 per cent unemployed (CBS 2003b).

4.6.5 Socio-economic Importance of the proposed project

The proposed project is in line with the governments' housing policy that aims to facilitate the attainment of adequate shelter and healthy living environment to all socioeconomic groups in Kenya. The project will therefore help to increase settlement in the region by investing in the construction industry; the proponent will also contribute towards the economic growth of our nation through revenue collection. In particular, the proposed project will generate the following positive socio-economic impacts:

1. The proponent will rent the residential houses to the public. The proposed project will therefore serve as a source of income to the proponent thereby improving their living standards
2. During the operation phase of the project, the proponent will be required to pay tax to the government hence contributing to the economic growth of our nation
3. The proposed project will indirectly contribute towards enhancement of security in the neighbourhood of the area
4. The proposed project will generate revenue to the County through payment of connection and service fee.

Apart from the direct employment of construction workers, the proposed project will also benefit the following categories of individuals:

- Transporters. Investors on lorry and trailer transport will benefit greatly from the project. This benefit will extend to vehicle dealers and manufacturers, lorry drivers and turn boys.
- Cement Manufacturers. The local cement manufacturers and their employees and shareholders are direct beneficiaries of the development.
- The government will also get some impressive increase in V.A.T. and other taxes levied on cement.

• Manufacturers and dealers of other building materials. Most of the building materials to be used are locally manufactured. Relevant companies, their workers and shareholders will be direct beneficiaries of the development.
• Sand Harvesters. Locals involved in sand harvesting in sand harvesting are to be major beneficiaries of the project. The benefit will extend to the local authority entitled to levy taxes on sand transporters.
• Ballast Quarries. There will be massive use of ballast. These will ensure that the Quarry owners and workers benefits greatly.

4.7 Water Resources

Although Nairobi relies mainly on surface water supplies, the sources of these supplies lie outside the city. The surface streams, though numerous, are heavily contaminated by domestic and industrial effluents and solid wastes. Naturally rivers are expected to cleanse themselves as they move downwards, but this is not the case with the Nairobi River and its tributaries, because there are many sources of organic pollution along the river.

Even when water is available, it is often unsuitable for human consumption, and boiling it is expensive. Poor water quality and its high cost may contribute to malnutrition, child mortality and exposure to water-borne diseases and also impede efforts to reduce hunger and poverty. The natural groundwater quality is generally good and reaches the drinking water standards for most constituents, except for fluoride, which often exceeds 1 mg/l (Foster and Tuinh of 2005).

4.8 Waste Management.

Waste management is a growing problem in Nairobi. Increasing urbanization, rural-urban migration, rising standards of living and rapid development associated with population growth have resulted in increased solid waste generation by industrial, domestic and other activities. The increase in solid waste generation has not been accompanied by an equivalent increase in the capacity of the relevant urban authorities to deal with this problem. Only about 40 per cent of the waste generated in Nairobi is collected by the City Council of Nairobi, the private sector collects about 20 per cent and the balance is left uncollected, or is disposed of through other means, including by burning, dumping in pits and other unauthorised places, or is collected by the numerous nongovernmental organizations, communitybased groups and other ad hoc or voluntary groups (Ikiara 2006). It is estimated that there are at least 60 private companies engaged in solid waste collection services in the city (JICA 1998 in UNEP/NEMA 2005). The existing waste management practices in the neighbourhood of the proposed project site and within the Nairobi County in general include: NEMA, in line with the Environmental Management and

Coordination (Waste Management) Regulations, 2006 requires all solid waste (unless the generator opts to recycle) to be dumped at approved sites.

The neighborhood of the proposed site relies on private garbage collectors to dispose of solid waste. The Proponent will contract a licensed solid waste transporter to collect and transport solid waste from the site for dumping at approved sites.

CHAPTER FIVE: IMPACT ASSESSMENT METHODOLOGY & ANALYSIS OF ALTERNATIVES

5.1 Introduction

This chapter will describe the impact assessment methodology to be used for this project. The methodology has been developed by the consultant and aims to provide a relatively objective approach for the assessment of potential impacts.

5.2 Methodology

To ensure a direct comparison between various impacts, standard rating scales have been defined for assessing and quantifying the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. Five factors need to be considered when assessing the significance of impacts, namely:

1. Relationship of the impact to **temporal** scales – the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
2. Relationship of the impact to **spatial** scales – the spatial scale defines the physical extent of the impact.
3. The severity of the impact – the **severity/beneficial** scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party. The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' means not just 'compensation', but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.
4. The **likelihood** of the impact occurring – the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g., loss of vegetation), but other impacts are not as likely to occur (e.g., vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

Each criterion is ranked with scores assigned to determine the overall **significance** of an activity. The criterion is then considered in two categories, viz.

- Effect of the activity and the likelihood of the impact.

- The total scores recorded for the effect and likelihood are then read off the matrix presented to determine the overall significance of the impact.
- The overall significance is either negative or positive.

5.3 Analysis of Alternatives

5.3.1 The No Action Alternative

The No Action Alternative in respect to the proposed project implies that the status quo is maintained i.e., no construction/development activity to take place. This option is most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. However, the need for such development is high and the anticipated insignificance environmental impacts resulting from construction have already been experienced. This option will however, involve several losses both to the project proponent/land owner and the Kenya society and Government. The property will remain under-utilized or neglected. The No Project Option is the least preferred from the socio-economic and partly environmental perspective since if the project is not done: -

- The economic benefits especially during constriction i.e., provision of jobs for skilled and non-skilled workers will not be realized.
- There will be no generation of income by the developer and the Government.
- The social-economic status of Kenyans and local people would remain unchanged.
- The local skills would remain under utilized
- No employment opportunities will be created for Kenyans who will work in the project area.
- Discouragement for investors to produce this level of standard and affordable developments.

5.3.2 The 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 doesn't have an alternative site). This means that the proponent has to look for the land if relocation is proposed. Looking for the land to accommodate the scale and size of the project and completing official transaction on it may take a long period. In addition, it is not a guarantee that such land would be available. It's also worth noting that the said project is already underway in terms of seeking development approvals in various government departments.

The project proponent would spend another long period of time on design and approvals of the plans by the relevant government departments. The project design and planning before the stage of implementation would call for costs; already incurred in the proposed development i.e., whatever has been done and paid to date would be counted as a loss to the proponent. In consideration of the above concerns and assessment of the current proposed site, relocation is not a viable option. From the analysis above, it becomes apparent that the No Project Alternative is not the appropriate alternative to the local people, Kenyans, and the Government of Kenya.

5.3.3 Alternative Land Use Activities

The area is in a residential zone i.e., used for residence. Alternative land use activities such as farming and car repairs will conflict with surrounding land use activities. For uniformity purposes, the proponent is interested in construction of residential houses similar both in form and character to what is existing in the neighborhood (residential apartments).

5.3.4 Alternative to Construction Materials and Technology.

There is a wide range of construction and furnishing materials which can be sourced locally and internationally. In this construction, certified raw materials/equipment's and modern technology will be used. Also, electrical appliances that save energy will be given first priority. The concrete pillars and walls will be made using locally sourced stones, cement, sand (washed and clean), metal bars and fittings that meet the Kenya Bureau of Standards requirements.

5.3.5 Solid Waste Management Alternatives.

Throughout construction, the project will produce wastes such as soil, wood chips, metal scraps and paper wrappings among other. Wastes to be generated during operation phase are mainly domestic in nature. The Proponent is expected to observe EMCA (Waste Management Regulations, 2006). Priority will be given to reduction of wastes, recycling, and reuse. This will minimize environmental pollution.

5.3.6 Project Design

This Environmental Impact Assessment Study Report is based on information and consultations with the project proponent, the Architect and details contained in the architectural plans and drawings of the project. (***Please see attached copies of Architectural Plans)*.**

CHAPTER SIX: POTENTIAL ENVIRONMENTAL IMPACTS

6.1 Introduction

This chapter outlines the potential negative and positive impacts that will be associated with the housing project. The impacts will be related to activities to be carried out during construction of the project. The operational phase impacts of the project will be associated with the activities carried out by the residents/tenants, which will mainly be domestic. In addition, closure and decommissioning phase impacts of the project are also highlighted.

The impacts of the housing project during its life cycle stages (construction, operation and decommissioning) can be categorized into: impacts on the biophysical environment; health and safety impacts; and socio-economic impacts. Construction of the proposed residential apartment's development is likely to present several environmental impacts. These can be either positive or negative.

6.2 Anticipated Environmental Impacts

During the field survey, key impacts both positive and negative relating to the proposed residential development was identified. They were obtained by making physical observations at the project site as well as existing land use in the neighborhood.

6.3 Positive Environmental Impacts of Construction Activities

6.3.1 Creation of Employment Opportunities

One of the main positive impacts during projects construction phase is the availability of employment opportunities especially to casual workers and several other skilled workers such as building and construction engineers. Employment opportunities are of benefit both economically and socially.

Several workers including casual labourers, masons, carpenters, joiners, electricians, and plumbers are expected to work on the site during the construction phase. Apart from casual labour, semi-skilled, unskilled labour and formal employees are also expected to obtain gainful employment during the period of construction. Generally, employment during the construction phase will lead to multidimensional development in the area and in Nairobi at large and improve several people's living standards.

6.3.2 Provision of Market for Supply of Building Materials

The project will require supply of large quantities of building materials most, of which will be sourced locally. This provides ready market for building material

suppliers such as quarrying companies, hardware shops and individuals with such materials.

6.3.3 Increased Business Opportunities

The large number of project staff required will provide ready market for various goods and services, leading to several business opportunities for small-scale traders such as food vendors around the construction site.

6.3.4 Individual Investment

Economically, the project will be an investment to the proponent. The proposed project once complete can also be used as a collateral asset.

6.3.5 Optimal Use of Land

In Africa the UN predicts that the current 400 million urban citizens will exceed 750 million by 2030 and will reach 1.2 billion by 2050. The increasing population will require adequate facilities at learning institutions that are mostly located in cities. It is also plausible to note that while urban population increases the size of land available for development will continue to decrease. The effect of this trend has been the reduction of farmland and encroachment into animal habitats and migration routes. Thus, it is highly recommended that land being a finite resource must be optimally utilized.

The proposed project will see conversion of idle land into an apartment complex. The residence will accommodate more than 200 families. This type of land use in a city also makes it easier for provision of services such as waste management, piped water and electricity. It is reported that detached houses/dwellings have a larger ecological footprint than storied houses (Bastinoni, et al. 2006). Thus, through the construction of multi-storeyed buildings it is possible to reduce both the direct and indirect demand of built up and bio productive areas correspondingly.

6.3.6 Economic growth

Through the use of locally available materials during the construction phase e.g., cement, concrete and ceramic tiles, timber, sand, ballast electrical cables and others; the project will contribute towards growth of the country 's economy by contributing to the gross domestic product. The consumption of these materials, oil, fuel 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.

6.3.7 Enhanced Security.

During the operation of the project, security will be enhanced in the premise and the houses through distribution of suitable security lights and presence of a security guard. This will lead to improvement in the general security in the surrounding area.

6.3.8 Improved Infrastructure.

Project activities will lead to improvement of transport, sewerage, water supply and telecommunication networks. Such services are a prerequisite to development in any region.

6.4 Negative Environmental Impacts of Construction Activities

6.4.1 Extraction and Use of Building Materials

Building materials such as hard core, ballast, cement, rough stone and sand required for construction of the residential project will be obtained from quarries, hardware shops and sand harvesters who extract such materials from natural resource banks such as rivers and land. Since substantial quantities of these materials will be required for construction of the buildings, the availability and sustainability of such resources at the extraction sites will be negatively affected, as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in several ways including landscape changes, displacement of animals and vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health impacts.

6.4.2 Dust Emissions

During construction, the project will generate substantial quantities of dust at the construction site and its surrounding. The sources of dust emissions will include site preparation and levelling works, and to a small extent, transport vehicles delivering building materials. Emission of large quantities of dust may lead to significant impacts on construction workers and the local residents, which will be accentuated during dry weather conditions.

6.4.3 Exhaust Emissions.

The trucks used to transport various building materials from their sources to the project site contribute to increases in emissions of CO2, NO2 and fine particulate along the way as a result of diesel combustion. Such emissions can lead to several environmental impacts including global warming and health impacts. Because large quantities of building materials are required, some of which are sourced outside Nairobi, such emissions can be enormous and may affect a

wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent gunning of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

6.4.4 Traffic flow during construction

Obstruction by construction transport vehicles and construction activities adjacent to the nearby roads during construction phase may lead to the increase traffic along USIU road. This may be exacerbated if these activities schedule coincide with peak traffic hours.

6.4.5 Noise and Vibration

Significant increases in noise and vibration levels may be expected during construction of the proposed Project. Such noise and vibrations may be generated by construction machinery and vehicles as well as construction workers. The impact of noise and vibrations on the surrounding community depends upon the characteristics of the noise and vibrations source (instantaneous, intermittent, or continuous in nature); time of day at which noise and vibrations occur; and the location of noise and vibrations source with respect to sensitive receptor.

Though the level of discomfort caused by noise and vibrations is subjective, the most commonly rreported impacts of increased noise levels are interference in oral communication, hearing loss, anxiety and disturbance of sleep. Vibration impacts may include the cracking of nearby existing structures such as foundations, walls and water reservoirs. Noise and vibrations may also have an impact on the workers in the proposed project.

6.4.6 Risks of Accidents and Injuries to Workers

Because of the intensive engineering and construction activities including erection and fastening of roofing materials, metal grinding and cutting, concrete work, steel erection and welding among others, construction workers will be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others.

6.4.7 Solid Waste Generation

Large quantities of solid waste (soil) will be generated as a result of excavation of the site. In addition, additional solid waste will be generated at the site during construction of the building and related infrastructure. Such waste will consist of metal cuttings, rejected materials, surplus materials, surplus oil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. Such solid waste materials can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on human and animal health. This may be accentuated by the fact that some of the waste materials contain hazardous substances such as paints, cement, adhesives and cleaning solvents, while some of the waste materials including metal cuttings and plastic containers are not biodegradable and can have long-term and cumulative effects on the environment.

6.4.8 Energy Consumption

The project will consume fossil fuels (mainly diesel) to run transport vehicles and construction machinery. Fossil fuel is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability. The project will use electricity supplied by KPLC for construction and operation. Electricity in Kenya is generated mainly through natural resources, namely, water and geothermal resources. Approximately 32% of electricity in Kenya is generated from thermal sources. Thus, it should be prudently used e.g., by installing occupational sensing lights and use of energy saving bulbs. The buildings will be IFC Edge compliant with applications that can support the environmental aspect of the project including low flow faucets, showerheads, dual flash water closets and LED lighting. Such initiatives will lower grid emissions and the overall project carbon footprint.

6.4.9 Water Use

The construction activities will require large quantities of water. Water will mainly be used for concrete mixing, curing, sanitary and washing purposes. Excessive water use may negatively impact on the water source and its sustainability.

6.5 Positive Environmental Impacts of Operational Activities

6.5.1 Provision of Housing Facilities

The project will provide modern Housing with new and state of the art infrastructure to Nairobi residents. This impact will be significant since Nairobi is currently experiencing a shortage of Housing facilities for its residents.

6.5.2 Employment Opportunities

Some people will be employed by the project as management agents, caretakers, cleaners, security personnel and technicians.

6.5.3 Revenue to National and Local Governments

Through payment of relevant taxes, rates and fees to the government and the local authority, the housing project will contribute towards the national and local revenue earnings.

6.5.4 Improved Security

Security will be ensured around the Houses through distribution of suitable security lights and presence of 24-hour security guards. This will lead to improvement in the general security in the surrounding area.

6.6 Negative Environmental Impacts of Operational Activities

6.6.1 Solid Waste Generation

The project is expected to generate enormous amounts of solid waste during its operation phase. The bulk of the solid waste generated during the operation of the project will consist of paper, plastic, glass, metal, textile and organic wastes. Such wastes can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on animal health. Some of these waste materials especially the plastic/polythene are not biodegradable may cause long-term injurious effects to the environment. Even the biodegradable ones such as organic wastes may be injurious to the environment because as they decompose, they produce methane gas, a powerful greenhouse gas known to contribute to global warming.

6.6.2 Energy Consumption

During operation, the family units will use a lot of electrical energy mainly for domestic purposes including lighting, cooking, running of air conditioning equipment, running of refrigeration systems, pumping water into reservoirs. Since electricity generation involves utilization of natural resources, excessive electricity consumption will strain the resources and negatively impact on their sustainability.

6.6.3 Water Use

The domestic activities during the operation phase of the project will involve the use of large quantities of water.

6.7 Negative Environmental Impacts of Decommissioning Activities

6.7.1 Solid Waste

Demolition of the project small buildings and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are 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. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia, which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

6.7.2 Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas.

6.8 Positive Environmental Impacts of Decommissioning Activities

6.8.1 Rehabilitation

Upon decommissioning the project, rehabilitation of the project site will be carried out to restore the site to acceptable status. This will include replacement of topsoil and re-vegetation that will lead to improved visual quality of the area.

6.8.2 Employment Opportunities

Several employment opportunities will be created for demolition and construction staff.

CHAPTER SEVEN: IMPACTS MITIGATION MEASURES

7.1 Introduction

This chapter highlights the necessary mitigation measures that will be adopted to prevent or minimize significant negative environmental, health and safety impacts associated with the activities of the project during its construction, operation and decommissioning phases. Allocation of responsibilities, time frame and estimated costs for implementation of these measures are presented in the environmental management programme (EMP) in Chapter 8.

7.2 Mitigation of Construction Phase Impacts

7.2.1. Efficient sourcing and Use of Raw Materials

The proponent will source building materials such as sand, ballast and hard core from registered quarry and sand mining firms, whose projects have undergone satisfactory environmental impact assessment/audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are considerably well mitigated.

To reduce the negative impacts on availability and sustainability of the materials, the proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction or purchase materials.

In addition to the above measures, the proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

7.2.2. Minimization of Run-off

The proponent will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site. These measures will include terracing and levelling the project site to reduce run-off velocity and increase infiltration of rainwater into the soil. In addition, construction vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off.

7.2.3. Minimization of Construction Waste

It is recommended that demolition and construction waste be recycled or reused to ensure that materials that would otherwise be disposed off as waste are diverted for productive uses. In this regard, the proponent is committed to ensuring that construction materials left over at the end of construction will be used in other projects rather than being disposed of. In addition, damaged or wasted construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects. Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, local community groups, institutions and individual residents or homeowners. The proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal.

It is further recommended that the proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste. Additional recommendations for minimization of solid waste during construction of the project include: -

i. Use of durable, long- lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time
ii. Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements
iii. Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials
iv. Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste
v. Use of construction materials containing recycled content when possible and in accordance with accepted standards.

7.2.4. Reduction of Dust Generation and Emission

Dust emission during construction will be minimized through strict enforcement of onsite speed controls as well as limiting unnecessary traffic within the project site. In addition, it is recommended that excavation works be carried out in wet weather; and traffic routes on site be sprinkled with water regularly to reduce amount of dust generated by the construction trucks.

Controlling dust during construction is useful in minimizing nuisance conditions. It is recommended that a standard set of feasible dust control measures be implemented for all construction activities. Emissions of other contaminants (greenhouse gases, and diesel related particulate matter) that would occur in the exhaust from heavy equipment are also included. The proponent is committed to implementing measures that shall reduce air quality impacts associated with construction.

All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. This means that construction workers will be trained regarding the minimization of emissions during construction. Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Construction vehicles drivers will be under strict instructions to minimize unnecessary trips and minimize idling of engines. Dust emissions will be controlled by the following measures:

- Watering all active construction areas as and when necessary to lay dust.
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.
- Sweep daily (with physical sweepers) all paved access roads, parking areas and staging areas at construction sites.
- Cover construction site with hessian cloth/ scaffolding netting to contain the dust within the premises and plant trees around the site upon construction completion.

7.2.5. Minimization of impacts on traffic flow

The proponent will put in place measures to address such concerns by ensuring that construction vehicles preferably deliver materials during off-peak hours when traffic volume is low. There will also be provision for caution signs on the access road to alert users on construction activities in progress in order to prevent occurrence of accidents. This will be achieved through proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road. In addition, truck drivers will be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines at these points.

7.2.6. Minimization of Noise and Vibration

Significance of noise impacts depends on whether the project would increase noise levels above the existing ambient levels by introducing new sources of noise. Noise impacts would be considered significant if the project would result in the following:

a) Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
b) Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels.
c) A substantial permanent increase in ambient noise levels (more than five decibels) in the project vicinity above levels existing without the project.
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The proponents shall put in place several measures that will mitigate noise pollution arising
during the construction phase. The following noise-suppression techniques will be employed to minimise the impact of temporary construction noise at the project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Establishment of noise buffer.
- Use quiet equipment (i.e., equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all substation construction activities in the residential areas.
- Install sound barriers for pile driving activity.
- Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- Construction works should be done during the day when people are away and also the outside environment is also noisy.
- Adhere to the provisions of Noise Prevention and Control Rules 2005, Legal notice no. 24 regarding noise limits at the workplace.

7.2.7. Health and safety of Workers on site

The proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act (Cap 514). In this regard, the proponent is committed to provision of appropriate

personal protective equipment such as gloves; helmets, overall as well as ensuring a safe and healthy environment for construction workers by providing sanitary facilities (toilets) and portable water while food will be bought by workers from the nearby hotels.

7.2.8. Reduction of Energy Consumption

The proponent shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used.

In addition, proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during construction and set targets for reduction of energy use.

7.2.9. Minimization of Water Use

The proponent shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water use. The proponent will install water conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff.

7.3 Mitigation of Operation Phase Impacts

7.3.1 Ensuring Efficient Solid Waste Management

The proponent will be responsible for efficient management of solid 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 domestic waste generated at the site. In addition, the proponent will ensure that such disposed of regularly and appropriately. It is recommended that the proponent put in place measures to ensure that the occupants of the Houses manage their waste efficiently through recycling, reuse and proper disposal procedures.

7.3.2 Minimization of Sewage Release

The proponent will ensure that there are adequate means for handling the large quantities of sewage generated by the units being directed to the NCWCC sewer line.

7.3.3 Ensure Efficient Energy Consumption

The proponent plans to install an energy-efficient lighting system for the project. This will contribute immensely to energy saving during the operational phase of the project. In addition, occupants of the apartments will be sensitized to ensure

energy efficiency in their domestic operations. To complement these measures, it will be important to monitor energy use during the occupation of the houses and set targets for efficient energy use.

7.3.4 Ensure Efficient Water Use

The proponent will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. In addition, the occupants of the apartments will be sensitized to use water efficiently.

7.4 Mitigation of Decommissioning Phase Impacts

7.4.1 Efficient Solid Waste Management

Solid waste resulting from demolition or dismantling works will be managed as previously described.

7.4.2 Reduction of Dust Concentration

High levels of dust concentration resulting from demolition or dismantling works will be minimized as described in Section 7.2.4.

7.4.3 Minimization of Noise and Vibration

Significant impacts on the acoustic environment will be mitigated as described above.

CHAPTER EIGHT: ENVIRONMENTAL MANAGEMENT PLAN

8.1 Introduction

Integrating environmental issues in business management, such as those related to real estate development is that it increases efficiency while enhancing the project proponent financial and environmental management. These issues, which are normally of financial concern, are: costs, product quality, investments, level of productivity and planning.

Environmental planning and management as a concept seek to improve and protect environmental quality for both the project site and the neighbourhood through segregation of activities that are environmentally incompatible. Environmental planning and management integrate land use structure, social systems, regulatory law, environmental awareness and ethics.

Environmental management plan (EMP) for development projects such as the proposed residential apartment complex development is aimed at providing a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, EMP assigns responsibilities for action to various actors, and provides time frame within which mitigation measures can be done.

EMP is a vital output for an environmental impact assessment as it provides a checklist for project monitoring and evaluation. A number of mitigation measures are already incorporated into the project design.

The EMP outlined in Table 8-1 has addressed the identified potential negative impacts and mitigation measures for the proposed residential development.

8.2 Environmental Monitoring and Evaluation

Environmental monitoring and evaluation are essential in the project lifespan as they are conducted to establish if the project implementation has complied with the set environmental management standards as articulated in the Environmental Management and Coordination Act (EMCA) No. 8 of 1999, and its attendant Environmental (Impact Assessment and Audit) Regulations, 2003. In the context of the proposed project, design has made provisions for an elaborate operational monitoring framework for the following among others:

- Disruption of natural environment and modification of microclimate
- Air and noise pollution
- Proliferation of kiosks
- Worker's accidents and health infections during construction process

EMP for Construction Phase

Foreseen Impacts	Proposed Mitigation Measures	Responsibility For Implementation	Time Frame & Mitigation cost (Ksh)	Monitoring indicators
1. **Curb project associated conflicts and Lost Time Injuries (LTI) e.g., land ownership disputes.**				
Project implementation disputes	Sufficient planning for adequate resources required i.e., financial, personnel and equipment	Proponent & Contractor	Project planning phase (100,000)	Monetary and material Resources allocated for the project
	Land transfer agreements should be formalized before the project start as per the laws of the land	Proponent/Government of Kenya	Project planning phase (400,000)	Land ownership documents
	Community support mobilization and sensitization through consultative forums or questionnaire methods	Proponent & EIA Experts	Project planning phase (600,000)	Public meetings and interviews conducted
	Change of use to multiple residential and commercial (Mixed use)	Proponent & County government	Project planning phase (800,000)	Change of use certificate obtained
2. **Minimize extraction site impacts and ensure efficient use of raw materials in construction**				
	Source building materials from local suppliers who use environmentally friendly processes in their operations			Number of complaints received from

High Demand of Raw material		Project Manager & Contractor	Throughout construction period	material sources e.g., stone quarries
	Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered			-
	Ensure that damage or loss of materials at the construction site is kept minimal through proper storage.			Quantity of damaged material
	Use at least 5%-10% recycled, refurbished or salvaged materials to reduce the use of raw materials and divert material from landfills			Quantity of recycled material e.g., steel used
3. **Reduce storm-water, runoff and soil erosion**				
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	The Civil Engineer, Mechanical Engineer and Project Manager	1 month (400,000)	Types of soil erosion control measures in place; Number of complaints received from
	Apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and increase infiltration of storm water		1 months (70,000)	

	into the soil.			neighbours;
	Ensure that construction vehicles are restricted to existing graded roads to avoid soil compaction within the project site		Throughout construction period	
	Ensure that any compacted areas are ripped to reduce run-off.		2 months (400,000)	
	Open drains all interconnected will be provided on site	Civil Engineer	Throughout construction period	-
4. **Minimize solid waste generation and ensure efficient solid waste management during construction**				
Increased solid waste generation	Use of an integrated solid waste management system i.e., through a hierarchy of options: 1. Source reduction 2. Recycling 3. Composting and reuse 4. Combustion 5. Sanitary land filling	Project Manager & Contractor	Throughout construction period (500,000)	Quantity of wastes removed from the site; Quantity of recycled and reused waste
	Through accurate estimation of the sizes and quantities of materials required, order materials in the sizes and quantities they will be needed rather than cutting them to size, or having large quantities of residual materials		During construction phase	Inventory of material used
	Ensure that construction materials left over at the end of construction will be used in other projects rather			Inventory of unused material

	than being disposed.			
	Ensure that damaged or waste construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects			Inventory of damaged material
	Donate recyclable/reusable or residual materials to local community groups, institutions and individual local residents or homeowners.			Quantity and type of donated material
	Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time	Project Manager & Contractor	Throughout construction period (900,000)	-
	Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements		During construction Phase (100,000)	-
	Purchase of perishable construction materials such as paints should be done incrementally to ensure		Throughout construction period	Inventory of unused material

	reduced spoilage of unused materials.			
	Use building materials that have minimal or no packaging to avoid the generation of excessive waste		Throughout construction period (300,000)	Quantity and type of packaging
	Use construction materials containing recycled content when possible and in accordance with accepted standards.			Inventory of recyclable material such as steel
	Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers to reduce waste at the site	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	Quantity and type of reused material
	Dispose waste more responsibly at designated waste treatment sites or landfills only.	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	Quantity of disposed wastes; Number of waste Tracking documents filled
	Waste collection bins to be provided at designated points on the site	Project Manager, Mechanical Engineer & Contractor	Throughout construction period (30,000)	Number of waste Tracking documents filled;
	Private waste disposal company to be contracted to transport and dispose the solid waste from site		Throughout construction period	Waste transport licenses from the waste handler;

			(2000,000)	
	Running an educational campaign amongst employees, e.g., through use of posters, to encourage reuse or recycling of the solid waste		Throughout construction period (20,000)	Number of wastes related complaints received from tenants, homeowners and neighbours
5. **Reduce dust emissions**				
Dust emission	Ensure strict enforcement of on-site speed limit regulations	Project Manager & Contractor	Throughout construction period	Dust emission levels measured
	Avoid excavation works in extremely dry weathers	Project Manager & Contractor		
	Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles	Project Manager & Contractor		
	Personal Protective equipment to be worn always when at work place	Project Manager		
6. **Minimization of noise and vibration**				
Noise and vibration	Sensitise construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.			Number of training sessions with truck drivers

	Sensitise construction drivers to avoid running of vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals	Project Manager & Contractor	Throughout construction period	-
	Ensure that all generators and heavy-duty equipment are insulated or placed in enclosures to minimize ambient noise levels			Number of noise complaints received
	The noisy construction works will entirely be planned to be during daytime when most of the neighbours will be at work.	Project Manager & all site foremen		
	Comply with the provisions of Noise Prevention and Control Rules 2005, Legal notice no. 24 regarding noise limits at the workplace	Project Manager & all site foremen		Noise levels measured during construction activities; Number of noise complaints received
7. **Minimization of energy consumption**				
Increased energy consumption	Ensure electrical equipment, appliances and lights are switched off when not being used			-
	Install energy saving fluorescent tubes at all lighting points instead of bulbs which consume higher electric	Project Manager &	Throughout	Number of energy saving lights used

	energy	Contractor	construction period	
	Ensure planning of transportation of materials to ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts by using feasible short routes			Quantity of fuel consumed
	Monitor energy use during construction and set targets for reduction of energy use.			Quantity of fuel consumed
8. **Minimize water consumption and ensure more efficient and safe water use**				
High water demand	Install water conserving taps that turnoff automatically when water is not being used	Project Manager & Contractor	Throughout construction period	-
	Promote recycling and reuse of water as much as possible			
	Promptly detect and repair water pipe and tank leaks			Number of recorded leaks and repairs
	Sensitize staff to conserve water by avoiding unnecessary water use			Number of trainings done on water conservation
9. **Minimize release of liquid effluent**				
Generation of wastewater	Use portable chemical toilets where there is no viable alternative	Mechanical Engineer & Project Manager	Throughout construction period	-
	Conduct regular checks for pipe blockages or damages since such vices can lead to release of the effluent into			Number of repairs done and complains received

	the land and water bodies		(40,000)	
	Monitor effluent quality regularly to ensure that the stipulated discharge rules and standards are not violated			Analytical report for effluent
10. **Minimize occupational health and safety risks**				
Approval of building plans	Ensure that all building plans are approved by the Local Authority and the local Occupational Health	Proponent	One-off (900,000)	-
Incidents, accidents and dangerous occurrences.	Ensure that provisions for reporting incidents, accidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO) are in place.	Project Manager, Developer & Contractor	Continuous (400,000)	Number of accidents ooccurring during construction; Type of PPEs used by workers
	Enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training shall be emphasized.	The Contractor, Project Manager& Site Safety Officer	Continuous (150,000)	-
Insurance	Ensure that the premises are insured as per statutory requirements	Developer	Annually (200,000)	Number of insured workers and vehicles
Health and safety committee	Provisions must be put in place for the formation of a Health and Safety Committee, in which the employer/contractor and the	Project Manager	Continuous	-

	workers are represented			
Sanitary conveniences	Suitable, efficient, clean, well-lit and adequate sanitary conveniences should be provided for construction workers	Project Manager	Continuous (400,000)	Type of sanitary facilities provided; number of complaints received
Machinery/equipment Safety	Ensure that machinery, equipment, personal protective equipment, appliances and hand tools used in construction do comply with the prescribed safety and health standards and be appropriately installed maintained and safeguarded	Project Manager, Developer & contractor	Continuous (700,000)	Number of accidents recorded; Types of PPEs provided
	Ensure that equipment and work tasks are adapted to fit workers and their ability including protection against mental strain	Project Manager, Developer & Contractor	Continuous (150,000)	-
	All machines and other moving parts of equipment must be enclosed or guarded to protect all workers from injury	Project Manager	Continuous (150,000)	-
	Equipment such as fire extinguishers must be examined by a government authorized person. The equipment may only be used if a	Project Manager	Continuous (150,000)	Frequency of inspection of fire extinguishers

	certificate of examination has been issued			
First Aid	Well, stocked first aid box which is easily available and accessible, should be provided within the premises	Project Manager & Contractor	One-off (150,000)	Number of first aid kits provided
	Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.	Project Manager & Contractor	One-off (150,000)	Number of workers trained as first aiders; ratio of first aiders to rest of workers
Storage of materials	Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse	Project Manager	Continuous (150,000)	-
	Ensure that items are not stored/stacked against weak walls and partitions	Project Manager	Continuous (150,000)	-

EMP for occupational phase

Foreseen Negative impacts	**Proposed Mitigation Measures**	**Responsible Party**	**Time Frame**	**Monitoring indicators**
1. Minimization of solid waste generation and ensuring more efficient solid waste management				
	Use of an integrated solid waste	Proponent/Property	During the life of	Quantity of recycled,

Increased generation of solid waste	management system i.e., through a hierarchy of options: 1. Source reduction 2. Recycling 3. Composting and reuse 4. Combustion 5. Sanitary landfilling.	Managers	the project (150,000)	composted & land filled waste Number of tenants/homeowners segregating their waste
	Provide solid waste handling facilities such as waste bins and skips	Proponent/Property Managers	Continuous (150,000)	Type and number of waste bins and skips provided
	Ensure that solid waste generated is regularly disposed appropriately at authorized waste treatment sites	Proponent/Property Managers	Continuous (250,000)	Frequency of waste collection Quantity of waste collected
	Donate redundant but serviceable equipment to charities and institutions	Proponent/Property Managers	Continuous (150,000)	Types and quantity of equipment and material donated
	Comply with the provisions of Environmental Management and Coordination (Solid Waste) Regulations 2006	Proponent/Property Managers	Continuous (50,000)	Number of waste tracking documents filled Waste transport licenses from the waste handler Quantity of segregated wastes
2. Minimize risks of liquid waste release into environment				
Liquid waste release into the environment	Comply with the provisions of Environmental Management and Coordination (Water Quality) Regulations 2006 and related by laws	Proponent/Property Managers	Continuous	Cost of sewerage connection and usage paid to the county government

	Connect all waste water streams to the sewer line	Proponent/Property Managers	One off	Permit or sewer connection works
3. Minimize energy consumption				
Energy Use	Installation and use of solar PV for lighting pavements and roads;	Proponent	Continuous (950,000)	Number of solar street lights installed;
	Switch off electrical equipment, appliances and lights when not in use	Proponent/Property Managers	Continuous (150,000)	Savings (electricity bills) made when compared to a business-as-usual scenario
	Install occupation sensing lighting at various locations such as the parking areas which are not in use all the time	Proponent/Property Managers	One-off (150,000)	Number of occupational sensing lights installed
4. Minimize water consumption and ensure more efficient and safe water use				
Water management	Promptly detect and repair water pipe and tank leakages	Proponent/Property Managers	Continuous (150,000)	Number of repairs done
	Install water conserving taps that turnoff automatically when water is not being used	Proponent/Property Managers	One-off (150,000)	Number of water conservation taps installed
	Install a discharge meter at water outlets to determine and monitor total water usage	Proponent/Property Managers	One-off (150,000)	Quantity of water used per month
5. Minimization of health and safety impacts				
Implement all necessary measures to ensure health and safety of workers and the general public during operation of the offices as stipulated in the Occupational Safety and Health Act,2007		Proponent/Property Managers	Continuous (150,000)	Number of occupational accidents recorded per year

6. Ensure the general safety and security of the premises and surrounding areas			
Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premises	Proponent/Property Managers	Continuous (150,000)	Number of security complaints received
7. Ensure environmental compliance			
Undertake an environmental audit within 12 months after operation commences as required by law	Consultant	12 months after Operation commences (150,000)	Number of improvement notices and or compliance letters obtained

EMP for Decommissioning Phase

Foreseen Negative Impacts	**Proposed Mitigation Measures**	**Responsible Party**	**Time Frame**	**Monitoring indicators**
1. Demolition waste management				
Demolition waste	Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3. Composting and reuse 4. Combustion 5. Sanitary land filling.	Project Manager & Contractor	One month (50,000)	Quantity of waste generated
	All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and	Project Manager & Contractor	During decommissioning (50,000)	Quantity of recovered material that can be recycled

	recycled/reused as far as possible			
	All foundations must be removed and recycled, reused or disposed of at a licensed disposal site	Project Manager & Contractor	During decommissioning (50,000)	
	Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site	Project Manager & Contractor		Quantity of material recycled or sold for recycling
2. Rehabilitation of project site				
Site degradation	Implement an appropriate re-vegetation programme to restore the site to its original status	Project Manager & Contractor	During decommissioning (50,000)	Area of and that has been re-vegetated

CHAPTER NINE: ENVIRONMENTAL HEALTH AND SAFETY (EHS)

9.1 EHS Management and Administration

The EHS is a broader and holistic aspect of protecting the worker, the workplace, the tools/ equipment and the biotic environment. It is an essential tool in determining the EIA study. The objective of the EHS on the proposed project is to develop rules that will regulate environmentally instigated diseases and occupational safety measures during construction and the operation phases of the proposed project by:

- Avoidance of injuries
- Provision of safe and healthy working environment for workers' comfort so as to enhance maximum output.
- Control of losses and damages to plants, machines, equipment and other products.
- Enhance environmental sustainability through developing sound conservation measures.

9.2 Policy, Administrative and Legislative Framework

It is the primary responsibility of the contractor to promote a safe and healthy environment at the workplace and within the neighborhood in which the proposed project will be constructed by implementing effective systems to prevent occupational diseases and ill-health, and to prevent damage to property. The EHS Management Plan when completed will be used as a tool and a checklist by the contracted engineers in planning and development of the construction of this project.

9.3 Organization and implementation of the EHS Management Plan

The contactor shall use the EHS plan at the proposed project site both during construction and operation. The engineer will use it during construction phase with the assistance of an EHS consultant who shall enforce its provision throughout the life of the project.

9.4 The Guiding Principles to be adopted by the contractor

The company will be guided by the following principle: -

- It will be a conscious organization committed to the promotion and maintenance of high standards of health and safety for its employees, the neighboring population and the public at large.
- Ensuring that EHS activities are implemented to protect the environment and prevent pollution.

- Management shall demonstrate commitment and exercise constant vigilance in order to provide employees, neighbors of the project and the environment, with the greatest safeguards relating to EHS.
- Employees will be expected to take personal responsibility for their safety, safety of colleagues and of the general public as it relates to the EHS management plan.

9.5 EHS management strategy to be adopted by the contractor

The following strategies will be adopted to achieve the above objectives:

- Create an Environment Health and Safety Management committee and incorporate EHS as an effective structure at various levels and units to manage and oversee EHS programs in all construction and operation phases of the project
- Maintain an effective reporting procedure for all accidents.
- Provide appropriate tools and protective devices for the success of the project.
- Encourage, motivate, reward and support employees to take personal initiatives and commitment on EHS.

9.6 Safety Agenda for both the proponent and contractor

There will be a permanent EHS agenda during construction.

(a) Contractors

The EHS management plan code of practice shall be applicable to the contractors working in the premises, and shall be read and signed. It shall be incorporated into the contract to perform work. This should also remind the contractor of his/her;

- Statutory obligations.
- Legal requirements.
- Obligation to lay-down a system for reporting accidents
- Responsibility to ensure that his/her employees are supplied with personal protective equipment and where applicable as per the EHS management plan for the whole project.
- Responsibilities as it relates to contracting an EHS consultant in liaison with the proponent
- Obligation to ensure that he obtains detail of jobs and areas where permit-to-work must be issued

(b) All residents' and workers' responsibility

- Know the location of all safety equipment, and learn to use them efficiently

9.7 Safety requirement at the project site during construction and operation Period

(a) The contractor

The contractor will ensure that:

- Safe means of entry and exit at the proposed project site.
- Ensure adequate briefing of job at hand on the safe system of work before commencement of work.
- The EHS coordinator must be in attendance at all times throughout the duration of the project.
- The EHS consultant must maintain constant assessment of the risk involved as the work progresses
- A safety harness must be worn before entry into all confined spaces
- An EHS consultant must be posted at the entrance at the project site to monitor progress and safety of the persons working at the construction site.

(b) The Traffic / Drivers

Within the construction premises, the following traffic rules will be observed:

- Observe speed limits and all other signs and obey traffic rules.
- Use the vehicle for the purpose to which it is intended only.

c) Fire hazard at the construction site,

Workers at the site shall ensure that: -

- Oxy-acetylene cylinders are not contaminated with grease or oil.
- Oxy-acetylene cylinders are not subjected to direct sunlight or heat.
- Oxy-acetylene cylinders are not to be used or stored standing in a vertical position.
- When in use, ensure the inclination should never be over 30° from the vertical.

9.8 Welding at the construction site

It is the responsibility of the contractor during construction to: -

- Ensure that welding clamp is fixed such that no current passes through any moving parts of any machine.
- Ensure that all welding clamps are in good operating condition and conduct current without arcing at the point of contact.
- Ensure that welding clamps are free from any contact with explosive vapors i.e. Oil spillage, Fuel tanks, Coal dusts and miscellaneous combustible material (e.g. Cotton rags filter bags, rubber belting, and wood shavings).

- Ensure that any slag or molten metal arising from welding activities does not start up fires by:
  - ✓ Clearing combustible material to a distance of at least 3 meters away from the working area or covering area with metal or asbestos sheet.
  - ✓ Appropriate fire extinguisher is to be kept available for immediate use at all times

9.9 Emergency procedure during construction and operation

An emergency situation means:

- Unforeseen happening resulting in serious or fatal injury to employed persons or the neighboring communities.
- Fire or explosion, Natural catastrophe.

In the event of such an emergency during construction, the workers shall:

- Alert other persons exposed to danger.
- Inform the EHS coordinator, Do a quick assessment on the nature of emergency.
- Call for ambulance on standby, When emergency is over the EHS coordinator shall notify the workers by putting a message: "ALL CLEAR"

CHAPTER TEN: CONCLUSION AND RECOMMENDATIONS

10.1 Overview

From the foregoing analysis, the social and economic rating for this project is highly positive. Evaluation of alternatives has already shown that options are limited and costly. Already the proponent has sunk a substantial amount of money in the project. Further delay of the project is denying all stakeholders the anticipated benefits of the investment. On the other hand, redesigning or relocation will lead to loss of time and money that is already tied in the preliminary costs of the project. The project does not pose any serious and negative environmental impacts. Adequate mitigation measures have been proposed to address any of the negative impacts arising from the project. The project will create employment and improve income earnings. The project will boost the diminishing housing supply in the country and more in urban areas.

During the preparation of this report for the proposed apartment's complex development it is observed and established that most of the negative impacts on the environment are rated low and short term with no significant effect. The positive impacts are highly rated and will benefit all stakeholders and the USIU students at large. The project proponents have proposed to adhere to prudent implementation of the environmental management plan. They are obtaining all necessary permits and licenses from the relevant authorities and have qualified and adequate personnel to do the project as proposed to extent. They have proposed adequate safety and health mitigation measures as part of the relevant statutory requirements

10.2 Conclusion

This study is recommendable and should be approved by NEMA for issuance of an EIA license for extension subject to annual environmental audits after it has been completed and occupied. This will be in compliance with the Environmental Management and Coordination Act of 1999 revised 2015 and the Environmental Impact Assessment and Audit regulations, 2003. Above all the proponent should carry out Environmental Audit 12 months after the project is completed.

The proponent should therefore be licensed to extent this project subject to adherence to the environmental management plan proposed in this report and the statutory requirements.

References

i. Kenya gazette supplement Acts 2000, Environmental Management and Coordination Act Number 8 of 1999. *Government printer, Nairobi*

ii. Kenya gazette supplement Acts Building Code 2000 by government printer, Nairobi

iii. Kenya gazette supplement Acts *Land Planning Act (Cap. 303) government printer, Nairobi*

iv. Kenya gazette supplement Acts *Local Authority Act (Cap. 265) government printer,*
Nairobi

v. Kenya gazette supplement Acts Penal Code Act (Cap.63) *government printer, Nairobi*

vi. Kenya gazette supplement Acts *Physical Planning Act, 1999 government printer, Nairobi*

vii. Kenya National Housing Policy in 2004.

APPENDICES

1. Questionnaire forms
2. Architectural Designs
3. Land ownwership documents
4. Certificate of incorporation
5. KRA pin