ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY REPORT

FOR THE PROPOSED RESIDENTIAL DEVELOPMENT (APARTMENT) AND ASSOCIATED AMENITIES LOCATED ON LAND REFERENCE 13330/389 AT THOME, ROYSAMBU LOCATION, NAIROBI COUNTY.

PROPONENT	**NEMA LEAD EXPERT**
KIFARU ENTERPRISES LIMITED P.O BOX 66334-00800 NAIROBI, KENYA	CALEB NYAGAH NEMA LEAD EXPERT 7880 P.O BOX 8247-00100 NAOROBI, KENYA +254 729714153,

APRIL 2023

DECLARATION

PROPOSED PROJECT PROPONENT:

The proponent, declares that the environmental and social impacts assessment(ESIA) study for the proposed residential development (apartment) and associated amenities located on land reference 13330/389 at Thome, Roysambu location, Nairobi County has been prepared in accordance with Environmental Management and Coordination Act (EMCA) 387 and Environmental Impact Assessment and Audit Regulations 2003. The proponent shall comply with the law and the world best standard on residential (apartment) development. The study report has been submitted to The National Environmental Management Authority (NEMA) for licensing.

KIFARU ENTERPRISES LIMITED.

P.O BOX 66334-00800

NAIROBI, KENYA.

NAME: Mr. Kalpesh Shah.

DESIGNATION: Chief Executive officer.

Signature…….……Date……..……

EIA/EA LEAD EXPERT:

The undersigned NEMA EIA/EA lead expert certify that the information in this ESIA study report is correct representation as per the project's information provided by the proponent.

CALEB NYAGAH, REG. NO. 7880

P.O BOX 8247-00100

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Signature……Date…..……

ACKNOWLEDGEMENT

Mr. **Caleb Nyagah and team** takes this opportunity to thank the management of Kifaru Enterprises Limited, for providing us a chance to conduct EIA for the proposed residential development (apartment) and associated amenities located on land reference 13330/389 at Thome, Roysambu location, Nairobi County. ESIA is done in compliance with the Legal requirements of section 58 of the Environmental Management and Co-ordination Act (EMCA) CAP 387 and legal Notice No.8. The ESIA team extends our gratitude to the interested parties involved in stakeholder engagement.

TEAM OF CONSULTANTS

The team was led by Caleb Nyagah and Consultants applied attentiveness and professionalism on data collection and information generation.

1. Mr. Caleb Njage Nyagah, NEMA lead EIA/EA expert 7880
2. Mr. John Kiama, Environment scientist
3. Ms. Monica Njiru, environment associate and climate change expert.
4. Ms. Lilian M. sociologist
5. Mr. P.Kimani Supeyo (Registered Hydrogeologist)
6. Mr Omare Christohper Nicholas, physical planner
7. Architect Mr. Mancha Momanyi Laban, Character studios

LIST OF ABBREVIATIONS AND ACRONYMS

NEMA	National Environment Management Authority
CGN	County Government of Nairobi
E&S	Environmental and social
CO	Carbon-monoxide
CO2	Carbon-dioxide
dBA	Decibels (a unit of measuring sound)
EPRA	Energy and Petroleum Regulatory Authority
^{o}C	Degrees Celsius (a unit of measuring temperature)
ESMMP	Environmental and Social Management and Monitoring Plan
ESIA	Environmental and Social Impact Assessment
Ft	Feet (a unit of measuring length)
Hr(s)	Hour(s) (a unit of measuring time)
KEBS	Kenya Bureau of Standard
Km	Kilometers (a unit of measuring distance)
Km^2	Square kilometers (a unit of measuring area)
EHS	Environment health and safety
M	Metres (a unit of measuring distance)
M/s	Metres per second (a unit of measuring speed)
M^3	Cubic metres (a unit of measuring volume)
Mm	Millimeters (a unit of measuring distance)
NCA	National Construction Authority
LPG	Liquefied Petroleum Gas
NEC	National Environmental Council
OSHA	Occupational Health and Safety Act
PPE	Personal Protective Equipment
PVC	Polyvinyl chloride
Reg. No.	Registration number
TOR	Terms of Reference
Cap.	Refers to ‘chapter’ in the Laws of Kenya

DEFINITIONS OF OPERATIONAL TERMS

Authority: Refers to NEMA established under section 7 of EMCA, 387.

Decommissioning: This is the permanent withdrawal from a site or close down of a facility forrestoration.

Developer/Proponent: Means a person proposing or executing a project that is subjected to EIA orundertaking an activity specified in the second schedule of EMCA, 387.

EA: The systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing in conservation or preservation of theenvironment.

ESIA: A systematic evaluation of activities and processes of an upcoming project/facility to determine how far these activities and programs conform to the approved environmental management plan of that specific project and sound environmental management practices.

EMP: Means all details of project activities, impacts, mitigation measure, time, schedule, costs, impact or activities, including monitoring and environmental audit during implementationand decommissioning phase of a project.

Environment: Physical factors of surroundings of human beings including land, water, atmosphere, climate, sound, odour, taste, the biological factors of animals and plants and social factor of aesthetics, culture and includes both the natural and the built environment.

Mitigation: Measures which include engineering works, technology improvement management ways and means of minimizing negative aspects, including socio-economic and cultural losses suffered by communities and individuals, whilst enhancing positive aspects of the project.

Project: Means any undertaking that may have an impact on the environment.

Scoping: Is the process of determining the content and extent of the matters that should be covered in the environmental information to be submitted to a competent authority for projects that are subject to ESIA.

Standards: Means the limit of discharge or emission established under the Act or under Regulations.

Waste: Includes any matter whether liquid, solid, gaseous or radioactive, which is discharged, emitted Or disposed in the environmental in such a volume composition or manner likely to cause an alteration of the environment.

EXECUTIVE SUMMARY

Introduction

Environmental impacts assessment (EIA) is a tool which seeks to minimize adverse impacts on the environment and reduces risks, hazards and vulnerabilities at all stages of the project: planning, design, construction, operation and decommissioning. Kenyan Environmental management and coordination act 387 (EMCA), framework law on environmental management and conservation in Kenya is the principle Act was amended in 2015 to align to the constitution, 2010. According to section 58 of the Environmental Management and Coordination Act (EMCA) chapter 387 second schedule 9 (1), and Environmental (Impact Assessment and Audit) regulation, 2003, proposed developments must undergo EIA, Therefore, EMCA 387 categorizes projects of similar magnitude under High Risk Projects, thus; establishment of new housing estate developments exceeding One hundred housing units;

Project Justification

According to UN habitat, the housing shortages in Kenya stand at 2 million and continue to increase at a rate of about 200,000 units per year. With 61% of the urban population living in slums and overcrowded homes, families are high risks of diseases such as malaria, respiratory infections. Thome area, Roysambu location has a fast growing population and the client conducted a feasibility study and intends to construct and apartment to fill the niche accommodation market.

Land use Approval

The proposed project conforms to the land use with in terms of project site, roads, power supply, waste management and effluent disposal. The change of user to multidwelling units has been approved by the Nairobi physical and urban planning department.

Scope

Kifaru Enterprises Limited Proposed residential development (apartment) of Three hundred and ninety eight units (390) will be located on land reference 13330/389 at Thome, Roysambu location, Nairobi City County. The proposed development will comprise of one hundred and one hundred and one (101) parking spaces on basement and ground floor. The development entails one bedroom units and studios, drive way, garbage collection cubicle, Three (3) lifts, Guardhouse and solid waste collection cubicle.

Methodology

The project site conforms to the surrounding. There are similar numerous apartments in the neighourhood that comprise of more than 100 housing units. Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development included;

1. Formulation of the Terms of Reference (submitted under Ref: NEMA/TOR/5/2/555).

2. Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of the EMCA Cap 387
3. Environmental scoping that provided the key environmental issues
4. Desktop studies and public/stakeholders interviews
5. Physical inspection of the site and surrounding areas
6. EIA Public participation. The EIA team used of questionnaires and photography
7. Reporting.

Positive impacts

In summary positive impacts includes Affordable, high quality standard housing and thus wellbeing, optimal land use by the proponent, creation of employment throughout the project cycle, government rental tax revenues and levies and Rental income to the proponent

Negative impacts summary

Project activities from the proposed project are likely to cause environmental and social risks. Below are tabulated likely negative impacts and their mitigation measures

Table 1: summary likely negative impacts and their mitigation measures

Likely Impacts	**Mitigation measures**
Increased storm water, run off, soil erosion	A storm water management plan done. proponent will ensure proper demarcation of the project area to be affected by the construction works
Dust emission and emission	Sprinkle water on graded access routes when necessaryto reduce dust generation by construction vehicles and equipment Provide dust screen where necessary
Noise andvibration	Sensitise construction vehicle drivers and machinery operators to switch o engines of vehicles or machinerynot being used. Ensure that construction machinery are kept in goodcondition to reduce noise generation Provide workers with PPES
Solid Waste Generation of solid waste generation	All solid waste to be collected at a central location, and segregate recycled, re-used and disposed. Conduct regular inspections for sewage pipe blockages or damages and f appropriately

Water resources	Good water management solutions- water harvesting, storage tanks and water use monitoring
occupational health and safety risks	Proponent will Ensure that all building plans are approved by County Loca authority and NCA Conduct regular inspections for sewage pipe blockages ordamages and fix appropriately
Exhaust emissions	Provide appropriate PPE Vehicle idling time shall be minimized Sensitise truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading points

EIA Team recommendations

1. The proponent has designed the apartment as per Kenya standard and the world best practice. The compliance will ensure that environmental and social risks are less likely to happen.

2. Stakeholders have been involved in project design, and determination of possible impacts of the project, it's extent and how to mitigate them.

3. The proponent will adhere to an elaborate ESMMP in order to mitigate likely environmental and social risks that can arise from the project activities.

4. The developer be licensed to implement the project as proposed

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CHAPTER ONE
INTRODUCTION

1.1 Background history of sustainable development

Sustainable development is the organizing principle for meeting human development goals while simultaneously sustaining the ability of natural systems to provide the natural resources and ecosystem services based upon which the economy and society depend. Sustainable development thinking is widely recognized to have its origins in the 1972 UN Conference on the Human Environment, Sustainable development as a concept began to gather momentum following the 1987 Brundtland Report, and the 1992 UN Conference on Environment and Development (UNCED), also known as the Earth Summit.

All projects must meet sustainable development criteria. The republic of Kenya has enacted Environmental Management and Coordination Act (EMCA) CAP 387 which makes Environmental and social Impacts Assessment and environmental audits a legal requirement for all projects. Moreover, The Kenya constitution 2010 gave a lot of emphasis on environmental conservation and sustainable development Article 70 provides an avenue for redress for any person who alleges that the right to a clean and healthy environment has been is being or is likely to be denied, violated, infringed or threatened.

1.2 Project overview and rationale of EIA study.

Kifaru Enterprise Limited Proposed residential development (apartment) of Three hundred and ninety eight units (390) will be located on land reference 13330/389 at Thome, Roysambu location, Nairobi City County. The proposed development will comprise of one hundred and one hundred and one (101) parking spaces on basement and ground floor. The development entails one bedroom units and studios, Drive way, garbage collection cubicle, Three (3) lifts, Guardhouse and solid waste collection cubicle.

The proposed project conforms to the land use with in terms of project site, roads, power supply, waste management and effluent disposal. The site is connected to the sewer line, and 200 metres from Marurui Road(Kenya Urban Roads Authority Road) that connects to the Thika road superhighway. The change of user to multi-dwelling units has been approved by the Nairobi physical and urban planning department. The EIA study has established a comprehensive environmental and social management and monitoring plans to mitigate likely environmental and social impacts that can arise from project activities.

This EIA is done as result of Environmental Management and Co-ordination Act, 1999 (Cap. 387) that regulate various matters relating to the institutions established and various matters relating to

protection of the environment including environmental impact assessment, environmental audit and monitoring of the environment. The proposed apartment study report shall be reviewed and licensed by NEMA.

1.3 Proposed project justification

Kenya's vision 2030 goal on housing is to adequate Preparation and implementation of strategic development and provides decent homes for Kenyans, create additional jobs, provide market for manufacturers and building materials suppliers, and raise real estate and construction sector GDP. The proponent will help meeting the rising demand for such accommodation in Thome area and Nairobi.

1.4 Objectives of the project and Environmental impacts assessment (EIA) Study.

The project objective is optimal land use and provision of modern adequate housing for letting to Thome residents.

The EIA study objectives for the proposed project were

1. Integrate environmental factors into project planning and decision making so as to achieve ecologically sustainable development and modify and improve the project design.
2. Ensure efficient resource use
3. Enhance social aspects by conducting stakeholder engagement.
4. Identify key impacts and measures for mitigating them by formulating a comprehensive ESMMP and avoid serious and irreversible damage to the environment
5. Protect human health and safety.

1.5 Terms of Reference (TOR)

The TORs for the EIA study was approved by the authority under Ref: NEMA/TOR/5/2/555

The TOR specifically developed specifically for the proposed project are;-

a) The proposed location of the project including GPS coordinates
b) Project objectives and EIA objectives.
c) A concise description of the national environmental legislative and regulatory framework, baseline information.
d) 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.
e) A description of the potentially affected environment
f) 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.
g) Alternative technologies and processes available and reasons for preferring the chosen technology and processes; analysis of alternatives including project site, No project alternative, proposed project alternative and solid waste management alternative.
h) 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 project activities.

i) Likely Occupation risks in the working employment of employees and resident during construction, operation and decommissioning phases.

j) Non-technical summary outlining the key findings, conclusions and recommendations of the study and shall be signed by the proponent and environmental impact assessment experts involved in its preparation.

k) Stakeholder engagement as per EMCA 387 guidelines including public meeting.

1.6 Scope of the study

The scope of Environmental Impact Assessment includes the following:

1. Identification of likely adverse environmental and social impacts to the environment arising from the proposed project activities.
2. Mitigation measures to likely adverse environmental and social impacts of proposed project activities.
3. An Environmental and social Management and monitoring Plan (ESMMP) for the proposed project.
4. The baseline conditions of the proposed project area,
5. Relevant legislative, policy and administrative frameworks,
6. Seek the Views/opinions of the public through structured questionnaires.

1.7 Methodology

General steps followed during the study.

1. Formulation of the Terms of Reference (submitted under Ref: NEMA/TOR/5/2/555).
2. Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of the EMCA Cap 387
3. Environmental scoping that provided the key environmental issues
4. Desktop studies and public/stakeholders interviews
5. Physical inspection of the site and surrounding areas
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CHAPTER TWO

PROJECT DESCRIPTION

2.1. Location

Kifaru enterprises Limited proposed residential development (apartment) and associated amenities will be located on property land size 0.2135ha and on land reference 13330/389, at Thome, Roysambu location, Nairobi County. The plot is vacant and undeveloped. The project site GPS coordinates are -1.227387 latitude, 36.876678 longitude respectively. The proposed project is located approximately 200 metres from Marurui road junction at the Loft club lounge.

Figure 2. 1 Proposed project site

Figure 2. 2 Google Earth Location

2.2 Project Cost

The total project cost will be Five hundred and one million, Eight Hundred and forty eight thousand, nine hundred and sixteen shillings and fifteen cents,(Ksh ksh501,848,916.15) Kenya shillings. Five hundred and one thousand, eight hundred and forty eight shillings and ninety two cents (ksh501,848.92) of is payable to the authority (NEMA) being the sum of 0.1% as seen in the annexed Bill of quantities.

2.3 Design of the project

Kifaru Enterprise Limited Proposed residential development (apartment) is construct Three hundred and ninety eight units (390) will be located on land reference 13330/389 at Thome, Roysambu location, Nairobi City County.

2.3.1 Project architectural Designs.

A. Basement floor

Proposed parking for Fifty (50) cars, Drive way, guardhouse & water closet and main gate

B. Ground floor

Proposed parking for Fifty One (51) cars, Drive way, garbage collection cubicle, Three (3) lifts, Guardhouse and water closet.

There will a total of **one hundred and one parking spaces (101) in** this proposed residential(apartment) development

C. First floor:

a) Will comprise of Eight (8) one bedroom units. The units will consist of one bedroom, shower, water closet, open lounge and open kitchen.

b) Eighteen (18) bedsitters/studios. The units will consist of open kitchen, lounge, bed area, shower and water closet.

There will be a total of twenty six(26) units on this floor.

D. Second floor upto 15th floor

a) Will comprise of Eight (8) one bedroom units. The units will consist of one bedroom, shower, water closet, open lounge and open kitchen.
b) Eighteen (18) bedsitters/studios. The units will consist of open kitchen, lounge, bed area, shower and water closet.

E. There will be a total of twenty six (26) units on each floor.

F. There will a total of Three hundred and ninety units (390) in the proposed residential development.

G. Roof floor – There will be provision for water storage tanks, terrace, restaurant, clothes lines, solar panels, outdoor seating spaces.

The proponent ensured that the proposed project architectural, structural designs are guided by Kenya Building code and world construction standard.

2.3.2 Electrical system

The project site is well served with Kenya Power and Lighting Company. Electrical distribution boards includes; the incoming supply circuit breaker or main switch. The control and distribution board (consumer unit), Surge protective devices, resistance value of the earth electrode. The installation will be done a qualified electrical engineer.

2.3.3 Water reticulation system

The project site is served with water from Nairobi Water Company. In addition, proponent will drill borehole water as a backup supply in situations of municipal water shortages Water storage tanks will be installed.

2.3.4 Waste/Sewerage & Storm water run-off

Effluent discharge from the proposed site washrooms will be connected to the pre-existing Nairobi county sewerage sewer line. Solid waste will be segregated and managed appropriately. Polythene, aluminum cans, tetra waste cartons will recycled back for industrial processing. Organic garbage will be transported to the national government licensed dumpsite. All storm water drainage will be channeled into the existing storm drains.

2.4 Description of the project's construction activities

2.4.1 Excavation and foundation works

Excavation will be carried out to prepare the site for construction of foundations, pavements and drainage systems. This will involve a combination of earthmoving machinery such as excavators and wheel loaders as well as manual labour.

2.4.2 Storage of materials

Construction materials such quarry stones, ballast, sand and steel be placed at site. The proponent will purchase Building materials using Just in time (JIT) inventory system. Just in time ensures that materials are purchase when optimally when needed.

2.4.3 Masonry, concrete work and related activities

Construction of apartment walls, foundation construction, stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces floors, pavements, drainage systems, among other components are labour intensive masonry works. These activities will use concrete mixers and vibrators.

2.4.4 Structural steel works

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

2.4.5 Plumbing

The two separate subsystems made of pipes will be installed. One brings freshwater inside, and the other transports wastewater away. The freshwater system uses pressure to move water to where it's needed in the building.

The wastewater system doesn't need pressure, since wastewater moves down and out of the building. The drainage pipes always aim downward to let wastewater flow through. Shutoff valves for the entire system will be done as well as for specific areas will be systems also use a meter to measure water usage. Plumbing activities will include metal and plastic pipe cuttings, the use of adhesives, metal grinding and wall drilling among others.

2.5. Description of the project's occupational activities

2.5.1 Solid waste and waste water management

The proponent will embrace waste segregation in coloured bins. Waste segregation of biodegradable waste, polythene/cartons, aluminum will Waste segregation helps in the easier disposal and recycling of waste materials. Sewage from the proposed apartment will be channeled into Nairobi county council sewer line.

2.5.2 Cleaning of the apartment

The proponent will adopt purchase of Antibacterial, bio-degradable, natural cleaning detergent with exceptional degreasing properties. The bio-degradable detergents will not harm the environment.

2.5.3 General repairs and maintenance

Regular repair of apartment will be essential. Grounds keeping, Appliance repair, Security, Pest control, plumbing maintenance and solving electrical issues.

2.6 Description of the project's decommissioning activities

2.6.1 Demolition works

Demolition contrasts with deconstruction, which involves taking a building apart while carefully preserving valuable elements for reuse purposes. Demolition activities includes loading and unloading debris and waste onto and off trucks, refilling excavated holes and ditches, as well as building and dismantling scaffolding and temporary structures.

There are four things that make a successful demolition project:

1. Proper safety.
2. Proper planning.
3. Proper staffing.
4. Proper tools and machinery

2.6.2 Dismantling apartment process

Stage 1: Hazardous materials diagnosis.

Stage 2: Organization and planning of the demolition.

Stage 3: Clearing the building to be demolished. ...

Stage 4: Building decontamination.

Stage 5: Building demolition and reusable equipment removal

Stage 6: Cleaning the site

- The equipment such as doors, power generators, can be donated to charity.
- Steel and aluminium can be sold off for recycling

2.6.3 Site restoration

The last step in the demolition process is the cleanup of the project site and re-vegetation The proponent will Planting of new trees and, particularly, of native plants in disturbed sites where the vegetation cover has been destroyed, to stabilize the land surface from wind and water erosion and to reclaim the land for other uses.

2.7 Borehole drilling project description.

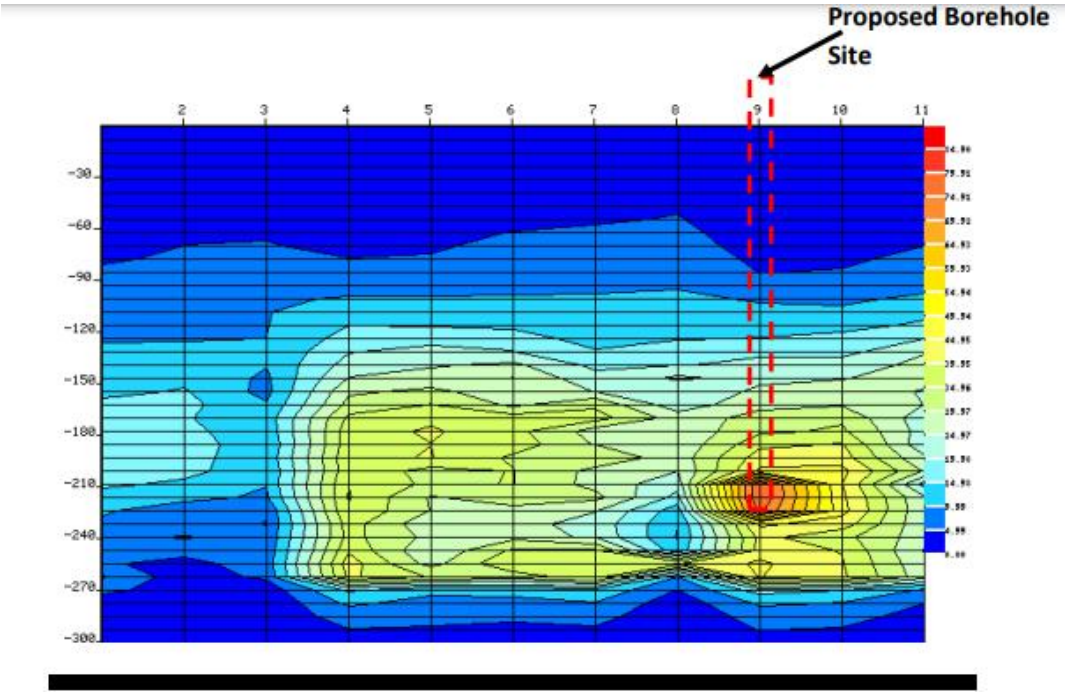
Borehole description

The proposed borehole will be used as the alternative water source for domestic purposes within the premises. The water demand is estimated to be about 40m^3/day. According to the hydrogeological survey, the project area is situated in a zone with medium to high groundwater potential. A borehole is recommended to be drilled at the selected **position to a maximum depth of 250m to ensure deeper aquiver penetration.** The surrounding boreholes whose technical data is available have varying yields thatrange. The approximate co-ordinates of the proposed drilling point on the plot is 37m 0263629 and utm 9864151 and it is located in kiambu map sheet 148/2. the plot has elevation of 1,621 metres above sea level between **4.38 and 15.**1m^3/hr. This study report and hydrogeological survey will be shared with water resources authority's (WRA) for review and approval.

2.7.1 Geophysical investigation methods and prospecting methods

Field work was carried out on 27th of march, 2023. sounding using a pqwt-s 500 seriesequipment on 15 stations along a determined profile line was executed using 10m distances.

Figure 2. 3 Geophysical Investigations



2.7.2 Groundwater Quality

The quality of groundwater throughout the project area is generally good. Water sample from the proposed borehole should be analyzed before consumption at Kenya gazette approved laboratory.

Table 2. 1 showing Groundwater suitability based on dissolved solids content by UNICEF.

TDS* (mg/l)	**Category**	**SUITABILITY**
0 - 1,500	Fresh water	Suitable for all normal purposes
1,500 - 3,000	Brackish water	Suitable for livestock, marginal for human consumption
3,000 - 5,000		Suitable for livestock, unsuitable for human consumption
5,000 - 7,000		Suitable for camels, marginal for other livestock
7,000 - 10,000		Suitable for all camels, marginal for goats and sheep, unsuitable for cattle
10,000 - 15,000	Saline	Marginal for camels, only in emergencies for goats and sheep
> 15,000		Unsuitable for any domesticated animal life

Total *Dissolved* Solids (in parts per million = mg per litre

Table 2. 2 Showing Maximum dissolved constituent limits as per WHO/EU standard

Parameter	**WHO/ EU Guideline**
Cations (mg/l)	
Iron	0.2
Manganese	0.5
Calcium	No Guideline
Magnesium	No Guideline
Sodium	200
Potassium	No Guideline
Anions (mg/l)	
Chloride	250
Fluoride	1.5
Nitrate	50
Nitrite	0.50
Sulphate	250
Total Hardness (mg$CaCO_3$/l)	Desirable: 150-500
Total Alkalinity (mg$CaCO_3$/l)	No Guideline
Physical Parameters	
PH	Desirable: 6.5-8.5
Colour (mgPt/l)	Desirable: 15
Turbidity (NTU)	Desirable:< 5
Permanganate Value (mgO_2/l	No Guideline
Conductivity (S/cm)	250 microS/cm
Total Dissolved Solids (mg/l)	No Guideline
Free Carbon Dioxide (mg/l)	No Guideline

2.7.3 Well Design

The design of well should ensure that screens are placed against the optimum aquifer zones. The final design should be made by an experienced hydrogeologist.

2.7.4 Casing and Screens

The well should be screened with good quality screens considering the depth of the borehole. Slots should be of maximum 2mm in size.

2.7.5 Gravel pack

The use of gravel pack is recommended within the aquifer zone, because the aquifer could contain sands or silts which are finer than the screen slot size. An 81/2 diameter borehole screened at 6", which should be sufficient.

2.7.6 Well Construction

Once the design has been agreed, construction can be done. In installing screen and casing, centralizers at 6 metre intervals should be used to ensure centrality within the borehole. This is particularly important to insert the artificial gravel pack all around the screen. If installed gravel

packed sections should be sealed off, top and bottom with clay(2m), the remaining annular space should bebackfilled with an inert material and the top five metres grouted with cement to ensure that no surface water at the well head can enter the well and thus prevent contamination.

2.7.7 Well Development

Once screen, pack, seals and backfill have been installed, the well should be developed. Development aims at repairing the damage done to the aquifer during the course of drilling by removing clays and other additives from borehole wall. Secondly, it alters the physical characteristics of the aquifer around the screen and removes fine particles. Wells development is an expensive element in the completion of a well, but is usually justified in longer well-life, greater efficiencies, lower operational and maintenance costs and a more constant yield.

2.7.8 Testing

After development and preliminary tests, a long duration well test should be carried out. Well tests have to be carried out on all newly-completed wells because not only does this give an indication of the success of the drilling, design and development, but it also yields information on aquifer parameters which are vital to a hydro geologist. The duration of the test should be 24 hours with a further 24 hours for a recovery test or less depending on the rate of recovery during which the rate discovery to SWL is recorded.

2.7.9 Pump Installation

After testing and analysis of the results the pump can be selected and installed. It is important to select the right type of pump, which matches the characteristic of the well. It should have the right capacity to lift the water directly to the storagetank. The pump should never be installed in the slotted section, but at least 2 meters above or below the screened section. The electric submersible pump should be protected with a cut-off switch 2 meters above the pump inlet level.

Figure 2. 4 Drilling proposed site

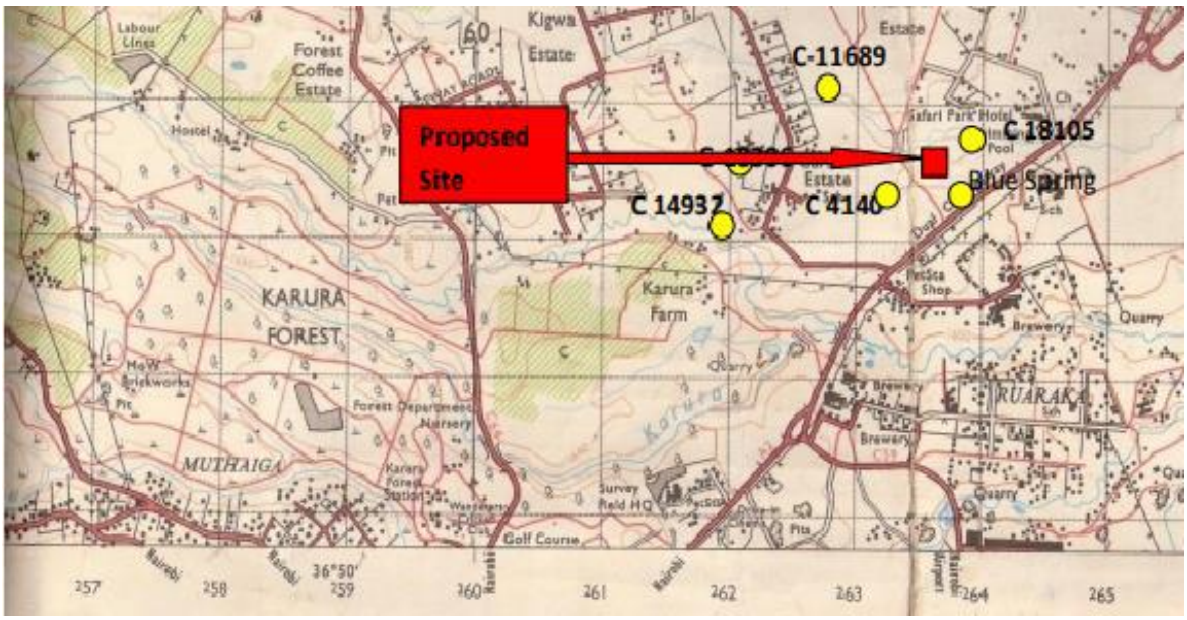


Figure 2. 5 Drilling Google map

Table 2. 3 Borehole Project activities and mitigation measures

Likely Risks	Mitigation measures
Drilling Solid waste generation	1. Use construction materials containing recycled content where possible and in accordance with accepted standards.
Air pollution	1. Ensure strict enforcement of on-site speed limit Regulations 2. Sensitize truck drivers to avoid unnecessary racing of drilling and supply materials supply trucks.
Noise Pollution	1. Suitable overalls, safety footwear, dust masks, gas masks, respirators, gloves, ear protection equipment etc should be made available and drilling personnel must be trained to use the Equipment 2. Provide workers in areas with elevated noise and vibration levels, with suitable ear protection equipment such as ear muffs
Occupational and safety risks	1. 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 2. All machines and other moving parts of equipment must be enclosed or guarded to protect all workers from injury 3. Display of current emergency telephone numbers at the construction Site 4. Well stocked first aid box 5. Hand tools must be of appropriate size and shape for easy use.

2.7.10 Borehole project cost

Borehole drilling is an amenity to the proposed development. The Borehole drilling cost has been included in the proposed residential (multidwelling Units) Project bill of quantities.

CHAPTER THREE
BASELINE STUDIES

3.1 Introduction

Environment Impact Evaluation baseline study is the study of the original status of the environment in the area before the development work of the project is started. Baseline study establishes identity of a project; identifies affected communities and their status, and provides yardsticks for impact prediction. It also describes the baseline of the Nairobi County. Our baseline study will study components; - air, noise, water, land, flora and fauna and socio-economic.

3.2 Biodiversity

Biodiversity is all the living creatures, plants and animals, on and in the earth, water and air in a particular place. Biodiversity also describes the interaction between these living creatures and the area (ecosystem) in which they live. This Environmental impact assessment (EIA) study takes into account the effects of development projects on biodiversity by integrating potential impacts into the mitigation hierarchy of avoidance, reduction, and offset measures

3.2.1 Flora

The site location is made up of shrubs, grass and trees. The location is not agriculturally productive so it is not favorable for vegetation growing or food production. During construction, grass and shrubs will be cleared but there will be minimal cutting down of mature trees to minimize flora disruption. Post construction, vegetation cover will be restored on any bare land.

3.2.2 Fauna

There is no major fauna in the site that could be threatened by the development. The only existing fauna is made up of microorganisms inside the soil like millipedes and earthworms. These could be affected, together with other crawling insects.

3.2.3 Waste management and pollution prevention:

The EIA study has put in place adequate waste management plans in ESMMP. The waste management policy and practices during construction, operational and decommissioning phase will ensure pollution prevention. The proponent will be connected to the Nairobi water and sewerage line.

3.2.4 Water resources

Surface water replenished by precipitation is the water in streams, rivers, lakes, ponds, reservoirs and wetlands. The proposed project site will be connected to by Nairobi City Water & Sewerage Company Ltd (NCWSC)

Ground water occurrence is dependent upon geology, rainfall, weathering and recharge. Nairobi upper aquifer is particularly vulnerable to pollution from human activities such as landfills and

dumpsites; seepage from latrines. The proposed project will ensure that all solid waste is managed appropriately as per Environmental Management and Coordination (Waste Management) Regulations, 2006 and Environmental Management and Coordination (Water Quality) Regulations, 2006. The EIA study has documented elaborate ESMMP.

The project site is connected with the Nairobi water and sewerage company (NWSCO). Borehole water will be a backup in situations of water shortage. Hydrogeological reports done and application to water resources authority (WRA) has been done.

3.2.5 Topography and drainage

The plot Location: -1.227387E, 36.876678S and is Plot average elevation: 1,620M. Thome area follows the regional slope towards Ruaraka. There is wetland near the project site. However, the proponent will ensure that waste water is channeled to sewer line, Nairobi City Water & Sewerage Company Ltd (NCWSC).

3.2.6 Geology and Hydrogeology

Nairobi Trachyte (NT)

This trachytic lava is a greenish-grey, occasionally porphyritic rock, with feldspar phenocrysts in a fine-grained groundmass. Lamination and banding which are common in the NT are due to flow patterns and pressures, as well as differences in viscosity.

Athi Series

The Athi Series Formation is a composite of tuffs and 'Lake Beds'. The latter are predominantly lacustrine sediments consisting of reworked volcanic material. They are intercalated with tuff bands, pumice bands and welded tuff deposits. The material includes obsidian sands, conglomerates and siliceous agglomerates. Kunkar nodules occur. The series are sub-divided into three units: the Lower, the Middle and the Upper

Athi Series.

Recent deposits Superficial deposits in the area comprise the red volcanic soils, clays, alluvial and windblown material

3.3 Climatic conditions

3.31 Temperature

The *warm season* lasts for *2.0 months*, from *January 24* to *March 26*, with an average daily high temperature above *79°F*. The hottest day of the year is *February 26*, with an average high of *81°F* andlow of *60°F*.s. The *cool season* lasts for *2.6 months*, from *June 4* to *August 24*, with an average daily high temperaturebelow *73°F*. The coldest day of the year is *July 13*, with an average low of *54°F* and high of *71°F*.

3.3.2 Rainfall

Thome, like most of Nairobi, experiences biannual seasons with long rains running from March to May and short rains from November to December. No proper rainfall records exist for Thome in particular but Nairobi experiences rainfall of an average of 726.05 mm. January to March are the hottest months, and July is the coldest month. The mean annual temperature for the area is 25.08 °C.

3.3.3 Wind speed

The winds determine the onset of Kenya's two rainy seasons, with the hot northeast monsoon or kaskazi blowing dry air in from the Persian Gulf from November to March/April and the warm, moist kusi monsoon blowing in from the southeast from April/May to October. The winds blow at 20-25 miles per hour towards northeast between October and April, and they are shifted southeast between May and September.

3.3.4 sunshine

On average in Nairobi, January is the sunniest month with 288 hours of sunshine. August has on average the lowest amount of sunshine with 127 hours. The average annual amount of sun hours is: 2452 hours. Nairobi is often cloudy in the morning, and the sunshine is at its peak at noon. During rainy season, the sunshine hours are less to about four (4) hours.

3.3.5 Average Humidity values

Kenya experience average temperatures of 85 °F (29 °C) or more, while annual precipitation is only about 10 inches (250 mm) in the north and less than 20 inches (500 mm) in the south. In most parts of the coast, average temperatures exceed 80 °F (27 °C) and relative humidity is high year-round.

3.4 Socio-economic environment

3.4.1 Administrative location and demography of Thome

Thome is located in Nairobi County, Kasarani sub-county, Roysambu constituency and Roysambu ward Roysambu ward has a population of 30,331 as per the 2019 census data. The general Roysambu ward is densely populated, with mixed use developments featuring high end facilities like malls. The population is made up of mostly middle-income earners residing in townhouses and apartments. The living standard is middle- and upper-class level.

3.4.2 Position and size of the Nairobi County.

Nairobi is the capital and largest city of Kenya. The city and its surrounding area also form Nairobi County. The place name "Nairobi" comes from the Maasai phrase *Enkare Nairobi,* which translates to "cool water". The phrase is also the Maasai name of the Nairobi River, which in turn lent its name to the city. However, it is popularly known as the "Green City in the Sun". Nairobi lies on GPRS Latitude: -1° 16' 60.00" S and Longitude: 36° 48' 59.99" E. According to the 2019 Census

and Kenya National Bureau of Statistics (KNBS) Nairobi County Nairobihas a total population of 4,394,073. Nairobi county area is 694.9 km^2

3.4.3 Site ownership

The government of Kenya certificate of lease for a nine ninety nine years(99)tenure beginning 1st January 1999 The property interest registration in favour of Kifaru Enterprise limited was registered on 28th September 2021. The property size is 0.2135 hactares. The project site GPS coordinates are -1.227387 latitude, 36.876678 longitude respectively. Lease and deep plan showing plot dimensions attached as appendix.

3.4.4 Land use

The area is predominant mixed use with several upcoming apartments' construction due the growing population of Thome area. The proposed apartment conforms to the land use. Change of user to apartment (multidwelling units) has been approved by the Nairobi County physical planning and urban development department.

3.4.5 Telecommunications and infrastructure

The site is well is well served with a good road network. Thome is off Thika Superhighway, from which there is access through the Marurui Road. The site also has a good communication network connection from major service providers like Safaricom Airtel and Telkom. The site also has power, water and sewer accessibility from the Kenya Power and Lighting Company and Nairobi Water and Sewerage Company (NWSCO) respectively. The area is predominantly made up of mixed-use development, meaning there is access to schools, shopping centers, recreational facilities and areas of worship. The site is also located near major shopping malls like Mountain Mall, Garden city mall. There are universities in the neighbourhood , notably, USIS Africa, Mirema School, Ruaraka Academy, Ngara Girls High School ,Thika Road Christianity School, Mahanaim University and pan African Christian university

Generally, Nairobi has airport such as Jomo Kenyatta International Airport and Wilson Airport. There is both standard gauge railway line running from Mombasa port to Kisumu and meter gauge railway serving major towns in Kenya. The major economic activity is in the community, social and personal services and professional business services sector accounting for 52.1% of all the income generated in the city. This is followed by the agriculture and forestry sector, the wholesale and retail trade, the manufacturing sector and tourism

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CHAPTER FOUR
POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

4.1 Brief Introduction

Over the years Kenya has put into place necessary frameworks that require environmental impact assessment to be carried out on every new major project, programme or activity (EMCA 1999) and that thereafter a report should be submitted to the National Environmental Management Authority for approval and issuance of relevant licenses/documentation. Environmental Impact Assessment is recognized as a very vital body in new project/activity enactment. Regulations on environmental impact assessments and environmental audits have been established under the Kenya gazette supplement No 56 of June 13th 2003. These regulations act as a conveyor belt in facilitating the process. National policies and legal statutes have been reviewed by the relevant actors as years progress to enhance environmental sustainability in national development projects across all quarters. Below are some of the policy and legal provisions relevant to this proposed project.

4.2 Policy and Constitutional Framework.

4.2.1The Constitution of Kenya 2010.

Upon enactment of the 2010 constitution, Kenya has been praised as a model of environmental progress in the region as our constitution contains specific measures and guidelines for environmental management. Provision of legal and institutional mechanisms is one of the basic conceptual tools for environmental management. Environmental provisions are included inchapter 4 under “Rights and fundamental freedom” ,chapter 5 “Environmental and natural resources” and chapter 10 under “Judicial authority and legal system” of our 2010 constitution. Article 69 of the constitution states that “ The state shall establish systems of environmental impact assessments, environmental audits and monitoring of the environment” this has encouraged continued establishment of systems to support EIA, Environmental audits and monitoring. Our constitution provides a clear road map of the direction in which our country is headed on matters of environmental conservation. Inclusion of environmental considerations in the constitution encourages the country to evaluate its current development activities and how these can be aligned to the requirements of the constitution.

Compliance with the law

Through ESIA on the proposed project will help in mitigating likely environmental and social risks from project activities that are likely to endanger the environment, thus upholding article 69(g) of the constitution.

4.2.2 The National Environmental Policy,2013.

The policy promotes the use of environmental and social assessment tools such as ESIA/EA necessary to ensure environmental quality and resource productivity on long term basis. Furtherit calls for management in use of hazardous and toxic chemicals as well as radiation regulations. integrate environmental management with economic growth, poverty reduction and improving livelihoods, as the project will offer employment opportunities to job seekers during pre-constructionand post construction period, paying revised ground rent and rates thus harmonizing the National Environmental policy, 2013. The Policy requires the project which is likely to have significant environmental and social impacts to undergo ESIA in order to establish sound environmental management practices.

4.2.3 National Policy on Water Resources Management and Development (Sessional paper No. 1 of 1999)

In order to ensure sustainable water schemes, there is need to apply alternatives management options and technologies that are participatory rather than wholly recipient. This will require that there exist an enhanced participation in the programme by the various water users. The policy states that it will be necessary for the government to embark on a conscious effort to sensitize recipient communities on the principles of management of such projects and equip them withthe necessary knowledge and skills for sustainable management.

4.2.4 Compliance with law

The proposed project alienates with National policy and water resources management and development policy as mitigation measures which include water storage tanks, installation of automatic water taps and record keeping/monitoring of water usage to ensure sustainable management of water.

4.2.5 Policy on Environment and Development

Among the key objectives of this policy include;

1. To ensure that an independent environmental impact assessment is prepared for any industrial venture or other development before implementation.
2. To come up with effluent treatment standards that are in line with the placed health guidelines.
3. To ensure that from the onset all development programs, policies and projects take environmental considerations into account.

The policy recommends need for enhanced recycling/reusing of residues such as wastewater,

increased public awareness, use of low non waste technologies such as bio digester. The policy encourages participation of stakeholders in the management of wastes within their localities.

The Land Policy(Sessional paper No .3 of 2009) and Land Act 2012 , the Land Registration Act 2012 and the National Land Commission Act 2012

Since independence Kenya has not had a clearly defined land policy, it is as such that the National land policy was formulated with a view/vision of guiding the country towards efficient, sustainable and equitable use of land for prosperity and posterity. Through the sessional paper the government will ensure that all land is put into productive use on a sustainable basis by facilitating the implementation of key principles on land use, productivity targets and guidelines as well as conservation. It will encourage a multi sectoral approach to land use, provide social, economic and other incentives and put in place an enabling environment for investments , agriculture, livestock development and the exploitation of natural resources.

Compliance with the law

The proposed project complies with law. The change of user of the proposed project to multidwelling units has been applied and approved by Nairobi county physical/urban planning department. Proposed apartment construction aims at optimal land use and provision of housing modern housing.

4.2.6. The Kenya Health Policy (2012 - 2030)

The goal of this policy is attaining the highest possible standard of health in a manner responsive to the needs of the population. The policy aims to achieve this through supporting provision of equitable, affordable and quality health and related services at the highest attainable standards to all Kenyans. Focus of this policy is on contribution to development and realization of the right to health. Overall objective of this policy is to attain universal coverage of critical services that positively contribute to the realization of the overall policy goal. Through environmental impact assessment of the proposed project

4.2.7 The National Environmental Sanitation and Hygiene Policy (2007)

The goal of this policy document is to create and enhance an enabling environment in which all Kenyans will be motivated to improve their hygiene behaviour and environmental sanitation which gives people access to the necessary support to achieve this. As a basic human right all Kenyans ought to enjoy a dignified quality of life in a hygienic and sanitary environment and be free from suffering any ill health caused by poor sanitation.

Compliance with the law.

There will be a central solid waste disposal point for eventual collection by a NEMA licensed handler additionally the client has incorporated in the apartment technical design to connect the proposed development to the Nairobi sewer line.

4.3 National Regulatory Framework

4.3.1. Environmental Management and Co-ordination Act, 1999 and Environment (repealed cap 387)

Part II of the Environment Management & Co-ordination Act, 1999 states that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. In order to ensure that this is achieved part VI, section 58, of the same Act directs that any proponent of a new project should carry out an environmental impact assessment and prepare an appropriate report for submission to the National Environmental Management Authority (NEMA), who in turn issues a license as appropriate. The second schedule of the same Act lists proposed urban development activities as among the facilities that should undergo environmental impact assessments. Part VIII, section 72, of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. Section 73 requires that operators of projects, which discharge effluent or other pollutants, submit to NEMA accurate information about the quantity and quality of the effluent. Section 74 demands that effluent generated from any trade undertaking are discharged only into the existing sewerage system upon issuance of a license from the Authority.

Compliance with the law

The project shall comply with the provisions of this regulation on issues related to, environmental assessment, solid waste, wastewater management, air emissions, noise and vibrations among others and the proponent shall comply with the elaborate ESMMP throughout the project cycle.

4.3.2 EMCA Related Regulation

This regulation provides guidelines to govern the conduct of Environmental Assessment and Audits in Kenya. Section 3 indicates that the regulations apply to policies, plans, programs, projects and activities specified in Part IV, Part V and 2nd schedule of the Act .

Compliance to the law

The ESIA has been carried out by a NEMA licensed expert in accordance with the law.

4.3.2.1 Environmental(Impact Assessment and Audit) Regulations, 2003

June 13th 2003, the Minister of Environment, Natural Resources and Wildlife, Kenya promulgated the Environment (Impact Assessment and Audit) regulations 2003 (EIA/EA Regulations) under section 147 of the EMCA. These regulations provide the framework for carrying out Environmental Impact assessment and Environmental audits in Kenya as an environmental conservation measure.

4.3.2.2 EMCA (Water quality) Regulations, 2006

These regulations provide rules relative to the use and discharge of water for domestic,agricultural and industrial purposes make provision for the protection of water resources frompollution and define water quality standards.

Compliance to the law

The proponent will ensure that the appropriate measures to prevent pollution of underground water and surface water sources are implemented in all project phases such as channeling all wastewater effluent to the sewer system and undertake periodic monitoring of the waste effluent to ensure compliance with the acceptable standards. Necessary water supply or wastewater discharge permits, and compliance with such permits shall alsobe sought.

4.3.2.2 EMCA (Waste management) Regulations, 2006.

The regulations provide guidelines on waste management (handling, storage, transportation, treatment and disposal) of various waste streams including: domestic waste, industrial waste, hazardous and toxic waste, pesticides and toxic substances, biomedical wastes; and radioactive wastes. Through the Nairobi county government the proposed project has been provided with the necessary licenses required for the smooth flow of the project.

4.3.2.3 (Noise and Excessive Vibration Pollution Control)Regulations, 2009.

Part II section 3(I) of these Regulations states that: no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures orendangers the comfort, repose, health or safety of others and the environment and section 3(2) states that in determining whether noise is loud, unreasonable, unnecessary or unusual depends on; (i) the time of the day, (ii) proximity to residential area (iii) whether the noise is recurrent/constant,

level/intensity of noise. The contractor shall ensure construction activities are carried out within the permissible noise levels. The contractor will also be required to take into consideration monitoring of the noise and vibrations levels within the hospital during construction and renovation and operational period to ensure compliance.

4.3.2.4 EMCA (Air Quality) Regulations 2013.

Provide for the prevention, control and abatement of air pollution to ensure clean and healthy ambient air. Part II sections 5 to 9 prohibits compromise of the ambient air quality levels specified in the first and third schedules of the regulations. Section 11 of the regulations prohibits offensive emissions into controlled areas (national parks, schools, hospitals, residential areas and populated urban centers). Section 33 prohibits any person from causing/allowing emissions of particulate matter during demolition of structures. Section 34 prohibits any person from allowing stock piling of material to cause effect to ambient air quality, section 35 prohibits operators of the incinerators to cause emission of air pollutants as set out in second schedule in excess of mass emission rates indicated in third schedule of the act.

Compliance to the law

The project contractor during the construction and operationalization will abide with sections 33, 34 & 35 of these regulations. The client will apply for the licenses to own and operate. During operational phase, no waste will be left for long at the temporary waste storage area.

4.4 Other Environment, Health and Safety, Physical planning related laws.

4.4.1 Water Act 2002.

The Water act 2002 led to the establishment of WASREB as the regulatory board with powers to; issue licenses for the provision of water services; determine standards for the provision of water services to consumers and establish procedures for handling complaints by consumers against licensees among others.

4.4.2 The Penal Code CAP 63

4.4.2.1 Occupational Health and Safety Act (OSHA) No.15 of 2007 and the 2007 subsidiary legislation (Cap 514) (Safety and health committee)Rules 2004

The Act applies to All Workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to: Secure the safety, health and welfare of persons at work; and Protect persons other than persons work against risks to safety and health arising out of, or in connection with, the activities of persons at work.

Compliance to the law

All Safety and Health measures should be in place to ensure workers at and the neighboring

communities are not exposed to Safety andHealth risks during project construction, operation and decommissioning phases. Provision of appropriate PPE, training of workers, appointing health and safety personnel will be taken into consideration.

a) Safety

Fencing of the premises and dangerous work stations should be done. Workers must be trained on personal safety and how to handle equipment's and machines. They should be provided with Personal Protective Equipment which should be worn at all times. Special precaution against gassing should be laid down for duties in confined spaces where people are liable to be overcome by hazardous fumes. Air receivers and fittings must be of sound quality and should be regularly maintained. There should be a fire risk and disaster preparedness plan clearly spelt out and implemented. Adequate fire extinguishers should be installed and a clearly marked emergency exit.

b) Health

The premises must be kept clean; dusting done daily and separate washrooms (Gents & Ladies) kept clean and in good working conditions and necessary facilities provided. The workstations must be adequately ventilated, with enough light to ensure workers are not subjected to any form of hazards while at work.

4.4.2.2 (Noise Prevention and Control) Rules

No worker shall be exposed to noise levels in excess for a continuous period of. The project will make sure that the workers are supplied with the necessary PPE during the construction and decommissioning process so that there are protected against excess noise.

4.4.2.3 Medical Examination Rules, 2005

These Rules may be cited as the Factories and other places of work (Medical Examination) Rules, 2005. These Rules shall apply to medical examination of all those employees in employment or have been in employment in every workplace, to which the provisions of the Act apply. It shall be the duty of the employer to ensure that all persons employed in any of the occupations outlined in the Eighth Schedule to the Act undergo both pre-employment and periodic medical examinations by the Designated Health Practitioner as outlined in the First Schedule

4.4.2.4 Fire Risk Reduction Rule, 2007

These rules shall apply to every workplace, process and operations to which the provisions of the Act apply. Every owner and occupier of a workplace shall ensure that every workroom where flammable substances are used, manufactured or manipulated is constructed with fire resistant

material. Fire resistant material shall include; concrete block, brick work or stone of not less than 115mm thickness; concrete slab of not less than 76mm thickness; iron or steel of not less than 16 Imperial Standard Gauge.

Compliance to the law

The project structural and architectural designs have been done to the Kenya standards and world construction practice.

4.4.2.6 The Work Injury Benefit Act (WIBA), 2007.

This provides for compensation to employees for work related injuries and diseases contracted in the course of employment.

Compliance to the law

The proponent must comply with the provisions of this legislation with regard to the above Act at the time occupational phase of the proposed project.

4.4.2.7 The Public Health Act Cap 242.

Part IX, section 115, of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires Local Authorities to take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 as waste pipes, sewers, drains or refuse pits in such a state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health. Any noxious matter or waste water flowing or discharged from any premises into a public street or into the gutter or side channel or watercourse, irrigation channel or bed not approved for discharge is also deemed as a nuisance. Other nuisances are accumulation of materials or refuse which in the opinion of the medical office of health is likely to harbour rats or other vermin. On the responsibility of local authorities, Part XI, section 129, of the Act states in part "it shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its district has a right to use for drinking or domestic purposes." Every municipal council and every urban area council may make by-laws as to buildings and sanitation. The contractor is required to abide by these provisions throughout the project cycle.

Compliance with the law

The proponent shall prevent occurrence of nuisance or condition liable to be injurious or

dangerous to human health. The mitigation plans on waste water from the washrooms, solid waste segregation and disposal have been documented in the ESMMP.

4.4.2.8 The Land and Environment Court

The Environment and Land Court was created by the Constitution. It is a Superior Court of record exercising exclusive jurisdiction to determine disputes related to the environment, the use and occupation of, and title to land (Art 162 (b).Might there be any environmental issues misunderstanding arising from the proposed development project, they will be heard and determined by the Land and Environment Court.

4.4.2.9 The County Council Act Cap 265

This Act provides with respect to local government and local authority (i.e. a municipal, county, town or urban council) in Kenya. The Minister shall have the power to establish municipalities, counties or townships. Local authorities may enter into agreement between them for purposes of joint management and control. A local authority may, for the purpose of any of its functions under this or any other written law, by agreement acquire land or subject to the approval of the Minister, apply to the Government or any other authority having power to acquire land for any land required for the purpose of any of its functions to be acquired compulsorily for and on behalf and at the expense of the local authority.

4.4.2.10 The County Council By- Laws

A permit is not transferable without the consent of the council. Nairobi city council approved change of use -new from single dwelling unit to residential apartments.

4.4.2.11 Approval of Building Plans.

Construction approval by Nairobi county planning office has been adhered to in the proposed development project.

4.4.2.12 Occupational Certificate.

This has been issued by the Nairobi city county, under the physical and land use planning act (No 13 of 2019).

4.4.2.13 The Physical Planning Act of 1996 Cap 286.

The Physical Planning Act has provisions to control development and use of land in particular areas, especially where a project may involve subdivisions or amalgamation of land parcels, or located in an area otherwise reserved for other uses. It aims at guiding the development in the

whole country irrespective of the land tenure limitations.

Section 30 (1) of the Act stipulates that no person shall carry out development within the area of a local authority without a development permission granted by the local authority under section 33. Section 29 of this Act provides for development control. It empowers the local authority to prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area. Section 36 states that a local authority may if deem necessary require a submission of EIA report together with development application if they feel the project has some injurious effects on the environment.

Compliance with the law

The proposed project has been approved by the Nairobi county physical and urban planning department.

4.4.2.14 Traffic Act Cap 403

A local authority may, by by-laws, (a) designate parking places on roads, within its area of jurisdiction for vehicles or vehicles of any particular class or description, having regard to both the interests of traffic and the interests of owners and occupiers of adjoining property; (b) prescribe the manner in which vehicles shall stand in or be driven into or out of the designated parking place; (c) provide that a vehicle may not be left continuously in the designated parking place for longer than a specified period. The architectural design of the proposed project has put in place adequate parking space that is in line with the Traffic act cap 403.

Compliance with the law.

The traffic assessment has been done and approval by Kenya urban roads authority has approved use of the road leading to the proposed apartment.

4.4.2.15 Building Code 2000

This by-law recognizes the Local authorities as the leading planning agencies. It compels the potential developer to submit development application for the approval. The local authorities are hence empowered to approve or disapprove any plans if they do or don't comply with the law respectively. Any developer who intends to erect a building as herein proposed must give the respective local authority a notice of inspection before the erection of the structure. On completion of the structure, a notice of completion shall be issued by the local authority to facilitate final inspection and approval. No person therefore shall occupy a building whose certificate of completion has not been issued by the local authority.

Section 214 of the by law requires that any public building where the floor is more than 20 feet

above the ground level should be provided with firefighting equipment that may include one or more of the following hydrants, hose reels and fire appliances, external conation portable fire appliances, water storage tanks, dry risers, sprinkler, drencher and water spray spring protector system.

Compliance with the law.

All structural and architectural plans have been submitted to the Nairobi county government development committees for review and approval.

4.4.2.16 Energy Act 2019

AN ACT of Parliament to consolidate the laws relating to energy, to provide for National and County Government functions in relation to energy, to provide for the establishment, powers and functions of the energy sector entities; promotion of renewable energy; exploration, recovery and commercial utilization of geothermal energy; regulation of midstream and downstream petroleum and coal activities; regulation, production, supply and use of electricity and other energy forms; and for connected purposes.

Compliance with the law

Proponent shall install energy saving lighting system to save power.

4.4.2.17 Climate Change Act 2016

The Acts provide for a regulatory framework for enhanced response to climate change; toprovide for mechanism and measures to achieve low carbon climate development, and forconnected purposes. The project should always function optimally to ensure no release of greenhouse gases into the atmosphere.

4.4.2.18 Kenya Standards on Construction, occupation and decommissioning of the apartment.

Through Environmental Impact Assessment, Kenya standards on construction will be observed and adhered to.

4.4.2.19 Fire Risk Reduction Rules 2007 (Legal notice no 59)

Every occupier shall continuously monitor the work place with a view to making an assessment of any possible fire risks and militate against them. (2) A person who contravenes the provisions of this Rule commits an offence.

Compliance with the law

Mitigation measures include but not limited to; All the electrical connections shall be connected to

one central emergency stop switch; in addition, they shall be designed by a registered engineer; One 9kg Co2 fire extinguisher shall be installed. Fire exit point and emergency doors shall be marked.

4.4.2.20 Applicable Standards and codes on Construction.

A person who intends to erect a building shall submit a written application to do so in such form as the council may require, completing all details required therein in so far as they apply to the proposals. The application form shall be completed in ink, signed by the developer or by a person representing himself to be his duly authorized agent in which event it shall state the name of the person on whose behalf it has been submitted. The form shall be attached to any plans or documents submitted in accordance with by-law 5 of these By-laws. The proposed building might be disapproved by the council if (a) the plans are not correctly drawn or do not provide sufficient information or detail to show whether or not the submission complies with these By-laws; (b) such plans disclose a contravention of these By-laws or of any other written law.

Compliance with the law

Proposed development project structural and architectural have been done to standard and provides sufficient information Proposed development maintaining the requisite of 3m, 6m, 9m building line as per the statutes are some of the architectural illustrations that satisfy the construction standards and codes.

4.5 Institutional Framework.

The Environmental Management and Coordination Act 387 (EMCA) was enacted with the aim of ensuring that projects with potential to have negative impacts on the environment incorporate measures to mitigate those risks and therefore ensuring sustainable development. Identification of the potential to cause harm to the environment is achieved during the environmental impact assessment (EIA) stage which is the first stage of any proposed development. The product of this EIA process is an EIA report that is submitted to NEMA- the environmental regulatory authority as an application for an environmental license. A proposed project can commence only after NEMA has issued a go ahead in form of an EIA license, after it is satisfied that the proposed project has adequately incorporated measures to mitigate potential adverse impacts and therefore safeguard safety, health, property and the general environmental wellbeing.

EIA is a tool for incorporating environmental sustainability into projects and is used for the identification of significant environmental aspects and impacts (positive and negative) of proposed projects prior to implementation in order for adequate mitigation measures for

addressing negative impacts to be incorporated in the project design before project implementation. Positive impacts are also identified and measures for enhancing them incorporated in the project design. Addressing the identified impacts before implementation ensures sustainable operation of the proposed project with respect to environmental resources and harmonious co-existence with other socioeconomic activities in the neighborhood.

Compliance with the law

EIA lead expert has been appointed to carry out the EIA study.

4.5.1 National Construction Authority

The NCA is responsible for issuing permits to construction sites and advising the government of Kenya on construction. The proponent shall liaise with NCA to ensure licensed contractors are the ones to be awarded the construction contracts so ensure compliance to Kenya construction standards.

Compliance with the law

Proponent shall only appoint contractors authorized by NCA.

4.5.2 Water Resource Authority

Is a state corporation mandated to safeguard the right to clean water by ensuring that there is a proper regulation of the management and use of water resources, in order to ensure sufficient water for everyone now and in the future.

Compliance with the law

The proposed borehole hydrogeological survey has been done a done and water resource authority (WRA) extraction permit has been applied with the authority.

4.5.3 Kenya Urban Roads Authority(KURA)

The proposed project is located off Marurui Road. The road is under Kenya urban roads Authority. infrastructure Housing and urban Development (MOTIHUD); established under kenya Roads Act, 2007 with the core mandate of management, development, rehabilitation and maintenance of national urban road network. KURA gives approval for access after review of traffic and design.

Compliance with the law

Designs have been submitted to KURA for review and approval

4.6 Development Policy Framework

Provides the context and guidance for establishing policies/procedures and ensures policies are relevant and consistent with applicable Executive Council directives, legislation and regulations. It

also describes how to review and approve policies (information on the governance structure of the institution) and it establishes a policy management program. Policy Development Framework provides protocols and clarifies roles and responsibilities in the policy development process.

4.7 World Bank Environment and Social Framework.

The ESF supports green, resilient and inclusive development by strengthening protections for people and the environment and making important advances in areas such as labor, inclusion and non-discrimination, gender, climate change, biodiversity, community health and safety, and stakeholder engagement. It uses a risk-based and proportionate approach that applies increased oversight and resources to complex projects and allows for greater responsiveness to changes in project circumstances through adaptive risk management and stakeholder engagement. It promotes integrated environmental and social risk management. The ESF places an emphasis on strengthening national environmental and social management systems and institutions, and supporting Borrower capacity building. It promotes enhanced transparency and stakeholder engagement through timely information disclosure, meaningful and ongoing consultations throughout the project life cycle, and responsive grievance mechanisms to facilitate resolution of concerns and grievances of project-affected parties.

Compliance with word bank ESF

Comprehensive stakeholder engagement will be implemented throughout the project cycle. EMCA 387 lays emphasis on stakeholder engagement during EIA study and annual audits.

4.8 The World Commission on Environment and Development.

The aim of the Brundtland Commission was to help direct the nations of the world towards the goal of sustainable development. The commission is also known as the World Commission on Environment and Development (WCED). It operated from 1984 to 1987. The commission published its results in the Brundtland report in 1987.

4.9 The Rio Declaration on Environment and Development.

The Rio Declaration states that the only way to have long term economic progress is to link it with environmental protection. This will only happen if nations establish a new and equitable global partnership involving governments, their people and key sectors of societies. They must build international agreements that protect the integrity of the global environmental and the developmental system.

The Rio Declaration include following principles:

“Human beings are at the centre of concerns for sustainable development. They are entitled to a

healthy and productive life in harmony with nature. (Principe 1)

The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations. (Principle 3)

All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world. (Principle 5). States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and development context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economicand social cost to other countries, in particular developing countries. (Principle 11)

Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed conflict and cooperate in its further development, as necessary. (Principle 24)".

4.10 The Kenya Vision 2030.

To support the social pillar, Kenya aims to provide its citizens with a clean, secure, and sustainable environment by the year 2030.This has been achieved through; implementation of the National Climate Change Action Plan, initialization of National Urban Development Policy and development of a framework to guide solid waste management and storm water drainage systems in urban areas, revision of Environmental Management and Coordination Act 1999; Multilateral Environmental Agreements such as climate change will be domesticated and a Climate Change Policy formulated and a Bill prepared to guide the country's mitigation and adaptation, Finalization of National Environment Policy, Geology, Mineral and Mining Policy and Bill, Education for Sustainable Development Policy, National Chemicals Management Policy, Natural Products Industry Policy, and Master Plan for the conservation of water towers and the National Climate Change Response Strategy.

Compliance with the law

Modern multidwelling units' construction is part of vision 2030.

CHAPTER FIVE
PUBLIC PARTICIPATION

5.1 Introduction

Public involvement is a fundamental principle of EIA. The inclusion of the views of the affected and interested public helps to ensure the decision making process is equitable and fair and leads to more informed choice and better environmental outcomes.

5.2 Five (5) Benefits of Stakeholder Engagement

1. Effective decision making.
2. Better relationships with stakeholders.
3. Prevention of project delays or roadblocks.
4. Risk management and accountability.
5. Trust and goodwill

5.3 Stakeholders engagement scope of works

The EIA team scope of works included

1. Stakeholders ID,
2. Mapping and
3. Engagement strategies.

5.3.1 Stakeholder's engagement plan and strategies.

During the process of conducting the Environmental Impact Assessment study, the proponent together with the EIA team collected the views of persons who may be affected by the project by:-

a) One (1) public meeting as per the approved terms of reference under regulation 15 of Environmental Management and Coordination act (EMCA 387) with the affected parties and communities in a venue convenient and accessible. The views were collected and documented.
b) The EIA team ensured that appropriate notices indicating the dates, times and venues of the meetings, are publicized to the affected communities and the other concerned parties at least fourteen (14) days prior to the meetings.
c) Posters were laced in strategic public places and in the vicinity of the site of the proposed project site.
d) During the public participation meeting, participants were shown the project detailed designs (both architectural and structural) and other project associated amenities.
e) The participants were explained of all project activities in the preconstruction, construction, occupational and decommissioning phases of the project and possible environmental and social impacts.
f) The respondents gave both oral and written concerns, and recommendations.

g) The structured short structured questionnaires have been attached as appendix.

5.3.2 Mapping and stakeholder's identification.

a) The residents within a Five kilometer (5km) radius were contacted for participation with the help of the chairman and treasurer of Thome 1 and Thome 5 residents association. The exercise was led by The treasurer Francis Kihika

b) The Roysambu area chief Mr. George Mose notification was notified with a letter that and he acknowledged by signing and stamping and was requested to notify the residents about the public participation meeting.

c) The area chief helped identify other focus groups of participants that will include, church ministers, area security chairpersons, the neighboring Safari rooks school director, and other residents.

The public participation meeting, minutes, inputs, views and concerns were taken into to account in the Environmental Impact Assessment (EIA) and project decision making and annexed Environmental Impact Assessment study report.

5.3.3 The team structured environmental and social surveys into four (4) components

1. Possible risks/benefits associated with the proposed project
2. Environmental risks likely to be linked with the proposed development (Noise, soil, air, waterpollution, Energy use, solid waste/waste water, storm water/drainage)
3. Occupational Health and public safety(construction and operation phase of the project)

The Recommendations of the proposed project is aimed to improve areas of Environmental and social risks identified and ESMMP formulated.

5.3.4 Analysis of the public consultation

Below are Impacts and mitigation measures Impacts mentioned by respondents

1. Providing accommodation to students and staff to the expanding universities i.e USIU Mahaiman University , KCA, Kenyatta university
2. Accommodation for more people and employment
3. Creation of more employment for residents and businesses creation of employment
4. More housing accommodation in the area
5. The Construction activities will cause noise
6. Building of our economy in the area and job creation
7. Creation of employment through supply of materials
8. Increase living spaces, employment and buying of building materials
9. Dust pollution

10. Risks to workers

Mitigation measures mentioned by respondents

1. Formulate elaborate noise protection plans
2. It is normal for dust and noise during construction-the contractor should install green dust protective devices
3. Sprinkle water to surfaces to suppress dust
4. Adhere to the rules and the law of safety
5. Install road sign for turning vehicles
6. Fence the project area during construction
7. Spilling of water on the dusty roads leading to the proposed site
8. Plant grass and trees around the building after construction
9. Tarmac the dusty roads
10. Use the cooking gas for cooking instead of charcoal
11. Connect 415V for three phase
12. Install 6 inch size pipe for incoming water for residents
13. Discharge waste to be connected to the sewer line
14. The Proposed project can degrade environment ,proper construction planning and implementation, planting trees in the area
15. Construct between 8.00 am to 5.00 pm
16. Water pollution can be cause through sewage pollution- the proponent should always inspect sewer pipes

Figure 5. 1 Public Participation With Shareholders

CHAPTER SIX

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Introduction

6.0 Environmental impact assessment risk Mitigation matrix

Environmental Impact Assessment (EIA) is a tool used to assess the significant effects of a project or development proposal on the environment. EIAs make sure that project decision makers think about the likely effects on the environment at the earliest possible time and aim to avoid, reduce or offset those effects

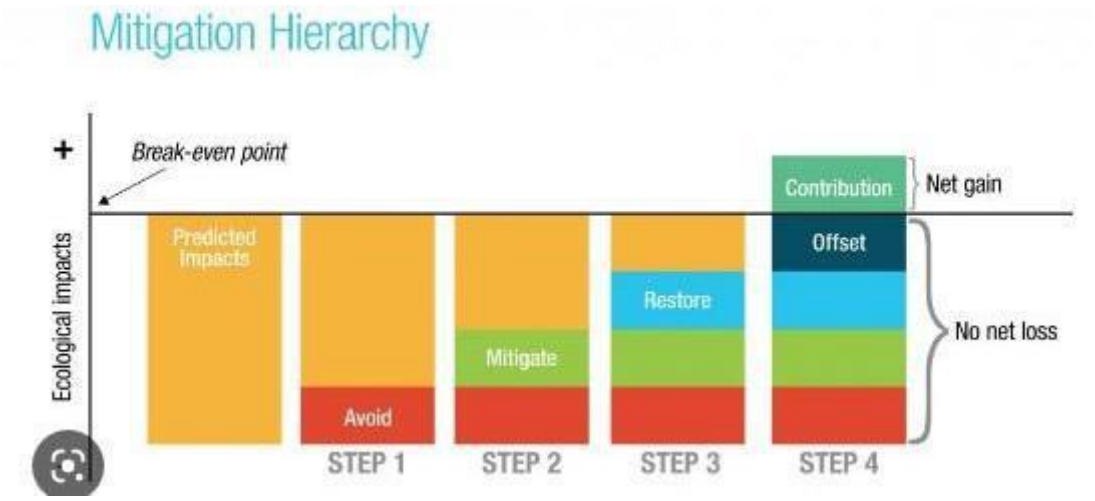

Figure 6. 1 Risk mitigation hierarchy

A. Potential adverse impacts during the construction phase

6.1 Removal and disturbance of flora and fauna Assessment

The proposed project site has minimal vegetation and shrubs. There are some grasses and forbs growing under the shrubs and some scattered trees can be observed. Most of these plants will be cleared to pave way for excavation and laying of the foundation of the proposed structures.

6.1.1 Mitigation

It is impossible to avoid vegetation removal and disturbance during the construction phase. It is however important to ensure that any flora and fauna removal and disturbance is restricted to the actual project area to avoid spill-over effects to neighboring areas and that the same are restored. Thefollowing measures are important in the management of vegetation clearing and disturbance:

a) Ensuring proper demarcation of the project area to be affected by the construction works to avoid spillover effects to neighboring areas.
b) Sparing some plants and re-establishing some plants in some of the affected areas through in a well-designed landscaping programme by planting of appropriate plants. Part of the topsoil excavated from the site can be re-spread in areas to be landscaped to enhance plant health.

c) Strictly controlling construction vehicles to ensure that they operate judiciously and over designated areas to minimize destruction of vegetation.

6.2 Excavation Assessment

Excavation results into loose soil making soil prone to both water and/or wind erosion. This causes a disturbance in soil quality and structure though on a localized scale. Soil erosion results into siltation of water

6.2.1 Mitigation

(a) The proponent will ensure proper demarcation of the project area to be affected by the construction works.

(b) All excavation and cutting to take place as instructed in the approved architectural plans for the proposed structures.

6.3 Soil compaction Assessment

Soil compaction occurs when soil particles are pressed together, reducing pore s**pace between them.** Heavily compacted soils contain few large pores, less total pore volume and, consequently, a greater density. A compacted soil has a reduced rate of both water infiltration and drainag**e.**

6.3.1 Mitigation

(a) Strictly control construction vehicles to ensure that they operate judiciously and over designated areas to reduce soil compaction.

(b) Any compacted areas should be ripped off after construction to allow aeration of soil and ease infiltration of water into the soil.

6.4 Extraction and use of construction materials Assessment

The proposed project will require significant amounts of materials. Many construction materials are components of natural resources and their extraction has an effect of depletion of land resources and the subsequent off-site degradation of the environment. For instance, building quarry stones, ballast and cement.

6.4.1 Mitigation

To minimize the impacts associated with depletion of raw materials. Use of recycled materials. Purchasing of materials only from the NEMA licensed mining sites.

6.5 Noise and vibrations Assessment

Noise is unavoidable during the construction period. The construction works will most likely be a noisy operation due to the machines such as concrete mixers, incoming vehicles to deliver construction materials and communication among workers. The noise generated during any construction is at best described as part of a normal occupational hazard that workers in the construction phase. Noise levels in construction works are usually below the threshold limit 85 dBA.

The proposed site is a farm whose nearest neighbours are not less than 180 M away. Therefore, the noise effects on neighbours will not be a major concern.

6.5.1 Mitigation

Noise is to be minimized at the site and in the surrounding areas through:

1. Sensitization of truck drivers to switch off vehicle engines while offloading materials;
2. Instructing truck drivers to avoid running of vehicle engines or hooting especially when passing through noise sensitive areas such as religious areas, residential areas, hospitals and schools;
3. Properly servicing and maintaining and tuning construction machinery such as generators and other heavy-duty equipment to reduce noise generation or placing them in enclosures to minimize ambient noise levels; and
4. Adhering to Kenya Noise Prevention and Control rule passed in 1996 under legal notice No. 296as a subsidiary legislation to OSHA, 2007 that require putting in place several measures that willmitigate noise pollution.

6.6 Excess excavated soil Assessment

There will be deep excavation to pave way for building foundations.

6.6.1 Mitigation

1. Part of the excavated topsoil to be re-spread in areas to be landscaped to enhance plant health.
2. Excess soil could be used in leveling the site, making bricks for walling purposes or be used infilling road potholes.

6.7 Construction wastes and pollution Assessment

During the construction phase, construction wastes including excess soil will form the main sources of pollutant. Potential sources of pollution may include:

(a) Spillage of paints, cement and chemicals;
(b) Improper disposal from the site of waste water and solid wastes including excess excavated soil;
(c) Dust from the excavation, stone shaping areas and from trucks carrying construction materials;
(d) Pieces of wood, polythene papers, metals, glasses and tins among other materials;
(e) Exhaust emissions containing contaminants such as nitrates and carbon-dioxide CO2 from automobiles including vehicles and machines and possible burning of wastes at the site.

6.7.1 Mitigation

Contractors' contracts shall contain clauses on ESMMP prior to starting construction. Specific training should be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Construction vehicles' drivers will be under strict supervision and instructions to minimize unnecessary trips and minimize idling of engines. Dust emissions will be controlled by

the following measures: Covering all trucks hauling soil, sand and other loose materials and/or requiring all trucks to maintain at least two feet of freeboard;

1. Watering all dust-active construction areas to reduce dust emissions; and
2. Paving or applying water or applying non-toxic soil stabilizers when necessary on all unpavedaccess roads and parking areas.

In order to reduce exhaust emissions, the following measures shall be implemented:

(a) Vehicle idling time will be minimized;
(b) Equipment will be properly tuned and maintained to good working conditions; and
(c) Proper planning of transportation of materials will be done to ensure that vehicle fills areincreased in order to reduce the number of trips done or the number of vehicles on the road.

The following are the suggested measures to be observed during the construction of the proposedproject so as to manage the effects of pollution:

(a) Carefully handle chemicals and other potential pollutants. This should be achieved through prior training and education of the workers on use and safe disposal of these materials.
(b) Sawdust to be spread over spilt liquid pollutants and later be burned at a designated site away from any flammable materials at the construction site.
(c) Have a fully equipped First Aid kit on the site at all times and ensure that trained First Aid personnel are available to handle any incidents due to pollution at site.
(d) The contractor should provide PPE to all construction workers. PPE include masks, goggles, scarfs, footwear especially boots and overalls among other protective clothing as spelt out undersection 101 (1) of OSHA, 2007.
(e) Regular dust control especially by spraying water during dry spells.
(f) Operation of shorter shift period for workers in highly polluted working areas.
(g) Ensure presence of sanitary and waste disposal facilities at the construction site and their high standards of cleanliness.
(h) Any deliberate and purposeful burning must be controlled and supervised.
(i) Where possible material considered as waste may be reused or recycled or be given to who may consider them useful for others uses.

During the transition from the construction phase to the operation phase, the following will be done:

(a) Removal and appropriate disposal of all wastes from the site;
(b) Extension of sanitary and waste collection facilities at the site;
(c) Rehabilitation of any areas adversely affected by the construction through spillages of pollutants: liquids, chemicals, cement and paint among others at the site and any other

areas disturbed because of the construction outside the site.

B. Potential adverse impacts cutting across the construction and operation phases

The impacts as discussed below will affect the proposed project during the construction and operationphases

6.8 Fire risk assessment

6.8.1 Mitigation

The following measures are important in mitigation of fires:

1. Places with flammable materials will be declared "NO SMOKING ZONES" and clear notices of the same be displayed.
2. Low voltage smoke detectors will be installed in the proposed apartment
3. Installation of fire extinguishers, fire hose reels and fire hydrants at strategic locations.
4. An inventory should be made detailing all fire protection measures.
5. The "FIRE EXIT" points from the buildings should clearly be seen.
6. Fire assembly points will be established and marked at specific points outside the plant.
7. Emergency evacuation plans will be documented and staff trained.
8. Subject to availability of resources fire alarms incorporating smoke sensors should be installed.
9. Enough parking spaces will be provided for emergency vehicles
10. There is enough water storage
11. There is back up diesel power generator to pump water in case of power outages
12. Annual Environmental audit, Annual Occupational health and risks assessment will be done.

6.9 Degradation of air quality Assessment

a. Air quality may be affected moving machinery an excavation
b. Moving materials delivery trucks my degrade the air quality.

6.9.1 Mitigation

1. Air quality assessment may be conducted.
2. Informatory sign shall be provided to encourage vehicle owners to maintain their vehicles;
3. Stand-by generators and other machines will regularly be serviced to ensure that they are ingood conditions and that they do not produce harmful exhaust emissions;

6.10 Other solid wastes other than construction wastes Assessment

There will be construction waste generation

6.10.1 Mitigation

The proponent is to be responsible for efficient management of solid waste generated by the project during its operation. In this regard, the proponent is to:

1. Provide waste handling facilities such as waste bins
2. Installation of double bins for separate collection of recyclables and non-recyclable wastes;
3. Ensure the collection and disposal of the wastes is done regularly and appropriately by a NEMA licensed waste handler.
4. Dumping of waste will be done in government gazetted sites

6.11 Use of water Assessment

During the construction phase, water will be used. Water will be mostly used by the workers in cleaning, in the concrete mixing for construction works and for wetting surfaces or cleaning completed structures. During operation, both workers and activities at the site will create additional demand for water.

6.11.1 Mitigation

Besides considering the Water Act, 2002 and EMCA, 387 which governs water abstraction and use and require permits for abstraction of large volumes of water for commercial use, the following opportunities should be adopted for management of water use:

1. Conduct regular maintenance of pipes and taps to fix leakages.
2. Ensure that installation of water supply system follows county government requirements.
3. Every supply pipe will be provided with an approved stop valve.
4. Maximize on other sources of water for some uses such as harvested rainwater.
5. Water tanks will be installed to be able to cope with potential stresses in supply.
6. Fix and use self-closing taps with shorter hand-wash cycle.
7. A water meter shall be installed for monitoring water use at the site.

6.12 Use of energy (electricity and fuel) Assessment

During the construction period, electricity may be required. Fuel will be required to run generators and construction vehicles. On completion, the project shall consume large amounts of electricity for running pumps and equipment.

6.12.1 Mitigation

Possible options for minimization of energy include:

1. Use of energy saving devices in the construction site.
2. Light sensor switches are to be provided to ensure outdoor lights are not used in daytime.
3. All energy using equipment used should be switched off when not in use.
4. Consider installing alternative energy sources such as solar panels not only for power back-upbut also to reduce dependency on electricity.

6.13 Sewerage and wastewater Assessment

The wastewater could arise from water used in cleaning the surfaces.The plant will be connected to the Nairobi sewer line.

6.13.1 Mitigation

(a) Sanitary facilities will be constructed and connected to the sewer.

(b) The diameter of the wastewater and sewage pipes will be made large enough and will be regularly maintained.

(c) Inspection of the sewerage and wastewater drainage systems from the premises will be carried out regularly to detect breakages and make repairs in order to minimize risks of flushing.

6.14 Increased traffic flow Assessment

During the construction, there will be an influx of traffic to and from the proposed construction site. There will be increased movement for both vehicles and people on the road. Vehicles include those to be used in facilitating the construction work for example transportation of construction materials and/or construction workers or supervisors to the site. People coming to the site will be those seeking employment opportunities, workers, managers, environmental inspectors and suppliers of foodstuffs to the construction workers.

6.14.1 Mitigation

1. Adequate space to be created at the entry and/or exit to the site and at the parking in order togive drivers enough room to maneuver into and out of the construction site.
2. Road signage to be provided to alert road users of the presence of the construction.
3. Proper planning of transportation of materials to ensure that vehicle fills are increased in orderto reduce the number of trips done or the number of vehicles on the road.
4. The proponent has applied for review of traffic flow and construction acceleration lanes from Kenya urban roads authority (KURA) , the approval of use of road has been approved.

Impacts during the decommissioning phase

Demolition is the most critical part of decommissioning. If the project is demolished the likely impacts will include: dust, noise and vibrations, solid wastes and impacts associated with occupational health and safety among others.

6.15 Noise and vibrations

The demolition works may lead to significant deterioration of the environment within the project site and the surrounding areas through noise and vibrations. Noise is a health hazard while vibrations have the effect of lowering the strength of adjacent buildings by creating cracks in the walls. Dust and exhaust emissions

Large quantities of dust will be generated during demolition works. Exhaust emissions will result from the machinery and equipment used in demolition. Dust and exhaust emissions are linked with health problems ranging from respiratory disorders to complex diseases of the respiratory system.

6.15 Solid wastes

Demolition of the project buildings and related infrastructure will result in large quantities of solid wastes. The wastes will contain the materials used in construction including concrete, metals, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since it is composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as compounds of chlorides and sodium, sulphates and ammonia which may be released as a result of leaching of demolition waste are known to lead to degradation of ground water quality.

6.15.1 Mitigation to impacts during the decommissioning phase

a) The proponent should prepare and submit to NEMA a decommissioning report three months before decommissioning takes place.
b) The use of the site or the buildings may be changed to other appropriate uses after renovation, rehabilitation and some structural changes have taken place.
c) The decommissioning and alternative land-use options will be facilitated by appropriate professional personnel incorporating environmental experts; planners; public works officers and public health officers among others.
d) Mitigation for decommissioning phase impacts will follow general guidelines discussed in this report and in the decommissioning report.

6.16 Safety at the site

The proponent will contract approved and licensed specialists to be in charge of specialized operations at the construction site. These include the contractors for the construction, wiring and installations among other specialized activities. These specialists shall put the following in place in order to ensure safety at the construction site:

(a) Fence the construction site using iron sheets supported on wooden posts.

(b) Supervise all specialty works at the site.
(c) Adopt proper working procedures when handling tasks and when working with machines and equipment.
(d) Keep all passages clear at all times.
(e) All workers must wear appropriate PPE.
(f) Put in place an appropriate emergency response plan including having emergency telephone numbers properly displayed at places where everybody at the site can see them.
(g) Support all structures under construction.
(h) Remove all soil, boulders and other heavy materials from the edges of excavations.
(i) Remove and dispose all wastes in designated areas whenever they are produced.

6.17 Impacts related to occupational health and safety Assessment

There are three main types of occupational health and safety hazards. These are physical, chemical and biological. Potential physical hazards at the proposed development during the construction and operational phases will ordinarily include noise, accidents and accidental occurrences. Chemical hazards will involve exposure to harmful gases and chemicals either by inhalation, ingestion or by skin contact especially of volatile chemicals that penetrate the body. Biological hazards involve exposure to pathogenic organisms that may cause diseases. Specific areas of concern include:

(a) Poor sanitation and presence of potential environmental pollutants at the site including waste water, decomposing solid wastes, dust and exhaust emissions and used chemicals and equipmentwhich could result into waterborne diseases such as typhoid.
(b) Fire hazards
(c) Noise and vibrations
(d) Congestion
(e) Accidents including cuts, pricks and bruises; electrocution from naked electrical cables; fallingin uncovered manholes and trenches, from raised places and on slippery or poorly constructed floors and staircases and suffocation from gas accumulation or lack of oxygen in confined spaces. Accidents could result from lack of supervision and safety and job training, improper handling of machinery and hand tools and inappropriate carrying out of tasks.

6.17.1 Mitigation

Mitigation options to most of the occupational health and safety impacts: noise and vibrations; fires anddust and exhaust emissions have been discussed. Additional mitigation measures to other impacts are:

1. Provide appropriate PPE which must be worn in all situations where the body and skin are potentially exposed to hazards such as chemicals, harmful dusts, highly infectious wastes, sharp objects, burns and extreme temperature or are working in areas that present threatening experiences.
2. Provide equipped first aid kits and other first aid facilities and services.
3. Ensure that trained first aid personnel are available on site at all times to handle emergencies.
4. Ensure adequate water supply to ensure high standards of sanitation that keeps to the minimum chances of disease outbreaks.
5. Conservancy tanks will be done.
6. All sanitary facilities will always be kept clean.
7. Frequently train personnel in order to make them have a basic understanding of the tasks they handle, the hazards involved and how to manage them.
8. Ensure high standards of construction as recommended in the approved structural and Provide hazard notifications, signage and warnings to warn visitors and staff of potential dangers that may exist in different areas of the facility, or warn the persons on potential consequences of their actions should be put in place.
9. Fence the site to protect the site, provide privacy to the site, reduce cases of trespass and theft, also control entry by straying animals and therefore avoid conflicts between workers at the site and the surrounding community.
10. Ensure employee welfare including provision of free or subsidized medical attendance if injuredon work and making provisions for leaves and offs.
11. Opening windows and using exhaust fans at strategic points to allow good air circulation into and out of the offices and working and learning areas.
12. Advising workers and visitors to take precautions not to cause any effect on their own health orto the health of other persons.

Potential positive impacts

6.18 Capital into the economy

The proposed project capital cost will be used to

1. Buy construction materials,
2. Pay wages to the skilled and unskilled workers,
3. pay contractors,
4. architects,
5. structural engineers,
6. advocates

7. environmentalists and other service providers

6.19 Creation of employment opportunities

The project will create employment opportunities directly and indirectly. These include professional services of project managers, finance experts, lawyers, physical/town planners, environmental experts, land surveyors, architects, engineers and skilled and unskilled labour. Indirect employment will be created where suppliers of foodstuffs and other goods and products will gain income by supplying their commodities. With creation of employment opportunities, income earnings will increase thus improvingthe living standards of the people.

6.20 Revenue to the government

The local community will benefit from supply of materials. The county and national will earn taxes.

6.21 Demand for raw materials

Most of the materials for civil works will procurement of materials. This includes building stones, bricks, sand, steel, tiles and cement among others. The supply of these materials translates into boostingboth the local and national economy.

6.22 Optimal use of land

The proponent will utilize the vacant land.

6.23 Improved aesthetics

Spill-off infrastructure development will entail road expansions, drainage improvements, as well as an improvement to the general aesthetic of the area. The proposed development adds to improved aesthetics of the local area. This will attract new residents and new businesses into the area.

CHAPTER SEVEN
PROJECT ALTERNATIVES

7.1 Introduction

Alternatives in project EIAs require consideration of projects of a similar technical character or functionality that will meet the specified objective. Alternatives could be different locations, sizes, technologies, design, time frames, or operational procedures.

The team analyzed the project alternatives in terms of project site, technology and waste management options. The findings and recommendations are based on;

1. Relocation option,
2. Alternative land use
3. No project alternative,
4. Proposed project alternative
5. alternative of construction materials and technologies used and
6. solid waste management alternatives.

7.1.1 Benefits of evaluating project alternatives

The role of alternatives is to find the most effective way of meeting the need and purpose of the proposal, either through enhancing the environmental benefits of the proposed activity, and or through reducing or avoiding potentially significant negative impacts

7.2 Relocation option to a different site option.

The proponent has no other appropriate alternative land that can accommodate multidwelling units. Finding a substitute and appropriate land to accommodate the size of the proposed development is not possible. The proponent has already incurred the cost of land purchase, project designs and other government permits. In consideration to all aspects, alternative location is not a viable option.

7.3 Alternative land use

The alternative land use includes factory, warehouse, offices and farming. The project site is not an industrial zones and factories and warehouses are not viable. In addition, the size of the plot of 0.2135ha cannot accommodate commercial farming. The project proponent conducted a feasibility study on residential development and found it most viable investment

7.4 No project alternative.

The No Project option in respect to the proposed project implies non implementation of the project proposal hence the status quo remains. The proposed construction site will remain unchanged. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-

interference with the existing conditions. The option has greatest adverse impact on socioeconomic conditions of the community.

No Project Option is the least preferred from the socio-economic and partly environmental perspective because the economic status of government, local population, land and the proponent would remain unchanged.

1. No modern housing creation for the Nairobi growing population.
2. No creation of employment to the youth and professionals
3. No rental revenue to the proponent
4. No income taxes to the government and levies

7.5 The proposed development alternative.

This alternative, the EIA license will be issued to the proponent. The EIA study findings on land availability in the Thome area, land size, stakeholder engagement and suitability of housing in the Thome, the proposed development is most suitable.

1. The project area is not within any critical ecological ecosystem
2. The land is not under any dispute
3. The area is characterized by apartment construction.
4. The ESIA study report has documented elaborate ESMMP and possible mitigation measures to that can arise from project activities in all phase of the project cycle and the proposed project is ecologically and socially ideal for the project and the resulting impacts will adequately be mitigated. After NEMA approval the residents get employment and modern housing, the proponent shall earn rental income and the government shall earn rent income taxes and levies.

7.6 Analysis of Alternative Construction Materials and Technology.

The proponent should consider installing solar panels so that solar energy is also used as an alternative. The proponent shall ensure that construction materials used such as cement (KS EAS 18-1), steel for the reinforcement of concrete (KS EAS 412-1, 2&3), Structural steel for construction (KS 572), Natural Aggregates for Concrete (KS 95), Natural Building Stones (KS 965) have diamond mark of quality. Proponent shall ensure that building materials used bear the diamond mark of quality showing that they have been manufactured in a controlled environment where the finished products would be subjected to periodic testing at KEBS Materials Laboratories.

Moreover, the proponent shall ensure that quarry sand, building stones shall be acquired from NEMA licensed sites. NEMA licensed sites conduct annual environmental audits as per EMCA 387 and comply with sustainable mining.

The project architectural and structural designs are unique with ambience, natural lighting to save power. Additionally, The proponent will harvest rain water to conserve water and will install energy saving bulbs to conserve power.

7.7 Solid waste management alternatives.

The proposed project will generate considerable amounts of solid wastes both during construction and operational phases. An integrated solid waste management system is recommended. The proponent will give priority to reduction of the materials at source. This option will demand a solid waste management awareness programme to be effected by the management and the entire workforce.

7.8 Construction waste alternative management

Proponent will reduce the source intake of building materials and use Just in time (JIT) inventory system to minimise materials piling up at construction site. Recycling will be given priority to dumping of construction materials such as steel, paint drums and electrical wires . Proponent will sign off a contract with a licensed solid waste handler to ensure timely waste disposal of construction of materials.

7.9 Solid waste alternative at occupation phase of the project

Recycling-The proponent shall ensure Solid waste segregation of plastic, organic and polythene to enable easier recycling alternative.

7.9 Decommissioning waste alternative management

Recycling of steel, doors, timber, will be the best alternative to dumping in landfill

CHAPTER EIGHT

ENVIRONMENTAL SOCIAL MANAGEMENT PLAN (ESMP)

8.0 Environmental management

8.1 Introduction.

ESMMP is an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced. During construction, the main contractor has the responsibility for ensuring systems are in place so that relevant employees, contractors and sub- contractors are aware of the environmental and social requirements for construction, including the ESMMP.

8.2 Environmental monitoring and audits

The key objectives of an environmental audit therefore are to: determine how well the environmental management systems and equipment are performing. Verify compliance with the relevant national, local or other laws and regulations. Minimize human exposure to risks from environmental, health and safety problems. EMCA 387 obligates the proponent to conduct annul audit every 12 months.

8.2 Corrective action

There are several mechanisms for implementing corrective action, both during the construction and operational phases. The correction cans be done after an environmental audit, Grievance by Affectedparties and compliance of new policy with the regulators.

Table 8. 1 ESMP during the construction phase

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh.)
1. Property dispute risks				
Proposed project implementation timelag.	1. Property leases transfer and registration into propo 2. Change of land use approval 3. Stakeholder engagement in accordance with EMC/	Proponent	During the property purchase period and EIA study	This part is completed
2. Minimize extraction site impacts and ensure efficient use of raw materials during construction				
High Demand of Raw material	Building materials acquired from NEMA licensed sites with efficient conservation practices.	Project Manager & Contractor	Throughout constructionperiod	6,000
	Ensure that efficient Just in Time (JIT) system is used in ordering of building materials.	Project Manager & Contractor	Throughout constructionperiod	10,000
	Ensure that damage or loss of materials at the construction site is kept minimal through proper storage.	Project Manager & Contractor	Throughout constructionperiod	0
	Use at least 5%-10% recycled, refurbished or salvaged materials to reduce the use of raw materials.	Project Manager & Contractor	Throughout constructionperiod	0
3. Reduce storm-water, runoff and soil erosion				

Increased storm water, run off and soil erosion	Surface runoff and roof water shall be harvested and stored in underground reservoir for reuse.	Project Manager	Throughout construction period	18,000
		The Civil Engineer, Mechanical Engineer and Project Manager	Throughout construction period	
	A storm water management plan done.			
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	Project Manager & Contractor	Throughout construction period	3,200
	Solid waste discharged by a NEMA licensed wastehandler,	Project Manager & Contractor and the Quantity Surveyor	One-off	0
Expected Negative Impacts	**Recommended Mitigation Measures**	**Responsible Party**	**Time Frame**	**Cost (Ksh.)**

	Construction materials residuals will be reused in other construction and installation.	Project Manager & Contractor	One-off	15,000
	Ensure that damaged or wasted construction materialsincluding cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects	Project Manager & Contractor	One-off	25,000
	Donate recyclable/reusable or residual materials to local community groups, institutions.	Project Manager & Contractor	One-off	0
	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	0
	Provide facilities for proper handling and storage of construction materials to reduce the amount of wastecaused by damage or exposure to the elements	Project Manager & Contractor	One-off	4,000
	Use building materials that have minimal or no packaging to avoid the generation of excessive packaging waste	Project Manager & Contractor	Throughout construction period	0
5. Reduce dust emissions				

Dust emission	Ensure strict enforcement of on-site speed limit regulations	Project Manager & Contractor	Throughout construction period	50,000 per month
	Planned excavation extreme dry weather conditions	Project Manager & Contractor	Throughout construction period	
	Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles and equipment.	Project Manager & Contractor	Throughout construction period	

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh.)
	Personal Protective equipment to be worn	Project Manager	Throughout construction period	
6. Minimization of exhaust emissions				
Exhaust emission	Vehicle idling time shall be minimized	Project Manager & Contractor	Throughout construction period	0
	Modern low emission construction machineries and well maintained machines to be used.	Project Manager & Contractor	Throughout construction period	
	Sensitise truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading points and parking areas, and to switch off or keep vehicle engines at these points	Project Manager & Contractor	Throughout construction period	
7. 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.	Project Manager & Contractor	Throughout construction period	0
	Sensitise construction drivers to avoid gunning of vehicle engines.	Project Manager & Contractor	Throughout construction period	0
	Ensure that construction machinery are kept in good condition to reduce noise generation	Project Manager & Contractor	Throughout construction period	20,000
	Ensure that all generators and heavy duty equipment are insulated or placed in enclosures to minimize ambient noise levels.	Project Manager & Contractor	Throughout construction period	3,000

Power conservation

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh.)
Increased energy consumption	Ensure electrical equipment, appliances and lights are switched off when not being used	Project Manager & Contractor	Throughout construction period	0
	Install energy saving fluorescent tubes at all lighting points instead of bulbs which consume higher electric energy	Resident Project Manager & Contractor	Throughout construction period	11,000
8. Minimize water consumption and ensure more efficient and safe water use				
High Water Demand	Promptly detect and repair of water pipe and tank leaks	Proponent	Continuous	11,000/month
	Ensure taps are not running when not in use	Proponent	Continuous	20,000/month
	Install a discharge meter at water outlets to determine and monitor total water usage	Proponent	In place	

LIKELY NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBE PARTY	TIME FRAME	COST (KSHS)
9. Minimize occupational health and safety risks				
Approval of building architectural and structural plans	Proponent will Ensure that all building plans are approved by County Local authority and NCA	Developer	One-off	7,000
Registration of the apartment	Registration of the premises to DOSHS under Occupational Safety and Health Act, 2007(OSHA 2007).	Developer	One-off	15,000
General register	An employer shall cause all workplace injuries to be entered in the general register specified in section 122. Occupational Safety and Health Act, 2007.	Project Manager &Contractor	One-off	0
Posting of abstract of Act,rules and notices	Premises are required that there shall be displayed in the factory any other notices or poster relating to the health, safety or welfare of the workers in the factory. stipulated insection 121 of the OSHA, 2007.	Project Manager &Contractor	One-off	2,500
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	5,000/ month
	Enforcing adherence to safety procedures andpreparing contingency plan for accident response in addition safety education and training shall beemphasized.	The Contractor, Project Manager&Site Safety	Continuous	11,600

Security	Ensure the general safety and security at all times by providing day and night security guards and adequatelighting within and around the premises.	Proponent	Continuous	16,000/Month
Personal Protective Equipment (PPE)	Suitable overalls, safety footwear, dust masks, gas masks, respirators, gloves, ear protection equipment etc.should be made available and construction personnel must be trained to use the equipment	Proponent & Contractor	Once off	10,000
Health and safetyimpacts	Implement all necessary measures to ensure health and safety of workers and the general public during operation of the commercial property as stipulated in theOccupational Safety and Health Act, 2007	Proponent	Continuous	-
First Aid	Well stocked first aid boxes which is easily available and accessible should be provided within the premises Provision must be made for persons to be trained in firstaid, with a certificate issued by a recognized body	Proponent		
Fire protection	a. Alternative means of lighting using secondarymeans b. Heat and smoke detectors to be installed. c. Break-glass fire alarm system to be installed. d. Fire Hydrants to be provided e. Fire notice and fire exit signs at each strategicposition to be provided.	proponent	750,000	

Table 8. 2 Environmental Management Plan ESMP during the Operation Phase

Expected Negative impact	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh.)
1. Minimization of solid waste generation and ensuring more efficient solid waste management				
Solid wastegeneration	Provide solid waste handling facilities such as waste bins	Proponent	One-off	11,000
	Ensure that solid waste generated at the building is regularly disposed of appropriately at authorized dumpingsites	Proponent	Continuous	19,000/PM
	Ensure waste used efficiently through recycling, reuse andproper disposal procedures.	Proponent	Continuous	
	Donate redundant but serviceable equipment to charitiesand institutions	Proponent	Continuous	0
2 Minimise risks of sewage release into environment				
Sewage disposal	Regular checks of waste pipes connected to the sewer.Sewer.	Proponent & Contractor	Continuous	-
	Conduct regular inspections for sewage pipe blockages or damages and fix appropriately	Proponent & Contractor	Continuous	5,000 per inspection

Expected Negativeimpact	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh.)
	Ensure regular monitoring of the sewage discharged from the project to ensure that the stipulated sewage/effluent discharge rules and standards are not violated	Proponent	Continuous	15,000
3 Minimize energy consumption				
Energy Resource Utilisation	Switch off electrical equipment, appliances and lights when not being used	Proponent	Continuous	_
	Install occupation sensing lighting at various locationssuch as storage areas which are not in use all the time	Proponent	One-off	10-40 % higherthan ordinary lighting
	Install energy saving security lights	Proponent	One-off	10-40 % higherthan ordinary lighting
	Monitor energy use during the operation of the projectand set targets for efficient energy use	Proponent	Continuous	8,000/month
	Sensitize workers to use energy efficiently	Proponent	Continuous	800/month
4. Minimize water consumption and ensure more efficient and safe water use				
Water consumption	Promptly detect and repair water pipe and tank leaks	Proponent	Continuous	3,000/month
	Ensure water Conservation policies	Proponent	Continuous	500/month

Expected Negativeimpact	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh.)
	Ensure taps are not running when not in use	Proponent	Continuous	-
	Install water conserving taps that turn-off automatically when water is not being used	Proponent	One-off	10-40 % higher than ordinary taps
	Install a discharge meter at water outlets to determine and monitor total water usage	Proponent	One-off	1,500
5. Minimization of health and safety impacts				
Implement all necessary measures to ensure health and safety of the workers and the general public during operation of the commercial buildings project as stipulated in the Occupational Safety and Health Act, 2007. Conduct annual fire safety audits and occupational safety audits.		Proponent	Continuous	150,000/year
6. Ensure the general safety and security of the premises and surrounding areas				
Employ security guards, install CCTV cameras and boundary walls for security.		Proponent	Continuous	75,000/month

Table 8. 3 Environmental Management Plan ESMP during the Decommissioning Phase

Expected Negative Impacts	Recommended Mitigation Measures	Responsible party	Time frame	cost
1. Demolition waste -Scraps, structures waste and other debris on site	Use of an integrated solid waste management system:	contractor	contractor	150,000
	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. Wastes generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures. Disposal locations will be selected by the contractor based must be a licensed site by the national government.	contractor and proponent		
	All buildings, machinery, equipment, structures and tools that will not be used for other purposes should be removed and recycled/ reused say in other projects.		contractor	5,000
	Where recycling/reuse of the machinery, equipment, implements, structures, tools and other waste is not possible, the materials should be taken to approved dumpsites.		contractor	12,000
2. Rehabilitation of project site	Re-vegetation programme to restore the site to its original status.	Contractor/proponent		25,000
	Consider use of indigenous plant species in re-vegetation			
3. soil erosion, surface water run-off	Conduct appropriate surface water runoff controls will be taken to prevent surface erosion;			14,000
	Fencing and signs restricting access will be posted to minimize disturbance to newly-vegetated areas;			
4. Social impacts				
economic Impcats	Adapt a project – completion policy: identifying key issues to be considered earlier before decommissioning.	Contractor/proponent		150,000
loss of income		Contractor/proponent		250,000

8.3 Proposed project decommissioning

Decommissioning is the last phase in the lifetime of such facilities, following their design, construction, operation and permanent shutdown. It comprises different administrative and technical activities whose purpose is to remove or to minimize the residual hazards in the facility after it is shut down.

8.4 Purpose and objectives of decommissioning

The generally accepted purpose of decommissioning is to allow for release of valuable assets such as buildings and sites for alternative use, recycling and reuse of materials and the restoration of environmental amenity. In all cases, the basic objective is to achieve an end-point that is sensible in technical, social and financial terms, that properly protects workers, the public and the environment and, in summary, complies with the basic principles of sustainable development.

8.5 Measures to be taken during decommissioning

1. Upon decommissioning of the proposed project, rehabilitation of the project site and restoration of the site.
2. Businesses associated with the development should be notified of intention of decommissioning in good time, so as to adjust;
3. Redeployment of the affected workers.

8.6 Solid Waste Generation of solid waste generation

1. All solid waste to be collected at a central location, and be stored temporarily until removal by a licensed solid waste handler;
2. Contractor should adopt the method of planned and selective demolition as far as practicable to enable the removal of wastes of the same category one at a time thus facilitating recycling of wastes for beneficial reuse.
3. No dumping within the surrounding area is to be permitted. Where potentially hazardous substances are being disposed of, a chain of custody document should be kept with the environmental register as proof of final disposal. General waste is to be collected eitherby the County Government or via a licensed waste disposal contractor. The frequency of collections should be such that waste containment receptacles do not overflow;
4. Waste generated at the site should be categorized by the contractor and disposed of in a suitable manner into different waste streams (including general and hazardous waste). Wherever possible recycling should be carried out;

5. Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly at registered waste disposal sites;
6. All rubble must be removed from the site to an approved disposal site as approved by the Engineer. Burying rubble on the site is prohibited;
7. Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders wastes generatedon the premises is placed, dumped or deposited on adjacent/surrounding properties duringor after the decommissioning period of the project. These have to be disposed of at dumping site as approved by the County government.

8.7 Excessive Noise and Vibration pollution.

The decommissioning related activities such as demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas. This will be as a result of the noise and vibration that will be experienced as a result of demolishing ofthe proposed project buildings and related components.

Mitigation measures

1. Construction machinery shall be kept in good condition e.g. greasing to reduce noise generation from friction of movable parts;
2. Generators and heavy duty equipment be insulated or placed in enclosures to minimizenoise levels during demolition works;
3. Obtain special permit from NEMA to undertake demolitions works;
4. Ensure that noise & excessive vibration from construction activities are within permissible levels as per the provision of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. This includes among others adhering to permissible noise and vibration level.

8.8 Occupational /Public Health and Safety Hazards

Demolition works will inevitably expose workers and the public to occupational health and public safety risks. In particular, working with heavy equipment, handling and use of tools provoke certain risks. The construction workers are also likely to be exposed to risk of accidents and injuries resulting from accidental falls, falling objects, and injuries from hand tools and otherequipment.

Proposed mitigation measures

1. Decommissioning workers be issued with appropriate PPEs and the decommissioning contractor to enforce their use;
2. Restrict onlookers/scavengers from site;
3. Develop safe work procedures for demolition works.

CHAPTER NINE
CONCLUSIONS AND RECOMMENDATIONS

9.0 Introduction

The proposed project will provide modern Accommodation to the fast growing Thome population. The interested/affected parties have participated in the environmental/social surveys about the possible social and environmental that is likely to arise from the project activities. The proposed project has been designed and will be operated in accordance with the laws applicable; The environmental and social risks from the project implementation are unlikely to happen. Appropriate mitigation measures have been taken into place in the project design and an elaborate ESMMP has been documented.

9.1 Recommendations

The proponent, contractor and subcontractors are advised to implement Environmental Management and Monitoring Plan (EMMP) laws, best practices on environment, health and safety must also be followed in order avoid all possible environmental and social risks. Recommendations for the prevention and mitigation of adverse impacts are as follows: -

1. **Change of user**- has already been applied to the Nairobi county government.
2. **Land ownership**- attached
3. **Stakeholders engagement**- Adequate stakeholder's engagement was carried out, questionnaires attached, attendance register, minutes attached as appendix
4. **Standards-**Proposed project architectural and structural designs done to the Kenya standard and the world practice
5. Kenya Urban roads authority (KURA) has reviewed the proposed construction road access , expected traffic flow and approved the use of the road and construction of acceleration and deceleration lanes.
6. Borehole will be drilled for surplus water in situations of water shortage-Detailed project activities for the borehole drilling have been documented in the study report, hydrogeological report, and Water resource authority (WRA) permit applied.
7. Worker's occupational health and safety standards are maintained mainly during construction phase in accordance with OSHA 2007.
8. The proponent should ensure that the proposed ESMMP is fully implemented in all phases ofthe

project life cycle.

9. Construction activities must be undertaken only during the day i.e. between 0800 hours to 1700 hours. This will minimize disturbance to the general public within the proximity of the site/project especially the immediate neighbors.
10. Rainwater harvesting systems should be provided as well as standard storage systems to every unit to enhance collection of the run-off generated from the roof catchments.
11. All solid waste materials and debris resulting from construction activities must be disposed off at approved dumpsites. There should be proper waste segregation to allow for recycling. Some excavation such as stone materials should be used for backfilling.
12. Environmental audits will be done every year after the project operation.

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APPENDIX

Appendix I: Land ownership document

Appendix II: change of user Approval

Appendix III: Experts Practising License

Appendix IV: PIN Certificate

Appendix V: Filled Questionnaires from respondents

Appendix VI: Architectural and structural designs drawings

Appendix VI I: Copy of Certificate of Incorporation

Appendix VIII: Copy of meeting minutes, attendance list

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