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ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY REPORT FOR THE PROPOSED RESIDENTIAL APARTMENTS ON L.R.NO.12715/535 & 12715/536 (AMALGAMATED) OFF SYOKIMAU AIRPORT ROAD, SYOKIMAU AREA, MAVOKO SUB COUNTY, MACHAKOS COUNTY.

COORDINATES 1°21'27.59"S, 36°55'18.07"E

This Environmental Impact Assessment (EIA) Project Report is submitted to the National Environmental Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination (Amendment) Act, 2015 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

PROJECT PROPONENT
ROYAL COURTYARD & MOUNTAIN VIEW VILLAS LTD
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SEPTEMBER 2023

DOCUMENT AUTHENTICATION

This Environmental Impact Assessment project report has been prepared by iPlan Consult (Int'l) Limited (registered and licensed EIA /EA firm of Experts No. 7597) in accordance with the Environmental Management and Coordination (Amendment) Act of 2005 and the Environmental (Impact Assessment) and Audit regulations 2003 which requires that every development project must have an EIA report prepared for submission to the National Environmental Management Authority (NEMA). We the undersigned, certify that the particulars in this report are correct and righteous to the best of our knowledge.

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ACRONYMS

EA	Environmental Audit
EIA	Environmental Impact Assessment
EMCA	Environmental Management Coordination Act
EMP	Environmental Management Plan
EMS	Environmental Management System
HFCs	Hydrofluorocarbons
ICT	Information Communication Technology
KPLC	Kenya Power and Lighting Company
KRA	Kenya Revenue Authority
MDGs	Millennium Development Goals
NEAP	National Environment Action Plan
NEC	National Environment Council
NEMA	National Environment Management Authority
UNFCCC	United Nations Framework Convention on Climate Change
WRMA	Water Resources Management Authority
WSB	Water Services Board
WSRB	Water Services Regulatory Board

EXECUTIVE SUMMARY

Environmental impacts assessment (EIA) is a tool that 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(EMCA), a framework law on environmental management and conservation in Kenya was amended in 2015 to align with 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, 2019, 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;

The proponent has Proposed a residential development (apartments) of five hundred and four units (504) will be located on land reference No.12715/535 & 12715/536 (Amalgamated) Off Syokimau Airport Road, Syokimau Area, Mavoko Sub County, Machakos County. The proposed development will have a total of **504 Units** within **Twenty-one blocks of a ground floor and five Levels**. Each of the Ten blocks will comprise 24 units of two bedrooms and each of the eleven blocks will comprise 24 units of three bedrooms, 546 parkings, clubhouse and pool, Turf pitch, and other associated amenities.

The proponent contracted iPlan Consult (intl) LTD to carry out an Environmental and Impact Assessment (EIA) study report on the project area in accordance with the Environmental Impact Assessment and Audit Regulations, 2019, and submit a report to NEMA for approval. The Team examined the project brief from the proponent highlighting the need for inculcation of best environmental practices in the proposed mixed-use modern building. The objectives and scope of the study as well as the EIA approach and methodology employed were derived and incorporated in the eventual report.

The team formulated the baseline data on the Syokimau area where the proposed project will be implemented. The baseline findings comprehensively describe the physical location, the land environment in terms of the topography, geology, soils and the current land use, the water use, the air environment in terms of air quality, climate, existing infrastructure and service activities, the waste management and the demographics of the region.

The project description is elaborated through a detailed description of the project justification, project location, project scope, construction activities, project budget, project influence area, site description, land use, and ground coverage. The impacts of construction activities to be undertaken will include; site preparation, earthworks, transportation of building materials, storage of construction materials, construction of the foundations, construction of the main structures, installation of internal utility services, and external works.

The policy, legal, and institutional framework relevant to the project and consistent with the laws of Kenya were used. Public participation was carried out in order to find out the public views and opinions regarding the proposed project. The Consultant examined both negative and positive impacts associated with the proposed project on account of three phases, that is, during

construction, operational, and decommissioning. Necessary mitigation measures were recommended to control the negative impacts predicted in these phases.

A Project alternative analysis was done highlighting alternative facility use and alternative sites in the event that there are significant potential environmental impacts due to the implementation of the project. It also provides for alternatives to technology to improve on environmental performance of the project during the operation phase as well as waste management alternatives for better management of gaseous, liquid, biomedical, and solid waste.

The team formulated an environmental management plan outlining the anticipated environmental impacts, the proposed mitigation measures, the responsible parties to implement the measures, the period, and the cost of implementing the environmental recommendations.

After implementation of the recommended mitigation measures, the environmental consultant will continue to undertake annual environmental audits as required by Section 68 of EMCA and Section 31 of EIA/EA regulations. The environmental Audits will be undertaken at the end of each year to evaluate conformity to the EMP, identify gaps, and recommend corrective adjustments to the plan.

The team outlined the essence of the proposed development in the country, which includes a more productive society. It also enhances people's ability to reach their full potential, positively influencing their quality of life as envisaged in Kenya's development blueprint, Vision 2030 which states "Kenya aims to be a nation living in a clean, secure, and sustainable environment by 2030". The expert subsequently recommends the implementation of the project.

CHAPTER ONE: INTRODUCTION

1.1 Rationale

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. Kenya has enacted Environmental Management and Coordination Act (EMCA) CAP 387 which makes Environmental and social impact 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 Proposed project justification

The right to accessible and adequate housing is provided for under the bill of rights in the Kenyan constitution (Republic of Kenya 2010). Under the Vision 2030, the Kenyan government has committed to provide adequate, affordable and quality housing for all citizens, particularly the low-income groups (Government of Kenya 2007). Furthermore, the Kenyan government launched an ambitious goal of supporting the construction of at least 500,000 affordable houses by the year 2022. One of the key targets of sustainable development goal 11 is to ensure access to adequate, safe and affordable housing and basic services for all and upgrade slums by 2030. Kenya ratified the SDGs in 2015.

1.3 Objectives of the EIA Study.

The overall purpose of this report was to ensure that all the environmental concerns are integrated into the implementation of the project in order to contribute to the sustainable development of the general project area. This is to ensure compliance with Section 58 of the Environmental Management and Coordination Act (EMCA), which requires a proponent of any project under the second schedule of the Act to carry out an EIA project report for approval by NEMA and be issued with an EIA license. The project falls under the second schedule of EMCA 2019 as it is provided for in the general clauses 1a, b, and c. The clauses state that any project that is out of character with the surroundings, any construction of scale not keeping with its surroundings, and any project that brings about major changes to land use are to ensure compliance to EMCA through conducting an EIA for the project before it is carried out. The study is designed to comply with the Environment Impact Assessment and Audit Regulations of 2003, Revised 2019.

General Objectives of the Project

a) Integrate environmental factors into project planning and decision making so as to achieve ecologically sustainable development and modify and improve the project design.

b) Ensure efficient resource use
c) Enhance social aspects by conducting stakeholder engagement.
d) Identify key impacts and measures for mitigating them by formulating a comprehensive ESMMP and avoid serious and irreversible damage to the environment
e) Protect human health and safety.

1.4 Terms of Reference (TOR)

The TOR for the EIA study was approved by the authority under. 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 originating 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.

1.5 Scope of the study

The scope of Environmental Impact Assessment includes the following:

- Identification of likely adverse environmental and social impacts to the environmentarising from the proposed project activities.
- Mitigation measures to likely adverse environmental and social impacts of proposedproject activities.
- An Environmental Management and Monitoring Plan (EMP) for theproposed project.
- The baseline conditions of the proposed project area,
- Relevant legislative, policy and administrative frameworks,
- Seek the Views/opinions of the public through structured questionnaires.

1.6 Methodology

General steps followed during the study.

- Formulation of the Terms of Reference (submitted and approved) Reference number NEMA/TOR/5/2622
- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of the EMCA Cap 387
- Environmental scoping that provided the key environmental issues
- Desktop studies and public/stakeholders' interviews
- Physical inspection of the site and surrounding areas
- EIA Public participation. The EIA team used of questionnaires and photography
- Reporting.

CHAPTER TWO: BASELINE INFORMATION OF THE STUDY AREA

2.1 Physical Environment

Climatic Condition

The Syokimau area where the project lies just like many parts of Machakos County experiences abimodal rainfall pattern. The short rains fall between October and December while the long rainsfall between mid-March and May. Annual rainfall is influenced by altitude with a mean annual rainfall of 800 mm. The climate is humid highland subtropical in character with seasonal dry andwet periods. Temperatures vary with altitude rising from the lowest 10°C into the highest are 27°C. The warmest period occurs from January to March with coolest period falling between months of May to August.

The climate of Syokimau is semi-arid, being dry for most of the year. Rainfall is bi-modal [March- May and October- December] Mean annual rainfall is approximately 530mm.Temperatures are highest in the months of January to March; Annual mean daily minimum and maximum 13 to 26°C (TAMS, 1980). Potential evaporation is between 1,800 and 2,000mm per year and these losses are exacerbated by frequent high winds in the area. July is the coldest month of the year at an average of 19.5°C.

Topography

The site lies at an altitude of about 1500 meters above sea-level. It gradually slopes towards the northern part of the property where there is a stream. Physiographical, the area slopes from the Lukenya hills to the south-east into the Athi river to the north west. The slope is gentle and, in most cases, unnoticed. The water drains in the same way where it meets the main drainage from the Ngong hills to the northwest.

Geology and Soils

The geology and soils of an area have a great influence on the type of physical development and also determine the type of land use appropriate for the area. Geologically, the main rock outcropsin the study area include migmatites, trachytic tuff, basalts, upper athi series, granites, granitoid gneisses and paragneisses. These occur in fairly regular belts which are common in the vicinityof this area mainly undifferentiated banded pelitic gneisses and schists, and undifferentiated basements.

Hydrology

The hydrogeology of an area is normally intimately dependent upon the nature of the parent rock, structures; weathering process, recharge mechanism and the form and frequency of precipitation. The general area is drained by tributaries of the small rivers which flow to the north- western direction from Lukenya hills. Due to the semi-arid climatic conditions in the area, these Rivers are mainly seasonal therefore of little use for the intended purposes.

There is a seasonal stream that borders the northern part of the proposed site. Proper care will be taken into consideration to avoid dumping of any waste to the stream especially during construction and operation phases. A riparian reserve of 15 meters has been set out. A comprehensive landscaping exercise will be carried out to minimize run off during rainy seasons and adequate storm water drains designed and constructed

Wind Flows

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

Sunshine

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

2.2 Biological Environment

This section describes key biological elements, including the identification and distribution of dominant, rare and unique flora and faunal species within the region of concern (proposed project site and other potentially affected areas). The proponent has reserved ample space for treeplanting and landscaping to compensate for affected vegetation and further improve the environment.

Flora

Natural vegetation in most parts of Machakos has been cleared to pave way for the establishmentof both institutions, residential and commercial developments. The proposed project site is, however, among the few places that have no extensive natural vegetation cover. The proposed project site has no natural trees and grass as the main vegetative cover. The proponent is committed to abide by LEED certification requirements of maintaining a green environment is maintained. This shall be attained through a well-organized landscaping that is already there in the architectural designs of the project.

Fauna

Human activity has also impacted upon faunal species but some animals were observed during the site visits. These range from insects like butterflies, beetles, bees, ants and birds as well as big animals (wild and domesticated) such as cattle, Sheep and Goats etc. There is need to protect these faunal species to help maintain a balance within the ecological set- up.

2.3 Socio-Economic Environment

Land use

Urban land use refers to spatial distribution of social and economic activities. Accordingly, an up-to-date land use inventory is frequently required to facilitate urban planning and growth patterns as well as monitoring of urban expansion. The neighborhood of this site is characterized by mixed use, Commercial, institutions, religion set up, and residential land uses. Mixed use developments are also experienced along the main road leading to site.

Plate 1: Similar Developments within the area

Socio-economic Importance of the proposed project

The proposed project is in line with the governments' Big 4 Agenda on housing in that it intends train health care givers within the School of Nursing thus contributing immensely towards achieving the same. Besides this; the proponent will also contribute towards the economic growth of our nation through revenue collection. In particular, the proposed project will generate the following positive socio-economic impacts:

- Market for goods and services during construction (construction materials)
- Creation of direct employment during both construction and operation stages
- The proposed project will generate revenue to the County through payment of approval fees and other levies.

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

Transporters. Investors on lorry and trailer transport will benefit greatly from the project. This benefit will extend to vehicle dealers and manufacturers, lorry drivers and turn boys.

Cement Manufacturers. The local cement manufacturers and their employees andshareholders are direct beneficiaries of the development.

2.4 Security

Security in the area is provided by the nearby Police Station which is located approximately1 kilometer from the proposed site.

2.5 Infrastructure

Roads and accessibility

The property is accessed along the 18-meter road (Syokimau Airport Road) that feeds Mombasa Road in Mavoko Sub- County of Machakos County. The road is of Bitumen standard with the road already tarmacked.

Surface Drainage

The surface water/run-off will mainly be absorbed within the site i.e., open areas. However, increased surface run-off is anticipated from roof catchments of building structure; drive wayand parking, which are partially impervious. Therefore, as rain falls much water/run-off is anticipated due to slight decrease in recharge areas. In connection to this, the volume of water reaching the drain system will be large and as such it greatly influences the design of effective surface drainage system of the proposed project.

In line with the above, surface drainage systems will effectively be designed and installed to manage the storm water such as may be derived from the parking, driveways and roof of the building blocks. Open (concrete drainage-inverted concrete drains) channels will be used to drainthe excess surface water/storm into the drainage nearby.

Solid Waste Management

Increased solid waste generation (from the project) is anticipated mainly arising from the construction activities (wooden, debris, metals, glass, plastics, and sanitary litter etc.). All debris generated during project implementation process will be disposed suitably into the approved dumpsite or as directed by the Engineer, Ministry of Works. Handling of wastes during occupation phase shall be fundamentally considered and especially through inclusion of Waste Collection Centre (WCC) at the entrance to the site. This will enhance storage, collection, transportation and disposal of all solid waste of the entire project, on occupation.

Electricity

The site is not served by electricity from the National grid and there are electric lines along the road adjacent to the property. Upon completion of construction, the proponent will connect the proposed development to the national grid upon acquiring relevant permits.

Communication

The area is well covered by communication facilities such a Telkom, Safaricom, Airtel among others. All these will facilitate communication during the project cycle.

CHAPTER THREE: PROJECT DESCRIPTION

The proponent, Royal Courtyard and Mountain View Villas Ltd, is proposing to construct Residential Apartments.

3.1 Project Location and Size

The property lies within coordinates, **1°21'27.59"S, 36°55'18.07"E**. The proposed development will comprise of five hundred and four units (504) will be located on land reference No.12715/535 & 12715/536 (Amalgamated) Off Syokimau Airport Road, Syokimau Area, Mavoko Sub County, Machakos County. The area is well served with utilities such as electricity, water and access road as presented in figure below.

Plate 2: Project Location

3.2 Project Description

The proposed development will have a total of **504 Units** within **Twenty-one blocks of a ground floor and five Levels**. Each of the Ten blocks will comprise 24 units of two bedrooms and each of the eleven blocks will comprise 24 units of three bedrooms, 546 parkings, clubhouse and pool, Turf pitch, and other associated amenities. The development will aim at providing habitable housing infrastructure and increase the utility of the Land in the area.

3.3 Project Technology

The construction technology to be used in the project will employ light mechanization and high labour inputs. Locally available equipment, construction materials and labour will be used, which will be provided by a locally registered contractor. Light earth-moving equipment will be used at the initial stages especially in the excavation, removal, and transportation of soils. Transportation of building materials and waste debris into the site will also involve sizeable trucks.

Concrete mixing and mobile elevator equipment will be installed during the construction. Other equipment will include dump trucks and an assortment of hand tools. As such dust and noise will arise from the operations of the equipment and are likely to be issues of concern. This requires the contractor to undertake the use appropriate technology that will reduce the impact of both noise and dust at the construction site.

The project will employ considerable number of workers at various stages of construction. This will include manual laborer's, technicians, foremen and supervisors and a host of professional involved in various fields. Minimal staff will remain during the operation phase. A registered contractor and several sub-contractors will undertake the construction process. All the construction process will be under the close supervision of the project engineer, county building inspectors and the project architect.

3.4 Project Materials

The choice of construction material is important to bring out the character and aesthetic value. The floor will be made of cement screed and ceramic tiles, the walls of natural dressed stone with internal plaster painted and ceramic tiles, ceiling of plaster painted and a roof finish of corrugated iron sheets.

3.5 Description of the Project's Construction Activities

Pre-construction Investigations

The implementation of the project's design and construction phase will start with thorough investigation of the site's biological and physical resources to minimize any unforeseen adverse impacts during the project cycle. Excavation will be carried out to prepare the site for construction of foundations, pavements, and drainage systems. This will involve a combination of earth-moving machinery such as bulldozers and wheel loaders as well as manual labour.

Sourcing and Transportation of Building Materials

Building materials will be transported to the project site from their extraction, manufacture, or storage sites using transport trucks. The building materials to be used in the construction of the project will be sourced from various countries. Greater emphasis will be laid on procurement of building materials from within the local area, which will make both economic and environmental sense as it will reduce negative impacts of transportation of the materials to the project site through reduced distance of travel by the materials transport vehicles.

Site Clearance

The vegetation cover including grass on the site will be cleared. The proponent shall ensure as many indigenous trees as possible are used for re-vegetation as well as conserving the trees along the plot boundary.

Storage of Materials

Building materials will be stored on site. Bulky materials such as rough stones, ballast, sand and steel will be carefully piled on site. To avoid piling large quantities of materials on site, the proponent will order bulky materials such as sand, gravel, and stones in bits. Materials such as cement, paints and glasses among others will be stored in temporary storage structures, which will be constructed within the project site for this purpose.

Excavation and Foundation Works

Excavation will be carried out to prepare the site for construction of foundations, pavements, and drainage systems. This will involve the use of heavy earth moving machinery such as tractors and bulldozers.

Masonry, Concrete Work, and Related Activities

The construction of the building walls, foundations, floors, pavements, drainage systems, boundary wall and parking area among other components of the project will involve a lot of masonry work and related activities. General masonry and related activities will include stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These activities are known to be labour intensive and will be supplemented by machinery such as concrete mixers.

Structural Steel Works

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

Electrical Work

Electrical work during construction of the premises will include installation of electrical gadgets, devices and appliances including electrical cables, lighting apparatus, sockets etc. In addition, there will be other activities involving the use of electricity such as welding and metal cutting. All the electrical works will be carried out by a licensed electrician to the satisfaction of the Kenya Power and Lighting Company (KPLC).

Mechanical works

- The mechanical works shall be done by qualified technicians under the supervision of the Project Mechanical Engineer and shall follow the set standards. The works will include the following:
- Plumbing and drainage
- Service ducts accessible from all floor levels
- Soil vent pipes (SVP) provided on doors and windows
- Storm drains pipes
- Inspection chamber covers and framing
- Underground foul and waste drainpipes

Landscaping

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

3.6 Description of the Project's Operational Activities

Residence

The proposed development will comprise of 504 units. Several activities such as cooking, washing, leisure and recreational activities will thus accompany residence.

Solid Waste

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

company. Private waste disposal companies that are approved by NEMA and County Government will be responsible for solid waste
disposal.

Wastewater and storm water Management

Sewage generated from each unit will be discharged into a waste water treatment plant and. Storm water will be properly channeled to improve drainage within the development.

Cleaning

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

General Repairs and Maintenance

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

3.7 Description of the Project's Decommissioning Activities

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

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

Dismantling of Equipment and Fixtures

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

Site Restoration

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

Construction Products, By Products and Wastes

It is anticipated that the project will generate a variety of products, by-products and wastes during its construction and operational phases. The characteristics of the products, by-products and wastes are discussed in this section.

Product. Final product will be 504 housing units

By-Products. By-products will be disposed-off as follows:

- Soil: The soil generated during excavation will be reused elsewhere in the project. Unusable soil will be transported for disposal at designated dumping sites.
- Pieces of timber/wood: large pieces of timber/wood generated during the construction phase will be transported back to the contractor 's yard for reuse in future while the small pieces of timber/wood will be disposed-off for use as fuel for cooking and heating.
- Empty cans and drums: These will be used to store water during construction. The damaged ones will be disposed-off to registered scrap metal and plastic waste dealers.
- Excess sand, ballast, and stockpiles: These can be used for future construction activities for example during future renovations. Upon completion of the project, these will be moved by the contractor to a suitable yard.

Waste

The waste generated during construction will include construction debris, excavated soil and rocks and sanitary waste. The other wastes that may likely to be generated during operation are solid waste such as paper, plastics, cans, organic waste, and sanitary waste. These wastes will be disposed by the proponent in accordance with the standards and documented procedures stipulated in the EMCA Waste Management
Regulations.

3.8 Project Budget and Duration

The proposed project is estimated to cost approximately Kes.1,103,670,614.00 as indicated in the table below. The project implementation works is estimated to take 48 months after commencement

CHAPTER FOUR: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

There is a growing concern in Kenya and at a global level that many forms of development activities cause damage to the environment. Development activities have the potential to damage the natural resources upon which the economy is based. EIA is a useful tool for the protection of the environment from the negative effects of development activities. It is now accepted that development projects must be economically viable, socially acceptable, and environmentally sound. According to Sections 58 and 138 of the Environmental Management and Coordination Act (EMCA) No. 5 of 2015 and Section 3 of the Environmental (Impact Assessment and Audit) Regulations 2003, Revised 2019. (Legal No. 101), requires an EIA project/study report prepared and submitted to the National Environment Management Authority (NEMA) for review and eventual Licensing before the development commences. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development through sustainable use of natural resources without interfering with the environment.

4.0 Global policies

The development of this project has been bench-marked against UN and International guidelines.

4.0.1. The World Commission on Environment and Development

The commission commonly referred to as the Brundtland Commission is focused on the environmental aspects of development. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. Social sustainable development maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition, shelter, cultural expression, and political involvement.

4.0.2. The Rio Declaration on Environment and Development

The Rio Declaration on Environment and Development was adopted by more than 178 governments at the United Nations Conference on Environment and Development, known as the Earth Summit, held in Rio de Janeiro, Brazil from 3rd to 14 June 1992.

Under Agenda 21, Principal No. 10 of the declaration underscores that environmental. Issues are best handled with the participation of all concerned citizens at all relevant levels. At the national level, everyone shall have appropriate access to information concerning the environment that is held by public authorities. States shall encourage and facilitate public participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy shall be provided. The foregoing discussion is relevant to the proposed development because Kenya legislation demands that the public must be involved before any development project that is likely to have adverse impacts on the environment is initiated by a project proponent. The Environment Act has further established a public complaints committee (PCC) where the issues raised by the public regarding any proposed development can be addressed

4.0.3 Sustainable Development Goals (SDG's)

On September 25, 2015, countries adopted the United Nations Sustainable Development Goals (SDGs 's) of the United Nations Conference on Sustainable Development, Rio+20 which took place in Rio de Janeiro, Brazil on 20-22 June 2012. The SDGs are aimed at contributing towards ending poverty, protecting the planet, and ensuring prosperity for all as part of a new sustainable development agenda. The SDGs have very significant implications for investment needs and the role of the public sector is fundamental and pivotal. At the same time, the contribution of the private sector is indispensable. The proponent has committed to the SDG 's through the proposed development.

4.1 National Environmental Policies

4.1.1 National Environmental Action Plan (NEAP)

The purpose of the National Environmental Action Plan (NEAP) is to promote and facilitate the coordination of strategies and measures to protect and manage the environment into plans and programmes for the social and economic development of Kenya. The Environmental Management and Coordination Act, established the NEAP to address the protection and management of the environment at district, provincial and national levels.

Relevance to the project

The proponent should comply with the NEAP policies and legislation with regard to preventing, controlling, or mitigating specific as well as general adverse impacts on the environment. The project activities will interact with the various elements and components of the physical, social, and economic environments in ways that could lead to negative impacts. Stakeholders in the project will therefore ensure that projects covered under consideration should be implemented in ways that ensure environmental integrity. Issues of environmental integrity will be addressed through project-level Environmental Impact Assessments (EIAs).

4.1.2 Environmental and Development Policy (Session Paper No. 6 1999):

The goal of this Policy is a better quality of life for present and future generations through sustainable management and use of the environment and natural resources Relevance to the project The main objective of this Policy is a better quality of life for present and future generations through sustainable management and use of the environment and natural resources. The proposed project once complete will offer the best housing units to the people of Syokimau Area.

4.1.3 National Environment Policy, 2012

The major objective of the policy is to provide a framework for an integrated approach to planning and sustainable management of Kenya's environment and its natural resources. The policy further ensures that the environment is integrated into all government policies to facilitate and realize sustainable development at all levels. This would help promote a green economy, enhance social inclusion, improve human welfare, and create opportunities for employment and maintenance of a healthy ecosystem Relevance to the project EIA study will develop an environmental management and monitoring plan to mitigate the impacts that may result during the construction and operation phases of the project. This tool is aimed at

promoting coordination of environmental management of the project such that sensitive ecosystems are not destabilized by project activities. The developer should ensure that the provisions of this policy are followed to ensure the protection of the environment.

4.2 National Legislative Framework

4.2.1. Constitution of Kenya (2010)

Article 42-Environment; Indicates that every person has the right to a clean and healthy environment, which includes the right to – a) Have the environment protected for the benefit of present, and future generations through legislative and other measures, particularly those contemplated in Article 69, and b) Have obligations relating to the environment fulfilled under Article 701. Article 43-Economic and Social Rights Indicates that every person has the right to accessible and adequate housing and to reasonable standards of sanitation.

4.2.2 County Government Act 2012

This Act vests responsibility upon the County Governments in planning development projects within their areas of jurisdiction on projects of importance to the local County Government or those of national importance. Section 102 of the Act provides the principles of planning and development facilitation which include integration of national values in county planning, protection of the right to self-fulfillment within the county communities and with responsibility to future generations, protection of rights of minorities and marginalized groups and communities, promotion of equity resource allocation, among others.

Relevance to the proposed project

The project proponent should initiate the process of County Government engagement in the initial project planning through the application of essential development approvals from Machakos County Government. The proponent will comply fully with the Act.

4.2.3 The Environmental Management and Coordination Act, 1999 Revised in 2015

The Environmental Management and Coordination Act (EMCA) chapter 387, and its Attendant Environmental (Impact Assessment and Audit) Regulations of 2003, Revised 2015 Provide for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya. The Act introduces two important aspects of urban environmental management, which are directly related to the proposed project: environmental impact assessment (EIA) and environmental audit (EA). Section 58 (1) has underscored that any person being a proponent of a project Shall submit an EIA report to the National Environmental Management Authority (NEMA) of Kenya before financing, commencing, or proceeding with. Section 68 (1) gives NEMA the mandate for carrying out all environmental audits of all activities that are likely to have significant impacts on the environment. It authorizes environmental inspectors, as appointed by NEMA to enter any premise and determine how far the activities carried out conform to statements in the EIA study.

Compliance

a) The proponent has undertaken an EIA study as per the requirements of Section 58 (1) of EMCA chapter 387 awaiting approval prior to the commencement of the project.

b) The proponent will implement the proposed EMP and adhere to the conditions set in the license of the proposed project.
c) The proponent will adhere to subsequent EMCA legislations such as the noise and waste regulations throughout the cycle of the project.
d) The proponent shall undertake EA for the project and submit the reports to NEMA as per the EIA/EA guidelines

4.2.4 Physical Planning and Land Use Planning Act, 2019

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

Section 57 (1) A person shall not carry out development within a county without development permission granted by the respective county executive committee member. (2) A person who commences any development without obtaining development permission commits an offense and is liable on conviction to a fine not exceeding five hundred thousand shillings or to imprisonment for a term not exceeding two months or to both. (3) A county executive committee member shall require a person who has commenced a development without obtaining development permission to restore the land on which the development is taking place to its original condition or as near to its original condition as is possible and that such restoration shall take place within ninety days.

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

Section 65 A county executive committee member may impose conditions or impose a fine to be prescribed in regulations on an applicant for development permission for building works where that applicant fails to complete the building works within five years. According to the Third Schedule Development Control, Section 4. Planning authorities shall require applications for major developments to be subjected to environmental and social impact assessment. Compliance with this legislation a) The architectural plans of the proposed development are within the requirements of the larger Machakos County Zoning guide, b) The proposed project has been subjected to the requisite EIA and report submitted to NEMA for licensing to acquire the EIA license. c) The proponent will ensure that the land is utilized in an eco-friendly manner and is restored to its original condition once the project is decommissioned. d) Ensure the development does not in a way have injurious impact on the environment and that a developmental footprint does not cover the entire parcel.

4.2.5 Physical Planning (Building and Development Control) Regulations Under the provisions of the Physical Planning (Building and Development Control) Regulations; The Director of Physical Planning shall refuse to recommend any new building or proposed development, alteration or addition to any existing building if: a) The proposal is not in conformity with the approved development plan. b) Such plans disclose a contravention of the physical Planning (Building and Development) rules. c) The plans are not correctly drawn or omit to show the information required. d) On such being required, a separate application accompanied by sets of

plans has not been lodged in respect of building on separate plots or subplots, etc. e) The proposed development is in line with the overall project site zoning guide and will acquire approval from Machakos County. f) The proponent shall adhere to the recommendations given in the building order by the county physical planner g) The proponent shall ensure that the building plans are available on site for inspection by county officials during construction and at any other time.

4.2.6 Public Health Act (Cap 242)

Section 15 (1x) –Nuisance Any noxious matter or wastewater discharged from any premise, such as a building constitutes a nuisance. Any premise not kept clean and free from offensive smells such as gases that are injurious to health such as those from commercial establishments shall therefore generate nuisance. The Act therefore stresses that no person shall cause a nuisance to exist on any land or premise occupied by him. The Act acknowledges that all local authorities shall take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to health. To safeguard against this, part X of the Public Health Act states that where in the opinion of the Medical Officer of Health that foodstuff within a warehouse, or a building is insufficiently protected, the owner shall be compelled to observe the required regulations, or else he shall be guilty of an offense. The Public Health (Drainage and Latrine) Rules made under s.126 of the Act, makes more specific provision for drainage. The Rules require the drainage of new buildings;

- Prohibit the drainage of surface water into foul water sewers;
- Prohibit the discharge into sewers of matter that may interface with the free flow of the sewage or injure the sewer;
- Empower the local authority to prohibit the discharge of injurious matter into sewers;
- Impose a requirement for permits to be obtained from the local authority before the making of sewer connections or the construction of sewage treatment works.

Compliance

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

4.2.7 Occupational Health and Safety Act

The purpose of this Act is to secure the safety, health, and welfare of persons at work, and protect persons other than persons at work against risks to safety and health arising out of, or in connection with, the activities of persons at work. It applies to all workplaces where any person is at work, whether temporarily or permanently. Failure to comply with the OSHA, 2007 attracts penalties of up to KES 300,000 or a 3-month jail term or both or penalties of KES 1,000,000- or 12-month jail term or both for cases where death occurs and is in consequence.

Compliance

a) The proponent shall register the site as a workplace
b) The proponent will appoint a reputable contractor who will be responsible for enforcing the requirements during construction and subsequent repairs and maintenance after project completion. c) The proponent will make provision for the health, safety, and welfare of persons employed in factories and other places of work.
c) The proponent shall ensure that every workplace shall be kept in a clean state and free from effluvia, arising from any drain, sanitary convenience, or nuisance.
d) Avail fire extinguishers, which shall be adequate and suitable in case of fire outbreaks. Provide adequate means of escape in case of fire outbreak for the employees.
e) Provide suitable PPEs for all workers.

4.2.8 The Workmen's Injury and Benefits Act

This Act provides for compensation to employees for work-related injuries and diseases contracted in the course of their employment and for connected purposes. Key sections of the Act include the obligations of employers; the right to compensation; reporting of accidents; compensation; occupational diseases; medical aid; appeals; and miscellaneous provisions. Schedules provided in the Act outline the degree of disablement; occupational diseases; and dependent's compensation. In case of any accidents or incidents during the project cycle, this Act will guide the course of action to be taken Compliance: The proponent will comply fully with the Act.

4.2.9 National Building Regulations, 2017

The National Building Regulations (NBR) is a set of rules to be used by professionals in the building industry to guide the design, construction, and maintenance of buildings in Kenya. The review was necessitated by the frequent disasters that have befallen the country in the recent past and the generally decaying built environment. The NBR replaced the 1968 Building Code which has been in use since the colonial era. The 1968 Building Code had many shortcomings and could not adequately address the need for a safer, more secure, healthier, attractive, and well-maintained built environment. It remained static and failed to move in tandem with the trends and shifts in the building industry, such as emerging technologies and materials, green building, and security intelligence. The NBR 2015 is informed by the Constitution of Kenya 2010, Vision 2030, and other relevant unfolding reviews such as the National Construction Act which seeks to register contractors in Kenya. Section A - 5 Development Permissions; A - 5.1 No person shall develop or cause to be developed any building on land where development permissions applicable to the area have not been granted. A - 5.2 Any person who contravenes the provisions of these Regulations shall be guilty of an offense. Section 27 Construction All workmanship in the erection of any building shall be in accordance with sound planning and building practice. Any building, including any structural element or component thereof, shall be constructed so as to comply with the design requirements of these Regulations.

Precautions shall be taken during all stages of construction or any building to ensure that the structural system is not damaged or distorted during the course or erection of such building. Section A - 33 Certificates of Occupation A - 33.1 On completion of any building works, the

person for whom the building works were carried out shall apply to the approving authority for: - (a) a full Occupation Certificate; or (b) a Sectional Completion Certificate (c) a Temporary Occupation permit. A - 34.5; Protection of Persons and Property Throughout the progress of any work to which these Regulations apply, every person responsible for the erection of a building, shall ensure by suitable means the safety and protection of all persons and property liable to be affected by the work.

Compliance

The proponent should ensure that the regulations as guided by various approving and licensing authorities are adhered to strictly. The project proponent has submitted the building plans and the required information to the approving authority County Government of Machakos for requisite approval before the commencement of the work and regular monitoring will follow to ensure compliance with set standards and conditions. The proponent should ensure that any persons affected by the project's activities are protected from all harm and that all hoarding of the site is made to prevent unauthorized entry. The proponent will obtain a Certificate of Completion. They shall further provide firefighting equipment that may include one or more of the following: hydrants, hose reels and fire appliances, portable fire appliances, water storage tanks, and dry risers.

4.2.10 Penal Code (Cap. 63)

The chapter on ―Offences against Health and Conveniences‖ strictly prohibits the release of foul air into the environment, which affects the health of other persons. Any person who voluntarily violates the atmosphere at any place, to make it noxious to the health of persons in general dwelling or carrying out business in the neighborhood or passing along public ways is guilty of a misdemeanor, i.e., imprisonment not exceeding two years with no option of fine. Under this Act, any person who for the purpose of trade or otherwise makes a loud noise or offensive awful smell in such places and circumstances as to annoy any considerable number of persons in the exercise of their rights, commits some offenses, and is liable to be punished for a common nuisance, i.e. imprisonment not exceeding one year with no option of fine.

4.2.11 The Employment Act

This Act declares and defines the fundamental rights of employees; minimum terms and conditions of employment; to provide basic conditions of employment of employees; and regulates the employment of children, among other rights. Key sections of the Act elaborate on the employment relationship; protection of wages; rights and duties in employment; termination and dismissal and protection of children, among others.

Compliance

The contractor is to be strictly advised not to engage any underage persons (under 18 years of age) to perform any form of work at the site during construction. The proponent shall also ensure that the contractor is conversant and adheres to all the provisions of the Employment Act

4.2.12 The Energy Act 2019

The Act consolidates the laws relating to energy & and provides for National & and county government functions in relation to energy. Provides for 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; Enforcement and review of environmental, health, safety, and quality standards. Provision for construction permit request to be accompanied by EIA study.

Compliance

The project proponent will comply with Legal Notices 43 and 102 to ensure conformity with the Energy Act provisions. The proponent will be required to address provisions raised in the Energy (solar water heating) regulations.

4.2.13 National Construction Authority Act No. 41 of 2011

An Act of Parliament to provide for the registration of contractors operating or willing to undertake construction operations in Kenya as by law through the National Construction Authority (NCA), which is constituted under Act No. 41 of 2011 Laws of Kenya. Section 15 of this Act demands registration of contractors with NCA while section 17 and 18 outlines the procedure of registration of contractors.

Compliance

The proponent will comply with the Act by ensuring that the site and project contractors are registered and certified by NCA. The proponent will also ensure that the proposed project is registered with NCA.

4.2.14 Noise and Excessive Vibrations Pollution (Control) Regulations

Part II of the regulations; section 3 states: 1. Except as otherwise provided in these Regulations, no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

Compliance

The proponent shall take into concern the provisions of the act to ensure that the development complies with the provisions of the Act.

4.2.15 Air Quality Regulations, (Legal Notice No. 34 of 2014)

These regulations are aimed at controlling, preventing, and abating air pollution to ensure clean and healthy ambient air Compliance: The proponent will ensure that operations at the site do not generate dust, particulates, and other emissions beyond allowable limits, especially during construction by deploying efficient dust screens, PPE and other dust suppression measures.

4.2.16 Environmental Management and Coordination (Controlled Substances) Regulations

The regulations regulate the importation and use of Ozone Depleting Substances. Regulation No. 3 gives a classification of Controlled Substances.

Compliance

The proponent will comply fully with the Regulations by not using Ozone Depleting Substances

4.2.17 Environmental (Impact Assessment & Audit) Regulations, 2003 Amended 2019

Provides for the procedure for carrying out the EIA Provides for the contents of an EIA study report Compliance: The EIA is to be carried out in accordance with the regulations. The Project proponent is required to contract the services of a licensed EIA expert, submit an EIA report to NEMA, and acquire an EIA license before commencing any construction activities

4.2.18 The Water Act (Act No.8 of 2002) revised in 2016

Provides that a permit shall be required for any use of water from a resource, especially where there is abstraction and use of water with the employment of works. The legislation provides for the management of water resources at the national and county levels. Article 40(4) provides an application for a permit which shall be subject to public consultation and, where applicable EIA in accordance with the requirements of the EMCA. 108(1) sewages & and effluent management to avoid environmental pollution. Compliance: Use of water abstracted from the natural spring requires an abstraction permit. A permit will be required from WRMA for any water borehole construction works and an abstraction license. The proponent will comply fully with the Act.

4.2.19 Waste Management Regulations, 2016.

This legislation gives guidelines for handling different kinds of waste. Some of the relevant sections to the proposed project are as follows: Part II Section 1: No person shall dispose of any waste on a public highway, street, road, recreational area, or in any public place except in a designated waste receptacle Part II Section 6: Any person who owns or controls a facility or premises which generate waste shall minimize the waste generated by adopting the following cleaner production principles: a) Improvement of the production process through Conserving raw materials and energy eliminating the use of toxic raw materials within such time as may be prescribed by the Authority reducing toxic emissions and wastes b) Monitoring the product cycle from beginning to end by Identifying and eliminating potential negative impacts of the product. Enabling the recovery and re-use of the product where possible. Reclamation and recycling. c) Incorporating environmental concerns in the design, process, and disposal of a product.

Compliance

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

4.2.20 The National HIV Policy

The HIV policy is geared towards ensuring that new development projects encourage preventive and responsible behavior both for the workers involved in such projects and the local people within which projects are taking place as a goal towards curtailing the spread of the disease. The proponent is advised to put in place adequate measures so as to ensure that the implementation of the proposed projects does not heighten the spread of HIV and AIDS.

4.2.21 The Land Act, 2012

The Land Planning Act (Cap 303) Section 9 of the subsidiary legislation (the Development and Use of Land Regulations 1961) requires that before the local Authority submits any plans to the minister for approval, steps should be taken as may be necessary to acquire the owners of any land affected by such plans. Particulars of comments and objections made by the landowners should be submitted, which intends to reduce conflict of interest with other socio-economic activities. Land Titles Act, Cap 282 This Act makes provision for the removal of doubts that have arisen in regard to titles to land and to establish a Land Registration Court. Specific provisions include guidelines on the adjudication of claims and registration of documents after the certificate of ownership is granted. Registration of Titles Act, Cap 281 This Act provides for the transfer of land by registration of titles. Parts within the Act elaborate on mechanisms of bringing lands under the Act, grants, transfers and transmissions of land, registration of titles, and mode and effect of registration, transfers, leases, charges, powers of Attorney, and rectification of titles, among others. Registered Land Act, Cap 300 The Act provides for the registration of title to land and provides for the regulation of dealings in land so registered, and for purposes connected therewith. The Act elaborates on the organization and administration of the Act, the effect of registration, title deeds, certificates of lease and searches, instruments and agents, transmissions and trusts, restraints on disposition, rectification and indemnity, and decisions of registrars and appeals.

Compliance

The proposed project site is registered & and has a title deed. The proponent will be required to comply fully with these Acts

4.3 Institutional Framework

Developments can have impacts on the environment by degrading soils and waterways, altering landscapes, and destroying biodiversity and habitat. Other problems associated with development and human activity include land use conflicts, human and animal conflicts, water management, and environmental pollution. In addition to harming the environment, these impacts can and do have significant economic costs and negatively affect human health. Environmental Impact Assessment (EIA) is a tool that assists in the anticipation and minimization of the adverse effects of development.

Policy and institutional failures are responsible for the many environmental problems we face (i.e., the difference between actual outcomes and optimal resource use). Policy failure refers to situations where inappropriate government policies or the absence of required policies result in natural resource degradation by both private and public users.

Institutions are rules of conduct that facilitate coordination or govern relationships between individuals or groups in a society. Institutions are the rules of the game of a society or formally, institutions are defined as humanly devised constraints that structure human interactions. Formal rules are crafted approved or recognized by the state and include the constitution, property rights, laws, etc. Informal rules are crafted by communities and include norms of behavior, sanctions, taboos, and codes of conduct. Institutions important in natural resource management include but are not limited to the following: -

4.3.1 National Environmental Management Authority (NEMA)

The National Environmental Management Authority (NEMA) is established under Section 7of EMCA. NEMA is the principal Government institution charged with the overall supervision and coordination of all matters relating to the environment as well as the implementation of all policies relating to the environment. NEMA is responsible for dealing with EIA. NEMA has to date considerably developed its human and other resource capacity to enable it to coordinate the environmental management activities of Lead Agencies.

4.3.2 National Environmental Council (NEC)

The National Environment Council (NEC) was established by Section 4(1) of the Environmental Management and Coordination Act No. 8 of 1999. The NEC is chaired by the Cabinet Secretary responsible for environmental matters. Other members of the Council are:

The Permanent Secretaries responsible for matters in the First Schedule of the Act, namely: Agriculture, Economic planning and development, Education, Energy, Environment, Finance, Fisheries, Foreign affairs, Health, Industry, Law or Law enforcement, County

Governments, Natural resources, Public Administration, Public works, Research and Technology, Tourism and Water resources; representatives of public universities; specialized research institutions; the business community and non-governmental organizations; the Director General NEMA who shall be its Secretary.

Key Functions of NEC:

- Policy formulation and direction for the purposes of this act
- Set national goals and objectives and determine policies and priorities for the protection of the environment;
- Promote cooperation among public departments, local authorities, private sector, non-governmental organizations, and other organizations engaged in environmental protection programmes;
- Perform such other functions as are assigned under the Act.

4.3.3 County Environment Committees

Under section 29 (1) of EMCA, the Cabinet secretary shall by notice in the gazette appoint County Environment committees of NEMA in respect of every County. These committees assist NEMA in effectively carrying out its function of proper management of the environment at

these levels. It is instructive to note that the membership of these committees includes inter alia representatives of farmers or pastoralists, business community, women, and youth.

4.3.4 Public Complaints Committee PCC

The PCC is concerned with the investigation of complaints relating to environmental damage and degradation generally. The PCC has powers to investigate complaints against any person or even against NEMA or on its own motion investigate any suspected case of environmental degradation.

4.3.5 Standards and Enforcement Review Committee

This is a technical Committee responsible for the formulation of environmental standards, methods of analysis, inspection, monitoring, and technical advice on necessary mitigation measures.

4.3.6 National Environmental Tribunal (NET)

The NET is established under Section 125 of EMCA for the purpose of hearing appeals from administrative decisions by organs responsible for enforcement of environmental standards. An appeal may be lodged by a project proponent upon denial of an EIA License or by a local community upon the grant of an EIA License to a project proponent. NEMA may also refer any matter that involves a point of law or is of unusual importance or complexity to NET for direction. The proceedings of NET are not as stringent as those in a court of law and NET shall not be bound by the rules of evidence as set out in the Evidence Act. Upon the making of an award, NET's mandate ends there, as it does not have the power to enforce its awards. EMCA provides that any person aggrieved by a decision or award of NET may within 30 days appeal to the Environment and Land Court.

4.3.7 National Environment Action Plan Committee (NEAP)

This cross-sectoral committee is responsible inter alia, for the development of a five-year national environment action plan. The national environment action plan shall contain among other aspects analysis of the natural resources of Kenya and their distribution, quantity, and various uses. It shall also recommend legal and fiscal incentives for businesses that incorporate environmental requirements into their planning and operational processes as well as set out guidelines for the planning and management of the environment and natural resources.

The national environment action plan shall upon adoption by Parliament be binding on all organs of government. County environmental committees are also required to develop their own five-year environmental action plans which are incorporated in the national environment action plan.

4.3.8 The National Construction Authority (NCA)

The National Construction Authority (NCA) is a government organization that regulates, streamlines, and builds capacity in the construction industry. The purpose of the Act is to provide for the establishment, powers, and functions of the National Construction Authority and connected purposes (Section 1).

The National Construction Authority shall oversee the construction industry and coordinate its development and is given power for necessary performance. Furthermore, the Act stipulates the establishment of the Appeals Board and its function to make rules for or concerning the filing, hearing, and disposal of appeals, etc. NCA is an important factor in the construction industry as it checks and weeds out quarks puts an end to shoddy construction works, and curbs the collapsing of buildings. This complements the works of other institutions in as well dealing with environmental degradation. Every County Environment Committee shall consist of- (a) the member of the county executive committee in charge of environmental matters who shall be the chairperson; (b) an officer of the Authority whose area of jurisdiction falls wholly or partially within the county who shall be the Secretary to the County Environmental Committee; (c) one representative for each of the Ministries responsible for the matters specified in the First Schedule at the county level; (d) two representatives of farmers or pastoralists within the county to be appointed by the Governor; (e) two representatives of the business community operating within the concerned county appointed by the Governor; (f) two representatives of the public benefits organizations engaged in environmental management programmes within the county appointed by the Governor in consultation with the National Federation of Public Benefit Organizations; and (g) a representative of every regional development authority whose area of jurisdiction falls wholly or partially within the county.

CHAPTER FIVE: PUBLIC CONSULTATION

5.1. Introduction

Public Participation is one of the national values and principles of governance enshrined in the Constitution of Kenya, 2010. It is also a mandatory procedure as stipulated by EMCA 2015 section 58 on EIA for the purpose of achieving the fundamental principles of sustainable development. Views from the residents, stakeholders, and development partners who in one way or another would be affected or rather interested in the proposed project were sought through the administering of questionnaires and interviews

5.2 Policy and Legislative Provisions

5.2.1 International Policy

1. Agenda 21

Chapter 23: strengthening the role of Major Groups gives the right to access information regarding their environmental and social wellbeing

2 Rio Declaration on Environment and Development

Principle 10 provides that "Environmental issues are best handled with participation of all concerned citizens, at the relevant level".

5.2.2 National legislations

1. The constitution of Kenya (Cap 5, part II: Environment 69(1d). The legal rights availed to all Kenyan citizens and residents to be included in any project that involves characteristic alterations to their environment.
2. The Environmental Management and Coordination Act (Cap 387). The participation of the concerned community is a necessity for any development through the general principles section (part II, 5a).
3. Environmental (Impact Assessment and Audit) Regulations section 17. It provides that all EIA studies should undertake Public Consultation as part of the study.

5.3 Objectives of the Public Participation

The objectives of the public participation exercise were to:

a) Disseminate and inform the stakeholders about the project with special reference to its key components and location.
b) Create awareness among the public on the need for the EIA for the proposed
c) project.
d) Gather comments, suggestions, and concerns of the interested and affected parties.
e) Incorporate the information collected in the EIA study.

5.3 Methodology used in public participation

The Public Participation (PP) Process is a policy requirement by the Government of Kenya and a mandatory procedure stipulated by EMCA cap 387 of the laws of Kenya, on Environmental Impact Assessment for the purpose of achieving the fundamental principles of sustainable

development. The public participation was conducted on June 2023. The exercise was conducted in different ways, namely;

a. Meetings with the proponent.
b. Interviews and discussion,
c. Field surveys and observations
d. Administering of questionnaires,
e. Validation of findings.

The purpose for such interviews was to identify the positive and negative impacts and subsequently promote proposals on the best practices to be adopted and mitigate the negative impacts respectively. It also helped in identifying any other miscellaneous issues that may bring conflicts in case project implementation proceeds as planned.

5.4 Analysis of the Public Consultation Findings

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

Positive Issues

1. Creation of employment opportunities
2. Increase and enhance property values in the neighborhood
3. Improve security in the area
4. Increase supply of personnel accommodation
5. Creation of business opportunities
6. Market for supply of building materials

Negative Issues

Residents raised the following concerns in relation to the proposed development;

i. Dust emission
ii. Noise and vibrations
iii. Increased population in the area
iv. Pressure on the available water supply
v. Security in the area

Suggestions to the Proponent

Those interviewed and consulted made the following suggestions to the proponent:

- A proper solid waste management plan to be put in place during the construction and the operational phase
- Give priority to local youth in employment opportunities.

- They suggested that dust covers be used during the construction and transportation of materials like cement and sand.
- Re-planting of any trees and/or vegetation that would be cut down during construction.
- Provide the workers with the right PPEs to prevent accidents

CHAPTER SIX: ANTICIPATED IMPACTS AND MITIGATION MEASURES

This chapter will discuss the prediction, identification, and analysis of the anticipated project impacts throughout the project cycle, that is construction, operation, and decommissioning phases. The identified anticipated impacts emanating from the proposed project will result in effects that may be positive or negative on the environmental and social elements thus influencing to analysis and categorizing them into four major parameters, which are;

1. Magnitude - described as being major or minor positive/negative.
2. Duration – refers to period/time and is described as short-term or long-term
3. Extent – refers to the coverage and it is evaluated in terms of being specific (localized) or widespread
4. Reversibility – described in terms of being reversible or irreversible.

6.1 Positive impacts

That shall be associated with the implementation of the project including but not limited to the following:

Provision of housing units

The proposed development will provide 504 No. decent housing units for many Kenyans to buy and own.

Provision of employment opportunities

The proposed project will create employment opportunities for both skilled and semi-skilled workers. During the construction phase, the project will employ a large workforce including; masons, plumbers, electricians, and cooks among others. For the operation phase, the project will employ a workforce that will include cleaners, security guards, and caretakers among others.

Provision of the market for goods and services

During the construction phase, the project will consume a lot of building materials sourced both locally and in other parts of the region. This will have a positive impact on the economic status of the supplies and on the national economy through VAT rates for goods.

Increase in revenue to the government

Through payment of relevant taxes and rates, the project will contribute towards the national and local revenue earnings.

Gains in the local economy

The economy of the neighborhood will receive a boost, especially during the construction phase due to the activities of the workers; buying food, drink, and commodities.

Improved Security

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

Optimal Land Use

The development will result in a more economical use of the land without significant environmental degradation. The area has been zoned for residential units, meaning that the proposed development will be in conformity with the zoning regulations.

Infrastructure expansion

This being a project that will introduce a large population into the area, there is a need to provide services and utilities that will serve the people conveniently without depleting the existing ones. E.g., water delivery systems and connections to the sewer trunk in the future and the maintenance of the access road.

6.2 Negative Impacts and Potential Mitigation Measures

Exploitation of construction materials

Building materials such as hardcore, ballast, cement, rough stone, and sand required for the construction of the proposed Project will be obtained from quarries, sand harvesters, etc. Since substantial quantities of these materials will be required for the construction of the proposed project, the availability and sustainability of such resources at the extraction sites will be negatively affected as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in several ways including landscape changes, displacement of animals and vegetation, poor visual quality, and opening of depressions on the surface leading to several human and animal health impacts. Proposed mitigation measures

a) The Proponent will source building materials such as sand, ballast, and hardcore from the registered quarry and sand mining firms, whose extraction sites have undergone satisfactory environmental impact assessment/audit and received NEMA approval.
b) To reduce the negative impacts on the availability and sustainability of the materials, the Proponent will only order what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities.
c) c) The Proponent shall consider the reuse of building materials and the use of recycled building materials where applicable. This will lead to a reduction in the number of raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

Solid Waste Generation

Solid waste will have a major negative impact during the project cycle. The waste will consist of construction debris, cement bags, wood, broken glasses, containers, metal, sharp objects such as nails, organic waste, paper, and plastic among others during the development construction phase. The waste may result in the blockage of drainage systems, choking off water bodies, and

have a negative impact on human health. During the operation phase, wastes may be organic emanating from the kitchen, paper, plastic, and containers. Unfit disposal of construction waste could have medium or long-term environmental and public health impacts. The extent of this impact will be local to areas where waste is dumped or their immediate neighborhood.

Potential Mitigation Measures

a) Segregation of waste at the source during the project cycle.
b) Use of an Integrated Solid Waste Management System; through a hierarchy of options: source reduction, recycling, composting, and reuse, will facilitate waste handling during the operation/occupation phase.
c) Engage the services of registered waste handlers to collect and transport waste to designated disposal sites.
d) Provision of waste management rooms at strategic places within the development facility.
e) Efficient use of building material to reduce waste and recycling/reuse where feasible.
f) To manage waste in line with the Waste Management Regulations, 2016.

Increase Generation of Waste Water

There will be an increased generation of liquid waste as a result of increased population inflow within the project site both during the construction and operation phases of the development. Inadequate provision of sanitary facilities during the construction period may result in defecation of secluded areas within the site creating unsanitary conditions and a source for fly infestation. Improper liquid waste disposal may be a threat to human health for both workers and the neighboring community and also result in contamination of water resources, land, and air. All liquid waste shall be properly managed through connection to the existing sewerage system that serves the area.

Potential Mitigation Measures

a) Connecting and channeling all liquid/effluent wastes to the existing city county sewerage system or developing a waste treatment plant
b) Provision of adequate and appropriate sanitary facilities for the workers during the construction phase and tenants during the operation phase of the facility.
c) Proper decommissioning of the sanitary facilities shall be carried out once construction is complete.
d) Sanitary facilities shall be kept clean always through regular cleaning. e) Ensure regular maintenance of foul water drainage works at the premises to prevent clogging and fore-stall breakdowns.
e) The design of the internal wastewater system shall consider the estimated discharges from individual sources and the cumulative discharge of the entire project, that is, it will have the capacity to consistently handle the loads even during peak volumes.
f) All drain pipes passing under the building should be of heavy-duty PVC pipe tube encased in concrete surround.
g) All manholes should have heavy-duty covers set and double sealed airtight as approved by specialists.

Air Pollution and Dust Emission

Air pollution will be a major negative impact during the construction phase as a result of an increase in levels of fugitive dust emanating from demolition, excavation, construction activities, and stockpiled earth materials. This may be a public health hazard resulting in nuisance to the workers and the public. Air pollution may also be a result of the emission of fumes and particles or the combustion of fossil fuels from construction machinery. This is expected as a short-term and reversible impact after the end of construction.

Potential Mitigation Measures

a) Regular sprinkling of water on work areas to prevent fugitive dust violations.
b) Use of dust nets/screens around the construction site to contain and arrest dust.
c) Use environmentally friendly fuels such as low-sulfur diesel.
d) Minimize the period for idling of machinery and construction vehicles.
e) Minimize exposed areas through the schedule of construction activities to enable dust control.
f) Regular and prompt maintenance of construction machinery and equipment to minimize the generation of hazardous gases.
g) Ensure no burning of waste such as paper and plastic containers on sites/non-designated areas.
h) Onsite dirt piles or other stockpiled material should be covered, windbreaks installed, and water and/or soil stabilizers employed to reduce wind-blown dust emissions.
i) Restricting heights from which materials are to be dropped, as far as practicable to minimize the fugitive dust arising from unloading/loading.
j) Where a vehicle leaving a construction site is carrying a load of dusty materials, the load shall be covered entirely by clean impervious sheeting to ensure that the dusty materials will not leak from the vehicle.
k) Provide PPEs to the workers in dusty areas on the site.
l) Monitor the air pollution levels regularly as per the Air Quality regulations.

Noise and Excessive Vibrations

Noise pollution will have a negative impact and short term limited to the construction period. The noise will be caused by the construction activities and the use of heavy machinery and vehicles during the transportation of materials to and from the site. Vibrations will be experienced during the concrete vibration during the concreting of the structural elements and hacking of the walls and building elements during the plastering of the structure. On occupation and operation of the facility, there will be minimal noise and vibrations from the units.

Potential Mitigation Measures

a) Construction works shall be carried out only during the day from 0800hrs to 1700 hrs.
b) Noise shields shall be used on noisy equipment, such as corrugated iron sheet structures, to minimize exposure to the neighbors and other workers within the site
c) The construction vehicles and machinery shall be switched off when not in use to reduce idling time.
d) All noisy activities shall be scheduled concurrently during the construction period to reduce the exposure period to the PAPs.

e) Equipment installed with noise abatement devices shall be used as much as practicable.
f) All machines and equipment shall be maintained regularly to reduce frictional noise.
g) All workers shall be trained and provided with PPEs such as helmets, earmuffs, dust masks, etc. which will be used at all times when operating within the site area.
h) Drivers delivering materials shall avoid unnecessary horning of the trucks/vehicles.
i) A billboard shall be erected at the construction site entrance to notify of the construction activities and timings.
j) Regular monitoring of noise levels at the site as per the regulations.

Increased Water Demand

The demand and usage of water will increase during the project cycle. During construction, water will be required for activities such as cement mixing, curing of concrete, sprinkling of water on dusty areas to suppress dust, and drinking water for workers. During the operation phase, water will be needed for bathing, washing, cleaning, drinking, and cooking. This will place strain on the existing water supply by Machakos County Sewerage and Water Company (MCSWC).

Potential Mitigation Measures

a) Drill a borehole to supplement the county supply.
b) The contractor shall use water bowers and tankers to bring in water for construction activities i.e., during periods of high-water demand (i.e., during slab formation). Water fetching shall however be subject to authorization by the relevant authority.
c) Provision of adequate underground and roof tanks for water storage that covers two days' water demand.
d) Use water-efficient appliances and fixtures for the conservation of water during the project cycle.
e) Provide notices and information signs to sensitize on means and needs to conserve water resources i.e., "Keep/Leave the Tap Closed", etc. This will awaken the civic consciousness of the workers and residents with regard to water usage and management.
f) Prompt detection and repair of all the water fixtures and fittings to reduce water wastage.

Increased Energy Demand

There shall be increased demand and use of energy during the construction stage (fuel for running machinery and other equipment) and during the operation phase (electricity used by the occupants of the units). Energy conservation is thus fundamental and shall involve the optimum use of petroleum products (diesel and gasoline), electrical appliances (equipment), lighting systems, and other electric machinery as used for different purposes. It also includes the use of renewable energy sources.

Potential Mitigation Measures

a) Turn off machinery and equipment when not in use.
b) Use of solar energy as an alternative source of energy.
c) Monitor energy use during construction and set reasonable limits.
d) Put off all lights immediately when not in use or are not needed. e) Install and routine maintenance of energy-efficient appliances e.g., LED bulbs, etc.

e) Exterior lights shall be controlled by a programmable timer. g) The water booster set will contain inverter pumps for energy saving and precise control of flow and pressure rate.
f) The generator should be provided as a full backup energy source throughout the development.

Surface Run-off and Storm Water Management

The proposed project construction phase will lead to increased release of sediments into the drainage systems. The building roofs and pavements may lead to increased volume and velocity of stormwater or run-off flowing across the area covered by the building. This can lead to increased amounts of stormwater entering the drainage systems, resulting in overflow and damage to such systems.

Potential Mitigation Measures

a) Semi-permeable materials will be used for the construction of pavements.
b) After completion of construction, the proponent shall embark on comprehensive landscaping.
c) Drainage channels shall be covered; say with gratings, to avoid the occurrence of accidents and entry of dirt.
d) Construct gently sloping drains to convey water at non-erosive speed directing the storm water to the main drainage system in the area.

Risk of Fire Outbreak

The operations that lead to fire outbreaks include poor handling of electricity systems, faulty electrical equipment, carelessness, etc. These should be avoided both during the construction and operation phases of the project through the provision of firefighting facilities, proper training, and sensitizations.

Potential Mitigation Measures

a) Post "No smoking signs" where flammable materials are stored.
b) Hire a competent and properly authorized electrical contractor to do the electrical works.
c) Train staff on the use of the available firefighting equipment. At least one person trained in handling firefighting equipment should be available throughout the construction phase of the project.
d) Conduct regular firefighting drills within the site.
e) Develop and post at the site fire emergency and evacuation procedures.
f) Provide an adequate number of appropriate firefighting equipment at accessible strategic places within the property.
g) Organize for inspection and maintenance of fire equipment at least once in a period of six months.
h) Maintain on-site telephone contacts for the fire brigade and ambulance service provider.

Oil Leakages and Spills on the Environment

Though this may not be common at the site, it is wise to control and observe the little that could occur especially during maintenance of the involved machinery. During the operational phase, oil spills might occur at the parking lots and cooking oil from kitchens.

Potential Mitigation Measures

a) All machinery shall be keenly inspected so as not to leak oils on the ground. This can be ensured through regular maintenance.
b) Install oil trapping equipment in areas where there is a likelihood of oil spillage
c) Maintenance will be carried out in a well-designed and protected area and where oils/grease is completely restrained from reaching the ground. Such areas should be covered to avoid storms from carrying spilled oils into the soil/water systems.
d) All oils/grease and materials will be stored in a site's store, in the contractor's yard.
e) Proper disposal of oil-handling materials such as drums, oily clothes/papers/materials, and cans.
f) All drainage facilities shall be fitted with adequate functional oil-water separators and silt traps.
g) Collect the used oils and re-use, re-sell, or dispose of them appropriately using expertise from contracted licensed waste handlers.

Emergence and Spread of Social Vices

The proposed development will lead to the potential for employment opportunities and access to new services which will draw people to the area more specifically the project site. This factor will further lead to a temporary increase in economic activities and employment of skills for development. This will lead to population influx which might lead to changes in or unwanted behaviors in the area. This unwanted change in behavior may be in the form of loose morality, an increase in school drop-outs due to cheap labor, child labor, drug use, and abuse, theft/robbery, and increased incidences of HIV/AIDS and related infections/diseases and other communicable diseases.

Potential Mitigation Measures

a) To minimize project effects on local social setup, the proponent will;
b) The contractor shall ensure that there is adequate street lighting and a security guard within the site to help curb issues that may arise from theft. Also installing 24-hour operating CCTV surveillance, which will be monitored regularly.
c) It is recommended that the contractor employs workers from the immediate area where possible to avoid social conflict
d) Conduct periodic sensitization forums for employees on ethics, morals, general good behavior, and the need for the project to co-exist with the neighbors.
e) Offer awareness, guidance, and counseling on HIV/AIDS and other STDs to employees;
f) Provide safety tools such as condoms to employees
g) g) Ensure enforcement of relevant legal policy on sexual harassment and abuse of office.

Occupational Health and Safety

During the construction phase, there will be increased air and noise pollution which are considered harmful to human health. The neighbors and workforce involved shall be subjected to these environmental hazards putting them at high risk. Waste material such as pieces of glass and nails left lying on the ground may cause injuries/accidents to the workers on site. Food for the construction workforce is usually provided by mobile individuals most of whom

operate without licenses. This can compromise the health of the workers especially if such foodstuffs are prepared in unhygienic conditions.

Potential Mitigation Measures

a) Provide adequate and functional sanitary facilities for the workers.
b) All workers shall use properly fitting PPEs for injuries and illness which include working boots, overalls, helmets, goggles, earmuffs, masks, gloves, etc.
c) Provide appropriate signage and warnings in work areas to avoid injuries to the workers and occupants.
d) The contractor shall adopt a suitable emergency response plan to manage the occurrence of anticipated hazards during the construction phase.
e) Safety awareness may be gained through regular safety meetings, safety training, or personal interest in safety and health.
f) Provide first aid facilities and ensure that workers are trained in emergency response such as first aid skills.
g) Local individuals preparing food for the workers at the site shall be controlled, monitored, and evaluated to ensure that food is hygienically prepared.
h) Workers shall always be sensitized on social issues such as drugs, alcohol, diseases such as HIV/AIDS STIs, etc.
i) Comply with OSHA and all other relevant regulations governing the health and safety of workplaces.

Impacts on Workers' Health and Safety

Workers and community members in the project area may be exposed to various risks and hazards including falling from height during construction which may lead to fatality, falling objects, collapsing of excavations, road accidents, slips and trips, flammable and explosive substances, electrical shocks, dust, noise and vibrations, poor hygiene, fire exposures, bruises and cuts, etc.

Potential Mitigation Measures

The proponent and project contractor will implement all necessary measures to ensure the health and safety of the workers and the general public during the construction, operation, and decommissioning of the proposed development as stipulated in the Occupational Safety and Health Act,

Increased Traffic

Obstruction by construction transport vehicles and construction activities adjacent to the nearby roads during the construction phase may lead to an increase in traffic along Syokimau Airport North Road. This may be exacerbated if these activities time/schedule coincide with Peak Traffic hours.

Proposed mitigation measures

a) Ensure that the Entry/Exit to the project site is located where it will cause minimal traffic along adjacent roads

b) Ensure all construction vehicles to and from the construction site use the designated Entry/Exit to the project site
c) All transportation of construction raw materials and excavated materials are to be conducted at traffic off-peak hours only
d) Ensure there is a traffic marshal at the site directing traffic
e) Sensitize truck drivers to avoid unnecessary road obstruction
f) Cover all trucks hauling soil, sand, and other loose materials to avoid spillage and dust emissions that may interfere with smooth motoring g) "NO PARKING" signs will be posted around the building where Parking is prohibited and likely to cause obstruction as well as other necessary traffic signs.

Soil Erosion

The topographical nature of the proposed project site is generally flat and gentle slope. The activities involved in the site preparation such as excavations in order to construct the foundations may have a major negative impact on the soil and geology of the project site. Heavy machinery will be traversing the site may lead to soil compaction and erosion.

Potential Mitigation measures

a) Control excavation works especially during rainy/wet conditions
b) The stockpiling of construction materials shall be properly controlled and managed.
c) Materials to be delivered on-site in installments.
d) Provide soil erosion control measures i.e., suppressing open surfaces with water or use of soil erosion control structures on soil-erosion-prone areas within the site.
e) Avoid unnecessary excavations and other soil disturbances that can predispose it to the agents of erosion.
f) Avoid unnecessary movement of soil materials from the site.
g) Re-surface open areas on completion of the project and introduce appropriate vegetation.
h) Leveling of the project site to reduce run-off velocity and increase infiltration of stormwater into the soil.

CHAPTER SEVEN: ANALYSIS OF PROJECT ALTERNATIVES

In order to enable the proposed project to seek different ways of minimizing its impacts on the environment and at the same time achieve its objectives several alternatives were assessed.

7.1 'No Action' Alternative

This option implies forfeiting the proposed development and thus avoiding both the positive and negative impacts that would have arisen during its implementation. This option is mostly applicable in situations where the proposed project area is in ecologically sensitive areas. The land in which the proposed project is to be constructed is in a stable environment and therefore will not be affected by this development activity. From a socio-economic perspective, the "no action" alternative may not be the best alternative as the numerous benefits to be gained from the development both locally and nationally would not be realized and the resources in the area would continue to be underutilized. Furthermore, this is a noble initiative that enables middle-income earners dwelling in Nairobi to own homes and enjoy a sense of security for their families.

7.2 Proposed Project Alternative

In line with the zoning policies, the proposed site is in an area where residential buildings are allowed by Machakos County. The proposed project will provide modernized quality affordable housing units, create employment, increase the government" revenue through taxes, provide a market for goods and services, and ensure optimal use of the land. Thus, the project is a timely venture and this is the best option for the proposed site. Furthermore, support infrastructures such water supply system, sewer system, electricity, and tarmacked roads are available in the project area.

7.3 Alternative Design

This option entails undertaking the project but with different infrastructural designs that encompass building layouts and the location of supporting infrastructure. The presented project design was however achieved by considering the options available that would ensure cost-effectiveness and avoid or reduce environmental and social impacts as much as possible. The prevailing design shall increase commercial viability as well as its targeted balance with nature which will create ambient living conditions for its occupants. The proponent has settled on the proposed design after thorough consultation with the architect and engineers. The design meets the proponent's vision and objectives.

7.4 Alternative Construction Materials and Technologies

There is a wide range of construction and furnishing materials that can be sourced locally and internationally most of which shall be low maintenance and environmentally sound. The proposed project will be constructed using reinforced concrete, natural stones for the walling, cement for mortar and plaster works, structural steel, metal scaffolds, and formwork. The concrete structure will be built using locally sourced sand, cement, metal bars, and fittings that meet the Kenya Bureau of Standards (KBS) requirements. The metal scaffolds will be more advantageous than timber because they will reduce the waste of precious trees, have a longer lifetime, provide a steady and firm standing, are easily assembled and dismantled, and increase work efficiency. The technologies available include the conventional brick and mortar style, concrete frame construction, prefabricated concrete panels, timber construction, steel and

aluminum frame, and Expanded Polystyrene Technology. The proponent has preferred the use of reinforced concrete frame construction as the technology is durable, offers outstanding resistance to explosion and/or impact, and performs well during both natural and manmade disasters. Reinforced concrete can also endure very high temperatures from fire for a long time without loss of structural integrity. Priority shall be given to construction techniques and materials that are environmentally friendly, and save on time and cost of construction.

7.5 Waste Water Management Alternatives

Four locally available technologies are discussed below: -

Alternative One: Waste Water Treatment Plant This involves the construction of a plant that will enable the recycling of the wastewater from the project activities to reusable standards and utilized within the site in activities such as irrigating the flower gardens and flushing the toilets. It is usually expensive to construct and maintain, but it is the most reliable, efficient, and cost-effective in the long term. This option is not viable for the proposed project due to lack of space.

Alternative Two: Use of Stabilization Ponds/Lagoons This refers to the use of a series of ponds/lagoons that allow several biological processes to take place before the water is released back into the river. The lagoons can be used for aquaculture purposes and irrigation. However, they occupy a lot of space but are less costly. No chemicals are used/heavy metals sink and decomposition processes take place. They are usually a nuisance to the public because of the smell from the lagoons/ponds. This option is not preferable in the area because the required space is not only available, and the local community are not likely to accept the option.

Alternative Three: Use of Constructed/Artificial Wetland This is one of the powerful tools/methods used in raising the quality of life and health standards of local communities in developing countries. Constructed wetland plants act as filters for toxins. The advantages of the system are the simple technology, and low capital and maintenance costs required. However, they require space and a longer time to function. Long-term studies on plant species on the site will also be required to avoid toxin accumulation in the plants. Hence it is not the best alternative for this kind of project

Alternative Four: Use of Septic Tank This involves the construction of underground concrete-made tanks to store the sludge with soak pits. This option is viable in instances where the project is not served with a sewer system or is far from a sewer line.

Alternative Five: Use of Existing Sewer Line Systems This involves seeking approvals from the relevant authority and connecting the proposed project development with the NCWSC sewer system that exists and offers services within the area. This is the most viable alternative since the proposed development surrounding site area is connected and served by a 1.5M wide sewer system in addressing waste water issues.

CHAPTER EIGHT: ENVIRONMENTAL MANAGEMENT PLAN

8.1 Introduction

The Environmental Management Plan is an important process of ensuring project sustainability and environmental and social protection. The process and plan involve measurement of relevant parameters, at a level of details accurate enough, to distinguish the anticipated changes. It is therefore important to integrate the environmental and social impactassessment process, an environment monitoring and management plan that includes the monitoring of the progress of mitigation measures being implemented while also monitoring the project for any new negative impacts that were not earlier considered or anticipated.

Monitoring aims at determining the effectiveness of actions to improve environmental quality. The EMP outlined in the tables below addresses the identified issues of concern (potential negative impacts) and mitigation measures as well as roles, costs and monitorable time-frame that can help to determine the effectiveness of actions to upgrade the quality of environment; as regards the proposed project. The EMP have been considered for all phases; construction, operational and decommissioning phases.

Table 1: Environmental management and monitoring plan during the construction phase

Source Of Impact	Potential Impact	Controls	Responsible Party	Performance Indicator	Monitoring Requirement
General construction activities; unsafe site conditions; unsafe acts and practices	Accidents with the potential to cause physical injury, damage to property; environmental pollution	Provide Environmental, Health, and Safety training to workers to ensure that they understand the requirements of the environmental, health, and safety management plans as applicable to their responsibilities Ensure that workers sign a code of conduct to observe established procedures and are well-behaved towards the surrounding community	Contractor	Training carried out on the ESMP and HSP Signed code of conduct by worker	Quarterly inspection of training records

Site clearance; Excavations; alteration of ground level; piling of spoils on site	Loss of vegetation; soil erosion; siltation of water courses; loss of aesthetic value	Maintain as much as possible the natural drainage systems and patterns; Preserve the existing natural vegetation as much as possible Ensure the protection of vegetation using any of the following methods: mark, flag or fence areas of vegetation to be preserved; designate limits of root systems (tree drip line); and locate construction traffic routes, spoil piles etc. away from existing vegetation Where possible, commence landscaping activities as soon as superstructures are erected; Set out a plan for re-vegetation of disturbed areas, Prioritize indigenous trees and shrubs in the choice of plants		Non-interference with drainage patterns; Revegetation plan for disturbed areas Species of trees proposed for revegetation	Regular (monthly) Inspections Project completion once-Upon preparation of the revegetation plan

Earthworks; vehicle movements; transportation of materials and wastes; running of engines and motors	local air pollution by dust and exhaust fumes; potential respiratory illnesses among impacted neighbors	Sprinkle water on work areas, and materials heaps to minimize dust emissions; Minimize exposed areas through the schedule of construction activities to enable dust control Utilize vegetation, mulching, sprinkling, and stone/gravel layering to quickly stabilize exposed soil Identify and stabilize primary entrances/exits prior to commencement of construction; Direct construction vehicular traffic to stabilized roadways Maintain equipment and machinery to manufacturers' specifications by regular servicing to maintain efficiency in combustion and reduce carbon emissions; Use environmentally friendly fuels such as low Sulphur diesel; Minimize the period for machinery idling Ensure that no burning of waste is done on site; and Provide appropriate Personnel Protective Equipment such as dust masks to site workers.	Contractor	Dust levels at the site and accesses Disturbance outside active work areas Stabilized sections at the construction site and access Stabilized site entrance/exit Existence of stabilized roadway; Use of stabilized roadways by construction traffic opacity of exhaust gases from vehicles; Regular maintenance of vehicles; vehicle maintenance schedule Waste Disposal methods in use Existence and usage of PPE	Regular (weekly) inspections; sprinkling records Quarterly inspection of maintenance records Weekly inspection of usage of PPE

Use of fossil fuel-ran and/or electricity-ran equipment in construction works	Increased demand on fossil fuels and electricity to run equipment	Ensure the use of rated equipment in welding and related works; Maintain equipment and machinery to manufacturers' specifications by regular servicing to maintain efficiency in combustion and reduce carbon emissions Use environmentally friendly fuels such as low Sulphur diesel; Minimize the period for machinery idling to save on fuel Specify and procure the most energy efficient plant options fit for purpose and avoid use of plant with unnecessary and excess capacity	Contractor	Rating cards/plaque on equipment Established maintenance schedules for equipment in use Type of fuel in use on equipment Existing practices and awareness of operators about machinery idling List of requirements for each type of equipment	One-time inspection of existence of rating cards on equipment Quarterly review of maintenance records for adherence to schedules Quarterly review of the fuel type in use Visual observation of practices in weekly inspections inspection of equipment against specifications

Nuisance to surrounding communities	Potential to cause physical injury, damage to property; environmental pollution	Install portable hoods to shield compressors and other small stationary equipment where necessary Endeavor to use equipment installed with noise abatement devices as much as practicable; Reduce idling time on trucks and other noisy equipment Encourage drivers to turn off vehicle engines when not in use and avoid unnecessary hooting/revving of engines; Provide personal protective equipment such as ear muffs to workers at the site as necessary; and Carry out construction work during the day only. No works shall be carried out on Sundays	Contractor	Presence of noise attenuation features on equipment Presence of noise attenuation features on equipment awareness of operators about machinery idling Switch off machinery when not in use Existence and usage of PPE Defined construction hours of between 8 am and 5 pm	monthly inspection of equipment features and state Monthly inspection of equipment features and state; quarterly noise measurements at point sources quarterly noise measurements Weekly inspection of usage of PPE

Construction water needs; generation of the wastewater during construction works	Increased demand in the project area; contamination of surface and Ground water resources	Close water taps when not in use. Repair broken pipes Ensure that water is used efficiently by avoiding extravagant water use and wastage; Monitor water consumption and maintain records; Harvest storm water wherever possible to supplement other sources of water; Channel construction wastewater into temporary holding ponds to allow sedimentation before release in to the environment; and Recycle and reuse construction wastewater wherever possible	Contractor	Instituted measures for efficiency in consumption Installed consumption meter(s); records of deliveries by bowsers Water harvesting infrastructure at the site Presence of a sump for holding construction wastewater Evidence of recycling of wastewater at the site	Continuous review of usage and water requirements Monthly inspection of records Quarterly review of water harvesting opportunities Visual observation in weekly review of effectiveness of the sump Monthly review of opportunities for reuse or used of recycled water
Excavation for foundations; leveling of	Compaction of soil by vehicles leading to loss of soil structure	Salvage, stockpile and ensure re-use of native topsoil during re-vegetation activities in disturbed areas	Contractor	Preservation and reuse of topsoil at the site	Visual observation in quarterly inspection of soil management

the site; compaction of the soil by construction vehicles and machinery; storage and handling of hazardous materials and wastes at the site	and increased susceptibility to erosion; depletion of fertile top soil at the site; contamination of soil resources from spillages and leakages of hazardous materials and wastes; erosion and sedimentation of				practices
		Identify fertile soil borrow-pits as close as possible to the project site; Ensure re-vegetation of disturbed areas as soon as possible to prevent soil erosion; Ensure that construction vehicles use predetermined tracks at the site to reduce ground compaction;	Contractor	Nearness of identified borrow pits Time lag between disturbance actions and revegetation Established tracks/paths for use by construction vehicles	Visual observation in monthly inspection of activities and program of works Visual observation in weekly inspection of the site for extent of compaction outside established tracks

	Surface water resources	Utilize vegetation, mulching, sprinkling and stone/gravel layering to quickly stabilize exposed soil Utilize vegetation, mulching, sprinkling and stone/gravel layering to quickly stabilize exposed soil	Contractor	Stabilized sections at construction site and accesses	Visual observation in monthly inspection of accesses
		Identify and stabilize primary entrances/exits prior to commencement of construction	Contractor	Stabilized site entrance/exit	Visual observation in monthly inspection of entry/exit for effectiveness of stabilization
		Construction wastewater shall be channeled to a predetermined area such as a temporary holding pond where sedimentation can take place and reduce the amount of soil carried away in wastewater;	Contractor	Presence of a sump for holding construction wastewater	Visual observation in weekly inspection of use and effectiveness of the sump
		Oils, fuels, paints and any hazardous materials to be stored in accordance with their respective MSDS's, and in such a manner to avoid spillages or leakages. Bund walls should be constructed around these substances' storage area so as to enable containment in the event of spillage or leakage	Contractor	Storage of hazardous chemicals and wastes in bunded areas	Visual observation in weekly inspection of storage practices and evidence of leakage/spillage
		Implement erosion and sedimentation controls and ensure proper disposal of liquid waste	Contractor	Use of silt traps on potential erosion channels	Monthly inspection of effectiveness of silt traps

Construction vehicles movements in the project area	Accidents involving the surrounding community; nuisance from snarl ups	Contractor shall ensure that construction traffic movement does not coincide with the known rush hours in the project area, and that speed and loading limits are observed	Contractor	Delivery times for materials and carting of wastes; established speed limits	Review of delivery records for delivery times
		Develop a traffic management plan to ensure that site vehicles do not interfere with the regular traffic on the access roads, or pose safety hazards to site workers or the general public	Contractor	Established Traffic management plan	Monthly review of effectiveness of the Traffic management plan
		Set up traffic control/warning signs along the access road near the site entrance informing other motorists of potential hazards of construction vehicles turning	Contractor	Erected warning signage at critical areas	Visual observation in weekly inspection of signages
Construction Machinery	Soil, water pollution	Proper storage, handling and disposal of new oil and used oil and related wastes Maintain construction machinery and equipment to avoid leaks Maintenance of construction vehicles to be carried out in the contractor's yard (off the site) Provide oil interceptors along the drains leading from service bays	Contractor	Vehicle maintenance schedule	Daily inspection Routine maintenance

Use of materials in construction; rejection of defective construction materials; packaging of materials	Generation of construction wastes that cause environmental pollution, nuisance and breeding grounds for vermin	Identify a temporary holding area for demolition and construction wastes; Recycle and re-use demolition and construction waste as much as possible; Ensure that all non-recyclable/reusable wastes are cleared from site at the earliest opportunity to avoid pile-up; Avoid mixing excess concrete if possible. Discard excess concrete in a designated area; Washing of concrete-coated vehicles/equipment off-site or in a designated area. The concrete wash area will be at least 50m away from storm drain inlets or open drainage facilities. Runoff from onsite concrete wash area shall be contained in a temporary pit where concrete can set; Surface runoff within the site to be diverted in order to avoid flushing away soil and other material. Sediment traps to also be installed to remove sediments before discharge of the runoff from the site; Establish measures to ensure that construction material requirements are carefully budgeted to avoid leftovers;	Contractor	Identified area for storage of wastes Number of recycled wastes at the site Existent plans for off-site disposal of wastes Amount of concrete that is disposed as waste Designated wash area; an existent concrete washout pit at the site Installed sediment traps; lined drain for channeling of runoff Existent stock management plans	Weekly inspection of housekeeping Monthly review of records on quantities of recycled materials Weekly review of waste management practices Review of quantities of concrete wastes generated Weekly review of usage of wash area and maintenance of washout pit Monthly review of effectiveness of the site drainage Quarterly review of inventories to

Use of hand tools and machinery in construction; construction vehicle movements; housekeeping practices at the construction site; unsafe acts by construction workers	Physical injuries to workers and/or the public; damage to property	All workers will be sensitized before construction begins, on how to control accidents related to construction. A comprehensive contingency plan will be prepared before construction begins, on accident response. Keep record of the public emergency service telephone numbers including: Fire brigade, Ambulance. Accordingly, adherence to safety procedures will be enforced. Provide first aid kits at strategic places in the site. All workers to wear protective gear during construction e.g. helmets. Provide clean water and food to the workers. Construction work will be limited to daytime only. Workers to be adequately insured against accidents. Ensure that the workers are registered with NHIF and NSSF and remits appropriate fee	Contractor Project manager	Level of compliance with OSHA provisions	Routine inspection

Extraction of raw materials such as sand, masonry stones, ballast			Contractor	Available permits for materials sites existent stock management plans Existing arrangements for offsite preparation of building elements	Annual check of the licensing status of materials sources quarterly review of procurement plans for materials Quarterly review of opportunities for off-site manufacture of elements

Workers at the site	Soil and water pollution	Connecting and channeling all liquid/effluent wastes to the existing sewerage system. Provision of adequate sanitary facilities for the workers during construction and tenants during the operation phase of the facility. Proper decommissioning of the sanitary facilities shall be carried out once construction is complete. Sanitary facilities shall be kept clean always. Ensure regular maintenance of foul water drainage works at the premises to prevent clogging and fore-stall breakdowns. All drain pipes are heavy duty PVC pipe tube encased in concrete surround. All manholes should have heavy-duty covers set and double sealed airtight as approved by specialists.	Contractor		

Rainwater	Surface Run-off and Storm Water Drainage	Semi-permeable materials will be used for the construction of pavements. After completion of construction, the proponent shall embark on comprehensive landscaping. Drainage channels shall be covered; say with gratings, to avoid occurrence of accidents and entry of dirt. Construct gently sloping drains to convey water at non-erosive speed directing the storm water to the main drainage system in the area.	Contractor and proponent	Clean and unclogged drainage	Routine inspection
Any source that may ignite fire or cause fire	Fire Outbreak Risks Occurrence, Response and Safety	Post "No smoking signs" where flammable materials are stored. Hire competent and properly authorized electrical contractor to do the electrical works. Train staff on the use of the available firefighting equipment. At least one person trained on handling firefighting equipment should be available through-out the construction phase of the project. Develop and post at the site fire emergency and evacuation procedures. Provide adequate number of appropriate firefighting equipment at accessible strategic places within the property. Organize for inspection and maintenance of fire equipment at least once in a period of six months.	Contractor and proponent	No fire outbreaks	Routine inspection

Workers and tenants	Spread of HIV and security risks	To minimize project effects on local social set up, the proponent will; The contractor shall ensure that there is adequate street lighting and a security guard within the site to help curb with issues that may arise from theft. Also installing 24hr operating CCTV surveillance, which will be monitored regularly. It is recommended that the contractor employs workers from the immediate area where possible to avoid social conflict Conduct periodic sensitization forums for employees on ethics, morals, general good behavior, and the need for the project to co-exist with the neighbors. Provide safety tools such as condoms to employees Ensure enforcement of relevant legal policy on sexual harassment and abuse of office.	Contractor/ proponent	Scheduled review

Table 2: Environmental management and monitoring plan during the Operation phase

Source Of Impact	Potential Impact	Controls	Responsibility	Indicator	Monitoring Requirement
Use of the standby power generator during grid-power outages	Noise nuisance	Ensure that noise abatement devices are installed and maintained for the standby generator for power supply	Proponent	Noise levels from the standby generator when in use	**Annual noise measurements**
Use of electrical appliances; lighting within the development	Increased demand on grid energy supply	Encourage members to conserve energy through awareness programs Install and maintain energy efficient appliances e.g., indoor lights and outdoor security lights; and Continually seek avenues for energy conservation as international best practices evolve	Proponent Proponent Proponent	Instituted and program awareness conservation Installed efficient lighting energy Other energy-saving measures instituted	**Annual audit**

Usage of water by tenants	Increased demand; increased generation wastewater water	Incorporate water accounting systems and metering for all areas; Encourage members to conserve water through awareness programs; Install and maintain low volume fixtures in toilets, baths and other wet areas; Use harvested storm water in cleaning and irrigation of lawns; and Continually seek new avenues for water conservation as International best practices evolve.	Proponent	Installed water meters Instituted awareness programs Installed low-volume fixtures Use of harvested stormwater around the compound	Annual EA

Occupation of the housing by the tenants; consumption/use of materials	Generation of wastes; environmental Pollution and creation of health and safety hazards from mismanagement of wastes	Pursue waste minimization at source principles e.g., zero generation, reduction, re- use and/or recycling; Provide mechanisms to segregate wastes at source, ensure that all wastes are stored temporarily at the designated common collection area, and that they are regularly carried away for disposal in designated areas; and Ensure regular inspection and maintenance of foul water drainage works and storm water drainage works at the premises to prevent clogging, and fore-stall breakdowns. Waste water to be direct to WWTP. Ensure there is no blockages or leakages Solid waste from garage including brake pads, metal objects, plastics should be disposed off appropriately through a licensed waste recycler	Proponent	Implemented measures for reuse/recycling at household level Established mechanisms that allow segregation; Contracted waste handler; waste collection schedule Maintenance/inspection schedule; Blockage incidences Maintenance/inspection schedule; Blockage incidences Established mechanisms that allow segregation; Contracted waste handler; waste collection schedule	Annual environmental audit Waste water analysis Obtain discharge license from NEMA Routine inspection Annual environmental Audit

Table 3: Occupational Health and Safety EMP for the proposed project during construction and operational phase

Occupational Health and Safety EMP for the proposed project during construction and operational phase				
Key Issues	**Mitigation Measure**	**Responsibility**	**Time Frame**	**Cost Ksh.**
Registration of the premises	Register the premises under the Occupational Health and Safety Act Cap 514, of the Laws of Kenya is mandatory	Proponent	One-off	15, 000
General register	Keep a general register of all workers within the facility as stipulated in Sec 62 (1) of the Occupational Health and Safety Act	Proponent, contractor	Construction	5,000
Incidents and accidents	Report any incidents and accidents using prescribed forms obtainable from the Occupational Health and Safety Office Conduct regular safety education and training Prepare a contingency plan for emergency response before the start of the project.	Site Safety Officer	Continuous/ Quarterly	70,000
Insurance	Ensure the premises as per statutory requirements (third party and workman's compensation)	Proponent occupants and all	Annually	
Environment policy healthy Safety (SHE)	Develop, document and display prominently an appropriate Safety and Healthy Environment policy	Site Safety Officer	One-off	20,000
Sanitary conveniences	Provide suitable, efficient, clean, well-lit and adequate sanitary amenities at the site taking care of gender division	Contractor, proponent and all occupants	One-off	50,000
Machinery/equipment safety	Ensure that machinery, equipment, PPE, appliances and tools to be used comply with the prescribed safety and health standards and be appropriately installed, maintained and safeguarded		One-off	-

Storage of materials	Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse		Continuous	-
Emergency preparedness and evacuation procedures	Design suitable documented emergency preparedness and evacuation procedures for emergencies	Site Safety Officer	One-off	30,000
First Aid	on site a stocked first aid box which is easily available and accessible	Site Safety Officer	One-off	2, 000/kit
Fire protection	Regularly inspect and service fire-fighting equipment by a reputable service provider and maintain inspection records Prominently display signs such as "NO SMOKING" at the site especially in parts that were inflammable materials are stored	Site Safety Officer Site Safety Officer	Every 3 months One-off	20,000
Ventilation	Provide adequate space within the premises to allow for adequate natural ventilation through the circulation of fresh air	Contractor, occupants	One-off	-
Lighting	Provide adequate artificial or natural lighting in all parts of the premises where persons are working or passing	Contractor, all occupants	One-off	-
Electrical safety	Do not overload circuits Clearly mark distribution board switches to indicate respective circuits and pumps Ensure that no live electrical wires are exposed Earth all electrical equipment	Proponent and Contractor,	Continuous	-
Diseases	Provide complete refuse collection and handling service		Continuous	15,000
Security	Fence the site and employ security personnel operating 24 hours		Continuous	50,000

	Install security alarms and/or surveillance systems.			

Table 4: Decommissioning Phase Environmental Management Plan

Environmental/ Social Impact	Proposed Mitigation Measures	Responsibility	Monitoring	Frequency of monitoring
Demolition of existing structures	▪ Apply for demolition permit from relevant authorities before commencing the demolition ▪ Engage a registered contractor to carry out the demolition ▪ Provide workers with Personal Protective Equipment (PPEs) ▪ The demolition exercise to be limited at day time only ▪ Comply with EMCA (Noise and excessive vibration.	Project proponent Contractor NEMA inspectors	Inspection	**Daily during the demolition process**
Air pollution	▪ Dust suppression with water sprays on dusty areas ▪ Careful screening of construction site to contain and arrest construction related dust ▪ Ensure demolition machinery and equipment are well maintained to reduce exhaust gas emission	Proponent Contractor NEMA inspectors	Inspection Routine maintenance	**Daily**
Noise pollution	▪ Demolition activities to be restricted to daytime i.e. 8am to 5pm ▪ Use of Suppressors on noisy equipment or use of noise shields for instance corrugated iron sheet structures ▪ Workers in the vicinity or involved in high level noise to wear respective safety &	Proponent Contractor Workers NEMA inspectors	Inspection Observation Routine	Random

	protective gear. ▪ Comply with EMCA (Noise and excessive vibration pollution control) Regulations 2009		maintenance	

Safety of workers	▪ All workers will be sensitized before demolition begins, on how to control accidents related to construction. ▪ Accordingly, adherence to safety procedures will be enforced. ▪ All workers will be adequately insured against accidents.	Workers Proponent NEMA inspectors	activities checks	
Solid and liquid waste	▪ Ensure proper solid waste disposal and collection facilities ▪ Refuse collection vehicles will be covered to prevent scatter of wastes by wind. ▪ Demolition wastes to be collected by a licensed operator to avoid illegal final dumping at unauthorized sites. ▪ All persons involved in refuse collection shall be in full protective attire. 	Contractor Proponent NEMA inspectors Registered/licensed waste management company	Routine Activities checks	Daily

Re-vegetation and comprehensive landscaping	▪ Implement an appropriate re-vegetation programme to restore the site to its original status ▪ During the re-vegetation period, appropriate surface water run off controls will be taken to prevent surface erosion; ▪ Monitoring and inspection of the area for indications of erosion will be conducted and appropriate measures taken to correct any occurrences; ▪ Fencing and signs restricting access will be posted to minimize disturbance to newly-vegetated areas;	Contractor Proponent	Inspection	Random

CHAPTER NINE: SITE SAFETY AND ACCIDENT PREVENTION MEASURES

9.1 Project Employee Responsibilities

Project Manager- must lead project team by setting an example for safety awareness as well as developing, communicating and supervising the safety program. The project manager must enforce and set the tone for all safety related issues during and prior to the planning of each project phase. They must provide leadership and show commitment to a safe and healthy environment. Responsibilities shall include reviewing inspection reports, safety meeting reports and addressing health and safety issues on the jobsite.

Site Agent- must lead, oversee and manage all site work, including safety. The superintendent must ensure that safety procedures are applied in an effective manner and that all employees are conforming to established rules and regulations. Duties include establishing a pre-job assessment prior to the start of the project, ensuring site foremen comply with safety regulations, conducting safety orientations for all new employees, reviewing all incident & corrective action reports, pre-task plans and enforcing disciplinary action when necessary. The site agent will also work with the site safety representative overseeing regular site inspections, developing a site- specific emergency plan and implementing weekly tool box topics with subcontractors.

Project Engineer- Responsibilities include collecting all subcontractor safety programs, material safety data sheets (MSDS) and ensuring all site foreman have access to site plans.

Site Safety Representative- will act as the designated safety manager and will inspect the jobsite weekly, conducting safety inspections. Responsibilities include providing education and training opportunities to all employees, conducting safety audits, discussing & providing weekly tool box topics, developing an emergency action plan and procedures, reviewing all safety programs and safety data sheets (SDS), scheduling Pre-Task planning meetings & overseeing implementation, issuing violation notices, issuing corrective action reports.

9.2 Project Safety Orientation

Each employee working on the site are required to complete the Employee Safety Orientation. This must be complete within one week of any employee beginning work on site.

9.3 Job site Inspections

a) Site Safety Representative will conduct weekly site inspections, and review all safety documents (pre-task plan, crane plan, etc.).
b) Contractors shall perform daily safety inspections of their work area and equipment per OSHA, 2007 requirements.
c) After inspecting a job site/work area, the site safety representative and superintendent will identify and evaluate all potential hazards for: a. Possibility for severe injury. b. Probability of accident occurrence.

d) This site safety representative will also consider the skill and knowledge level demonstrated by exposed workers.

e) This site safety representative shall then take the following actions:

- ✓ Discuss all hazards with the necessary parties.
- ✓ Explain appropriate recommendations and precautions.
- ✓ Assist with any necessary training (i.e. provide appropriate Tool Box Talks), in accordance with the level of hazard.
- ✓ Issue citations & corrective actions.

f) Records shall be maintained for all recommendations, precautions, and training for each hazard identified.

g) All incidents, regardless of severity, will be discussed at the next project safety meeting, with an emphasis on eliminating future occurrences

9.4 Emergency Procedures, Investigation, and Reporting

Contractors/employees shall report all work related injuries, illnesses, first aid cases, near misses, property damage, and environmental incidents such as a spill or release of hazardous materials, regardless of severity, immediately to the Project Superintendent and Safety Manager.

The contractor shall investigate all incidents and forward copies of the incident report to the Safety Manager within 4 hours of the incident. An incident report must be provided for: near misses, first aid, recordable injuries, third party property damage or personal injury, and builders risk claims.

Corrective actions will be implemented and any worker compensation or liability claims shall be reported to project manager.

Follow-up information on personal injuries (doctor's reports, insurance or worker's compensation reports etc.), shall be forwarded to the Safety Manager within a reasonable time frame.

9.5 Emergency Signals and Procedures

Serious Emergency - A single long blast from an air horn shall be given by the Project Superintendent in the event of a serious emergency on the site. These include serious or life-threatening injury, severe weather or other impending natural disaster, or other emergencies not requiring immediate evacuation of the site. Please discontinue working and report to your foreman. Foremen shall report to the Project Superintendent for further instructions. Two quick blasts from an air horn shall signal the all clear.

Evacuation - Three or more long blasts from an air horn shall be given by the Project Superintendent in the event that total evacuation of the site is necessary. Immediately discontinue working and evacuate to a safe location (designated by project superintendent). Foremen shall account for all workers in their crew and shall report to the Project Superintendent. The Superintendent shall instruct the foremen according to circumstances to remain at the gathering location or retreat to a safer distance. Two quick blasts from an air horn shall signal the all clear.

9.6 Fire Prevention Program

There should be a programme committed to minimizing the threat of fire to employees,visitors, and property. It is the responsibility of the contractor to have their own Fire Prevention Program (FPP) and to instruct and train all employees in fire prevention andfire response.

When Cutting, Welding, and Open Flame Work are performed, the contractor shall at minimum ensure the following:

a) All cutting and welding equipment is inspected and operated by competent, trained personnel.
b) No cutting or welding shall take place on metal walls, ceilings, or roofs built of combustible sandwich-type panel construction or having combustible covering.
c) A fire extinguisher shall be located within 10' of all cutting, welding, or other hot work.
d) Proper PPE must be utilized.
e) All combustible materials must be properly secured and stored outdoors.
f) Smoking is prohibited at the site projects.
g) The contractor must establish and maintain a means of proper egress, and all exits must be marked by a readily visible sign.
h) Fire Extinguishers must comply with the following: a. readily available every 3,000sf. b. Require quarterly inspection tag. Any defective device must be removed from service immediately. c. Shall be located & labeled so it can be readily seen and accessible along normal paths of travel. In multi-story buildings, at least one extinguisher must be adjacent toa stairway.

9.7 Hazard Communication Program

Hazard Determination

SDS supplied by the contractors and manufacturers shall be utilized in identifyinghazardous materials. Subcontractors must submit all appropriate MSDS documentation to the project manager'soffice prior to beginning work on the project site.

Labeling

All containers on the job site shall be properly labeled by the responsible contractor. All labels shall clearly indicate: 1. Identity 2. Hazard 3. Precautionary Statement 4. Nameand address of responsible party

Safety Data Sheets (SDS)

SDS for all hazardous chemicals to which employees may be exposed will be kept at the corporate office and the jobsite field office. SDS will be available for review to all workers and employees. Notification of new or revised MSDS shall be posted

Employee Information

All known hazardous substances present on the site and location of SDS shall be disclosed to the workers in the mandatory Project Safety Orientation.

When workers are required to perform work in areas known to contain hazardous materials, it is the subcontractor's responsibility to identify: 1. Specific chemical hazards. 2. Protection/safety measures the employee is required to take to lessen risks. 3. Potential hazard reduction measures c. The main contractor will work with the subcontractor to the greatest extent feasible to limit exposure to the hazard(s).

Training

Employers must provide employees with effective information and training on hazardous chemicals in their work area, and whenever a new hazardous chemical is introduced. b. Employees are required to wear and have appropriate training on PPE associated with each hazardous chemical being used.

9.8 General Safety

Personal Protective Equipment (PPE)

- All personal protective equipment shall be provided by contractors prior to the start ofjob.
- Personal protective equipment including hard hats, safety glasses, work boots andhigh visibility shirts must be worn 100% of the time.
- Proper work attire.
- Fall protection is required for all trades when working at heights of 6' or more.
- Protective gloves or clothing shall be worn when required to protect against a hazard.
- A face shield or safety goggles are required when cutting, grinding, welding or power washing.
- Hearing protection is required when working in areas where noise levels exceed 85 decibels, or normal conversation cannot be conducted, or when the area is posted as a noise hazard.
- Dust masks or respirators shall be worn in all dusty environments. Pulmonary function testing, fit tests and written respiratory programs are required for respirator use.
- All personal protective equipment must be inspected daily as per OSHA, 2007 standards.

Moving Equipment

- All operating equipment shall be equipped with rollover guards per OSHA 2007 standards.
- Operating equipment shall be equipped with an audible notification, strobes and/or beacons per manufacturer's requirements.
- A spotter is required whenever a vehicle has a restricted view while operating on site.
- Properly set-up barricades or traffic control zones when operating equipment near public roadways. When construction activities are at a peak level, the use of a spotter/traffic controller is permitted to help direct and control traffic.
- Contractor/Sub-contractors is required to conduct daily inspections of all equipment.
- Employees assigned to traffic control duties must wear high visibility clothing per OSHA 2007 standards.

Excavating/ Site Utilities

The competent person must inspect the excavation:

- Daily before work activities commences.
- After a heavy rainfall.
- At depths greater than 4" for oxygen deficiencies or hazardous atmospheres.
- For failures of protective systems, equipment and adjacent structures.

✓ Miss Dig must be contacted prior to starting any excavating.

✓ When working in a trench 4 feet or more in depth, proper sloping, shoring, or other cave-in protection methods shall be utilized.

✓ Ladders shall be provided at least every 25 feet for access to trenches exceeding 4 feet in depth.

✓ Material and spoil piles shall be kept a minimum of 2 feet away from the edge of a trench.

✓ All open holes, trenches, and excavations shall be barricaded and clearly marked to alert the public and other workers in the area.

✓ Excavations and trenches may be confined spaces where air monitoring could be required.

✓ All vehicles hauling soil from site must pull into site and turn around.

Crane & Rigging Safety

- Must be included in a Pre-Task plan.
- All operators shall be certified and cards submitted to project supervision before start of work.
- All cranes are to be inspected on a daily basis.
- All cranes must have proof of annual inspection.
- Outriggers must be manufactured and be fully extended and on stable ground.
- The swing radius of all cranes must be properly barricaded.
- Contractor must submit a copy of the crane plan (operation, swing radius, etc.) to superintendent prior to the start of the project.

Fall Protection

✓ Fall protection systems are required when exposed to heights of 6' or more. Systems include: Guardrail, Safety nets and Personal fall arrest systems. All systems must be inspected, constructed and installed per OSHA, 2007 requirements. When conducting roofing work, contractors are required to submit a pre-task analysis.

✓ All holes/ floor openings greater than 2" in depth or diameter are required to be properly barricaded/covered or secured, and clearly marked with high visibility paint as a "hole". All hole/openings that are barricaded and covered shall be securely/mechanically fixed in place.

✓ Contractors are required to maintain all fall protection devices.

✓ If an employer can demonstrate conventional fall protection methods are infeasible or present a greater hazard, a fall protection plan may be implemented. The fall protection plan must comply with OSHA standards and include the following:

- Site specific requirements/unique circumstances.
- Prepared by a qualified person.
- Supervised by a competent person.
- Explain why conventional methods are infeasible.

- Discuss the safety measures that will be taken to reduce or eliminate the fall hazard ofthe workers.
- Describe all controlled access zones.
- Require training for all employees.

Electrical

- Cords and tools must be inspected on a daily basis. If the insulation or casing of the cord is damaged, or the ground prong is missing, the cord will be cut by project supervision.
- All cords must be 3 prong heavy duty cords and be protected from indoor/ outdoor traffic.
- Portable generators must be provided with ground fault circuit interrupters.
- Temporary lighting must be protected with safety guards.
- Stairwells, corridors & work areas shall be properly illuminated with either temporaryor permanent lighting.

Scaffolding Safety

- All scaffolds must be erected and inspected daily by a competent person
- Each work level of the scaffold system shall be full planked and overhang the end supports by a minimum of 6 inches and a maximum of 12 inches. Planking which does not meet this requirement must be cleated.
- The scaffold system must have a ladder provided for access. Climbing the bracing is not acceptable unless the system has a built-in ladder for that purpose.
- Scaffolding height must never exceed 4 times their minimum base dimension. If this is exceeded, the scaffold must be tied into the structure.
- All working and walking levels must be fully planked and not overloaded.
- Planks must be scaffold grade lumber. Cracks shall not penetrate more than 12 inches.
- The footing or anchorage for scaffolds must be sound, rigid and capable of carryingthe maximum intended load without settling or displacement.

Ladder Safety

- Only type 1A ladders with a heavy-duty rating are required.
- No painted or aluminum ladders are allowed on site.
- All ladders must extend a minimum of three (3) feet above the landing and be secured. If the ladder cannot be secured, it must be held at the bottom by another worker.
- Keep ladder bases clear from debris, hoses, wire, materials, etc.
- Use the "four and one" rule when positioning a ladder – one foot of base for everyfour feet of height.
- Step ladders must be fully extended and locked into place. Placement shall be onstable surfaces.
- Workers shall not straddle or stand on the top two rungs of a ladder, and shall work facing the ladder.

Aerial Work Platforms

- Must be inspected daily.
- Operated by trained and authorized personnel. Employees must have operator's certification readily available
- All employees must wear a body harness and be tied off inside the basket when elevated at all times.
- Lifts should only be operated in accordance with the manufacturer's manual.

Housekeeping

a) Contractor/Subcontractors must properly dispose of all waste materials on a daily basis.
b) Contractor/Subcontractors must properly store and secure all work material and equipment.
c) Site clean-up is required on a daily basis.
d) Stairways and passageways must be kept clear of debris.

9.9 Site Specific Safety Requirements

Site Work

- Employees must wear proper PPE.
- Contactor/Subcontractors must maintain a clear path through the job site.
- Storing of materials and goods will be located in a way as to prevent site congestion

Concrete

- All exposed rebar will be capped, or covered to protect against impalement or injury.
- Employees operating equipment such as vibrators pump nozzles, and/ or buggies will wear appropriate clothing and PPE, such as boots, eye protection and hearing protection. Long sleeve shirts will be worn to protect against the exposure of concrete.
- Concrete contractor must appropriately barricade working area during concreteforming and after concrete has been poured.
- Material used for formwork must be removed and properly disposed of. Subcontractorwill remove all debris and conduct a clean-up of the work area daily.

Steel Erection

- Subcontractor must conduct a pre-task analysis with the superintendent before all overhead hoisting activities take place.
- The area of erection must be securely barricaded. If necessary, a controlled accesszone may be permitted.
- All steel erectors must wear appropriate PPE, including fall protection at heights greater than 6 feet and a face mask when welding.
- Contractor must provide the following when using a crane: Crane operatorcertification. Crane plan, including staging area, swing radius and required barricades.

Block Masonry

- Mason contractor must provide, if applicable, wall bracing plan prior to start of work
- Competent person (foreman) must conduct daily inspections of scaffold equipment
- Employees working within restricted fall zone must be trained and certified to work in restricted fall zone area.
- Masonry block walls at heights of 8 feet or greater, not tied into the structure, must be adequately braced.
- Restricted fall zone areas must be established prior to the construction of the wall, andwill be restricted to employees who are actively engaged in constructing the wall.

Truss & Deck Framing

- All walkways and working surfaces must be clear of debris to prevent trippinghazards.
- Employees are required to wear appropriate PPE, including fall protection at heights greater than 6 feet.
- Contractors must establish a controlled access zone to prevent other contractors from entering work area.
- Trusses/Joists must be adequately braced to prevent falling or tipping.
- Contractor must barricade crane swing radius when loading and setting trusses in place.

Window Installation

- All window openings require a guardrail if the window sill measures a height below 39" and a width greater than 18".
- When installing windows on the upper floors, the area below (ground level) must be properly barricaded.
- Employees are required to wear a personal fall arrest system when installing windowson the upper floors.
- If using any lifting devices (rough terrain, aerial), employees must: A. Wear a personal fall arrest system B. Have operator's license to use equipment. C. Inspect equipment daily.

Drywall

- Daily cleanup is required.
- A clear path must be maintained.
- Proper storing methods are required.
- Employees must wear proper PPE at all times.

Paint Primer

- Contractor must submit all required MSDS.
- Employees must wear appropriate work attire and PPE, including face masks/respirators when spraying paint. A written respiratory program is required as well.
- Employees must use ladders/ lifts to reach difficult areas.

- While painting/ priming, contractor must make sure work area is properly ventilated.
- Contractor is permitted to set up a restricted work zone when spraying paint.
- Properly store all paint material, and dispose of empty paint buckets daily.

9.10 Sexual Harassment

Discrimination against any employee or applicant on the basis of the person's sex is strictly prohibited. Sexual harassment is a violation of state law and will not be tolerated. Any unwelcome sexual advances, requests for sexual favors and other verbal or physical conduct of a sexual nature constitute sexual harassment when:

a) It is stated or implied that submission to such conduct is a term or condition of a person's employment; or
b) Submission to or the rejection of such conduct by a person is used as a basis for any employment decision affecting such person, such as, but not limited to, pay increases, work assignments, promotions, performance evaluation, etc. or;
c) Such conduct has either the purpose or effect of interfering with a person's work performance or creates an intimidating, hostile or offensive work environment.

Any employee or applicant who feels that he or she has been subjected to sexual harassment should report any incidents of sexual harassment to his or her supervisor, or any member of management, without fear of reprisal. The totality of the circumstances, the nature of the alleged harassment and the context in which the alleged incidents occurred should be investigated in determining whether alleged conduct constitutes sexual harassment. Every reasonable effort will be made to maintain confidentiality. Sexual harassment case shall be reported to police for further investigation and prosecution.

CHAPTER TEN: CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

The proposed project design has integrated mitigation measures with a view to ensuring compliance with all the applicable laws and procedures. The proposed project will be implemented as per the approvals by among others; Machakos County Physical Planning Department, NEMA and NCA.

During project implementation and occupation, sustainable environmental management will be ensured through avoiding inadequate/inappropriate use of resources, conserving nature and guaranteeing a respectful and fair treatment of all people working on the project, general public at the vicinity and inhabitants of the project. In relation to the proposed mitigation measures that will be incorporated during construction phase, the development's input to the society; and cognation that the project is economically and environmentally sound. It is our considerable opinion that the proposed development is a timely venture that will subscribe to proponent's timely investment. It is thus our recommendation that the project be implemented provided the outlined mitigation measures are adhered to. Major concerns should nevertheless be focused towards minimizing the occurrence of impacts that would

degrade the general environment. This is possible through implementation of the recommended Environmental Management and Monitoring Plans.

10.2 Recommendations

Recommendations for the prevention and mitigation of adverse impacts are as follows:

1. That National Environmental Management Authority do consider, approve and grant required Environmental Impact Assessment License to the proponent
2. That the Project Report here now presented is sufficient and meets the requirements of the Environmental (Impact Assessment and Audit) Regulations 2003.

REFFERENCE

1. Government of the Republic of Kenya, Environmental (Impact Assessment and Audit) Regulations 2003 (Nairobi: Kenya Parliament, 2012)
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