

ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT

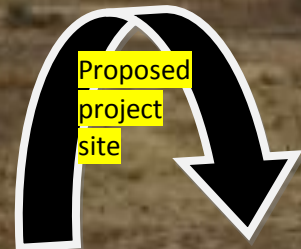
**KINGS SERENITY AFFORDABLE HOUSING
DEVELOPMENT BY KINGS SERENITY LIMITED ON
PLOT NO. NGONG/NGONG/52124, RONGAI, KAJIADO
COUNTY**

Project Proponent

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**ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT ON PROPOSED
KINGS SERENITY AFFORDABLE HOUSING SCHEME – KINGS SERENITY
LIMITED**

**SUMMARY OF ANTICIPATED IMPACTS AND PROPOSED MITIGATION
MEASURES**

| Impact | Proposed Mitigation |
|--|--|
| Changes in hydrology/impended drainage | <ul style="list-style-type: none"> • Proper installation of drainage structure. • Ensure efficiency of drainage structures through proper design and maintenance. |
| Soil erosion | <ul style="list-style-type: none"> • Control earthworks • Install drainage • Compact loose soil • Landscaping • Control activities during rainy conditions • Provide soil erosion control structures on the steep sides during construction phase |
| Air Pollution | <ul style="list-style-type: none"> • Control speed and operation regular maintenance of construction vehicles/plant equipment • Sprinkling of water during construction phase |
| Noise Pollution | <ul style="list-style-type: none"> • Sensitize drivers on noise management • Maintenance of plant equipment • Construction activities to be restricted to daytime • Workers in the vicinity of high level noise to wear safety and protective gear. • Provide noise buffers such as walls and trees around site. |
| Oil Pollution | <ul style="list-style-type: none"> • Proper storage handling and disposal of oil waste. • Maintain plant and equipment to avoid leaks • Maintenance of construction vehicles should be carried out in the contractor's yard of the site. • Provide oil interceptors along the drains leading from the carwash and service bays |
| High water demand | <ul style="list-style-type: none"> • Management of water use • Recycling of water during construction phase Rainwater harvesting |
| Contractors lay down area | <ul style="list-style-type: none"> • Special attention should be paid to sanitary facilities on site • Garbage should be disposed off periodically at approved dumpsites |
| Road Safety | <ul style="list-style-type: none"> • Enforce speed limits for contraction vehicles especially along roads leading to the site • Provide bill boards at the site entrance to notify motorists about the development |
| Public health and | <ul style="list-style-type: none"> • Ensure proper solid waste disposal facilities |



| | |
|---|---|
| occupational safety | <ul style="list-style-type: none"> • Ensure effective waste water management • Sensitize residents on environmental management • Provision of Personal Protective Equipment (PPE) |
| Vegetation | <ul style="list-style-type: none"> • Revegetation in the event of removal of vegetation • Landscaping |
| Fire Safety training/ emergency response | <ul style="list-style-type: none"> • Adapt effective emergency response plans • Enhance disaster preparedness among stakeholders • Ensure equipments are well maintained |
| Record Keeping | <ul style="list-style-type: none"> • Collection and analysis of relevant environmental data of the site |
| Internal Audits | <ul style="list-style-type: none"> • Monitoring will involve measurements, observations, evaluations, assessment of changes in water quality, waste management, noise levels, contractors safety etc |
| Fire Outbreaks | <ul style="list-style-type: none"> • Install firefighting equipment • Sensitize workers and residents on fire risks management • Adapt effective emergency response plan • Maintain firefighting machinery regularly • Provide emergency numbers at strategic points |
| Security | <ul style="list-style-type: none"> • Provide security guards and facilities during construction period • The gate should always be manned by security men even during occupation |



MAP OF KENYA: KAJIADO COUNTY



Kajiado County (blue) within Nairobi Metro (green) Kitengela town is located in [Kajiado](#) County just 30 kilometers south of [Nairobi](#). The town is part of the Nairobi Metropolitan Area.



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EXECUTIVE SUMMARY

Proposed development of 700 No. Two bedroom flats at Plot No L.R 52124 Rongai Kajiado.

1. Overview

The primary objective of the proposed project is to develop 10 No. blocks of 720 No. Two bedroom flats on Plot No L.R. Ngong/Ngong/52124 Rongai, Kajiado County. Presently, the project site is not developed and it has been used as a grazing land by the Wakaba family. The proposed development consists of the following key features:

- 1 No. block of 720 **No. Two bedroom flats of four and ground floor.**

Each of the 700 No. two bedroom units will have the following space elements among others.:

- 2 No. bedrooms
- Lounge area
- Kitchen/Store
- Toilets/Bathrooms etc.

The project occupies 8 acres. The main design components of the project include, but not limited to the following:

- Development of 1 No. block 720 No. Two bedroom flats
- Development of external works/services – driveway, car parking lots, water supply, sewer, electricity supply etc.
- Site landscaping
- Perimeter fence, gate/gatehouse.

2. Environmental Impacts and Mitigation Measures

The potential negative environmental impacts of the proposed project and possible mitigation measures are summarized below: -

| Potential Negative Environmental Impacts | Mitigation Measures |
|---|--|
| 1. Architectural Incompatibility leading to distortion of neighbourhood | 1-1 Harmonize building scale with existing development in neighbourhood. |



| | |
|---|---|
| aesthetic image | 1-2 Harmonize detail, material and finishes for roofs and walls with existing development in the neighbourhood |
| <p>2. Disruption of existing natural environment and modification of micro-climate:</p> <ul style="list-style-type: none"> - Increased development density - Increased glare/solar reflection - Reduced natural ground cover - Obstruction of ventilating wind - Increased surface run-off | <p>2-1 Development restricted to approved density – building line, plot coverage and plot ratio.</p> <p>2-2 Careful layout and orientation of buildings to respect wind and sun direction.</p> <p>2-3 Adequate provision of green and open space planted with grass, shrub and tree cover.</p> <p>2-4 Minimum use of reflective building material and finishes for roof, wall and pavement.</p> |
| <p>3. Pollution and health Hazards</p> <ul style="list-style-type: none"> - Dust and other construction waste - Noise generation from construction activities. | <p>3-1 Damping down of site e.g. sprinkling water to dusty areas on construction site.</p> <p>3-2 Containment of noisy operation, including locating noise operations away from sensitive neighbours</p> <p>3-3 Limit construction work to day hours only from 8.00 a.m -5.00 p.m</p> |
| <p>4 Increased loading of Infrastructure services</p> <ul style="list-style-type: none"> - Increased vehicular and/or pedestrian traffic - Increased demand on water, sanitation services etc. | <p>4-1 Have clear exit/entry on access road.</p> <p>4-2 Encourage rainwater harvesting.</p> <p>4-3 Provision of increased water storage capacity</p> |
| <p>5 Worker accidents and health infection</p> | <p>5-1 Employ skilled and trained workers, educated on construction site safety procedures. Also, provide workers with protective clothing.</p> <p>5-2 Prepare clear work schedule and the organization plan.</p> <p>5-3 Have adequate worker insurance cover</p> <p>5-4 Enforce occupational health and safety standards.</p> |
| <p>6 Increased social conflict</p> | <p>6-1 Encourage formation of community policing and neighbourhood association.</p> <p>6-2 Increased economic activities – increased employment opportunities, income and capital stock formation</p> <p>6-3 Increased housing stock in the area.</p> |



1 INTRODUCTION AND BASELINE INFORMATION

1-1 Terms of Reference (TOR)

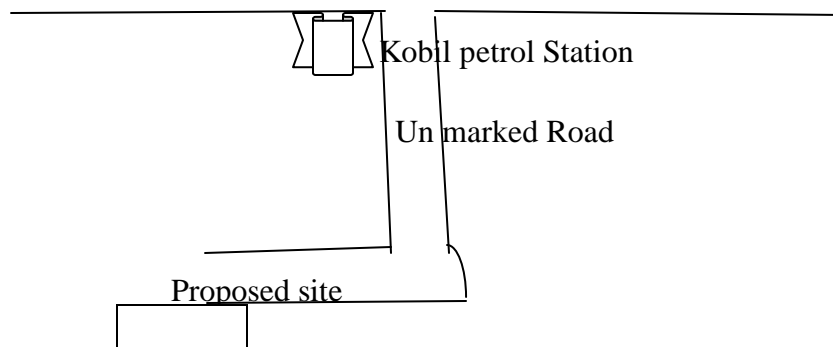
The TOR of this EIA Project Report for the proposed development addresses the following key specific objectives:

- To review existing legal and institutional framework related to the proposed project
- To collect and collate baseline information relevant to the proposed housing development
- To collect primary data through the community participatory process.
- To identify and assess positive and negative impacts of the proposed project
- To identify and analyze alternative options for the proposed project
- To develop mitigation measures and cost estimates for the negative impacts of project.
- To design an Environmental Management Plan (including cost estimates) and a monitoring framework for the environmental impact of the project.

1-2 Site Location

Kajiado has 5 sub-counties which we have listed as follows; Kajiado Central, Kajiado North, Loitokitok, Isinya, Mashuuru Sub-counties are decentralized units for the delivery of services at the counties which are headed by a sub-county administrator, appointed by a County Public Service. Rongai is in Kajiado North Sub- County

Kiserian- Magadi road





The property is located in Rongai residential area, Kajiado County. The county borders [Nairobi](#) and extends to the [Tanzania](#) border further south. The county headquarters is [Kajiado](#) but the largest towns is [Ngong](#), Kitengela and Keseria town.

(Other landmark features are several Churches, Banks, and supermarket among others)
The grid coordinates is. **Latl.1.401052,36.763457 and 251139.1E9845022.6N37M.**

1-3 * Project Proponents/Developer

Kings Serenity Limited is the project Proponent while the project developers are Kings Developers Limited.

1-4 Land Tenure and Approved Development

The property where the proposed residential high-rise residential housing development is located falls under Private Land. There is a title deed document for the land in the name of the proprietor.

1-5 Plot Size

The proposed development occupies 1 No. plots which measures 8 acres

1-6 Site Conditions

The climatic and physical conditions of the site compare favorably to that of the wider Kajiado county. A combination of one or more of these factors directly influence urban housing development, and are prerequisite to site analysis and planning:





1-6.1 Climate

The climate of the proposed project site identifies with that of the wider Kajiado County.

Below is a summary of the climatic conditions of Kajiado County where the proposed residential building development is located:

i) Rainfall

- Rongai has a bimodal rainfall pattern, in which the maxima occur in March- April (long rains) and November-December (short rains). The simple rainfall regime is complicated by the uncertainty of rainfall from year to year.
- Average annual rainfall is 875mm, which may actually vary from 500mm to more than 1500mm.
- Thunderstorms may occur, nearly always during the afternoon or evening, during most months of the year but they are rare during the period June/ August.
- Hail is comparatively rare in the area, being reported at any station on average less than once a year unlike other areas such as western part of Kenya.

ii) Temperature

Average, daily temperature varies from 17° C in July/August, to 28° C in March. The maximum daily range of temperature is quite large 10 ° C to 30 ° C in May and February respectively.



Neighbouring residential property under construction



Power line to the proposed project area.

iii) Wind Patterns

A significant feature of the climate of Kajiado is the frequency with which the wind comes from the North East and to a somewhat lesser degree to the South East. These are the North East and South East Monsoon, which blow very steadily but without high intensity. Both wind run and mean wind speed are at a maximum in December. Winds also remain high during January, February and March, which coincide with the period of higher potential evaporation. The strongest winds occur during the dry season just prior to the "Long Rains" when speeds of about 20 miles per hour are not uncommon from mid-morning to early afternoon; at other times of the year winds speeds are usually 10 to 15 miles per hour. During the night the wind is usually light. In the squalls sometimes associated with thunderstorms, short-lived wind speed of up to 70 miles per hour has been known to occur.

iv) Sunshine and Solar Radiation

Solar radiation and sunshine is considered together since they are so closely connected. Nairobi experiences a total of about 2,500 hours of bright sunshine per annum, which is equivalent to annual mean of approximately 6.8 hours of sunshine per day. July and August are characterized by cloudiness and during these months the average daily sunshine is 5 hours. Frequently there are several days in succession when the sun fails to penetrate the thick stratocumulus cover, although on other days the cloud does break to a greater or lesser extent for a short period. There is about 30% more sunshine in the afternoon than in the morning and it follows that westerly exposures receive more isolation than easterly one.



v) **Evaporation**

The annual variation of evaporation is as expected from consideration of temperature and sunshine factors. The mean annual evaporation as measured by the pan is seen slightly to exceed the mean rainfall of the area

Evaporation data is only available in Nairobi's Dagoretti Corner Meteorological Station. The peak evaporation values are during March, followed by January, February and October. The mean yearly evaporation is 1700 mm. The highest annual evaporation is 1951 mm while the lowest is 1519 mm.

vi) **Heat Balance**

On hot sunny days, when the wind is light, considerable turbulence is experienced in the first few 100 feet above the ground due to differential heating of the surface. Dangerous down draughts frequently occur in areas where the configuration of the ground is uneven. During the hot period there is a lot of dust inhibiting proper visibility.

1-6.2 **Physiography**

i) **Geology and Soils**

The geology of Kajiado has been dominated by rifting and volcanism associated with tectonic movements. The area where the proposed project is located within the phonolitic trachyte, which contains numerous closely spaced felsar phenocrysts about half an inch long. The rocks are grey and in rather coarse groundmass containing a little nepheline.

The phenocrysts often display sub parallel alignment, indicating the direction of flow of the lava. The project site is however characterized by black cotton soil. The black cotton soil on the project site is however stable and well drained.

ii) **Relief**

The formation of the Rift Valley has strongly influenced the geology and geomorphology of the Kajiado area. Kajiado region falls from the edge of the Rift Valley to the west with an elevation of 2,300 metres (7500ft) to 1,500metres (5,000ft) to the east of the city, with the center itself at 1,700metres (5,500ft). The proposed housing development in Dagoretti area is located on a flat ground.



Site Topographical



The site is partly covered by grass which has dried due to the dry spell

1-6.3 Vegetation

The project site has grass cover. These will however be cleared to pave way for the proposed development.

1-7 Land Use Zoning in Kitengela

The approved development includes –

- Residential user
- Flats and maisonettes allowed
- There is no sewer. Conservancy tank to be used.
- Approved plot coverage 0.35 and plot ratio 0.75 on sewer.

1-8 Socio-Economic Profile

Development of the proposed housing project in Kitengela is affected by two important socio-economic aspects: Population/demography and economic trends in the neighbourhood and the City of Nairobi:

1-8.2 Population Demography

Kitengela is one of the satellite towns of the city of Nairobi experiencing high rates of demographic transition over time and Mavoko Sub county of Machakos County which is experiencing an upsurge of industries. This is mainly due to the urban rural migration as well as natural population increase.



1-8.3 Total Housing Demand in Nairobi City

With an intercensal population growth rate of about 4.9%, the city's population is projected at about 2,855,792 persons, with 890,376 households, which also currently represent the current housing demand within Nairobi metropolitan area . This is projected to 5,852,736 persons on 2020 with 1,959,668 households/housing demand in 2020 – Table 1-2:

Table 1-2: Population and Total Housing Demand for Nairobi

| Years | 1999 | 2005 | 2010 | 2015 | 2020 |
|-------------------------|---------|---------|---------|---------|---------|
| Total Population | 2143254 | 2855792 | 3627472 | 4607671 | 5852736 |
| Housing Demand | 649426 | 8900376 | 1158181 | 1506536 | 1959668 |

Source: 2009 Census Survey used as base for projection

The table underscores that an increase of the city's population will subsequently lead to an increased number of households, hence an increased housing demand which also include that of the civil servants.

1-8.4 Total Housing Demand in Ongata Rongai Area

According to the 2009 population and housing census survey, the population for the area is at 687,312 persons. From the foregoing, the intercensal growth rate for the total population as well as the number of households is estimated at 30%. The current housing demand in the area is approximated at 3 967 units, and is projected to 6 002 units in 2020 – Table 1-3:

Table 1-3: Projected Housing Demand in Rongai Residential Area

| Item | Projection Years | | | | |
|--------------------------|------------------|------|------|------|------|
| | 1999 | 2005 | 2010 | 2015 | 2020 |
| Projected Housing Demand | 3361 | 3967 | 4554 | 5228 | 6002 |

Similarly, an increase in the population in Ongata Rongai, as accompanied by an increase in the number of households will create room for an increased demand in housing. The proposed project is therefore timely because it will help to meet the current and future housing demand especially to the middle income persons in the Kajiado and the neighbouring county of Machakos.

1-8.5 Employment Trends in the Neighbourhood



Currently most businesses including commercial and offices are located in the neighbourhood. These businesses employ workers both at managerial and lower levels. Some of these people would prefer to live close to their places of work. This further justifying the relevance of the proposed housing development project in Ongata Rongai

1-8.6 Socio-Economic Importance of Housing Development

Housing is a significant input in the process of economic production. People who are well housed will be in the right mental and physical health to contribute their labour or entrepreneurship as important factors of production. Well-housed population will therefore increase the general productivity of the national economy. Housing is also a very important social commodity/service.

A dwelling unit is the refuge for each family or social unit in the community. Good housing or lack of it therefore has a lot of implications on the welfare of families. Housing type and quality will reflect the social status of a family. But on an overall scale shelter is considered a basic need of mankind and hence responsibility.

1-8.7 Economic Importance of Construction Industry

The construction industry plays a very important role in the economy. Indeed, construction index is one of the indicators of overall economic performance. Construction plays an important role in the economy, in that it is a labour intensive activity that utilizes both skilled and unskilled labour.

That moneys spent in a construction project circulate in the local economy.

2.0 LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

2-1 Legal and Policy Framework

There are several pieces of legislations and policy documents related to housing development in Kenya. These include, but not limited to the Physical Planning Act (Cap. 286), the Penal Code (Cap 63), the Environmental Management and Coordination Act (No 8 of 1999), the Public Health Act (Cap.242), the Local Government Act (Cap. 265), the Building Code, the Factories and Places of Work



Act (Cap. 514), Sessional Paper No. 9 of 1999 on Environment and Development, National Environmental Action Plan (NEAP), Millennium Declaration and Brutland Commission Report of 1987.

The relevance of the aforementioned legislations as well as policy papers (national and international) and institutional framework related to the proposed development are discussed in the following sections:

2-1.1 The Physical Planning Act (Cap. 286)

The Physical Planning Act (Cap. 286), which commenced on 29th October 1998, aimed at developing a sound spatial framework for co-existence, through plan proposals that enhance and promote intergraded spatial/ physical development of socio-economic activities. Because building/construction of residential houses constitutes making of material change to land, the activity constitutes “development”, hence need to be controlled by local authorities. From the foregoing, the Physical Planning Act (Cap. 286) has made specific provisions in respect to the mandate of local authorities in the need for physical planning. As concerns, city, municipal, town and urban councils:

- Section 24(1): Director may prepare with reference to any Government land, trust land or private land within the area of authority of a city, municipal, town or urban council or with reference to any trading or marketing center, a local physical development plan.
- Section 24(3): the Director may prepare a local physical development plan for the general purpose of guiding and co-coordinating development of infrastructure facilities and services for an area referred to in subsection (1), and for the specific control of the use and development of land or for the provision of any land in such area for public purpose.
- Section 25(b): a local physical development plan shall consist of such maps and description as may be necessary to indicate the manner in which the land in the area may be used

According to Section 33 of the Physical Planning (Building and Development Control) Regulations, the Director of Physical Planning shall refuse to recommend any new building or proposed development, or alteration or addition to any existing building if:

- The proposal is not in conformity with approved development plan



- Such plans disclose a contravention of the physical planning (Building and Development) rules
- The plans are not correctly drawn or omit to show information required
- On such being required, a separate application accompanied by sets of plans has not been lodged in respect of buildings on separate plots or subplots
- The land or the proposed building or structure is not used for any purpose which might be calculated to depreciate the value of neighboring property or interfere with convenience or comfort of neighboring occupants
- The proposed building or land use is unsuitable, injurious to amenities or detrimental in respect of appearance or dignity or fails to comply with physical planning requirements in regard to sitting, design, height, elevation, size, shape, structure or appearance
- Roads of access, parking bays, vehicular and pedestrian circulation spaces or other services to the plot or premises are inadequate
- The building is not sited in a satisfactory position
- The system of drainage, including soil, waste and surface water of the plot, or subplot upon which the building is to or stand, is not satisfactory
- Provision has not been made for adequate natural light and ventilation, or
- Any other physical planning issue

Section 36 of the Act (Cap. 286) further compels that if in connection with a development application, a local authority is of the opinion that proposals for industrial location, or any other development activities (such as building developments) will have injurious impact on environment, the applicant will be required to submit together with application an environmental impact assessment report. The above provision compares well to Section 29 (a), which confers upon local authorities the powers to prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area.

2-1.2 The Environmental Management and Coordination Act No. 8 of 1999.

The Environmental Management and Coordination amended Act (EMCA) of 2015, and its attendant Environmental (Impact Assessment and Audit) Regulations of 2003 provides for the establishment of an appropriate legal and institutional framework for the management of 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 (I) has underscored that any person being a proponent of a project shall before financing, commencing or proceeding with submit an EIA report to the National Environmental Management Authority



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

2-1.3 The Public Health Act (Cap. 242)

Environmental degradation may pose a health hazard to the general public. this is among the factor considered by the Public Health Act to constitute “nuisance”. For the interpretation of the Act, Section 15 (IX) indicates that any noxious matter, or wastewater discharged from any premise, such as a building constitutes nuisance. Any premise not kept in a clean and free from offensive smell such as gases which are injurious to health such as those from commercial establishments shall therefore generate nuisance. The act therefore stresses that no person shall cause a nuisance to exist on any land or premise occupied by him. Because of the above, the Act acknowledge that it shall be the duty of all local authorities to take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to health. To safeguard against this, Part X of the Public Health Act states that where in the opinion of the Medical Officer of Health that food stuffs within a warehouse, or a building are insufficiently protected, the owner shall be compelled to observe the require regulations, else he shall be guilty of an offense.

2-1.4 The Local Government Act (Cap. 265)

This Act specifically sets out the procedures in administration of local authorities. Because of this, it clearly articulates the constitution as well as the conduct of all local authorities in Kenya. The Act empowers local authorities to control or prohibit all places of work that by reason of smoke, fumes, or chemical gases, dust smell, noise or vibration or other cause may be a source of danger, discomfort, or annoyance to the neighborhood, and to prescribe the conditions subject to which businesses, factories and workshops shall be carried on. Section 160 (a) underscores that every municipal council has the power to establish and maintain sanitary services for the removal and disinfection, or otherwise dealing with all kinds of refuse and effluent, such as spent oil, and where any such services is established, to compel the use of such services by persons to whom the service is available.



2-1.5 The Factories and Other Places of Work Act (Cap. 514)

The Act aims at making provision for the health, safety and welfare of persons employed in factories and other places of work. Section 13 states that every factory shall be kept in a clean state and free from effluvia, arising from any drain, sanitary convenience or nuisance. Effective and suitable provisions is also proposed for securing, maintaining by circulation of fresh air in each workroom, the adequate ventilation of the room. Section 36 provides for precautions with respect to explosive inflammable dust or gas. The Section is specific that where in any building, if dust that could escape to work man's room and explode by ignition, steps must be taken to prevent such an explosion. Section 41 compels that in every factory, there shall be maintained fire extinguishers, which shall be adequate and suitable in case of fire out breaks. Similarly, it mandates every factory to provide adequate means of escape in case of fire outbreak for the employees. The Act further requires that if a factory worker is employed in any process involving exposure to wet or to any injurious or offensive substance, suitable protective clothing must be provided by the employer.

2-1.6 The Building Code

In recognition of the role of local authorities as lead planning agencies, the adoptive by-law compels any potential developer to submit development application to relevant local authority for approval. The local authorities are empowered to disapprove any plan submitted if it is not correctly drawn or do not provide sufficient information that complies with the by-law. Any developer, who intends to erect a building such as a residential block, must give the concerned local authority a notice of inspection, before the erection of the structure. After erecting the building, a notice of completion shall be issued to the local authority to facilitate final inspection/approval. No person shall therefore occupy a building whose certificate of completion has not been issued by the local authority. As a precaution against fire breakout, the by-law states that the walls of any premise shall be non-combustible throughout, similarly, in every building, other than a small house, which comprises more than one storey, shall have fire resistance. The by-law, in Section 214 indicates that in any public building where floor is more than 20 feet above the ground level, the council may recommend the provision of firefighting equipment that may include one or more of the following: hydrants, hose reels and fire appliances, external conations, portable fire appliances, water storage tanks, dry risers, sprinkler, drencher and water spray spring protector system.



2-1.7 The Penal Code (Cap. 63)

The chapter on “Offences Against Health and Conveniences” contained in the Penal Code enacted in 1930 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 health of persons in general dwelling or carrying out business in the neighborhood or passing along public ways is guilty of misdemeanor, i.e. imprisonment not exceeding two years with no option of fine. Under this code, any person who for the purpose of trade or otherwise makes 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, commit any offence, and is liable to be punished for a common nuisance, i.e. imprisonment not exceeding one year with no option of fine

2-1.8 The World Commission on Environment and Development

The commission commonly referred to as “the Brundtland Commission” focused on the environmental aspects of development, in particular, the emphasis on sustainable development that produces no lasting damage to biosphere, and to particular ecosystems. In addition, environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. While 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, and shelter, cultural expression and political involvement.

2-1.10 The Rio Declaration on Environment and Development

Agenda 21 – a programme of action for sustainable development worldwide, 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 14th June 1992. Principle No. 10 of the declaration underscored that environmental issues are best handled with participation of all concerned citizens at all the relevant levels. At the national level, each individual shall have



appropriate access to information that is concerning 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 EMCA demands that public must be involved before any development project that is likely to have adverse impacts to the environment is initiated by a proponent. The Act has further established Public Complaints Committee (PCC) where the issues raised by the public in regard to any proposed development can be addressed.

2-1.11 Sessional Paper No. 6 of 1999 on Environment and Development

Every person in Kenya is entitled to a clean and healthy environment and has a duty to safeguard and enhance the environment (Kenya, 1999). As envisioned in Sessional Paper No. 6 of 1999 on Environment and Development, Kenya should strive to move along the path of sustainable development to meet the needs of the current generation without compromising the ability of the resource base to meet those of future generations. The overall goal is hence to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development (Kenya, 1999). The policy paper emphasized environmental impact assessments must be undertaken by the developers as an integral part of a project preparation. It also proposed for periodic environmental auditing to investigate if developer is fully mitigating the impacts identified in the assessment report.

2-1.12 The National Environmental Action Plan (NEAP)

The NEAP for Kenya was prepared in 1994. It was a deliberate policy to integrate environmental considerations in to the country's social and economic development process. The integration was achieved through multi-sectoral approach to develop a comprehensive framework to ensure that environmental management and conservation of natural resources is an integral part of societal decision-making process.



2-1.13 The National Shelter Strategy to the Year 2000

This strategy followed the International Year of Shelter for the Homeless in 1987 and was formulated to advocate a change in policy in order to allow other actors to come in and assist the Government in providing housing. The Government was to simply facilitate other actors such as for the proposed housing developers to invest in shelter.

2-1.14 The National Poverty Eradication Plan (NPEP)

The NPEP has the objective of reducing the incidence of poverty in both rural and urban areas by 50% by the year 2015; as well as strengthening the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow gender and geographical disparities and create a healthy, better-educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for Social Development (WSSD) of 1995. The plan focuses on the four WSSD themes of the poverty eradication; reduction of unemployment; social integration of the disadvantaged people and the creation of an enabling economic, political, and cultural environment. This plan is to be implemented by the Poverty Eradication Commission formed in collaboration with Government ministries, community based organizations, and private sector such as the proposed development will create employment opportunities for Kenyans, hence contributing to poverty eradication.

2-1.15 The Poverty Reduction Strategy Paper (PRSP)

The PRSP has the twin objectives of poverty reduction and economic growth. The paper articulates Kenya's commitment and approach to fighting poverty; with the basic rationale that the war against poverty cannot be won without the participation of the poor themselves. The proposed project during and after implementation, will offer jobs to many Kenyans as a way of contributing to this noble objective of reducing poverty in the nation.

2-2 Institutional Framework

The environmental impact assessment for the proposed development is bound to be influenced by the operational interests of several lead agencies, whether exclusively or concurrently. These include, but not limited to the following key institutions:



2-2.2 National Environmental Management Authority

In 2002 the government created the National Environmental Management Authority (NEMA) as the supreme regulatory and advisory body on environmental management in Kenya. NEMA is required to coordinate and supervise the various environmental management activities being undertaken by statutory organs with a view to promoting their integration into development policies, programmes, plans and projects that provide sustainable development and a safe and healthy environment to all Kenyans. The key functions of NEMA through the National Environment Council include: responsibility for policy formulation and direction for the purposes of the Act; setting national goals and objectives and determining policies and priorities for the protection of the environment; promotion of cooperation among public departments, local authorities, private sector, non-governmental organizations and such other organizations engaged in environmental protection programmes; and perform such other functions as are assigned by the Act.

NEMA will remain in charge of coordinating all activities related to environmental management in the project area, such as enforcement of environmental impact assessments, as well as environmental audits.

2-2.3 Director of Physical Planning

The Physical Planning Act (Cap 286) established the office of the Director of Physical Planning. The duties of the Director of Physical Planning shall include the following:

- Formulate national, regional and local physical development policies, guidelines and strategies
- Be responsible for the preparation of all regional, local and national physical development plans
- From time to time, initiate, undertake or direct studies and research into matters concerning physical planning
- Advise the Commissioner of Lands and local authorities on the most appropriate use of land including land management such as change of user, extension of user, extension of leases, subdivision of land, and amalgamation of land, and
- Require local authorities to ensure proper execution of physical development control and preservation orders.



2-2.4 Neighborhood Associations and/or General Public

The proposed housing development project is likely to attract the interests of the area's neighborhood association(s)/general public. An extensive public participation will hence form a major component of the study. From the foregoing, particular reference is made to Section 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003, which states that:

The proponent shall in consultation with the authority, seek the views of persons who may be affected by the project

The above expression clearly underscores the concept of "participatory environmental planning and management" in the context of urban development.

2-2.5 The Water Act, 2002

Part II, section 18, of the Water Act, 2002 provides for national monitoring and information systems on water resources. Section 73 of the Act allows a person with license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75 and sub-section 1 allows the licensee (CCN in this case) to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction. The proponent proposes to use water from the borehole on another different plot neighboring the proposed site belonging to the community for water supply and wastewater shall be directed to the existing wastewater treatment system for liquid waste disposal (read soil and waste water).

2-2.6 Energy Act 2006

The Energy Act of 2006, adheres to promote and develop prudent national energy efficiency and conservation where us promoting and developing the use of renewable energy. It's expected that owners of building shall conserve energy, audit and analyze energy consumption in his or her building in accordance with the standards, criteria and procedures prescribed by the set regulations.



2-2.7 Land Acts 2011

The act of parliament to give effect to article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide sustainable administration and management of land and land based resources ,and for connected purposes.

2-2.8 Housing Policy

According to the Sessional paper No.3 (2004) by the Government of Kenya, the overall goal of the housing policy is to facilitate the provision of adequate shelter and a healthy living environment at an affordable cost to all socio-economic groups in Kenya in order to foster sustainable human settlements. This is seen as a way of minimizing the number of citizens living in shelters that are below the habitable living conditions as well as curtail the mushrooming of slums and informal settlements in major towns. The policy creates an enabling environment to the private sector to provide housing population to mitigate against the housing shortfall which is more than 200,000 per year.

2-3 Summary

The institutions guided by relevant policies and legislations must regulate urban development and planning projects. The above expression is envisioned as a basic principle component of coordinated and harmonious development in urban areas, and is one of the core pillars for attaining sustainable development. These provisions will therefore guide the proposed project.



3. NATURE AND DESIGN COMPONENTS OF THE PROJECT

3-1 Overview

The project is focused on construction of 10 No. block of 720 No. Two bedroom flats. Currently the project site is vacant. The actual design components of the project include:

- Construction of 10 No. block of 720 No. two bedroom flats Construction of driveway, walkway and parking spaces
- Development of utilities (water, drainage, electricity etc)
- Site landscaping
- Construction of perimeter wall, including a gate

3-2 Existing Development in the Neighbourhood

The neighbourhood where the proposed development / project site is located is already characterized with high-rise residential flats, whose development was accordingly approved by the Ole Kejuado County Council. Furthermore, the project site for the proposed development is already developed with high-rise residential flats. The proposed development would hence easily blend with the existing character and development trends in the neighbourhood.

3-3 Construction of 10 No. blocks of 720 No. Two bedroom units

The project proposes to construct 1 No. block of 720 No. Two bedroom flats, including associated support services – Figure 3-1. Each of the residential flat units consists of the following space elements among others: Lounge area/ sitting room, kitchen, lobby area, bedrooms, bathrooms and toilets.

3-6 Utilities and Services

i) Water Supply

Each of the residential units will be connected to water from a borehole in the neighbouring plot though owned by a relative. The borehole has been in existence for over 30 years.



ii). Foul Waste

Each residential unit is connected by 150 mm diameter pipe which will connect to the biological septic tank. The waste is taken a process that the gases help stir the sludge, scum and liquid layer which promotes digestion of solids. Digestion takes place both aerobically and an-aerobically. Kings Serenity will have a similar Sewerage treatment plant found in below;



Inbuilt Sewerage septic tank in Mombasa at English point Marina

iii) Storm Water Drainage

The whole residential development drains into a 300 x 600 mm open storm water drain with steel grating cover. The drain will then be recycled to be used for greenery area and excess to drain to the storm drainage.

iv) Solid Waste Disposal

Dustbin cubicle is provided at the gate. This will provide a week storage for solid waste before the same is collected by the County Council and/or private contractor for final disposal.

v) Electricity Supply

Electricity is to be connected to each residential flat unit from the main national electricity grid.



vi) Telecommunication

High masts are available and visible. This is a good indication of existing telecommunication.

3-7 Site Landscaping

The project will involve excavation of soil material. The site development involves landscaping with excavated soil and rock material. Excess material will be disposed off-site.

3-8 Perimeter Wall, Access Gate

The proposed development will have a perimeter wall, gate and gate house.

PROJECT ACTIVITIES

4-1 Overview

The activities of the proposed project include –

- Site preparation
- Excavation and earth works
- Construction of foundation
- Construction of super structure
- Installation of internal / utility services
- Development of external works
- Final Inspection
- Decommissioning.

4-2 Site Preparation

i) Fencing

The site will be secured by hoarding the plot.



ii) Site Clearance

The site clearance entails removal of any obstructions on the way of the intended construction activity. In the proposed project, this will involve clearing of vegetation and removal of cotton soil which is in some section of the land. In the proposed project, site clearance will not involve the use of heavy machinery or explosives.

iii) Laying Out the Site

The site will then be laid out to identify the location of the proposed building structure units on the site. The corner points and edges of the proposed building units will be established accordingly. The marking out will use stakes and strings as well as chalk lines.

4-3 Excavation and Earth Works

In order to develop the 1 No. block of residential flat units, excavation and earth works are involved. The main method of excavation to be used is trenching in order to accommodate the building foundation / footing. The site is on black cotton soil. The excavated black cotton soil material will be disposed off-site. This disposal of the black cotton soil will not pose a problem as there is adequate disposal open space in the Municipality. No major rock obstruction is registered on site to warrant use of explosives. The load bearing capacity of the underlying rock is adequate and safe to support the building foundation without additional stabilization.

4-4 Construction of the Foundation

The foundation is that part of the building structure that is beneath the ground floor level. The foundation therefore includes the footing and foundation wall of a building. The proposed building has a continuous strip footing, reinforced concrete 600 mm wide and 200 mm deep. The foundation walling is made of load bearing masonry stone 200 mm wide. Both the strip footing and foundation wall are to be constructed to structural engineers detail and approval. The footing will be molded using customer built timber formwork fabricated on site. The steel reinforcement for strip foundation will be cut and fabricated on site.

The concrete is also to be mixed on site and poured using the bucket and simple pulley system. Minimal amount of ground water is expected to accumulate below



the ground surface thus installation of sub-surface drainage system will not be required. However, damp proof canvass and dump proof membrane are to be provided. The area enclosed by the foundation walls is to be backfilled with compacted hardcore. Termite treatment is also to be given to the foundation.

4-5 Construction of Super Structure

i) Ground Floor Slab

The ground floor slab is to be cast on the underlying compacted hardcore and ground. The concrete is to be poured and finished as necessary through screeding to level to top surface and remove excess concrete. The concrete will be floated to move coarse aggregate down into the concrete and also trowelled to smoothen the surface. A wooden board is to be used for screeding and floating, while steel powered trowel will be used to smoothen the surface. Vibrator will also be used during the casting of the slab.

ii) Walls

The building will utilize both load bearing wall and reinforced concrete columns. All external and other load bearing walls measure 200 mm thick. The masonry for the external walls is to be dressed to provide a pleasant view from the outside.

iii) Doors

All external door openings for the proposed maisonette units shall be fixed with paneled timber doors, while the solid core timber flush door will be used for internal openings.

iv) Windows

All window openings shall be closed with steel / aluminum casement and with ordinary 4 mm thick glass. The bathroom will be fixed with obscure patterned glass.



v) **First to Second Floor Slabs**

Timber formwork shall be prepared and steel reinforcement laid on which concrete shall be poured to cast the first and second floor slabs. The necessary finishing to the slab will be undertaken as described for the ground floor.

vi) **First to Second Floor Walls and Opening**

These will be constructed in the same manner outlined for the ground floor.

vii) **Roofing**

Trussed conventional timber structure frame shall be used to erect the roof based on a broken hip gable structure.

The roof cover shall be made of interlocking cement concrete tiles laid on the timber battens and laid on a water proof membrane or appropriate metal sheet.

viii) **Internal Finishes**

- **Floors** – Lounge, bedrooms and dining areas shall be finished in pvc tiles and wet areas shall be finished in ceramic tiles. The kitchen floor shall be finished in ceramic blocks.
- **Walls** – these will be finished with machine cut stone and given a render in some areas.
- **Ceilings** – the ceiling soffit to the roof floor will be made of a lime plaster render on the reinforced concrete slab.

4-6 Internal /Utility Services

i) **Plumbing System**

a) **Water Supply**



The internal water supply is cold water system. Since the supply is under pressure, the whole water supply system is designed leak proof and has valves to control the flow of water.

To ensure reliable water supply, each apartment unit will have adequate storage to cushion against unforeseen water shortage – 1000 litres underground storage and 200 litres roof tank storage.

b) Waste Water Drainage

The wastewater drainage system consists of both drain and vent pipes. These pipes also incorporate traps, gullies and other assorted fittings. The sewer plumbing will mainly be single stack, single-vent type. The development does not provide for air conditioning installation.

ii) Electrical System

The installation of electrical wiring and fittings will cater for lighting, appliances, heating and cooling system. The installation will also cater for television . All installations shall be to Kenya Power and Lighting Company approval.

4-7 External Works

i) Driveway, Walkway and Parking

Paved driveway and walkways shall be constructed to give motor vehicle and pedestrian traffic proper surface on which to move. The sub-grade will be made up of compacted quarry stone chippings and the sub-base will be of natural gravel and the base shall be 150 mm thick hand-packed hard quarry stone. The road surface shall be 50 mm thick standard cabro paving blocks.

ii) Water Supply

The development will be connected to an existing water borehole in the neighboring plot.



iii) Foul Water Drainage

Each residential unit is connected by 150 mm diameter pipe which will connect to the biological septic tank. The waste is taken a process that the gases help stir the sludge , scum and liquid layer which promotes digestion of solids. Digestion takes place both aerobically and an-aerobically.

iv) Surface Water Drainage

Surface run off from the proposed development site will collect in an open drain 300 mm wide and 600 mm deep and with steel grating cover. The drain will discharge onto an open main storm water drainage.

v) Solid Waste Disposal

A cubicle for storage of solid waste is to be provided next to the access gate. The storage capacity is one week and waste will then be collected by the County Council and/or private contractor for final disposal.

vi) Landscaping

The site is to be landscaped to plan. This will entail planting of trees, shrubs, grass and related ground cover in top soil. The top soil will also be treated with manure and/or fertilizer where necessary to encourage faster and improved plant growth. The common lawn/garden will be planted with continuous bed of grass lawn and provide aesthetically pleasing view

vii) Perimeter Wall, including Gate/Gate House

A perimeter wall is to be constructed. This wall will be enhanced and covered by planted green shrubs and/or flowers. Access gate is to be provided.

viii) Clearing of Site

The site will be given a general cleaning, and any leftover material and debris will be carted away. Similarly, any tools and equipment still on site will be removed.



4-8 Final Inspection

Final inspection is undertaken to ensure that the project has been done properly and according to the terms of the contract. The inspection team will normally include the project proponent/client, the architect, the engineer and the contractor or their representatives.

The inspection will normally begin at the bottom of the construction to the top and look at and inspect every detail of construction, functioning of mechanical and electrical installations etc.

The inspection team shall prepare a punch list indicating the in terms that need to be corrected. The list will be given to the contractor for necessary action within a specified period. If no new defects are noted, the job will officially be completed. A certificate of occupation will subsequently be issued. In issuing the certificate of occupation, the inspection will take into account health and safety considerations of intended occupants.

4-9 Decommissioning

Upon certification of the building for occupation, and upon receipt and consideration of necessary legal and other relevant documentation from the contractor, the project proponent will file a formal 'Notice of Completion'. The project will then be handed over to the proponent.



5. PROJECT MATERIAL AND PRODUCTS

5-1 Project Material

The main material input in the project include –

- Masonry stone
- Sand
- Cement
- Crushed stone
- Gravel
- Soil
- Timber
- Steel (reinforcement, casement, wiring, pipe etc)
- Glass
- PVC material (tiles pipes, conduits and fittings)
- Concrete tiles and paving blocks
- Paint
- Plant material – grass, tree seedlings etc.
- Water
- cabro

5-2 Project Products

The main products from the project are –

- 10 No. blocks of 720 No. Two bedroom .
- Landscaped site planted with grass, shrubs and tree cover
- Gate
- Increase surface water runoff
- Increased foul water discharge
- Increased solid waste generation
- Increased resident population
- Increased traffic (motor vehicle and pedestrian)



6. POTENTIAL ENVIRONMENTAL IMPACTS

6-1 Overview

Construction of the proposed residential development is likely to present several environmental impacts. These can be either positive or negative.

6-2 Anticipated Environmental Impacts

During the field survey, key environmental problems relating to the proposed residential development were identified. They were obtained by making physical observations at the project site as well as existing land use in the neighbourhood. The magnitude of each impact is described as significant (major), moderate (minor) or insignificant. Generally, insignificant impacts have no obvious long-term consequences (positive or negative), and are regarded as being minor. But those with long-term repercussions are classified as significant. Using an impact matrix, the anticipated environmental impacts for the proposed project has been presented in Table 6-1.

6-3 Impacts during Construction Process

The proposed development is likely to have the following impacts during the construction phase: -

a) Positive Impacts

It is estimated that 30% of the project cost will be reflected in employment of professional services and labour. During the construction period, the informal sector will benefit from the operations of the proposed residential development. This will involve kiosk owners who will be selling food to workers on site. This is envisioned to promote “jua kali” entrepreneurs in the local area. Second, there will be employment opportunities especially to casual workers.

Employment opportunities will be of a benefit from both social and economic perspectives. From economic perspective, abundant unskilled labour will be used in economic production, on the other hand, from social perspective, the labourers will be engaged in productive employment other than remaining idle, hence avoiding social vices such as drug abuse and robberies among others.



Apart from casual labourers, semi-skilled and skilled labour, professionals such as town planners, architects and structural engineers among others are also expected to obtain gainful employment during the period of construction. There will be gains in the local and national economy through consumption of locally available materials including concrete tiles, concrete, timber and cement.



Table 6-1: Detailed Impact Matrix for the Proposed Development

| Potential Impacts | Positive Impacts | | | Negative Impacts | | |
|--|-----------------------|----------|---------------------|-----------------------|----------|---------------------|
| | Insignificant (Minor) | Moderate | Significant (Major) | Insignificant (Minor) | Moderate | Significant (Major) |
| Fire out break | | | | | | |
| Architectural distortion of the neighbourhood | | | | | | |
| Proliferation of uncollected solid and hazardous/toxic wastes | | | | | | |
| Inadequate disposal of human waste during construction phase | | | | | | |
| Modification of micro-climate and disruption of vegetation | | | | | | |
| Increased development without commensurate services | | | | | | |
| Air pollution generated by dust during construction | | | | | | |
| Noise pollution generated by construction activities and generator during operation phase | | | | | | |
| Workers accidents during construction | | | | | | |
| Increased flooding leading to flooding from paved ground and expansive roofs | | | | | | |
| Pressure on infrastructure and services, e.g., traffic related conflicts, water, power and sanitation, | | | | | | |
| Mushrooming of food kiosks | | | | | | |
| Insecurity | | | | | | |
| Creation of employment opportunities | | | | | | |
| Increased tax revenue to central and local | | | | | | |



| | | | | | | |
|--|--|--|--|--|--|--|
| governments | | | | | | |
| Improved aesthetics | | | | | | |
| Optimal use of land in the area | | | | | | |
| Increased commercial/residential stock | | | | | | |



b) Negative Impacts

i) Inadequate Disposal of Human Waste

Lack of a toilet at the construction site is likely to encourage poor disposal of human waste, especially by the construction workers. This is foreseen a major public health concern.

ii) Workers Accidents During Construction

There is possibility of workers' accident during construction phase. This can fatal or lead to serious injuries if the proponent has not developed a comprehensive accident control and management plan prior beginning construction.

iii) Air Pollution

There is likely to be pollution in terms of noise and dust during the project's construction phase. This is likely to be from construction vehicles serviced/attended at the project site.

iv) Disruption of Existing Vegetation

The construction process will involve clearing of existing vegetation cover. In the long-term, this is likely to change the microclimate of the area.

v) Soil Disruption

Since the proposed project will involve extensive paving, construction and hard landscaping, this is likely to increase the volume and rate of stream water resulting to flooding and siltation. Excavation of the existing red coffee soil can also tamper with the natural soil types in the area.

6-2 Impacts during Operational Phase

6-2.1 Positive impacts

i) Employment Generation

The project will result in the generation of employment opportunities during operational phase. This will involve security personnel, solid waste management staff, among others.



ii) Increase in Revenue

There will be a positive gain for the revenue system. Land rent paid to the central government will be revised upwards. Rates paid to the Kajiado County will also be revised upwards owing to the capital appreciation of the property upon development.

iii) Individual Investment

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

iv) Optimal Use of Land

The housing development leads to optimal use of land. Considering the scarcity of land, the project enhances the returns on the limited land space.

v) Increase in Housing Stock

The project will add to the depressed housing supply in Ongata Rongai and the wider City of Nairobi, thus complementing the government's initiative of constructing 150 000 urban housing units per year.

vi) Improved Aesthetics

The proposed project adds to improved aesthetics of the local area. This will attract new resident's/business operators into the neighborhood.

6-2.2 Negative Impacts

i) Increased Population without Commensurate Services

The neighbourhood where the proposed project is located is already characterized by high-density development. The proposed development will further lead to an increased demand on commensurate services and facilities in Rongai

If population in the neighbourhood is not provided with appropriate services and facilities, then pressure on existing facilities is bound to increase.

ii) Increased Pressure on Infrastructure and Facilities



The neighbourhood is already established by high residential density development. These have intensified land use, hence leading to high demand for infrastructure and services.

The proposed building development is likely to increase pressure on existing infrastructure such as roads. This would be due to increased human and vehicular traffic.

iii) Proliferation of Solid Waste.

The proposed development is likely to contribute to an increased generation of solid waste. This has a potential of attracting disease vectors such as rats, flies, and cockroaches.

iv) Fire out Break

Fire is one of the common hazards within residential development. If its preparedness, management and mitigation are not well planned, then chances of loss of lives/injuries and properties are likely to be reported.

6-3 Impacts during Decommissioning Phase

a) Decommissioning of New Buildings

During the decommissioning phase, the wastes that were used in construction process, if not collected and safety disposed of are likely to pose environmental problems. These wastes include, but not limited to:

- Sand
- Cement
- Crushed stone
- Gravel
- Soil
- Concrete tiles and paving blocks
- Timber
- Steel (reinforcement, casement, wiring, pipe etc)
- Glass
- PVC material (pipes, conduits and fittings)
- Paint

The above wastes will be adequately cleared and disposed of at the site approved by the County Council of Ole kejuado.



b) Decommissioning at the end of Project Lifespan

If at the end of the project life span the buildings are to be demolished, then decommissioning stage will have to address two primary issues related to environmental impacts of demolishing old buildings:

- Minimizing waste disposal through reuse and recycling and
- Properly handling hazardous and regulated materials.

In addressing the first issue deconstruction of the old buildings is usually undertaken. Deconstruction is the manual dismantling of a building so materials can be salvaged for reuse. Deconstruction can range from the soft stripping of non-structural elements such as cabinets and plumbing to the full structural disassembly of the buildings. The deconstruction process is the opposite of the construction process; the last thing to go on is the first thing to come off. Of necessity, most deconstruction projects employ all three options reuse, recycling and disposal but reuse is often made the priority. Usually, when deciding whether to deconstruct or not, the first simple rule to remember is: Deconstruct no building before its time. Preservation should be the first choice when deciding what to do with old buildings. With increased mechanization, however, recycling and disposal of construction and development debris has become more appealing than dismantling for reuse. Current building methods and materials, such as use of composite materials, laminates and adhesives, also favor recycling or disposal.

Alternatively, if at this stage renovation of the old housing units is taken as an option, then in this case the renovation can range from relatively straightforward reorganization of interior space through to the complete upgrading of the building envelope and building systems. In this connection, four levels of renovation can be considered:

- Major renovations that generate significant waste because parts of the structure are removed and/or replaced;
- Minor renovation as part of routine repair and maintenance on the building; fit-up projects, where the facility is adjusted from base building standards to fit the needs of the house owners and / or tenants;
- House owners / tenant service renovations which they conduct themselves.

Since each renovation project presents its own unique problems and opportunities to provide cost-effective environmental upgrading; a prerequisite to consider in renovation projects is a detailed audit of the existing environmental characteristics



of the building including energy, water and materials. In addressing the second issue, necessary precautions will be undertaken such as:

- Mitigating against noise and dust by either manually disassembling the major portions of the existing building structures, as discussed above. The demolition requiring the use of heavy equipment will, however, be accomplished while wetting down the structures with water to reduce dust propagation. Wetting will also be done so as not to create runoff that could migrate from the site.
- All demolition debris will be handled with care to avoid material being blown by the wind from the proposed site of development to the surrounding environment. All debris should be packaged and transported to appropriate disposal site following established city council and public health waste management procedures.
- In case of asbestos the potential release of these fibers to the environment during demolition would be mitigated by having the tiles removed by a certified asbestos abatement firm prior to the startup of the demolition. The removed tiles would be packaged, properly labeled and turned in for retrograde following recommended regulations for asbestos containing materials. Abatement of asbestos containing materials requires the hire and deployment of an asbestos abatement firm. This cost has been factored into the project whenever applicable.
- All demolition work shall be carefully executed with the particular aim of preserving the items being removed. All materials, components and fittings arising from the demolitions shall become the property of the contractor as a way of reducing the disposal cost of existing old buildings.
- The method of demolition used shall be in line with all laws and by-laws governing such activities. In particular, the contractor will be required to protect the adjacent properties, users / workers and the public from any nuisance in form of noise and dust, and from falling objects. The contractor shall also take all necessary measures to prevent any damage or loss to third party.
- Before embarking on demolition, the contractor shall give all the necessary notices as required by law.



- An attempt shall be made to limit the quantity of materials removed from site or sent to landfill through reuse of the debris in the construction and landscaping stage.

- Re-sell or reuse reclaimed materials to reduce the cost of new materials and where possible minimize the projects overall environmental impact through reuse and recycling.

Table 6-2 presents the anticipated environmental impacts during the decommissioning of the proposed building development after the expiry of the project's lifespan -



Table 6-2: Anticipated Environmental Impacts and Mitigation Measures at the end of the project Life Cycle

| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation |
|--|--|---|
| Air pollution by dust generated during demolition process. | <ul style="list-style-type: none"> • The demolition exercise will be limited at day time only • All personnel working on the project will be trained prior to commencing the demolition exercise on methods for minimizing negative impacts on air quality. • Construction vehicle drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines. • All active demolition areas will be watered at least twice a day to reduce dust. • All trucks hauling demolition debris/wastes shall be covered. • Careful screening to contain and arrest demolition related dust will be adopted • Exposed demolition debris of e.g. dust and sand, will be enclosed, covered, and watered daily before transported to disposal site. • Demolition activities will be suspended when wind speed exceeds 25 mph. • Windbreakers will be installed at the windward side of the construction site. • All workers on the site will be required to wear protective clothing while on duty | <ul style="list-style-type: none"> • Project proponent |
| Noise pollution by demolition activities. | <ul style="list-style-type: none"> • Explosives will not be used during the exercise • Portable barriers will be installed to shield compressors and other small stationery equipment where applicable. • Use of equipment designed with noise control elements will be adopted where necessary. • Trucks used during demolition exercise on site shall be routed away from noise sensitive areas in the neighbourhood, where feasible. • Sound barriers are to be installed for pile driving activities. • Idling time for pick- up trucks and other small equipment will be minimized to limited time. • Use of very noisy equipment will be limited to daytime only. • All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise. • The demolition exercise will be limited at day time only | <ul style="list-style-type: none"> • Project proponent |
| Proliferation of uncollected demolition | <ul style="list-style-type: none"> • Private contractor will be engaged to collect demolition debris/wastes • All debris/wastes to be collected regularly to control air pollution and injury etc | <ul style="list-style-type: none"> • Project Proponent |



| | | |
|---------------------------|--|--|
| debris and related wastes | <ul style="list-style-type: none"> • Receptacles will be provided for storage of light demolition products e.g. timber, plastics tiles etc • Refuse collection vehicles will be covered to prevent scatter of waste by wind. • A licensed operator will collect demolition debris and avoid illegal dumping at unauthorized sites. • All persons involved in refuse collection shall be in full protective attire. | |
|---------------------------|--|--|

| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation |
|--|---|---|
| Workers accidents during demolition process. | <ul style="list-style-type: none"> • All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise • A comprehensive contingency plan will be prepared before demolition begins, on accident response. • Adherence to safety procedures will be enforced at all stages of the exercise • All workers, pursuant to labour laws, shall be accordingly insured against accidents. • All workers will be instructed to wear protective clothing and head helmet during demolition. • Demolition work will be limited to daytime only avoid workers accidents due to poor visibility | <ul style="list-style-type: none"> • Project proponent |



6-4 Stakeholder Consultation

During the field survey for the proposed development of residential block of flats, public consultation formed the integral part of project development. This was done pursuant to the Environmental Management and Coordination Act (EMCA) of 1999.

Interview and having a consultative forum were randomly administered to the residents and stakeholders within the neighbourhood – Appendix B. The following sections present the results of the public consultation.

6-4.1 Public Consultation in the Neighbourhood



Some of the Neighbours who attended the consultative meeting at the proposed site

During the survey, no serious and adverse objections were received from the neighbours in the area. This confirms that the project is suitable for the local area.

6-4.2 Length of Stay in the Area



The respondents who were consulted during the survey have stayed in the neighbourhood for appreciable length of time. They are therefore familiar with the needs of the area. The respondents live or work within 0.5 km radius of the project site.

6-4.3 Summary

From the foregoing, it is noted that:

- The proposed project has actively involved the key neighbourhood stakeholders who did not object the development.
- The proposed project does not pose adverse environmental impacts, and is an initiative towards increasing housing supply in the city.

7. HEALTH, SAFETY AND ACCIDENT PREVENTION PLAN

7-1 Site Organization

To ensure health and safety conditions and prevent accidents on site, efforts will be made to have a clear site organization plan. These include:

- Developing a clear site organization plan and construction schedule
- Delivery and storage of material at appropriate locations
- Right size of staff/workers with clear work schedule and appropriate dress gear
- Control staff and vehicle movement on site and keep out unwanted persons
- Site office with safety kit
- Site toilet
- Adequate water supply for both construction work and worker use.

7-2 Project Team

In order to ensure proper organization of activities during planning, design and construction of the project, there must be appropriate project team. This team include-

- Environmental Impact Assessment Expert



- Project Architect
- Structural / Civil Engineer
- Service Engineers
- Quantity Surveyor
- Land Surveyor

7-3 Enforcement of Standards and Legal Requirement

The project must ensure that appropriate standards and legal requirements are met. These include:

- That building work is in accordance to approved County council drawings and plans
- That building operations to meet the building code specifications
- That requirements of the Factories and other places of Work Act are followed
- That requirements of the Public Health Act are followed
- That requirements as outlined in the Environmental Action Plan are observed.

7-4 Activities of Workers

The following activities by workers are clearly identified and must be closely monitored and organized to ensure health, safety and accident standards on site:

- Excavation using pick axes and shovels
- Pushing of wheel barrows
- Watering of roads and walk surfaces
- Hand packing of stones on road surface
- Lifting and laying of building material – stone, concrete etc.
- Plastering of walls and ceiling
- Bending, cutting and laying of reinforcement steel
- Other general building work activities.

7-5 Activities by Machinery and Light Equipment

The activities of machinery and plant must also be properly organized and monitored in order to ensure health and safety conditions and prevent accidents. The machinery and plant to be used on site include –

- Compacting machine



- Vibrators
- Concrete mixer
- Hoisting machines
- Small size hoist machine
- Goods transport truck
- Tipper truck

7-6 Insurance

The project proponent and building contractor will take appropriate insurance cover for the various project activities and personnel and/or workers.

ENVIRONMENTAL MANAGEMENT PLAN

8-1 Introduction

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

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

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

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



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

8-2 Environmental Monitoring and Evaluation

Environmental monitoring and evaluation are essential in the project lifespan as they are conducted to establish if the project implementation has complied with the set environmental management standards as articulated in the Environmental Management and Coordination Act (EMCA) No. 8 of 1999, and its attendant Environmental (Impact Assessment and Audit) Regulations, 2003.

In the context of the proposed project, design has made provisions for an elaborate operational monitoring framework for the following among others:

- Disruption of natural environment and modification of microclimate
- Air and noise pollution
- Proliferation of kiosks
- Workers accidents and health infections during construction process
- Proliferation of uncollected wastes



Table 8-1: Environmental Management Plan Matrix for the Proposed Development

| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation | Monitoring Agent | Frequency for Monitoring | Estimated (KShs) |
|---|--|---|--|------------------------------|---|
| 1. Modification of Micro -Climate | <ul style="list-style-type: none"> Careful layout and orientation of buildings to respect microclimate: wind and sun direction. The project will use minimum reflective building materials and finishes for roof, walls and paving. | <ul style="list-style-type: none"> Project proponent | <ul style="list-style-type: none"> County Council of Ole Kejuado Provincial Public Health Officer NEMA inspectors Ministry of Labour | Periodic checks | Inclusive in development |
| 2. Increased development density likely to adversely affect ecological carrying capacity. | <ul style="list-style-type: none"> The proposed development will strictly adhere to the conditions attached to its approval such as zoning guidelines that include plot/ground coverage and floor index/plot ratio. | <ul style="list-style-type: none"> Project Proponent | <ul style="list-style-type: none"> County Council of Ole Kejuado Provincial Public Health Officer NEMA inspectors Ministry of Labour | Periodic checks | Inclusive in development |
| 3. Air pollution by dust generated during construction process. | <ul style="list-style-type: none"> All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. Construction vehicle drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines. All active construction areas will be watered at least twice a day to reduce dust. All trucks hauling soil, sand and other loose materials shall be covered. All paved access roads will be swept daily. This includes all paved parking areas and staging areas at construction site. Traffic speed of construction/other vehicles will be restricted to not more than 15 mph | <ul style="list-style-type: none"> Project proponent | <ul style="list-style-type: none"> County Council of Ole Kejuado Provincial Public Health Officer NEMA inspectors Ministry of Labour | Periodic and surprise checks | 30,000 per month over construction period |
| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation | Monitoring Agent | Frequency for | Estimated (KShs) |



| | | | | Monitoring | |
|--|---|---|--|------------------------------|---|
| | <ul style="list-style-type: none"> Careful screening of construction site to contain and arrest construction-related dust. Vegetation will be replanted in disturbed areas as soon as possible. Exposed stockpiles of e.g. dust and sand, will be enclosed, covered, and watered daily, or treated with non-toxic soil binders. Excavation and grading activities will be suspended when wind speed exceeds 25 mph. Windbreakers will be installed at the windward side of the construction site. All workers on the site will be required to wear protective clothing while on duty. | | <ul style="list-style-type: none"> County Council of Ole Kejuado Provincial Public Health Officer NEMA inspectors Ministry of Labour | | |
| 4. Noise pollution by construction activities. | <ul style="list-style-type: none"> Portable barriers will be installed to shield compressors and other small stationery equipment where applicable. Use of equipment designed with noise control elements will be adopted where necessary. Trucks used at construction site shall be routed away from noise sensitive areas in the neighbourhood, where feasible. Sound barriers are to be installed for pile driving activities. Idling time for pick up trucks and other small equipment will be minimized to limited time. Use of very noisy equipment will be limited to daytime only. All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise. | <ul style="list-style-type: none"> Project proponent | <ul style="list-style-type: none"> County Council of Ole Kejuado Provincial Public Health Officer NEMA inspectors Ministry of Labour | Periodic and surprise checks | 70,000 per month over construction period |



| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation | Monitoring Agent | Frequency for Monitoring | Estimated (KShs) |
|--|---|---|--|------------------------------|------------------------------|
| 5. Workers accidents and hazards when handling hazardous wastes. | <ul style="list-style-type: none"> • Adequate collection and storage of waste will be provided on site, and safe transportation to, and display methods at designated areas. • All receptacles for storing hazardous wastes shall be adequately covered. • All employees will be required to wear protective clothing when handling hazardous wastes. • All workers will be adequately insured against unforeseen accidents. | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County Council of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | Periodic and surprise checks | 50,000 per month |
| 6. Proliferation of uncollected solid waste. | <ul style="list-style-type: none"> • Private contractor will be engaged to collect solid waste generated. • Wastes to be collected regularly to control air pollution and vermin/insects etc. • Receptacles will be provided for waste storage prior to collection. • Resource recovery will be encouraged once the project takes off so as to shrink waste stream and recover non-recyclables. • Refuse collection vehicles will be covered to prevent scatter of wastes by wind. • Wastes will be collected by a licensed operator to avoid illegal final dumping at unauthorized sites • All persons involved in refuse | <ul style="list-style-type: none"> • Proponent | <ul style="list-style-type: none"> • County Council of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | Periodic and surprise checks | 60,000 per month @ 1% annum. |



| | | | | | |
|---|---|---|--|---------------------------------|--|
| | collection shall be in full protective attire. | | | | |
| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation | Monitoring Agent | Frequency for Monitoring | Estimated Cost (KSh) |
| 7. Workers accidents during construction process. | <ul style="list-style-type: none"> 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. Accordingly, adherence to safety procedures will be enforced. All workers, pursuant to labour laws, shall be insured against accidents. All workers will be instructed to wear protective clothing during construction, including helmets. Construction work will be limited to daytime only | <ul style="list-style-type: none"> Project proponent | <ul style="list-style-type: none"> County Council of Ole Kejuado Provincial Public Health Officer NEMA inspectors Ministry of Labour | Periodic checks | 80,000 per month |
| 8. Increased surface run off leading to flooding, from paved grounds and expansive roofs. | <ul style="list-style-type: none"> Surface run off and roof water will be harvested and stored in underground reservoir for re-use. Storm water management plan that minimizes impervious area increases infiltration by use of recharge areas, and use of retention, and/or retention with graduated outlet control structures, will be used. | <ul style="list-style-type: none"> Project proponent | <ul style="list-style-type: none"> County Council of Ole Kejuado Provincial Public Health Officer NEMA inspectors Ministry of Labour | Periodic checks | 35,000 per year, likely increase with age of project |
| 9. Pressure on infrastructure and | <ul style="list-style-type: none"> Delivery and collection hours by service vehicles will be limited to off- | <ul style="list-style-type: none"> Project proponent | <ul style="list-style-type: none"> County Council of | Periodic checks | 60,000 p.a likely to increase with age of project |



| <p>services, i.e. traffic related conflicts, water, power and sanitation.</p> | <p>peak hours.</p> <ul style="list-style-type: none"> • Service deceleration line will be provided at the entry point. • Adequate roof and underground water storage tanks will be provided. • Expansion of the capacity of water and sewer lines to accommodate the increased demand in the area • Standby generator may be installed to ensure uninterrupted power supply. | | <ul style="list-style-type: none"> • Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | | |
|---|--|---|--|-------------------------------------|---|
| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation | Monitoring Agent | Frequency for Monitoring | Estimated Cost (KSh) |
| <p>10. Mushrooming of food kiosks</p> | <ul style="list-style-type: none"> • Kiosks will be provided on site, with adequate sanitation, during construction process. • Pursuant to the Physical Planning Act (Cap.286), development control is to be enforced around the project site. | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County Council of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | <p>Periodic and surprise checks</p> | <p>6,000 per month construction period</p> |
| <p>11. Water supply and sewer/storm water breakdown.</p> | <ul style="list-style-type: none"> • Regular inspection and maintenance of water and sewer system. • Before construction begins, it will be determined where sewer and water pipes are located to avoid reticulation break down | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County Council of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | <p>Periodic checks</p> | <p>20,000 per year</p> |
| <p>12. Inadequate human waste disposal by workers during construction process</p> | <ul style="list-style-type: none"> • As provided for by the Building Code, a temporary latrine will be provided on site to be used by construction workers | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County Council of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | <p>Periodic checks</p> | <p>5,000 per month over construction period</p> |



| | | | | | |
|-----------------------|--|---|--|-----------------|--------------------|
| 13. Out break of fire | <ul style="list-style-type: none"> • All residents to be trained on fire fighting • Regular fire drills to be conducted to enhance emergency response • Fire extinguishers and related equipment to be strategically installed within the building • Building to be adequately insured against fire • Instructions on how to respond during fire emergencies to be strategically placed in the building • Building to be regularly inspected to ensure that all standards related to fire disaster control are adhered to • Adequate water storage will be maintained for fire fighting | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County Council of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | Periodic checks | KShs 50,000 per an |
|-----------------------|--|---|--|-----------------|--------------------|

ENVIRONMENTAL MANAGEMENT PLAN

8-1 Introduction

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

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



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

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

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

8-2 Environmental Monitoring and Evaluation

Environmental monitoring and evaluation are essential in the project lifespan as they are conducted to establish if the project implementation has complied with the set environmental management standards as articulated in the Environmental Management and Coordination amended Act (EMCA) 2015, and its attendant Environmental (Impact Assessment and Audit) Regulations, 2003.

In the context of the proposed project, design has made provisions for an elaborate operational monitoring framework for the following among others:

- Disruption of natural environment and modification of microclimate
- Air and noise pollution
- Proliferation of kiosks
- Workers accidents and health infections during construction process
- Proliferation of uncollected wastes



Table 8-1: Environmental Management Plan Matrix for the Proposed Development

| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation | Monitoring Agent | Frequency for Monitoring |
|---|--|---|--|---------------------------------|
| 1. Modification of Micro -Climate | <ul style="list-style-type: none"> • Careful layout and orientation of buildings to respect microclimate: wind and sun direction. • The project will use minimum reflective building materials and finishes for roof, walls and paving. | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | Periodic checks |
| 2. Increased development density likely to adversely affect ecological carrying capacity. | <ul style="list-style-type: none"> • The proposed development will strictly adhere to the conditions attached to its approval such as zoning guidelines that include plot/ground coverage and floor index/plot ratio. | <ul style="list-style-type: none"> • Project Proponent | <ul style="list-style-type: none"> • County of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | Periodic checks |
| 3. Air pollution by dust generated during construction process. | <ul style="list-style-type: none"> • All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. • Construction vehicle drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines. • All active construction areas will be watered at least twice a day to reduce dust. • All trucks hauling soil, sand and other loose materials shall be covered. • All paved access roads will be swept daily. This includes all paved parking areas and staging areas at construction site. • Traffic speed of construction/other vehicles will be restricted to not more than 15 mph | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | Periodic and surprise checks |
| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation | Monitoring Agent | Frequency for Monitoring |



| | | | | |
|---|---|---|--|-------------------------------------|
| | <ul style="list-style-type: none"> • Careful screening of construction site to contain and arrest construction-related dust. • Vegetation will be replanted in disturbed areas as soon as possible. • Exposed stockpiles of e.g. dust and sand, will be enclosed, covered, and watered daily, or treated with non-toxic soil binders. • Excavation and grading activities will be suspended when wind speed exceeds 25 mph. • Windbreakers will be installed at the windward side of the construction site. • All workers on the site will be required to wear protective clothing while on duty. | | <ul style="list-style-type: none"> • County of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | |
| <p>4. Noise pollution by construction activities.</p> | <ul style="list-style-type: none"> • Portable barriers will be installed to shield compressors and other small stationery equipment where applicable. • Use of equipment designed with noise control elements will be adopted where necessary. • Trucks used at construction site shall be routed away from noise sensitive areas in the neighbourhood, where feasible. • Sound barriers are to be installed for pile driving activities. • Idling time for pick up trucks and other small equipment will be minimized to limited time. • Use of very noisy equipment will be limited to daytime only. • All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise. | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County l of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | <p>Periodic and surprise checks</p> |



| Environmental Impacts | Proposed Mitigation Measures | Responsibility for Mitigation | Monitoring Agent | Frequency for Monitoring |
|--|--|---|--|---|
| 5. Workers accidents and hazards when handling hazardous wastes. | <ul style="list-style-type: none"> • Adequate collection and storage of waste will be provided on site, and safe transportation to, and display methods at designated areas. • All receptacles for storing hazardous wastes shall be adequately covered. • All employees will be required to wear protective clothing when handling hazardous wastes. • All workers will be adequately insured against unforeseen accidents. | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | Periodic and surprise checks |
| 6. Proliferation of uncollected solid waste. | <ul style="list-style-type: none"> • Private contractor will be engaged to collect solid waste generated. • Wastes to be collected regularly to control air pollution and vermin/insects etc. • Receptacles will be provided for waste storage prior to collection. • Resource recovery will be encouraged once the project takes off so as to shrink waste stream and recover non-recyclables. • Refuse collection vehicles will be covered to prevent scatter of wastes by wind. • Wastes will 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. | <ul style="list-style-type: none"> • Proponent | <ul style="list-style-type: none"> • County of Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | Periodic and surprise checks |
| 7. Workers accidents during construction | <ul style="list-style-type: none"> • All workers will be sensitized before construction begins, on how to control accidents related to construction. | | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County of Ole Kejuado Periodic checks |



| | | | | |
|---|---|---|--|-------------------------------------|
| <p>process.</p> | <ul style="list-style-type: none"> • A comprehensive contingency plan will be prepared before construction begins, on accident response. • Accordingly, adherence to safety procedures will be enforced. • All workers, pursuant to labour laws, shall be insured against accidents. • All workers will be instructed to wear protective clothing during construction, including helmets. • Construction work will be limited to daytime only | | <ul style="list-style-type: none"> • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | |
| <p>8. Increased surface run off leading to flooding, from paved grounds and expansive roofs.</p> | <ul style="list-style-type: none"> • Surface run off and roof water will be harvested and stored in underground reservoir for re-use. • Storm water management plan that minimizes impervious area increases infiltration by use of recharge areas, and use of retention, and/or retention with graduated outlet control structures, will be used. | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | <p>Periodic checks</p> |
| <p>9. Pressure on infrastructure and services, i.e. traffic related conflicts, water, power and sanitation.</p> | <ul style="list-style-type: none"> • Delivery and collection hours by service vehicles will be limited to off-peak hours. • Service deceleration line will be provided at the entry point. • Adequate roof and underground water storage tanks will be provided. • Expansion of the capacity of water and sewer lines to accommodate the increased demand in the area • Standby generator may be installed to ensure uninterrupted power supply. | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County of Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | <p>Periodic checks</p> |
| <p>10. Mushrooming of food kiosks</p> | <ul style="list-style-type: none"> • Kiosks will be provided on site, with adequate sanitation, during construction process. • Pursuant to the Physical Planning Act (Cap.286), development control is to be enforced around the project site. | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | <p>Periodic and surprise checks</p> |
| <p>11. Water supply and sewer/storm water breakdown.</p> | <ul style="list-style-type: none"> • Regular inspection and maintenance of water and sewer system. • Before construction begins, it will be determined where sewer and water pipes are located to avoid reticulation break down | <ul style="list-style-type: none"> • Project proponent | <ul style="list-style-type: none"> • County of Ole Kejuado • Provincial Public Health Officer • NEMA inspectors • Ministry of Labour | <p>Periodic checks</p> |



| | | | | |
|--|--|---|--|-----------------|
| 12. Inadequate human waste disposal by workers during construction process | <ul style="list-style-type: none"> As provided for by the Building Code, a temporary latrine will be provided on site to be used by construction workers | <ul style="list-style-type: none"> Project proponent | <ul style="list-style-type: none"> County of Ole Kejuado Provincial Public Health Officer NEMA inspectors Ministry of Labour | Periodic checks |
| 13. Out break of fire | <ul style="list-style-type: none"> All residents to be trained on fire fighting Regular fire drills to be conducted to enhance emergency response Fire extinguishers and related equipment to be strategically installed within the building Building to be adequately insured against fire Instructions on how to respond during fire emergencies to be strategically placed in the building Building to be regularly inspected to ensure that all standards related to fire disaster control are adhered to Adequate water storage will be maintained for fire fighting | <ul style="list-style-type: none"> Project proponent | <ul style="list-style-type: none"> County of Ole Kejuado Provincial Public Health Officer NEMA inspectors Ministry of Labour | Periodic checks |

MITIGATION MEASURES

9-1 Overview

A careful assessment affirms that most of the potential negative impacts in the project can be mitigated with significant level of success.

9-2 Appraisal of Alternative Development Options



9-2.1 No Development Investment

- The nil intervention describes a situation in which the proponent does not undertake the proposed building development. This option would imply economic loss to the proponent, local and national economics. The project site is currently idle while there is substantial housing demand in the area with 100% occupancy level in similar housing developments, yet the supply side has been limited. This means that if the current status is to prevail it will not be commensurate to the area's land rent value. In case the authorities such as NEMA settle for no development intervention, the owner would lose in terms of financial commitments already made in design and planning of the project amounting to approximately KShs. 110,000,000 thousand. This includes application fees to the County of Kajiado professional fees to Architects, Quantity Surveyors, Engineers and EIA lead experts as well as application for EIA approval. The option would similarly make the jobs that the project envisioned to create to be forgone. The cost of labour alone is estimated at KShs. 400 million. The local and central government will also lose the tax income that the project would generate if implemented. Needless to add that the project will increase supply of residential housing stock.

9-2.2 Relocation Option

The other option available for the project implementation is for the proponent to relocate it to an alternative site. At the moment, the proponent does not have an alternative site. This implies that he has to buy another piece of land elsewhere. Looking for land of the similar size and market location and completing official transactions might take over one year, with no guarantee that the land would be available, and if such land is available, its cost might be beyond affordable for the proponent. The proponent will have to restart the planning, design, and approval of the project afresh. The proponent will need to re-engage professionals like EIA lead/audit experts and physical planners to assess the viability of the new site. New costs will also arise from seeking an EIA approval from NEMA for the new site at 0.1% of development cost to the authority. Additional costs will arise from the design and approval of the architectural drawings for the new site. In addition, he will have to send a planning brief to the council, place a public notice on site and in the local daily planning brief to the council, place a public notice on site and in the local daily newspaper. By the time the proposal is approved by authorities, economic parameters such as cost of building materials would have changed. This would lead to a situation like zero option and the project may no longer be viable leading to eventual abandonment. The standoff will discourage



local and international investors from investing in housing and/or construction industry.

9-2.3 Exploration of Alternative Land uses

The developer could explore other uses for the site such as institutional, recreational, and/or light industry. If studies establish that these are better suited to the site in functional and economic sense, then the developer could apply for change/extension of use to allow for such development. However, the field survey revealed that the property is in high proximity to other existing commercial establishments and institutions. The light industry may lack complementary linkages in the neighbourhood. Considering the foregoing and coupled with the necessary procedural requirements for effecting such change, this option does not offer significant advantages over the current proposal.

9-2.4 Reorganization of Site Design

This option underscores that if deemed necessary, the design layout for the proposed building development could be revised as follows:

i) Reducing Floor Index/Plot Ratio

The current design layout has 4 No. floors, including ground floor. The proponent can however reduce the floor index/plot ratio. This option translates to reducing development density and, by extension, the number of households expected to occupy the proposed flat units, hence significantly reducing pressure on the areas of infrastructure and services such as water, electricity, sewer and solid waste management. Densification can be pursued later when the neighbourhood infrastructure and services have been upgraded. This option will not lead to additional expenses. However, returns in terms of rent accruing to the proponent would also be reduced. Furthermore, land rent to the government and land rates to the County Council that would have been realized if the proposed floor index were to be maintained would be reduced.

ii) Reducing Ground Coverage

This option implies that the proponent alters the design of the project by reducing the proportion of the plot covered by the proposed building development on the horizontal by limiting the plinth area of each flat unit. This is likely to reduce the



site loading and introduce additional open space for ventilation and landscaping, both of which are likely to enhance the site's carrying capacity. This redesign option could also enable the proponent to increase area for children play and offer more greenery spaces. However, reducing ground coverage will mean the spatial provision for each household will be squeezed, something that may not be desirable to the inhabitants. Indeed, what the proposed project has provided is the optimal and its further reduction may compromise the comfort of the intended occupants. Economically, even though there may be cost-cutting in construction, the resultant quality of the spaces are likely to reduce the rental value of each unit.

9-2.5 Developing Maisonettes

A maisonette is herein defined as a house built on more than one floor. Maisonettes form one of the house prototypes in the project area and are architecturally compatible. This option could achieve relatively low densities that ensure more privacy, are easy to integrate with the existing landscape, and do not generate excessive traffic; however, it does not offer any greater unit construction cost reduction. The option also implies that the proponent will have to incur fresh costs in redesigning the building plans, their site layouts, and development approval. Thus, this option would be less desirable because it provides a relatively lower rate of housing supply for hence not providing a rapid response to housing problems for civil servants in the city.

9-2.7 Preferred Development Option

All the alternative options analyzed have implications, which make the current design option proposed by the proponent to be more viable. It is concluded that:

- The alternatives are likely to reduce the returns to investment that the proponent would have realized if the current proposed design were to be approved
- The alternatives are likely to reduce the amount of housing stock that the proponent is willing to supply in Rongai.
- Prime land is scarce and costly. Because of this, the proposed project may not be relocated to an alternative site.
- There are several developed highrise flats in the neighborhood whose construction the County Council of Ole Kejuado approved. The proposed development will therefore blend easily with the current development trend.
- The project site is already approved for multi-family dwelling units. The project does not therefore translate to change in development density.



9-3 Potential Negative Impacts and Mitigation Measures

The potential negative impacts and possible mitigation measures for the proposed building development are summarized below:

Table 9-1: Potential Negative Impacts and Mitigation Measures

| Potential Negative Environmental Impacts | Mitigation Measures |
|--|--|
| 1. Architectural Incompatibility leading to distortion of neighbourhood aesthetic image | 1-1 Harmonize building scale with existing development in neighbourhood. 1-2 Harmonize detail, material and finishes for roofs and walls with existing development in the neighbourhood |
| 2. Disruption of existing natural environment and modification of micro-climate: <ul style="list-style-type: none"> - Increased development density - Increased glare/solar reflection - Reduced natural ground cover - Obstruction of ventilating wind - Increased surface run-off | 2-1 Development restricted to approved density – building line, plot coverage and plot ratio. 2-2 Careful layout and orientation of buildings to respect wind and sun direction. 2-3 Adequate provision of green and open space planted with grass, shrub and tree cover. 2-4 Minimum use of reflective building material and finishes for roof, wall and pavement. |
| 3. Pollution and health Hazards <ul style="list-style-type: none"> - Dust and other construction waste - Noise generation from construction activities. | 3-1 Damping down of site e.g. sprinkling water to dusty areas on construction site. 3-2 Containment of noisy operation, including locating noise operations away from sensitive neighbours 3-3 Limit construction work to day hours only. Construction work to take shortest time possible. |
| 4 Increased loading of Infrastructure services <ul style="list-style-type: none"> - Increased vehicular and/or pedestrian traffic - Increased demand on water, sanitation services etc. | 4-1 Have clear exit/entry on access road, encourage rainwater harvesting. Provision of increased water storage capacity 4-2 4-3 |



| | | |
|---|---------------------------------------|---|
| 5 | Worker accidents and health infection | 5-1 Employ skilled and trained workers, educated on construction site safety procedures. Also, provide workers with protective clothing. 5-2 Prepare clear work schedule and the organization plan. 5-3 Have adequate worker insurance cover 5-4 Enforce occupational health and safety standards. |
| 6 | Increased social conflict | 6-1 Encourage formation of community policing and neighbourhood association. 6-2 Increased economic activities – increased employment opportunities, income and capital stock formation 6-3 Increased housing stock in the area. |

PROJECT BUDGET

10-1 Overview

The total project cost is estimated at KShs. 700,000,000 Million

10-2 Capital Investment Costs

The main capital investment costs relate to:

- Land
- Site preparation
- Fencing and gate
- Building structure
- External / site work – access road, landscaping, water supply, power supply etc.

10-3 Professional Fees and Labour Costs

The project involves lawyers, town/physical planners, environmentalists, architects, engineers, quantity surveyors etc. It is estimated that 25% of the



project development cost will be allotted for labor charges. A labour force of 100 persons will also be employed. The total professional fees and labour costs is estimated at KShs. 7,800,000

10-4 Project Time Schedule

The whole project cycle from inception, planning and design, and construction is estimated take 18months. The construction period is estimated to take 12 months.

10-5 Financing

The proposed project will be financed by the Proponent.

RECOMMENDATIONS

11-1 Overview

From the foregoing analysis, the social and economic rating for this project is highly positive. Evaluation of alternatives has already shown that options are limited and costly. Already the proponent has sunk a substantial amount of money in the project up to design stage.

Further delay of the project is denying all stakeholders the anticipated benefits of the investment. While, redesigning or relocation of time will lead to loss of time and money that is already tied in the preliminary costs of the project

The project does not pose any serious and negative environmental impacts. Adequate mitigation measures have been proposed to address any of the negative impacts arising from the project.

The proposed project will inject KShs. 700,000,000/- to the town and national economy. The project will create employment and improve income earnings in the town. The project will boost the diminishing housing supply for Kenyans.

11-2 Recommendations



- That National Environmental Management Authority do consider, approve and grant required Environmental Impact Assessment License to the proponent in respect to Plot No Ngong/Ngong/52124
- That County of Ole Kejuado do support this application for Environmental Impact Assessment License in respect to the proposed housing project.
- That the Project Report here now presented is sufficient and meets the requirements of the Environmental (Impact Assessment and Audit) Regulations 2003.
- That the scale and scope of the project does not require the preparation of a full Environmental Impact Assessment Study Report.



References

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5. Kenya, Republic of (1982) The Factories and Other Places of Work Act (Cap. 514)
6. Kenya, Republic of (1994) The National Environmental Action Plan (NEAP)
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8. Kenya, Republic of (1999) The Environmental Management and Coordination Act No. 8 of 1999 amended 2015
9. Kenya, Republic of (1999) Sessional Paper No. 6 of 1999 on Environment and Development
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11. Kenya, Republic of (2000) The Poverty Reduction Strategy Paper (PRSP)
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15. United Nations (2000) The World Commission on Environment and Development





APPENDIX



APPENDIX A

Returns from Stakeholder Consultation

