ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED LEVEL (IV) HOSPITAL AND AUXILIARY FACILITIES ON PLOT L.R NOs.15312/3 & 15312/4, IN KITHIMANI, YATTA SUB-COUNTY, MACHAKOS COUNTY

Prepared By

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SEPTEMBER 2020

CERTIFICATION

This Environmental and Social Impact Assessment report has been prepared by Emerald Consultancy Kenya Limited (NEMA Reg. No. 10400) in accordance with the Environmental Management and Coordination Act (EMCA) Cap 387 and the Environmental Impact Assessment and Audit Regulations 2003. We the undersigned, certify that the particulars in this report are correct and righteous to the best of our knowledge.

DETAILS OF PROJECT PROPONENT:

NAME OF THE ORGANIZATION	**MULLY CHILDREN® FAMILY TRUST REGISTERED TRUSTEES**	
PROJECT LOCATION	In terms of latitude and longitude it lies between latitudes $1^0$06'22.8"South and longitudes $37^0$21'23.3" East.	
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DESIGNATION	CHIEF EXECUTIVE OFFICER	
SIGNATURE & DATE		

DETAILS OF ESIA/EA AUDIT EXPERTS

S/NO.	NAME	DESIGNATION	REG.NO.	SIGN.	DATE
1.	JACINTA KALITI	LEAD EXPERT	2065		
2.	ELIJAH MUTHUSI	LEAD EXPERT	0754		
3.	THEOBALD LUCHIDIO	LEAD EXPERT	1864		
4.	FRANCIS MUSEMBI	ASSOCIATE EXPERT	8806		

ACRONYMS AND ABBREVIATIONS

CDF	Constituency Development Fund
COMESA	Common Market for East and Central Africa
CSR	Corporate Social Responsibility
CSSD	Central Sterile Services Department
CU	Cardiac Unit
dB(A)	Decibel of Noise
DOSH	Directorate of Occupational Safety and Health
DU	Diagnostic Unit
EA	Environmental Audit
EHS	Environmental Health and Safety
ESIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
EMS	Environmental Management Standards
ESMP	Environmental and Social Management Plan
GHGs	Green House Gases
GoK	Government of Kenya
GPS	Global Positioning System
HVAC	Heating Ventilation & Air Conditioning
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
KENHA	Kenya National Highways Authority
KPLC	Kenya Power and Lighting Company
KURA	Kenya Urban Roads Authority
LDRP	Labour, Delivery, Recovery & Postpartum Room
LPG	Liquified Petroleum Gas
MCF	Mully Children Ⓢ Family
MCFTRT	Mully Children Ⓢ Family Trust Registered Trustees
MDD	Maximum Dry Density
MDGs	Millennium Development Goals
MOH	Ministry of Health
MSDS	Material Safety Data Sheet
NCA	National Construction Authority
NEMA	National Environment Management Authority
NICU	Neonatal Intensive Care Unit
NYS	National Youth Service
OSHA	Occupational Safety and Health Act
OSHO	Occupational Safety and Health Officer
PAPS	Project Affected Persons
PVC	Polyvinyl Chloride
QMS	Quality Management Standards
RoK	Republic of Kenya
RRA	Rapid Rural Appraisal
STDs	Sexually Transmitted Diseases
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environnemental Programme
UNFCCC	United Nations Framework Convention on Climate Change
WIBA	Work Injury Benefits Act

DEFINITION OF TERMS

Environmental Auditor:	Means an expert or a firm of experts registered in accordance with regulation 14 of Legal Notice No. 101 of 2003 (Environmental Audit and Impact Assessment Regulations).
Environmental Impact Study:	A systematic evaluation of activities and processes of an upcoming project/facility to determine how far these activities and programs conform to the approved Environmental Management plan of that specific project and sound environmental management practices.
Environmental Management Plan:	Means all details of project activities, impacts, mitigation measure, time, schedule, costs, impact or activities, including monitoring and environmental audit during implementation and decommissioning phase of a project
Mitigation:	Measures which include engineering works, technology improvement management ways and means of minimizing negative aspects, including socioeconomic and cultural losses suffered by communities and individuals, whilst enhancing positive aspects of the project.
Proponent:	Means a person proposing or executing a project, program or an undertaking specified in the second schedule of the Environmental Co-ordination and Management Act.
Standards:	Means the limit of discharge or emission established under the Act or under these Regulations;
Waste:	Includes any matter whether liquid, solid, gaseous or radioactive, which is discharged, emitted or disposed in the environment in such a volume, composition or manner likely to cause an alteration of the environment.
Scoping:	Is the process of determining the content and extent of the matters which should be covered in the environmental information to be submitted to a competent authority for projects which are subject to ESIA.
Screening:	It is a coarse analysis of the possible impacts of an action with a view to identifying those impacts which are worthy of detailed study for a project to be considered for an ESIA process or not.
Decommissioning:	This is the permanent withdrawal from a site or close down of a facility for restoration.

ACKNOWLEDGEMENT

The ESIA team wishes to recognize the whole fraternity of Mully Children Ⓢ Family together with Chiefs and Assistant Chiefs of Kithimani and Ngoliba locations for their helpful insights and support in this study.

We are greatly indebted to the MCF staff and management; Dr. Charles Mulli and his family for logistical and moral support accorded to the team in the course of undertaking the assessment. Finally, the team appreciates the community in the project area and other stakeholders who were very co-operative during this study.

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EXECUTIVE SUMMARY

This report contains findings of Environmental and Social Impact Assessment (ESIA) conducted in June-August of year 2020 for the proposed construction of a Level (IV) hospital and auxiliary facilities. The proposed site is located in Kithimani Location of Yatta Sub County in Machakos County a few meters from the boundary of Machakos County with Kiambu County.

The proposed project site is located at GPS Co-ordinates Latitude: 1^0 06'22.4"S and Longitude: 37^0 21'22.4"E along Thika–Garissa Highway next to Vegepro Horticulture Farm & Yatta NYS Academy, opposite National Youth Service-Yatta Field Station and a few meters from Ngoliba Shopping Centre in Kithimani Ward, Yatta Sub-County, Machakos County.

The project proponent is Mully Children Ⓢ Family Trust Registered Trustees (MCFTRT) whose core objective is to provide this service to this area as they are over stretched and inhibiting the growth of the area.

Pursuant to section 58 of the Environmental Management and Coordination Act, (EMCA) Cap 387, the National Environment Management Authority (NEMA) requires project proponents to carry out Environmental Impact Assessments (ESIA) for such projects which have the potential to cause negative social and environmental impacts. The ESIA report has been prepared by a team of ESIA/Audit experts registered with National Environment Management Authority (NEMA). The team carried out the assessment using a combination of methods including; ground surveys, review of existing literature pertinent to the proposed project, focused group discussions, public meetings and structured questionnaires to the identified stakeholders. The ESIA project report was prepared in line with the administrative procedure provided under the Environmental (Impact Assessment and Audit) Regulations of 2003.

Currently the site neighbours the Proponent's Yatta offices, farm land, Mully College and workers' residence. The construction is purposefully for providing access to a source of fuel to motorist plying the Thika-Garissa highway, provision of a better health care and boosts the growth of business in the area through provision of commercial spaces to the Yatta Community as well as the neighbouring counties.

The objective of the ESIA was to identify potential positive and negative environmental impacts associated with the proposed project and make recommendations on how to enhance the positive impacts on one hand and to mitigate the negative environmental impacts on the other. The findings of the ESIA indicate that the positive impacts far much outweigh the negative impacts.

The project will bring economic prosperity to the areas due to ease of accessing not only a better healthcare system but also the much needed fuel source and an all in one commercial hub that are lacking in the area. It will also provide employment opportunities for those involved in the diverse project activities and implementations thereby earning them income. The development will also open up the area to better health care, business and visitors. It is also anticipated that economic products from the area and land parcels prices will increase.

The potential negative social and environmental impacts identified are those associated with the following aspects: removal of vegetation, soil erosion and sedimentation, dust, noise,

indiscriminate disposal of waste, general health and safety aspects and spillage of hazardous materials on the ground surface.

The ESIA Study has been prepared by Emerald Consultancy Kenya Limited, a NEMA Licensed Firm of Experts Reg. No. 10400 for submission to the National Environment Management Authority (NEMA) for consideration based on the scoping result, field visits and information collected from both primary and secondary sources including information provided by the Project Proponent.

This ESIA has been prepared with the aim of mitigating above mentioned impacts. The mitigation measures include efficient solid waste management, optimal utilization of construction materials, adherence to the occupational health and safety rules and regulations as stipulated in Occupational Health and Safety Act 2007, minimal disturbance of biodiversity and consequent replenishment where possible, use of efficient equipment and machinery to curb emissions and noise.

The report findings indicate implementation of the project is long overdue and community members are eager to have the project take off due to accruing benefits on completion. The project benefits by far outweigh negative impacts whose effects can be minimized

The proposed project will cost approximately Two hundred and Fifty million (Ksh 250,000,000).

Potential Projects Impacts

Construction Impacts

The **positive impacts** that were identified during the construction of the proposed facilities were;

- Creation of employment for the skilled and semiskilled locals such as social-economists, trainers, casual labourers for facilities construction, cooks and cleaners at the construction sites and casual workers.
- Flourishing of businesses mainly at trading centres located along the facilities due to increased demand for basic commodities and services such as food, accommodation and construction materials.
- The incoming skilled and semi-skilled work force will provide for transfer of skills to the area residents and vice versa also true.
- The construction process will generate revenue to both the local and County governments from Cess payments for the construction materials at the County government cess points as well as through payment of income tax and other taxes by the proponent and workers.
- The project will require supply of large quantities of construction materials most of which will be sourced locally in Yatta Sub county and the surrounding areas.

The **negative impacts** identified during the construction of the proposed facilities are:

- Increased soil erosion due to excavation works along the facilities alignment as well as improper drainage of runoff from the facilities to lower catchment areas.
- There may be pollution of air resulting from dust, exhaust and engine emissions from vehicles and equipment used during the construction.

- Increase in vehicular movements accessing the construction site may cause traffic jam temporarily.
- There will be increased solid and liquid waste which may lead to pollution of air, land and water sources in the area.

Implementation Impacts (Operational Phase)

The **positive impacts** identified when the facilities will be under use are;

- Increased business opportunities due to opening up of the area as well as rise in demand for basic commodities. The facilities may lead to development of trading centres as well as improvement of existing ones in terms of basic needs such as housing, water and sanitation facilities.
- Increase in better healthcare among community members due to ease of access to a health facility in the area.
- There may also be unlimited employment opportunities for people who will be involved in day to day running of the facilities.
- Construction of the proposed project shall greatly render land economically useful. Land is a scarce resource in Kenya and through construction of the proposed project; this will ensure optimal use of land to the great benefit of the country and its people.
- The proposed development if executed will improve the aesthetic value of the land in the area which will attract more private and local investors.
- The operations will lead to maximization of available spaces for productivity
- The development will raise the land value in the area and beyond due to the nature of developments that will be coming up.

The negative impacts anticipated during operation of the facilities are,

- Exhaust and engine emissions from vehicles used for transportation of materials and equipment may cause air pollution, which can have an impact on public health, crops and vegetation along the facilities, soils and water sources. Regular servicing of these vehicles may reduce the emissions.
- Increased traffic along this route may lead to accidents along the busy Thika-Garissa Highway.
- The facilities will generate both solid and liquid wastes that if not well managed could cause a menace to the Environment as well as the local community.
- There may also be increased sexually transmitted diseases. Training should continue in the trading centres and in the areas where the workers will be accommodated.

Decommissioning Impacts

- **Positive Impacts**
  - There will be creation of employment although short lived for locals who will be involved in dismantling the facilities.
  - The Developer may consider selling off the recyclable materials to community living around the project site. This will come at a subsidized rate to the locals.

- **Negative Impacts**
  - There are likely to be accidents during the dismantling of the facilities. Barriers should be put where heavy machinery will be under use to avoid people trespassing.
  - All the solid waste accrued from the decommissioning process must be disposed as per the engineer's instruction and also in line with Waste management regulations 2006.
  - During the dismantling works, there is likely to be noise to the households living around the sites.
  - There will be air pollution from the equipment that will be used during the demolition works from dust. The exhaust fumes from vehicles and equipment used is also likely to pollute the soils, vegetation and water sources around the site. The Contractor may consider watering the area before demolition work starts.

- **Proposed Mitigation Measures**
  - The mitigation measures that can be incorporated into the design of the facilities during construction and operation stages of the level (IV) hospital and auxiliary facilities in order to mitigate the negative environmental impacts are;
  - Dust emissions can be reduced during construction by sprinkling occasionally with water along the diversion or access routes or on construction centre section. In the case of deviations, slowing the speed of traffic by using bumps and/ or clearly marked road signs may contribute to reducing dust levels. Haulage routes will need to be identified and maintained by watering to minimize the impact of dust.
  - Vehicles to be used during construction must be regularly maintained. Proper disposal of oil drained from trucks and Lorries and used oil filters should be done sensibly.
  - The areas to be excavated should be cordoned off through fencing to avoid accidents both to human and animals. Gravel pits must be landscaped and reinstated or back-filled with overburden if the depth of the overburden is sufficient to allow for this.
  - People should be informed of intended construction work activities, including likely dates for commencement and completion of works. Warning signs should also be introduced.
  - Workmen should be provided with suitable protective gear (such as nose masks, ear muffs, helmets, overalls, industrial boots, etc.).
  - There must be a fully equipped first aid kit and a Health Safety and Environment Officer who has first aid training and knowledge of safety regulations. In addition, the developer must have workmen's compensation cover.
  - The location of latrines in the site should preferably be downhill of potable water sources, or 50 m to 100m from any water body. Communal bathrooms/ lavatories with soak away pits are less polluting option, but would be slightly more expensive.
  - Sexually Transmitted Diseases (STDs) awareness should be conducted in the site as well as in the settlements/ trading centres.
  - All the affected communities will be alerted of the construction works through public consultation.

Environmental and Social Management Plan (ESMP)

Table 0-1: Summarised Environmental and Social Management Plan for the Construction and Operation Phases

Possible Environmental Impacts	Suggested Mitigation Measures
Air pollution, noise pollution and excessive vibration:	• Spray of water during construction work; • Control of speed and movement of construction vehicles; • Use of low-sulphur diesel for diesel-operated machinery; • Use of ear protection aids by construction workers; • No unnecessary hooting by project and occupants' vehicles • Restriction of construction activities to day time; • Use of attenuated equipment; • Hoarding of the entire construction site; • Limit pickup trucks and other small machinery to an idling time when necessary, observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
Clearing of vegetation	• Maintaining of grass around the site; • Planting of ornamental trees.
Disturbance of soil structure	• Put soil traps around perimeter fence and on steep areas; • Landscaping with ornamental trees and grass planting; • Maintaining specified routes for construction vehicles; • Control earthworks; • Use of light machinery and equipment.
Destruction of habitat	• Restrict vehicular movement to set out paths; • Maintaining of trees in areas not affected.
Generation of solid waste	• Provision of waste collection bins; • Re-use of soil, construction debris and other reusable waste; • Proper containment and disposal of solid waste; • Contracting a licensed waste collection and disposal company; • Creation of awareness on proper solid waste disposal;

	• Reuse of timber off-cuts and wooden support for fuel; • Comply with the requirements of the Environmental Management (Waste Management) Regulations Legal Notice 120.
Increased demand for water and electricity	• Conservation of water and electricity; • Provision of adequate water storage facilities; • Installation of rainwater harvesting structures; • Re-use of water where possible, mainly at construction phase; • Explore additional sources.
Occupational health and safety risks	• Use of suitable personal protective equipment; • Site to be sprinkled with water to minimize dust; • Use of stable ladders and other climbing/support structures; • Sensitize workers on occupational safety; • Maintain cleanliness and organization at the construction site; • Fencing or covering of risky areas such as deep pits; • Safety signage; • Engagement of skilled labourers; • Insurance of workers.
Fire hazards and accidents	• Acquire firefighting facilities; • Sensitize workers on fire safety; • No storage of flammable substances on site; • Keep well stocked first aid box; • Proper handling and use of tools and machinery.
Increase in traffic flow	• Set driving speed limits; • Adequate road warning signs to traffic regulations.
Security	• Guarding of site by a reputable security firm; • Constant site patrol; • Adequate screening of visitors to the site; • Collaboration with existing security machinery;

	• Partnership with neighbours and police in community policing;
Storm water/run off	• Proper maintenance of the drainage system; • Establish a storm water drainage system.
Generation of liquid waste	• Proper connection of waste water and sewerage system to the waste water treatment system as per approved design.
Public health and safety	• Ensure use of provided pit latrines by construction staff; • Proper handling and disposal of solid waste; • Control of visitors to the site; • Installation of adequate water supply; • Controlled developments around the facility.

Decommissioning Phase

In addition to the mitigation measures provided in above table, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the proposed project have ceased. The necessary objectives and mitigation measures pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the proposed project are outlined in the table below:

Table 0-2: Summarised Impacts During Project Decommissioning.

Environmental impact	Recommended Mitigation Measures
Solid waste generation	All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible.
	All wastes must be removed and recycled, reused or disposed of at a licensed disposal site
	Where recycling/reuse of the machinery, equipment, implements, structures and partitions waste is not possible, the materials should be taken to a licensed waste disposal site
	Donate reusable waste to charitable organizations, individuals and institutions

RECOMMENDATIONS AND CONCLUSIONS

- **Recommendations**

Following the impact analysis presented in the previous sections, here below are the recommendations:

- The Proposed project is to be implemented in compliance with the relevant legislation and planning requirements.
- The proponent must ensure that the impacts are kept to a minimum level
- A clear Environmental and Social Management Plans that have been developed must be enforced.
- The proponent should ensure the implementation of the mitigation guidelines provided in the ESMP in collaboration with the Contractor.
- The Engineer for the project needs to make progress reports indicating the implementation of the plans.

- **Conclusion:**

From the foregoing the following conclusions are made:

- No serious and adverse objections were received from the communities in the neighbourhood. The facilities will also lead to economic improvement of people living around the facilities. It is therefore considered suitable for the local area.
- The proposed project has actively involved the key stakeholders who did not object the development. Thus the success of the implementation project can be guaranteed.
- The proposed project does not pose adverse socio-economic impacts and is an initiative towards improving accessibility in the area.
- In conclusion, the study recommends timely implementation of the project with strict adherence to the proposed Environmental Management and Social Management Plans.
- The project benefits have been identified to far outweigh the negative impacts for which a mitigation plan has been prepared. Further, the proponent has carefully considered and applied acceptable local and international standard/regulations at all stages of project planning and would thus qualify for funding.
- MCF has a long-term plan to establish an eco-village within the MCF Yatta and Ndalani sites with an integrated environmental development, climate change adaptation and renewable energy options. This initiative is mainly focused on ensuring increased sustainable production, utilization and management of renewable energy for institutional, domestic and processing purposes, environmental development and watershed restoration, strengthened capacity through promotion of education, learning and research on renewable energy, environmental development and climate change adaptation and enhanced water harvesting, storage, utilization and conservation of watershed at the proponent's sites. With this in mind, it is clear that the proponent is committed towards Environmental conservation and protection.

CHAPTER ONE: INTRODUCTION

1.1 Overview

The proponent Mully Children Ⓢ Family Trust Registered Trustees is a Christian Based Charitable Organisation operating country wide and recognizes the importance of sustainable management of the environmental issues and the fundamental role it plays in business sustainability. Environmental performance is a shared responsibility and it is only by working together with neighbouring communities and other stakeholders that will make necessary progress to the journey of sustainable development.

The project will require approval by the Ministry of Health, KENHA, County government, NEMA and NCA. Therefore, the ESIA was conducted in accordance with the Environmental Assessment and Audit Regulations as promulgated in 2003.

The prediction and assessment is precisely aimed at identification of possible effects the project may have on the environment that is flora and fauna, physical environment, land, biodiversity, animals, human settlement, economic activities and social settings, workers as well as the community within and outside the project area. The ESIA starts with establishment of existing policies, standards as well as any guidelines related to the buildings construction works in Kenya. Specifically, the study will aim at identifying the guidelines that have been stipulated for the protection of environment, pollution prevention, and enhancement of community health, safety and security and conservation of biodiversity, indigenous people and existing cultural heritages. The policies will be used in outlining the measures that the proponent will need to put in place to avoid or if avoidance is not possible, minimize the impacts. This is then followed by collection of baseline information that indicates the existing conditions before the commencement of the Project. The baseline data include relevant physical, biological, socio-economic and labour conditions including any anticipated changes before the project commences. The baseline information is used for monitoring and evaluation how well the mitigation measures are being implemented during the project cycle.

1.2 Proponent's Background

Mully Children Ⓢ Family Trust is a Christian Based Charitable Organisation that makes a difference in the lives of thousands of needy children through rescue, holistic rehabilitation and re-integration back to the society. It was founded in 1989 by Ev. Dr. Charles M. Mulli ([PhD HSC) with a motto of "Saving Childrens Lives" and continues to touch more children who have no hope and provide them with an opportunity to flourish. The Family has two homes in Yatta (Ndalani & Yatta) with other homes spread country wide and internationally.

It is through the families **Vision** of seeing children, youth and the marginalized members of society leading a dignified livelihood coupled with the **Mission** of following Jesus Christ in transforming lives of Children, Youth and the marginalised members of the society embedded on their **Core Values** which include Unconditional Love, Character Development, Committed to Service, Humanity, Integrity, Transparency, Professionalism, Trust worthiness and accountability, that MCF is embarking in these community transformative initiatives that will be among one of the many projects intended to assist the proponent to achieve his goal.

1.3 Screening

Screening enables the project Experts & Developers to decide early at planning and design stage whether an ESIA study will be required or not. According to the Legal Notice No. 150 of the Environment Management and Coordination Act Cap 387 SECOND SCHEDULE

(s.58 (1), (4)) such construction works fall in the category of medium risk projects that requires an ESIA to be carried out.

1.4 Scoping

If the project screening indicates that an ESIA study is required, the next important task is "Scoping". The aim of scoping is to ensure that the ESIA study addresses all key environmental and social issues of importance to the decision makers. It involves deliberations of environmental issues with the project stakeholders including project developers, decision makers, the regulatory agency, concerned government and semi-government departments, local community leaders, local NGOs and other concerned to ensure that all environmental, social issues and concerns are discussed and key environmental and social impacts are identified. Scoping will be carried out through consultations with the affected communities, developmental management and monitoring plan in accordance to relevant as well as recommendations from and agreements with the affected communities, local leaders and area administrative authority, site surveys, focus group discussions with affected communities and collected information using questionnaires administered to key stakeholders.

1.5 Objective of conducting the ESIA

The National Environment Management Authority (NEMA) requires project proponents to carry out Environmental Impact Assessments (ESIA) and prepare related reports for developments that have the potential of resulting to negative social and environmental impacts.

The overall objective of Environmental Impact Assessment (ESIA) is to ensure that environmental concerns are integrated in all development activities in order to contribute to sustainable development.

The specific objective of conducting the ESIA with respect to the proposed project was to:

- Examine the likely adverse environmental aspects and associated impacts
- Propose appropriate mitigation measures for the significant negative impacts and
- Develop an Environmental Management Plan (EMP) with mechanisms for monitoring and evaluating compliance and environmental performance.

1.6 Project Justification

There is an increased development along this corridor occasioned by the rapid expansion of Thika Town that has witnessed a linear expansion towards Kithimani town. Within a close proximity to the proposed site, there exist very few health facilities, mainly level I & level II. There are only two level IV health facilities nearby; one within Thika Municipality (35km away) and another at Matuu which are several Kilometers away. The stretch between Ngoliba Shopping Centre & Kithimani is about 10km and does not have any Petrol Service Station. It is worth to note that Kithimani Ward has the highest population (31,213 persons as per the 2019 Census) among the other wards in Yatta Sub County.

1.7 Significance of the project

The project will play an integral part in provision of the much needed healthcare facility and assist in achieving the government objective of provision of Universal Health care to its citizens as well as provision of a fuelling point to commuters along Garissa Highway who have to drive all the way to Kithimani Market or Dillons in Ngoliba Market to access fuel for their cars.

1.8 Scope of the ESIA

The ESIA was undertaken with respect to the proposed construction of a level (IV) hospital and auxiliary facilities including, a petroleum filling station and a commercial hub. The ESIA report was prepared vis-a-vis the guidelines provided under the Environmental (Impact Assessment and Audit) Regulations, 2003. The guidelines provide that the ESIA report must capture the following salient features:

1.9 Description of Baseline environmental conditions of the area

- Description of the proposed project and associated activities
- Description of the national environmental legislative and regulatory framework
- The objectives of the project
- The products, by-products and waste generated by the project
- Identification and discussion of any significant impacts to the environment anticipated from the proposed project
- Description of appropriate mitigation measures proposed for the negative environmental impacts
- Provision of an Environmental Management Plan
- Alternative technologies and processes available and reasons for preferring the chosen technology and processes
- Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies
- Public consultation with various stakeholders.

1.10 ESIA Methodology

The ESIA study process entailed the following steps:

- Meeting with the MCF Management team
- Desk top study (literature review) pertinent to the proposed project and its location
- Review of the relevant laws and statutory requirements
- Field survey to collect baseline information through
- Direct observations
- Interviews and focus group discussions with relevant stakeholders
- Field survey that prepared the project design and project map
- Public consultative meeting with the local community and
- Preparation of the ESIA report as per the Environmental Impact (Assessment/Audit) Regulations of 2003.

1.11 Study Approach

The Study commenced after establishment of applicable Kenyan's Laws and Policies related to the construction of the proposed project. These policies and standards have extensively been discussed in Chapter 4. This information was mainly obtained from literature review. The baseline information/data that was found relevant in this report and needed to be evaluated included:

- Physical characteristics of the project area
- Location of the proposed facilities
- Topography
- Characteristics of existing soils where the facilities will be located
- Natural resources such as water, minerals, wetlands

- Biological life forms in the project area that are likely to be affected by the project
- Biodiversity which includes vegetation cover, forests, indigenous species
- Socio-economic profile of the communities living along the facilities alignment
- Economic activities that the communities living along the facilities profile are engaged in
- The size and demographic features of the population within the project area
- Poverty index of the communities living along the facilities profile
- Community health, safety and security conditions
- Indigenous people living in the area
- Cultural heritage including antiques and monuments that are in existence in the area

The impacts anticipated during the construction and operation of the facilities were related to degradation of environment such as loss of soil through erosion, excavations, destruction of vegetation, animal habitats and indigenous species, relocation of people and loss of land, pollution of air from dust, noise and water from sediment, waste management, stress on available water sources, community health and safety, creation of employment opportunities, improvement of accessibility to health care, improvement in energy industry among others.

The identification of these impacts was done through site visits and surveys, consultation with local opinion leaders and affected communities, focus group meetings with the local communities, interviews to the relevant authorities such as project management and minutes of the meeting held were recorded on paper.

1.12 Study Tools and Techniques

i. Questionnaires

The information that was sought using the questionnaires was related to perception of the community on the proposed project, any anticipated conflicts as a result of the project, socio-economic impacts, collaboration opportunities, benefits accrued from the project and any measures to mitigate negative impacts.

ii. Site visits and Survey

To understand the biophysical nature of the project area the field team visited the site. A survey along the proposed site was done and observations made on the settlement patterns, vegetation and existing ecosystems, forests, cultural heritages, socio-economic activities among others. During the site visits, the team was also able to meet the stakeholders.

iii. Public Consultation

The Consultant through the help of area chiefs, assistant chiefs and the developer organized a meeting with affected communities living around the proposed project site. During this meeting, the communities were briefed on the project background, scope design outline and the regulatory requirements for all the projects of lesser /similar/ higher magnitude whose implementation approval is vested on the National Environmental Management Authority (NEMA). The main objective of the meetings was to give them an opportunity to present their concerns and opinions regarding the proposed project. Key among the concerns were the destruction of trees and other vegetation especially pasture and use of locally available materials. Through the meetings, the communities were informed of the measures the proponent through the contractor was going to put in place to mitigate the impacts incorporating their views.

iv. Data analysis and presentation

Information/data obtained from the field was both qualitative and quantitative although the former formed the bulk of it. In this case therefore the information was synthesized into a report on project impacts, proposed measures for mitigating the impacts including the opinions and concerns of the affected communities.

v. Environmental and Social Management Plan

After carrying out the ESIA, an Environmental and Social Management Plan (ESMP) was then developed. The ESMP clearly showed proposed mitigation measures to identified impacts, parties responsible for mitigation, means and frequency of monitoring and estimated costs.

1.13 Environmental Expert Team

Details of the team that carried out the audit are summarized in the table below:

Table 1-1: Team of experts

S/NO.	NAME	DESIGNATION
1.	JACINTA KALITI	LEAD EXPERT
2.	ELIJAH MUTHUSI	LEAD EXPERT
3.	THEOBALD LUCHIDIO	LEAD EXPERT
4.	FRANCIS MUSEMBI	ASSOCIATE EXPERT

CHAPTER TWO:

2.0. PROJECT DESIGN DESCRIPTION AND ACTIVITIES

2.1 Overview

This chapter give a description of the actual project location, scope and the activities involved in the Construction of the proposed projects. It also highlights on the key inputs and outputs. Description of the plants and equipment that will be used is also provided.

2.2 Project Design Description and Layout Plan

2.2.1 Hospital Building comprising of the following Per Floor:

2.2.1.1 Ground Floor

- 2 waiting bays with a reception
- Pharmacy area with an office and a store
- IT Department
- Staff Lounge
- 2 consultation rooms
- Treatment rooms
- 2 Transfer rooms
- Laboratory with a procedure room
- Minor theatre area
- Radiology room
- MCH
- Immunization room
- Isolation room
- Counselling area
- Kitchen
- Body Holding area
- Proposed Medical School to be implemented in the future

2.2.1.2 First Floor

- 4 Admission rooms
- 2 Nurse stations one with a store
- 6 suites
- Paediatric area
- Staff washrooms
- Lobby & waiting area
- Dialysis area
- Reception with a waiting lounge
- NICU Area
- Nursery for new-borns
- Antenatal area
- Postnatal area
- Septic Labour area
- Medical ICU area
- 2 LDRP
- Fathers lounge
- CS Theatre area

- Office area
- Patients Washrooms
- Labour wards.

2.2.1.3 Second Floor

- Offices
- Administration area
- Treatment room
- Waiting lounge
- Pantry area
- 4 Admission rooms
- 7 Wards
- A Creche
- CSSD
- Patient washrooms
- Staff Washrooms
- Sluice, DU & CU rooms.

2.2.2 A Ground only Mortuary building that will be separately constructed from the main building comprising of the following:

- Preparation room
- 2 storage areas
- The chapel
- Reception and waiting areas
- Cleaners room/store
- Office
- Arrangements area
- Selection room
- Vestibule
- Ante room
- Music room
- Washrooms for both genders

2.2.3 A Ground only laundry area building to be separately constructed from the main building comprising of the following:

- Receiving and sorting area fronting the washing areas
- 2 stores
- Managers office
- Cleaning & dryer area
- Sluicing & washing area
- Infected linen washing area
- Processed linen store
- Distribution area
- Issue counter
- Repair and work area

2.2.4 The Incinerator

2.2.5 The Waste water treatment plant

2.2.6 Commercial Area (Ground floor only) comprising of the following:

- 2 shops
- Grocery shop
- Supermarket
- Banking hall
- Kitchen area
- Restaurant
- Washrooms
- Parking areas
- An outdoor sitting area.

2.2.7 Petrol Station

The service station will have the following main facilities at the court yard:

- Car wash bay with an office
- Car lube area with a store
- Car tyre bay
- Manager's office with a reception area, store and a strong room.
- LPG Sales office
- LPG Storage area.
- A store
- Forecourt, comprising the following:
  - Oil water interceptor;
  - Dustbin cubicles, protected from rain and animals (located within the station);
- Tank area and pump island installation, including:
  - Three USTs petroleum storage tank;
  - Product line network and vents;
  - 4 main pump islands with eight dispensers.

2.2.7.1 The Construction and installation of (USTs)

The service station intends to install the tank with the following features:

- The tank must be constructed from rolled carbon steel plate, welded together and meeting the requirements of the Kenya Bureau of Standards;
- External surfaces of the tank must be painted with a primer paint and then coated with an approved two-pack, coal-tar epoxy enamel or equivalent bituminous coating or aluminium paint;
- The tanks must be installed within a bonded wall for containment of the diesel spills to prevent seepage of petroleum hydrocarbons to the subsurface and thereby seeping to the underground water and surface water;
- The tank installed will have a design life of not more than 30 years;
- The tank to be installed will be new and NOT removed from other stations;
- All the above features are in line with the Petroleum Institute of East Africa Design Guidelines.

- The primary role of the oil water interceptor will be separation of water and oil, before water is discharged into the storm water drain / to the nearby environment. The waste oil will be skimmed off and discharged as per NEMA guidelines.

2.2.7.2 Construction and installation of Underground Piping System (UPS)

The pipelines will have the following characteristics

- A flexible, continuous pipework system must be used to connect the storage tanks to the associated dispensers.

The construction will incorporate the following and other measures in accordance with the pipe installation instructions:

- Sand bedding material, placed and compacted around the ducts to provide even support along the entire length;
- Pipes must be tested before backfilling to ensure leaks are identified and rectified (the records availed during the close-out environmental audit);
- Trenches must be back-filled with compacted sand or pea gravel.
- The product lines must be of the positive pressure type, with a submersible pumping system installed in each of the fuel storage tanks. All submersible pumps must be fitted with "Red Jacket" or similar leak detectors, which operate by detecting any loss in pressure within the pipeline. The submersible pump system will also provide flexibility in locating the mobile tanks, in this case any leaks will be easily detected and appropriate action taken. All the above characteristics are in line with the Petroleum Institute of East Africa Design Guidelines.

2.2.7.3 Construction and installation of Dispensers

All dispensers will be fitted with emergency shear valves and the dispenser hoses will have a cut-off system. In the event that a dispenser is overturned or knocked over, the emergency shear valve will automatically shut off the pipeline. The shear section (weak link) on the valve will be at the same level or up to a maximum of 15mm above the top level of the dispenser island and there will be ample clearance around the valve body to ensure that the normal functioning of the valve is not impaired.

2.2.7.4 Construction and installation of oil interceptors

The Consultant proposes that the station will have one oil interceptor for primary separation of waste oil and the final discharge to the public drain. The oil interceptor will have the following design characteristics:

- Three chambers: primary, intermediary and final;
- A mud catch-pit at the inlet, with grease traps and gratings;
- A gate valve at the outlet;
- Connection to storm drainage system.

The primary role of the oil interceptor will be separation of water and oil, before water is discharged into the storm drain / nearby environment. The waste oil will be skimmed off and discharged as per NEMA guidelines.

2.2.7.5 Filling and ventilation systems

One filler point, with separate fill lines for each mobile tanks will be provided within an enclosure to contain spillages and located such that delivery lorries will not obstruct the driveway. The filler point will also be positioned to ensure that, as far as possible according

to the site conditions, no reversing of the delivery vehicle will be necessary. Vent pipes will be located away from activities causing sparks and residential buildings

2.2.7.6 Fire protection at the filling station

Station will have the following fire protection measures:

- 10 in number 9kg dry powder fire extinguishers;
- Emergency lighting system, using secondary power supply;
- Manual "Break glass" fire alarm system;
- 10 litre buckets filled with dry sand, placed at each of the pump islands;
- Safety warnings at the dispenser areas, such as "No smoking", "No naked flames", "Switch off the engine" and "No use of mobile phones".

2.2.7.7 Sewage and storm water drainage systems from the filling station

Sewage from the toilets and other sanitary facilities will be directed to the waste treatment system where all waste water will be channeled for treatment before releasing to the environment. Forecourt wastewater will be directed into a grill covered drain, crossing at the front of the station into the oil interceptor, which will discharge into the storm drain / nearby environment (the quality is expected to meet NEMA guidelines).

2.3 Site Ownership

The land parcel (*Plot L.R, Nos. 15312/3 & 15312/4*) where the proposed project will be located is registered under the name *Mully Children℠ Family Trust Registered Trustees. The title and deed plans are attached on annex of this report.*

2.4 Project Location

The proposed project site is located at GPS Co-ordinates Latitude: 1^0 06'22.4"S and Longitude: 37^0 21'22.4"E along Thika–Garissa Highway next to Vegepro Horticulture Farm & Yatta NYS Academy, opposite National Youth Service-Yatta Field Station and a few meters from Ngoliba Shopping Centre in Kithimani Ward, Yatta Sub-County, Machakos County.

2.5 Infrastructure

The proposed site is accessed off Thika-Garissa highway immediately after crossing the Kiambu-Machakos Boundary. The proposed development will have a comprehensive and robust infrastructure including access roads, parking areas, water storage, electricity distribution and waste disposal mechanism.

2.5.1 Electrical system

There will be connection to the existing electricity main line of the Kenya Power and Lighting Company, which will be used in all phases of the project. The necessary guidelines and precautionary measures relating to the use of electricity shall be adhered to.

2.5.2 Water Reticulation system

Water from the existing borehole will be used during construction and operation phases. More over there will be water harvesting and storage tanks to increase water supply to various components of the development.

2.5.3 Sewerage

The area does not have a conventional sewer line. The proponent is proposing to put up a waste treatment facility to manage all waste water that will emanate from the facilities. The

proponent will undertake quarterly effluent assessment analysis reports from a NEMA credited laboratory to ensure the final water being discharged to the Environment is used for afforestation and watering of grass in the compound and meets the set standards.

All waste waters emanating from the forecourt and contaminated medical wastes will pass through silt trap as well as a water oil interceptor to be put in place at all service bays, car washing areas and the forecourt.

2.5.4 Solid Waste

Solid waste management will consist of labelled dustbins stored in cubicles protected from rain and animals. The solid wastes from the facilities will be separated depending on the nature of the waste. All medical waste will be incinerated in the proposed incinerator while all other unrecyclable wastes will be disposed of by a NEMA licensed waste disposal company in line with the Environmental Management and Co-ordination (Waste Management) Regulations, 2006.

2.5.5 Security

The site will be hoarded during construction process and a security agency will be contracted to man all access points to the sites. The guards will be charged to control movement of people in and out of the sites. During operations, a perimeter wall will be erected along the site boundaries and the boundary wall will be connected with security alarms. Entry control will be done also by a contracted security agency, and quick response systems will be used within the project area.

CCTV Cameras will also be put in place during operations of the facilities.

2.5.6 Fire safety

The development provides for firefighting facilities such as fire extinguishers in the form of hydrants and carbon dioxide gas extinguishers. Sand buckets and Fire blankets will also be put in place as well as horse powers in all fire risk areas majorly on the kitchen and petroleum filling station. Emergency exists will be well marked and fire assembly points be well indicated. Occupational Health and Safety audits, fire safety audits and annual fire drills will be conducted as per the DOSHS prerequisites.

2.5.7 Parking area

The drive way and parking area, which will be paved, spacious and will accommodate a considerable amount of cars.

2.5.8 Perimeter Fence

A concrete perimeter wall will be erected around the project site to offer the premises the required security and privacy.

2.5.9 Landscaping

The site will be landscaped after construction and planted with plant species available locally. This will include establishment of theme gardens and lush grass lawns to improve the visual quality of the site where pavements will not have taken space.

2.6 Buildings Construction

The technology used in the design and construction of the facilities will be based on international standards, which have been customized by various hospitals, petroleum, incinerator as well as morgue units in Kenya.

The buildings will be constructed as per the respective structural engineer's detail as provided for in the drawings presented in the Appendix. Basically, the building structures will consist of concrete appropriately reinforced with metal (steel and iron). The roof will consist of structural timber and steel members and roofing tiles. The buildings will be provided with a well-designed concrete staircase for every unit.

The buildings will be provided with facilities for drainage of storm water from the roof through peripheral drainage systems into the drainage channels provided and out into the natural drainage channel/system. Drainage pipes will be of the PVC type and will be laid under the buildings and the driveway encased in concrete. This is a sparsely build area and such no need for public drainage channel. The buildings will have adequate natural ventilation through provision of permanent vents in all habitable rooms, adequate natural and artificial light, piped water stored above ground water tanks and firefighting facilities.

2.7 Description of the Project's Construction Activities

2.7.1 Pre-construction Investigations

The implementation of the project's design and construction phase will start with thorough investigation of the site's biological and physical resources in order to minimize any unforeseen adverse impacts during the project cycle.

i. Sourcing and Transportation of Building Materials

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

ii. Clearance of Vegetation

The site has some vegetation cover including grass growing in it and few mature trees. *The proponent shall ensure as many indigenous trees as possible are used for re-vegetation as well as conserving the mature trees.*

iii. Storage of Materials

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

iv. Excavation and Foundation Works

The soil cover in the proposed construction areas is murramed. However, this shall be excavated and disposed off in approved sites (preferably exhausted quarries).

v. Masonry, Concrete Work and Related Activities

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

vi. Structural Steel Works

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

vii. Roofing and Sheet Metal Works

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

viii. Electrical Work

Electrical work during construction of the premises will include installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets etc. In addition, there will be other activities involving the use of electricity such as welding and metal cutting.

ix. Plumbing

Installation of pipe-work for water supply and distribution will be carried out within the entire building. In addition, pipe-work will be done to connect sewage from the premises to the effluent treatment plant.

x. Landscaping

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

xi. Building Materials and Energy Used

Several building materials will be required for construction of the facilities and associated amenities. These will include sand, ballast, hard core, timber, cement, clay tiles, metal sheets, electrical gadgets, and steel, plumbing materials, glass and paints among others. Most of these materials will be obtained locally within Thika and Kithimani as well as surrounding areas. The main sources of energy that will be required for construction of the project will include mains electricity and fossil fuels (especially diesel). Electricity will be used for welding, metal cutting/grinding and provision of light. Diesel will run material transport vehicles and building equipment/machinery such as bulldozers and concrete mixers. The

proponent intends to promote efficient use of building materials and energy through proper planning to reduce economic and environmental costs of construction activities.

xii. Solid Waste Generated

Large amounts of solid waste will be generated during construction of the project. These will include metal cuttings, rejected materials, surplus materials, surplus oil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. The proponent will take steps to minimize the generation of such waste and to ensure proper disposal procedures.

2.7.2 Equipment to be used in the Construction Works

a) Tractors:

They will mainly be used to pull and push loads during construction works. They will also be used as mounts for accessories, such as rippers, bulldozer blades, front end shovels and trenchers.

b) Bulldozers

Bulldozers are versatile machines that will be used for the following operations; to level the earth, to clear sites of debris and vegetation, excavation of the foundations, clear feeder roads, construct temporary roads, to move earth fill within short distances and maintain haul roads.

c) Scrappers

The scrappers will be employed in the earth moving fields to dig loads of soil, haul and discharge the excavated materials on the facilities. The scrapper aids in depositing, spreading and levelling the earth fill load in uniformly thick layers.

d) Shovels

Shovels will primarily be used for excavation and loading construction fills into trucks or tractor pulled wagons. They are capable of excavating in all types of earth except solid rock.

e) Rollers/Compactors

Rollers are essential equipment required for construction. Rollers will be used for compaction of murram to achieve the required consolidation levels. They are of two types; smooth wheeled rollers and sheep's foot rollers. Smooth rollers are effective in compacting granular soils such as sand, gravel and crushed stones. Sheep's foot rollers are suitable for cohesive soils.

f) Dump Trucks

Dump trucks will be employed in hauling materials from the foundations during excavation to the construction sites situated over short and long distances.

g) Concrete Mixers

The proposed project will involve considerable concrete works, both mass and reinforced concrete for construction of structures such as pipe and box culverts, drifts, small bridges,

retaining walls, site offices and stores and duty sites. Concrete mixers will be used for concrete batching.

2.8 Project Budget and timeline

The project is estimated to cost about ***Ksh. 250,000,000***. The actual construction is expected to take six to twelve months.

2.9 Description of the Project's Operational Activities

2.9.1 Operation of a Level IV Hospital with related amenities

The activities to be conducted in the proposed project's operation phase are the various health related/ medical procedures both inpatient and outpatient activities.

Related services such as operation of a mortuary will also take place where dead bodies will be kept before collection by the bereaved families.

A laundry area where all washing activities of all clothing materials will be done as well as operation of the incinerator where all medical wastes will be incinerated.

Other support services include catering, the general maintenance and cleaning of the premises and laundry. The human activities shall definitely generate some liquid and solid waste.

2.9.2 Operation of a petroleum filling station

Here is where vehicles will be fuelled from as well as servicing, washing and repairing. All waste waters generated from car wash, service bay as well as the forecourt will be passed through an oil water interceptor before being released to the drainage system. Ample measures will be put in place to ensure fire and safety considerations are observed.

2.9.3 The Commercial area

This is where operation of shops, food court from the farms, mini restaurant as well as a banking activities will take place.

2.9.4 Solid Waste

The proponent will provide facilities for handling solid waste generated within the facilities. These will include dust bins/skips for temporarily holding waste within the premises before final disposal at the designated dumping site. The solid wastes from the facilities will be segregated with respect to kind of wastes. Organic wastes (vegetable wastes) from the commercial area will be used on the farm, recyclable materials will be sold to the recyclers licensed by NEMA while all solid medical wastes will be incinerated. All waste collection bins will be colour coded with respect to nature of waste to be put into it.

2.9.5 Waste Water and storm water Management

Sewage generated from each unit will be discharged into the proposed water treatment plant where it will undergo biological treatment before being released into the environment. Contaminated water from the petrol station will be passed through an oil/water interceptor while kitchen waste water from washing utensils will be passed through silt traps. Storm water will be properly channelled to improve drainage within the development.

2.9.6 Cleaning

The proponent will be responsible for regular washing and cleaning of the facilities and communal areas. Cleaning operations will involve the use of substantial amounts of water, disinfectants and detergents.

2.9.7 General Repairs and Maintenance

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

2.10 Description of the Project's Decommissioning Activities

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

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

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

2.10.1 Site Restoration

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

CHAPTER THREE:

3.0. BASELINE INFORMATION OF THE PROJECT AREA

3.1 Introduction

This chapter deals with the background information of Machakos County which is the basis upon which this Environment and Social Impact Assessment has been grounded on. In view of this it is important to have an understanding of the background information of Machakos County. The background information covered in this Chapter includes the following;

- Location and size
- Physiographic and natural conditions
- Demographic profiles
- Administrative
- Demographics features
- Human development approach
- Political units
- Infrastructure and access
- Land and land use
- Environment and climate change
- Mining
- Water and sanitation
- Health access and nutrition,
- Energy
- Housing
- Tourism
- Transport and communication.

3.2 Location and Size

Machakos County is strategically located as it borders seven counties. To the north it is bordered by Nairobi County to the North West; Muranga and to the west Kiambu Counties, to the South west Nairobi and Kajiado counties, to the south Makueni County and to the East Kitui County. See Figure 3-2 below. In terms of latitude and longitude it lies between latitudes 0º45´South and 1º31´South and longitudes 36º45´East and 37º45´East.

The County covers an area of 6208.2 Km² with Machakos covering 925.2 Km², Kangundo 177.2 Km², Kathiani 207.1 Km², Athi River 843.2 Km², Yatta 1,057.3 Km², Masinga covering 1,402.8 Km², Matungulu covering 577.5 Km² and Mwala covering 1,017.9 Km². Given the foregoing coverage it is apparent that Masinga, Yatta, Mwala and Machakos have the biggest area coverage respectively while Kangundo, Kathiani and Matungulu have the lowest.

However, to take note is the fact that the area coverage of the sub county does not necessarily determine the population density. For instance, Kangundo, Kathiani and Matungulu have lowest area coverage while they are the highest population density. Mwala, Yatta, Masinga have a big area coverage yet they are not as densely populated as compared to Kangundo, Kathiani and Matungulu.

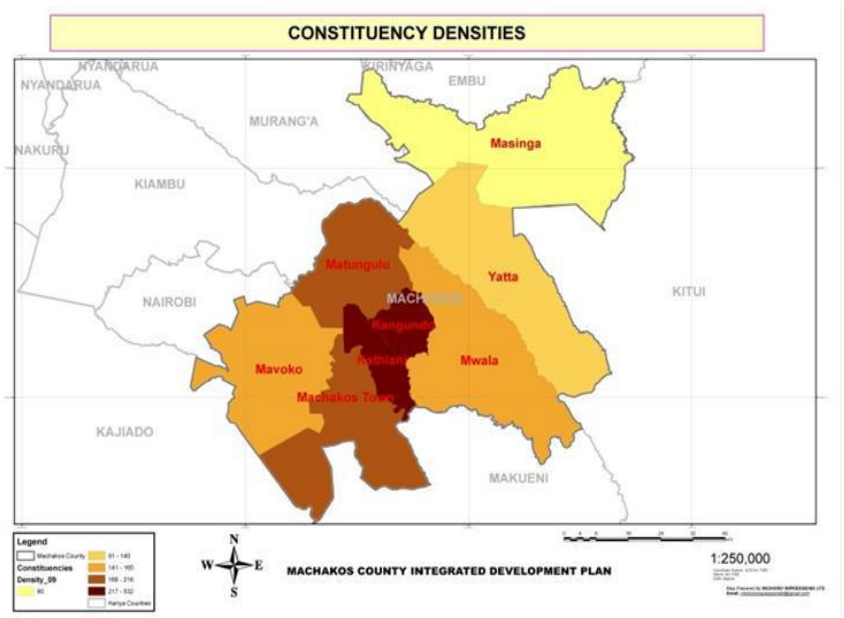

Figure 3-1: Population density per Sub County/

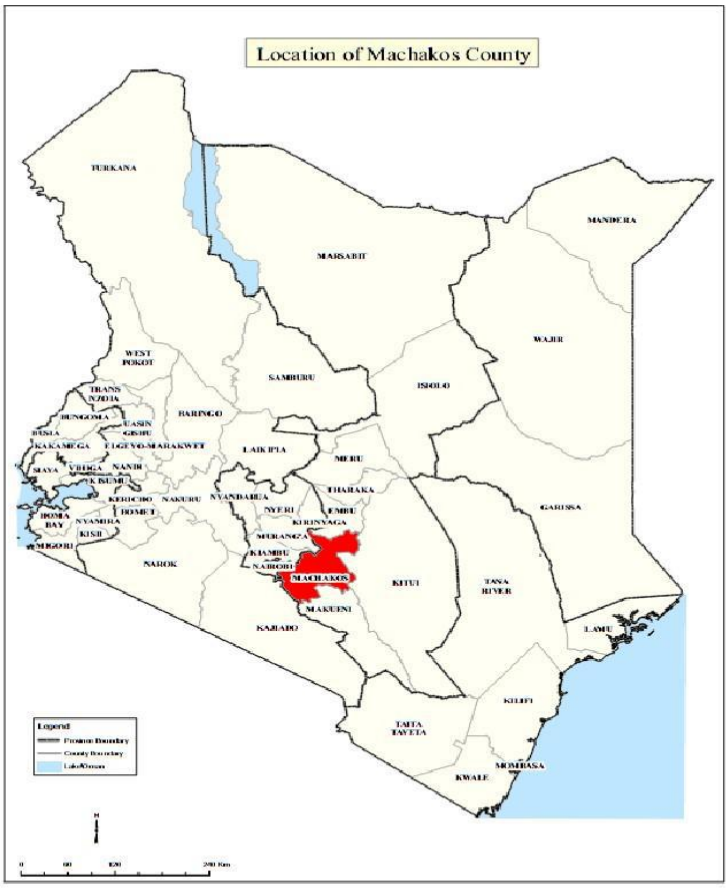

Figure 3-2: Geographical location of the Machakos County in Kenya

3.3 Physiographic and Natural Conditions

a) Physical & Topographic Features

Machakos County has very unique physical and topographical features. Hills and a small plateau rising to 1800-2100m above sea level constitute the central part of the County. To the West, the County has a large plateau elevated to about 1700m which is southeast sloping. The County rises from 790 to 1594 m above sea level. In the North West the County has stand-alone hills.

The soils are well drained shallow, dark red clay soils particularly in the plains. However, the vegetation across the entire County depends on the altitude of any given area/location. The rainfall distribution in the County depends on the topography of the areas. Since some areas of the County are arid while others have hills and volcanic soils and other areas are plains, the rainfall is widely distributed. For instance, the plains receive less amounts of rainfall as such the dominant vegetation is grasslands and some sparse acacia trees. The areas within the County are predominately hilly including Mutituni, Mwala, Mua, Iveti Hills and Kathiani.

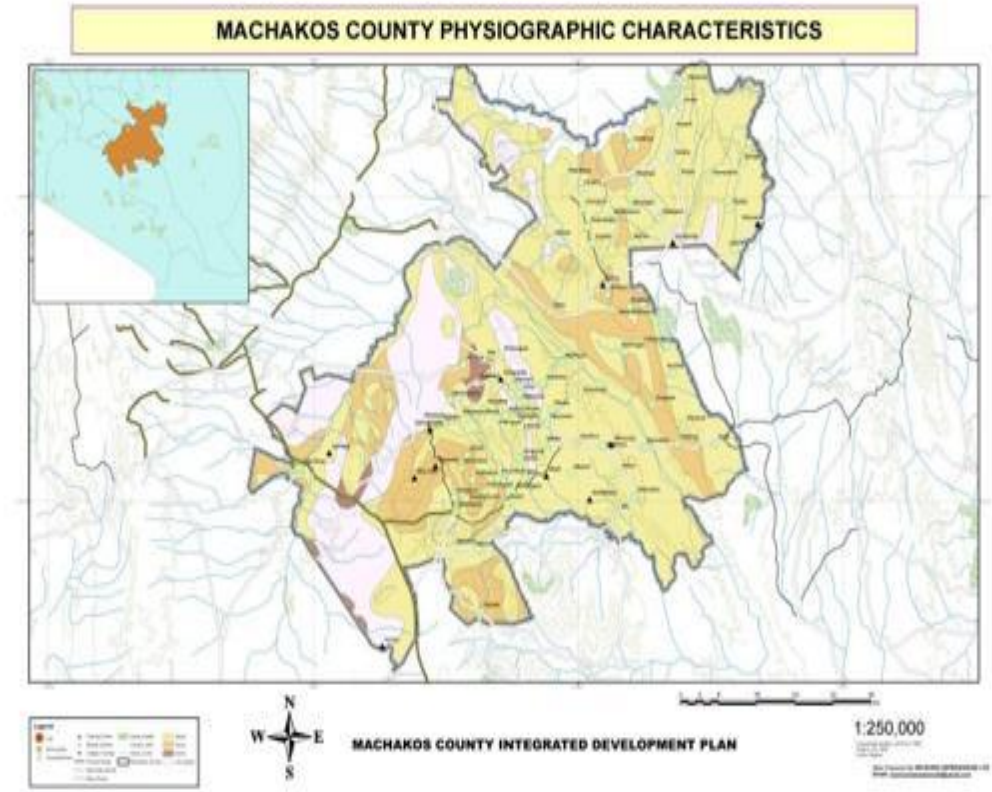

Figure 3-3: Machakos County physiographic characteristics

b) Ecological Conditions

Machakos County is the home for Yatta plateau which is situated within the Yatta Sub County. The Sub County has a land mass of 1,057 Km² thus the second biggest Sub County.

This Sub-County has numerous hills which include Iveti, Lukenya, Komarock, Kavila Koli, Ithanga, Mavoloni, Kangonde, Kamuthamba, Nzii, and Ekalakala. Tana River and Athi River are the two permanent rivers within Machakos County. They are also the main sources of water; however, we also have the Masinga dam within Masinga Sub-County which is the largest Sub County with a land mass of 1,402.8 Km².

c) Climatic Conditions

Generally, the annual rainfall of the County is unevenly distributed and unreliable. The average rainfall is between 500 mm and 1300 mm. The short rains are expected in October and December while the long rains are expected in March to May. The highland areas within the County such as Mua, Iveti and Kangundo receive an average of 1000mm while the lowland areas receive about 500mm; ideally the rainfall within the County is influenced by the latitude. In terms of temperature, July is the coldest month while October and March are the warmest. Temperature varies between 18°C and 29˚C throughout the year. Since the County does not experience rain throughout the year it then means that there are months that experience dry spells. These months are mainly February to March and August to September.

d) Administrative Units

The total land mass of Machakos County is divided into eight sub-counties/ constituencies, namely; Mavoko, Kathiani, Machakos, Matungulu, Yatta, Masinga, Mwala, Kalama and Kangundo. These nine sub-counties are further subdivided into twenty-two divisions, seventy-five locations and two hundred and thirty-nine sub locations respectively.

Sub-county/ Constituency	Area(Km^2)	Divisions	No. of locations	No. of sub-locations	2019 Census)	
					population	Density (Km^2)
Machakos	925.2	2	13	39	170606	609
Kangundo	177.2	3	9	25	97,917	567
Kathiani	207.1	1	4	21	111,890	544
Athi river	843.2	4	7	14	322,499	390
Yatta	1,057.3	3	9	29	172,583	162
Masinga	1,402.8	2	8	23	148,522	106
Matungulu	577.5	3	10	30	161,557	278
Mwala	1017.9	4	15	58	181,896	178
Kalama	683	4	4	8	54,462	112
TOTAL	6,208.2	22	75	239	1,421,932	235

Table 2-1: Area and administrative units by Sub-County

A comparison of the data in the above table, tells a story about Machakos County. It is apparent that Yatta is the second Sub County with the largest area coverage. However, it is not the Sub County with the highest number of divisions, locations and sub locations. To note also is the fact that it does not have the highest population. Mwala Sub County is the third largest Sub County however it is the Sub County with the largest number of divisions, locations, sub locations, though it is the second in terms of population. Though Matungulu is the 6th in terms of area coverage, it has three divisions, ten locations, thirty sub locations but it is the Sub County with the largest population. An interpretation of the foregoing data means that the equitable distribution of resources shall be guided by the area coverage and population.

3.4 Demographic Features

a) Population Size

According to the 2019 Kenya Population and Housing census the total population of the County is 1, 421,935. It is projected to increase to 1,566,516 in 2022, 1,638,649 in 2025 and 1,815,244 in 2030. This increase suggests that population will be increasing by 3%.

b) Population Density and Distribution

The population density and distribution in the County is driven by the economic activity carried out in the specific sub county. As at 2019 the County had a population density of 235 per Km^2, it was projected at 255 per Km2 as at 2022, 291 per Km2 as at 2025 and 302 per Km^2 as at 2030.

The population as reflected below is an indication of the social and public amenities that are necessary in each Sub County to provide sufficiently for the needs of the entire populations. Sub Counties like Machakos that have the highest population requires more social and public amenities than Kangundo Sub County would require. Considering the population growth projections, it is pertinent to note that the social and public amenities must increase Concurrently with the population growth.

It is apparent that Machakos has the highest population density per Km^2, followed by Kathiani Constituency/Sub County. The difference between Machakos which has the highest population density per Km^2 and Masinga which has the lowest. This can be attributed to the fact that Machakos has good agricultural and fertile soil as well as fertile soil which then acts as an attraction of populace while Masinga does not have favourable climate conditions conducive for agricultural activities. Athiriver/Mavoko Sub County has the highest population of which can be attributed to urban settlement and proximity to Nairobi. Kalama Constituency/Sub County has the lowest population of due to its small size relative to the other constituencies and the land tenure system with large areas under coffee plantations.

3.5 Infrastructure and Access

a) Roads, Rail Network, Ports and Airports, Airstrips and Jetties

The County has a total road network of 12,152.5 Km of which 375 Km is bitumen surface, 10,628Km is gravel surface, and 1149.5 Km is earth surface. Some are good roads including the Nairobi - Mombasa road, Machakos - Kitui road, Machakos - Wote road and Nairobi-Kangundo road. Since majority of the roads within the County are earthen and inaccessible during the rainy season; the County has prioritized the upgrading of the roads. The county has already started the upgrading and construction of roads.

b) Posts and Telecommunications

The mobile network coverage within the County is of 85 per cent of the total area. However, areas such as Kibauni and Yathui in Mwala, and Kalama in Machakos have a poor network coverage. The number of land line connection is 327 and its use is on the decline particularly because the use of internet as the main source of communication is on the rise and with the availability of fibre optic then the reliance on the landlines is on the decrease.

There are 14 post offices and 20 sub-post offices which are fairly distributed within the County. Radio ownership is 96 per cent which is attributed to low cost of purchase and maintenance while Television coverage is 58 per cent.

c) Financial Institutions

Because of the fact that Machakos County has very many commercial activities, numerous banks and microfinance institutions have been attracted. Currently there are about ten (10) commercial banks and fourteen (14) microfinance institutions with branches well distributed across the County. These banks and microfinance institutions include, Kenya Commercial Bank, Equity Bank, Cooperative Bank, Barclays Bank, Standard Chartered Bank, KREP Bank, National Bank of Kenya, Faulu Kenya, Kenya Women Finance Trust Kenya, Post Bank, Family Bank, small and micro enterprise programme (SMEP), three village banks and several SACCOS which include; Harambee Sacco, Hazina Sacco and Universal Traders Sacco.

d) Education Institutions

The County has 1,736 Early Childhood Development (ECD) centres, 688 primary schools and 190 secondary schools. The introduction of the free primary education increased the enrolment of children into primary school. This has led to a strain on the infrastructure of the primary schools particularly the classrooms, toilets and laboratories. Though primary education, secondary education and universities has not been devolved to the County government, the County is keen on cooperation with the National government to ensure that the infrastructure mentioned above takes into account the growing enrolment rates. Since the ECD and the village polytechnics have been devolved, the County government has set aside a budget to ensure that the number and quality of ECD centres increases.

The County has one Medical Training institution (MTC) located in Machakos town and two private universities Daystar University and Scott's Christian University which are situated in Mavoko and Machakos Town constituencies respectively. Other universities such as Nairobi University, Kenyatta University, Nazarene University, St. Pauls University and Jomo Kenyatta University of Agriculture and Technology have also opened various campuses in the County. Most of the campuses are situated in Machakos town. The institutions have created opportunities for the youth to acquire skills and knowledge.

e) Energy Access

Masinga dam is one of the seven forks dams which produces hydroelectricity for the National Electricity Grid and it is located within the County. The connection to the national grid across the County is commendable since, 77 per cent of all trading centres have power.

Though connection to individual homes is low and there is need for up scaling the rural electrification programme, the County is keen on cooperating with the Rural Electrification Authority to ensure that there is energy access across the County. The department responsible for energy has also set aside a budget with respect to the distribution of power across the County. In particular investors have shown an interest in the generation of wind energy, solar energy and mini hydro. Following the interests expressed by the investors, the County is keen on partnering with the investors so as to see an increase in the availability of energy across the County. The County takes cognizance of the fact that energy plays a very fundamental role in the cost of production of any product which is a key determinant as to whether an investor will set up an industry within the County or not.

Wood, paraffin, charcoal, solar, gas and electricity are the main sources of energy across the County. Though wood is the main source of cooking energy accounting for 81.6 per cent, while the main source of lighting energy is paraffin accounting for 88.1 per cent. From the foregoing it is apparent that diminishing forest coverage within the County can be attributed to the high use of wood as the main source of fuel. The photo below is a cross section of Masinga Dam Hydro-electricity power station.

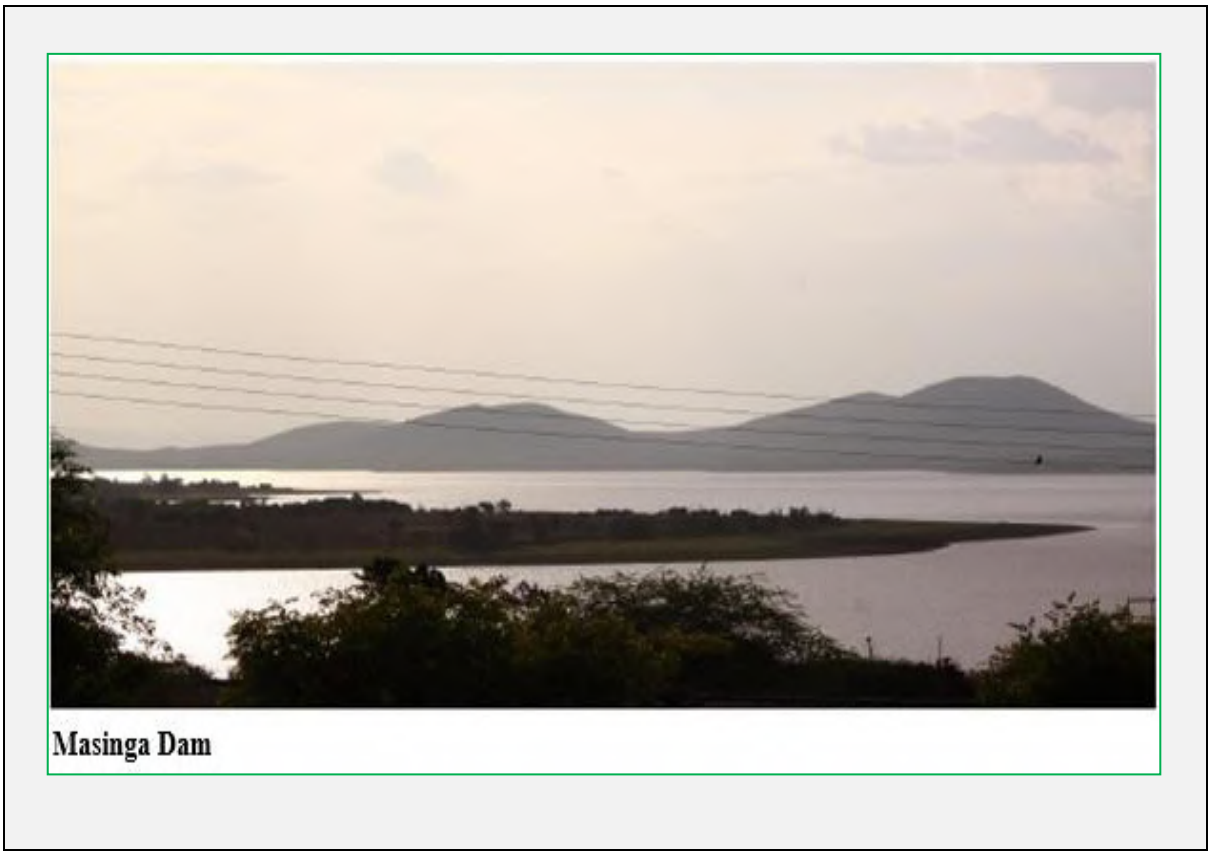

Plate 3-1: Masinga Dam

f) Markets and Urban Centres

The main urban centres in the County are Machakos, Kangundo-Tala, Athiriver, Kathiani Masii and Matuu, however the major urban centres are Machakos and Athi River. Other trading centres include Mlolongo, Kyumbi, Mwala, Mbiuni, Kaewa, Mitaboni and Kithimani among others. For purposes of categorizing markets, the County Finance Act has identified seven (7) urban centres and twenty-three (23) peri urban centres.

g) Housing

Houses in the County are both permanent and semi-permanent. 59.2 per cent of all the homes have brick/block walls, 23.9 per cent stone walled and 12.3 per cent mud / wood walls. Other houses have 1.5 per cent, 2.7 per cent wood wall and corrugated walls respectively. The highest number of houses has earth floor which accounts for 62.4 per cent, others have cement floors accounting for 46.6 per cent. Only 0.4 per cent of the housing have floor tiles. The main roofing materials in the County is corrugated iron sheets which represents 82 per cent of the total houses. Other houses are roofed using grass, tiles, concrete and asbestos sheets which accounts for 14.5 per cent, 1 per cent, 1.2 per cent and 0.5 per cent respectively.

h) Land and Land use

Land has aesthetic, cultural and traditional values and is a vital factor of production in the economy. Land in the County is broadly used for forest, government reserve, townships, game reserves, agriculture, ranches, industrialization, mining and livestock keeping. The absence of the national land use policy has led to the proliferation of informal settlement, inadequate infrastructure services, congestion environmental degradation, unplanned urban centres, pressure on agricultural land and conflicts.

3.6 Environment and Climate Change

As part of strengthening their sustainability initiatives, MCF is focused on initiating renewable energy projects both for institutional sustainability and promoting access to clean and affordable green energy sources by the poor households in neighbourhood communities. The projects implemented include biomass production, Biogas Plant development within MCF Ndalani, Solar energy access and energy saving cook-stoves production and promotion in neighbourhood communities to improve living conditions for children and families.

a) Major Contributors to Environmental Degradation

Environmental degradation across the entire world is a major concern. The County is not exempted from this degradation. This is particularly so because the County is the main supplier of sand. It is also the home of most of the cement factories that supply cement across the entire county, East African region and COMESA. This obviously has a negative impact on the environment particularly the quality of water because of the emissions and discharges from these industries. In addition to the foregoing, most of the locals use firewood and charcoal as the source of fuel. This has led to deforestation in various areas thus leading to expansive soil erosion. The most affected areas are Kibauni forest, Yathui, and Muumandu hills.

b) Effects of Environmental Degradation

The effects of environmental degradation are felt across the globe. As mentioned above, Machakos County has had its share of degradation. For example, sand harvesting has resulted in the drying up of some of the rivers. This has caused the surrounding communities to encounter water supply scarcity because of the substantial reduction of the water. An example of such a river is Thwake. Most of the factories and industries within the County have a tendency of polluting water bodies within their vicinity. In addition, there are treatment ponds at Kariobangi that have polluted Mitheu and Iliyini Rivers. Other environment issues of concern in the county include; the mushrooming of slums and the destruction of forests/catchment's areas particularly due to farming on the slopes.

c) Climate Change and Its Effects in the County

Climate change threatens to adversely affect economic growth in the County and endangers it from becoming a prosperous County with a high quality of life for all its citizens. The cumulative impacts of climate change have the potential to reverse much of the progress made towards the attainment of the Millennium Development Goals (MDGs) and Vision 2030. The effect of the climate change has seen increased periods of drought, erratic rainfalls and increase in temperatures which have led to low agricultural productivity.

d) Climate Change Mitigation Measures and Adaptation Strategies

The County has taken cognizance of the fact that climate change impacts have to be mitigated as such various strategies to address this issue have to be adapted. In view of this, the County has launched several tree planting programmes. The County has also put in place sand harvesting regulation.

MCF seeks to scale up community renewable energy uptake campaigns with special focus on the following;

- Annually supply Energy Saving Cook-Stoves (jikos) to a least 1000 families in the semi-arid Eastern region of Kenya;
- Establishing of additional Solar Energy Kiosks and Charging Stations; Currently the MCF Community Solar Energy Kiosk and charging station is accessed by at least 70 households for clean solar power for lighting and charging of electronic accessories through portable battery boxes.
- Facilitate establishment of community tree nurseries and woodlots in schools to sustain tree planting campaigns.

Water harvesting and conservation for irrigation as well as purification for domestic use and community supply.

e) Mining

The County is well endowed with mineral resources that are a valuable input to the building and construction industries. The large deposits of sand, limestone and granite have attracted all the major cement factories in Kenya including Bamburi Cement, East Africa Portland Cement Company, Mombasa Cement, National Cement and Savanna Cement to Athiriver where these minerals are found.

3.7 Water and Sanitation

a) Water Resources

Water resources in the County are under pressure from agricultural chemicals and urban and industrial wastes, as well as from use for hydroelectric power. The County has two permanent rivers namely Athi and Tana. Tana River is mainly used for hydroelectricity generation while Athi River is used for domestic and industrial uses. There are also several dams that serve as water resources and springs which are found in the hilly areas. Underground water sources supplement surface water sources.

b) Water Supply Schemes

There are established water supply schemes in every sub-County of the County. There are three water supply schemes in the County, Kayata in Matungulu, Yatta, and Kabaa in Mwala. There are various community management committees in various water catchments areas in the County. They help in protection of water catchments areas.

c) Water Sources

The main water sources are rivers, dams and boreholes. The average distance to the nearest water source in the County is 5Km. Fetching of water is mainly done by women especially in the rural areas who end up spending so much of man-hours on this activity.

d) Sanitation

The County has only two sewer lines; in Athi River and Machakos. Machakos is partially connected to the sewer systems. Parts of Kariobangi and Mjini are not connected and as high as 78.3 per cent of households use pit latrines. Other households use covered pit latrines, uncovered pit latrines, VIP latrine and flush toilets accounting for 47.8 per cent, 30.5 per cent, 6.2 per cent and 5.9 per cent use respectively. Garbage disposal in the County is mainly by farm garden which accounts for 48.4 per cent. Communities use other means such as local authority, private firms, garbage pit and burning and public garbage heaps.

3.8 Health access and Nutrition

a) Health Access

Access to health facilities has been improving with time. Many health facilities have been constructed under the Economic Stimulus Programme (ESP) and Constituency/Sub County Development Fund (CDF). The County has one level 5 hospital situated in Machakos, four level 4 hospitals in Kathiani, Mwala, Matuu and Kangundo, 43 public health centres, 83 dispensaries, 9 private nursing homes, and 95 private clinics spread all over the County. The doctor to patient ratio is 1:60,000. The County does not however have enough health facilities especially in the rural areas. 61.5 per cent of the residents cover 5Km and more to the nearest health facility while 35 per cent and one per cent of the residents take 1.1-4.9 Km and 0-1 Km respectively.

b) Morbidity

The most prevalent disease is malaria which accounts for 40 per cent of the total cases reported. Respiratory complications account for as high as 24 per cent. Other diseases are flu accounting for 15.9 per cent stomach-ache and Diarrhoea accounting for 5.2 per cent and 3.1 per cent respectively.

c) Tourist Class Hotels/Restaurants, Bed Occupancy `

Tourist class hotels found in the County include Gelian Hotel, Kyaka Hotel, Garden hotel, Tea Tot hotel, Maanzoni lodge, Lysak Haven Park hotel, Lukenya Get away, Dallas Hotel, and Yatta Dam Resort, The bed capacity ranges from 200 to 300. The County also has many boarding and lodgings in the major towns.

Masinga Dam Resort

Plate 3.2: Masinga Dam Resort

3.9 Key Issues in the county

- Charcoal burning
- Uncontrolled sand harvesting
- Gully erosion
- Inadequate communication network
- Poor facilities
- Inaccessibility of remote area
- Mushrooming of slums
- Poorly equipped health facilities
- Climate change effects

CHAPTER FOUR:

4.0. RELEVANT POLICY, LEGISLATIVE AND ADMINISTRATIVE FRAMEWORK

4.1 Overview

This chapter of the ESIA highlights the relevant legal provisions, which govern the process of ESIA under which this project falls. These provisions are broadly categorized as policies, legislations, regulations and administrative frameworks.

The current legal provisions for natural resources management in Kenya are contained in over Seventy-seven (77) sector- specific statutes. For a long time, the country lacked an umbrella legislative guide for harmonious and holistic environment management. As such resources were managed sectorial in accordance with the statutes that were in place. However, sometimes these statutes were contradictory. In 1999, the government enacted the Environment management and coordination Act (EMCA) which is an umbrella legal framework under which the environment is being managed. The Act which was repealed in 2015 establishes the institutional framework under which environmental management is to be coordinated. EMCA prevails over all other sectorial laws relating to the environment, in cases of conflict or contradictions. It also grants the public a *Locus standi* in matters of the environment. Kenya is also a signatory to various international environmental laws including the Ramsar Convention, the Vienna Convention, United Nations Framework Convention on Climate Change, The Montreal protocol and the Kyoto protocol.

4.2 National Legislative Frameworks

This sub-sectional explains the various legal provisions which govern the processes of EIA and EA. Some environment related acts that have been created deal with specific areas of the environment such as water pollution, soil erosion, air pollution, and resettlement among others. Before the establishment of Environment Impact Assessment and Environmental Audit regulations of 2003, environmental strategies were implemented through local authorities' acts and policy statements. The EMC Acts led to establishment of NEMA which coordinates all environmental issues in the country and enforces environmental laws.

The following is a highlight of some legal frameworks that govern this project;

Applications of national statutes and regulations on environmental conservation suggest that the proposed development is carried out without compromising the status of the natural resources in the area, public privacy, health and safety. This position enhances the importance of Environmental Impact Assessment for the proposed site to provide a benchmark for its sustainable operation. The key national laws that govern the management of environmental resources in the country are briefly discussed below. It is noteworthy that wherever any of the laws contradict each other, the Environmental Management and Coordination Act (EMC) Cap 387 prevails.

4.2.1 The Environment Management and Coordination Act, Cap 387

This is an Act of parliament, which provides for the establishment of an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto. Section 58(1) states that notwithstanding any approval, permit or license granted under this act or any other law in force in Kenya, any person being a proponent of a project shall, before carrying out, executing, or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person

any undertaking specified in the second schedule of this Act submit a Strategic Environmental Assessment report.

The proposed project falls under the second schedule of EMCA i.e.," any activity out of character with its surrounding" since it is likely to cause substantial impact to the environment in areas such as biodiversity, sustainable resource use, ecosystem maintenance, social environment, land use, water and drainage patterns. Some of the related regulations in the EMCA Cap 387 include:

4.2.2 Environmental Management and Co-ordination (Waste Management Regulations, 2006)

These regulations guide on the appropriate waste handling procedures and practices. It is anticipated that, the proposed project will generate large quantities of solid waste during construction which will need to be managed through reuse, recycling or appropriate disposal. It is therefore anticipated that, the amount of materials to be discarded as waste during the project implementation will be minimum.

It is recommended that the proponent should put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal. It is further recommended that the proponent should consider the use of recycled or refurbished construction materials including those excavated from existing facilities. Purchasing and using recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste.

To comply with the requirements of the regulations the proponent should undertake the following in addition to the above-mentioned recommendations;

- Should not dispose any waste on the highway, street facilities, recreational area and public places;
- Segregate waste and group them according to their similarity for example plastics, toxic, organic, hazardous etc.
- Ensure all waste is deposited in a designated dumping site approved by the local authority;
- All waste handlers engaged by the proponent should be licensed by NEMA and possess all relevant waste handling documents such as waste transport license, tracking documents, license to operate a waste yard, insurance cover, vehicle inspection documents among others;
- Implement cleaner production principles of waste management strategy namely reduce, reuse and recycle;
- Label all hazardous wastes as specified in section 24 (1-3) of the regulation.

The fourth schedule lists wastes considered as hazardous and solvents, emulsifiers/emulsion, waste oil/water and hydrocarbon/water mixtures. The proposed project will involve use of inputs which are likely to generate the mentioned wastes and thus will need to be handled as required by the regulations.

In order to adhere to this regulation, the proponent will undertake construction and operations of an incinerator as part of the related amenities to be constructed. The incinerator will be used to dispose all solid medical wastes that will be generated by the

facilities. The incinerator will be fitted with scrubbers to prevent air pollution through emissions.

4.2.3 Environmental Management and Co-ordination (Noise and Vibrations Control Regulations, 2009)

These regulations provide guidelines for acceptable levels of noise and vibration for different environments during the construction and operation phase. Section 5 of the regulation warns on operating beyond the permissible noise levels while section 6 gives guidelines on the control measures for managing excessive noises and copy of the first schedule indicating the permissible noise levels for different noise sources and zones. The project team should observe the noise regimes for the different zones especially when working in areas termed as silent zones which are areas with institutions and worship places. These areas are permitted exposure to sound level limits of not exceeding 40 dB (A) during the day and 35 dB (A) at night. The regulation states that a day starts from 6.01 a.m. to 8.00 p.m. while night starts from 8.01 p.m. – 6.00 a.m. Construction sites near the silent zones are allowed maximum noise level of 60 dB (A) during the day and night levels are maintained at 35 dB (A).

The time frame for construction sites are adjusted and the day is considered to start at 6.01 a.m. and ends at 6.00 pm while night duration from 6.01 p.m. to 6.00 a.m. Near the silent zones are allowed maximum noise level of 60 dB (A) during the day and night levels are maintained at 35 dB (A). Part III of the regulation gives guidelines on noise and vibration management from different sources. Sections 11, 12 and 13 of the stated part give guideline on noise and vibration management from machines, motor vehicles and night time construction respectively. Section 15 requires owners of activities likely to generate excessive noise to conduct an ESIA to be reviewed and approved by NEMA.

Table 4-3: Maximum permissible noise levels for construction sites

Maximum noise level permitted (leq) in dB(A)			
		Day	Night
	Health facilities, educational institutions homes for disabled etc.	60	35
	Residential	60	35
	Areas other than the one in (I) and (II) above	75	65

It is anticipated that the proposed project will generate excessive noise and/or vibration during excavations, this noise will originate from the excavation/construction equipment, vehicles and the workers.

To minimize the impacts of noise and vibrations from the proposed activities, the noise generating activities will be limited to working hours between 8.00 am and 5.00 pm. All possible care will be undertaken to ensure that the machinery is properly greased and oiled to reduce friction and possible noise emission. The proponent shall strictly adhere to the provisions and requirements of these Regulations.

4.2.4 Environmental Management and Co-ordination (Water Quality Regulations, 2006)

These Regulations provide guidelines on the use and management of water sources; the quality of water for domestic use and irrigation. The proponent will be required to observe the requirements of the Regulations which prohibit anyone to undertake development within a minimum of 6m from the highest ever recorded flood level. Section 4(2), 6 and section 24 of the regulation prohibits pollution of water bodies and r quires that all substances discharged into the water bodies should meet the standards set under third schedule of the regulation.

The project site area does not neighbour any water resources but underground water facilities cannot be ignored, design team has been advised on the requirements of this regulation and they have incorporated the regulations in the design document.

The proposed project will be connected to an already existing borehole that was drilled by the previous land owner in the early 90s for water supply; during project operations, a wastewater management system will be provided through the development of a comprehensive Effluent Treatment Plant to treat all waste water emanating from the different parts of the proposed project. Quarterly Effluent Analysis Reports will be undertaken from the effluent treatment plant to ascertain that the discharges emanating from the facility meet the set standards before using the resultant water for watering of tree nurseries and seedlings.

4.2.5 Environmental Management and Co-ordination (Fossil Fuel Emission Control Regulations, 2006)

These Regulation aim at eliminating or reducing emissions generated by internal combustion engines to acceptable standards. The regulation provides guidelines on use of clean fuels, use of catalysts and inspection procedures for engines and generators.

The activities of this project will involve the use of vehicles and equipment that depend on fossil fuel as their source of energy. It is recommended that the requirements of the regulation be implemented in order to eliminate or reduce negative air quality impacts.

4.2.6 Occupational Health and Safety Act 2007

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

The key areas addressed by the Act include:

- General duties including duties of occupiers, self-employed persons and employees
- Enforcement of the Act including powers of an occupational safety and health officer
- Registration of workplaces
- Health General provisions including cleanliness, ventilation, lighting and sanitary conveniences
- Machinery safety including safe handling of transmission machinery, hand held and portable power tools, self-acting machines, hoists and lifts, chains, ropes & lifting tackle,

cranes and other lifting machines, steam boilers, air receivers, refrigeration plants and compressed air receiver.

- Safety General Provisions including safe storage of dangerous liquids, fire safety, evacuation procedures, precautions with respect to explosives or inflammable dust or gas.
- Chemical safety including the use of material safety data sheets, control of air pollution, noise and vibration, the handling, transportation and disposal of chemicals and other hazardous substances materials.
- Welfare general provisions including supply of drinking water, washing facilities, and first aid.
- Offences, penalties and legal proceedings

Under sections 6 of this Act, every occupier is obliged to ensure safety, health and welfare of all persons working in his workplaces. The occupier shall achieve this objective by preparing and as often as may be appropriate, revising a written statement of his general policy with respect to the safety and health at work of his employees and the organization and arrangements for the time being in force for carrying out that policy (section 7). He is also required to establish a safety and health committee at the work place in a situation where the number of his employees exceeds twenty (section 9) and to cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a registered safety and health advisor (Section 11). In addition, any accident, dangerous occurrences, or occupational poisoning which has occurred at the workplace needs to be reported to the occupational safety and health officer of the respective area by an employed person (Section 21).

According to section 44, potential occupiers are required to obtain a registration certificate from the Director for all premises intended for use as workplaces. Such places shall be maintained in a clean state during the operation phase (Section 47). To ensure machinery safety, every hoist or lift- section 63 and/ or all chains, ropes and lifting tackles- section 64 (1d), shall be thoroughly examined at least every period of six months by a person approved by the Director of Occupational Health and Safety services. Similarly, every steam boiler-section 67(8) and /or steam receiver shall be thoroughly cleaned and examined at least once in every period of twenty-four months or after any extensive repairs-sections 69(5). According to section 71 (3), every refrigeration plant capable of being entered by an employee also needs to be examined, tested and certified at least once period of twelve months by an approved person.

In relation to fire safety, section 78 (3) requires spillage or leaks of any flammable liquid to be contained or immediately drained off to a suitable container or to a suitable container or to a safe place, or otherwise treated to make it safe. Furthermore, a clear and bold notice indicating that smoking is prohibited should be conspicuously displayed in any place in which explosive, highly flammable or highly combustible substances, are manufactured, used, handled or stored-section 78 (5). In addition, necessary precautions for dealing with fire incidents should be implemented including provision of means for extinguishing fire and means for escape, in case of fire, for the persons employed in any workplace or workroom-section 81. As far as disaster preparedness and emergence response programme is concerned, section 82 (1) makes it a mandatory requirement for every occupier of a workplace to design evacuation procedures to be used during any emergency situation and to have them tested at regular intervals.

To promote health and safety of employees who are at risk of being exposed to chemical substances, section 84 (3) and 85 (4) requires every employer to maintain at the workplace

material safety data sheets and chemical safety data sheets respectively for all chemicals and other hazardous substances in use and ensure that they are easily available to the employees.

The employer's positive contribution towards the welfare of the employees include provision and maintenance of adequate supply of wholesome drinking water-section 91 and first aid box or cup board of the prescribed standard –section 95 at suitable point (s) conveniently accessible to all employees. Other precautionary measures include: issuance of a permit to work to any employee, likely to be exposed to hazardous work processes or hazardous working environment, including such work processes as the maintenance and repair of boilers, dock work, confined spaces, and the maintenance of machinery and equipment ,electrical energy installations, indicating the necessary precautions to be taken-section 96 (1);provision and maintenance for the use of employees, adequate, effective and suitable protective clothing including suitable gloves, footwear, goggle and head coverings in workplace where employees are likely to be exposed to wet, injurious or offensive substance-section 101(1)

The proponent will be required to comply with the above mentioned provisions throughout the project cycle. This report has comprehensive EMP which integrates EHS issue to ensure the risks, accident and health issues from this activity are minimized to zero. The duties of the proponent and those of the contractor are clearly outlined.

4.2.7 Public Health Act Cap 242

The Act demands the adoption of practicable measures to prevent injurious and unhealthy conditions in the site.

The Act requires the proponent to enhance effective management of Nuisances i.e. noxious matter or wastewater as will be discharged from the proposed project throughout the project cycle. To achieve this, systems on the management of both solid and liquid waste (effluent) will be adopted as proposed in the report.

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

The proponent will be required to construct suitable pit latrines, bathrooms for use by workers in the sites and visitors to the sites & offices during construction phases of the proposed project.

During Project operation, the effluent will be discharged into the waste water treatment plant while all medical wastes will be incinerated on site. Non –medical solid waste will be collected by a contracted and NEMA Licensed Solid waste handler to dispose the unrecyclable wastes as per the waste regulations. Sanitary facilities will conform with MOH standards and installation of standard fittings.

4.2.8 Physical Planning Act, 2019

The said Act section 29 empowers the County governments to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section allows for prohibition or control of the use and development of an area.

Section 30 states that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local Authority. Authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local Authority.

The proposed project lies within Machakos County, the proponent had undertaken a change of use from Agricultural to above facilities and all drawings have been approved by the Machakos county government.

4.2.9 Water Act 2016

The Act provides guidelines on use and management of the water resources in the country. This Act prohibits the pollution of water. Part II, section 3 of this act states that "every water resource is hereby vested in the state, subject to any rights of user granted by or under the Act or any other law". Section 18 of this Act provides for national monitoring and information systems on water resources. Following on this, sub-section 3 mandates the water Resources Management Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specified records may require to be kept by site operator and the information thereof furnished to the authority. Section 73 of the Act provides that a person who is licensed to supply water has the responsibility of safeguarding the water sources against degradation. According to section 75 (1) such a person is required to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction.

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

The proponent will connect the facility with water supply from an existing borehole in the site. The proponent will also ensure that a*ppropriate measures to prevent potential for contaminating water resources will be put in place throughout the project cycle.*

4.2.10 The Forest Act 2005

This applies to all forests and woodlands on state, local authority and private land. Under this Act, no person shall, in state, local authority or provisional forest; fell, cut, take, burn, injure or remove any forest produce, be or remain therein between the hours of 7 p.m. and 6 a.m. unless he is using a recognized facilities or footpath, or is in occupation of a building authorized by the director, or is taking part in cultural, scientific or recreational activities;

The proposed activities will involve cutting of trees & shrubs at the project site. The proponent will ensure that re-forestation is done by extending the forested area of his land to cater for the trees that would have been cut down.

4.2.11 County Government Act 2012

The Act also contains provisions empowering County Governments to control discharges. Under section 163 County governments may control or prohibit activities, both industrial and domestic, which constitutes 'a source of danger, discomfort or annoyance to the neighbourhood', as an offensive trade or as has been gazette by the Minister. Section 165

another way of controlling development by empowering the county governments to refuse to license activities on the ground that the treatment method proposed is not adequate.

The proponent will ensure appropriate measures to avoid or reduce environmental pollution to be put in place during the construction and operation phases of the proposed projects.

4.2.12 Way Leave Act Cap 292

Section 3 of the Act states that the Government may carry any works through, over or under any land whatsoever, provided it shall not interfere with any existing building or structures. Notice, however, should be given one month before carrying out any such works (section 4) with full description of the intended works and targeted place for inspection. Any damages caused by the works would then be compensated to the owner as per Section 8 of the Act that states that any person whom without consent causes any building to be newly erected on a way leave, or cause hindrance along the way leave shall be guilty of an offence and any alterations will be done at his/her costs.

The proponent will ensure appropriate measures will be put in place to avoid any interference, damages that may be caused by the proposed project on the way leave.

4.2.13 Traffic Act Chapter 403

This Act consolidates the law relating to traffic on all public roads. The Act also prohibits encroachment on and damage of roads including land reserved for roads.

This proposed project will be well demarcated and the proponent will ensure appropriate measures are undertaken not to encroach on any public/private lands during construction.

4.2.14 Work Injury Compensation Benefit Act 2007

This Act provides guideline for compensating employees on work related injuries and diseases contacted in the course of employment and for connected purposes. The Act includes compulsory insurance for employees. The Act defines an employee as any worker on contract of service with employer.

The proponent will make sure that all workers contracted during the project implementation phase have the required insurance covers so that they can be compensated in case they get injured while working.

4.2.15 The Malaria Prevention Act (Cap 246)

This Act provides measures to curb the breeding of mosquitoes at development sites. Measures proposed in the Act to control the breeding of the vector include: maintenance of free drainage channels, removal of stagnant water from any land around an area to prevent larvae breeding, removal of waste and broken bottles among other measures.

The proponent will implement measures to control the malaria disease vectors by implementing the mitigation measures proposed in the regulations.

4.2.16 The Penal Code (Cap 63)

The Act provides guidelines on protecting the public against ill health and offensive trade activities such as noise and smell among others.

The proponent will observe the provisions of this Act by controlling excessive noise and by controlling pollution of water bodies and land.

4.2.17 The Standards Act Cap 496

This Act is implemented by the Kenya Bureau of Standards who provides standards on the requirements of equipment and project materials. Standards regulating security and safety of the public also have to be observed during the design phase of the project.

The proponent will implement the requirements of this Act especially those on standardization of project inputs and equipment in order to reduce waste and pollution.

4.2.18 The Land Act 2012

This Act states that; (1) There shall be the following forms of land tenure:

- Freehold;
- Leasehold;
- Such forms of partial interest as may be defined under this Act and other law, including but not limited to easements; and
- Customary land rights, where consistent with the Constitution.

(2) There shall be equal recognition and enforcement of land rights arising under all tenure systems and non-discrimination in ownership of, and access to land under all tenure systems.

Sections 9 of the Act states that; -

(1) Any land may be converted from one category to another in accordance with the provisions of this Act or any other written law.

(2) Without prejudice to the generality of subsection (1):

a. Public land may be converted to private land by alienation;

b. Subject to public needs or in the interest of defense, public safety, public order, public morality, public health, or land use planning, public land may be converted to community land;

Private land may be converted to public land by:

- Compulsory acquisition;
- Reversion of leasehold interest to Government after the expiry of a lease; and
- Transfers; or
- Surrender.

c. (Community land may be converted to either private or public land in accordance with the law relating to community land enacted pursuant to Article 63(5) of the Constitution.

d. Under Section 143, the Act states that; Subject to and in accordance with this section and section 146, the Commission may, create a right of way which shall be known as public right of way.

(2) A public right of way may be:

a. a right of way created for the benefit of the national or county government, a local authority, a public authority or any corporate body to enable all such institutions, organizations, authorities and bodies to carry out their functions, referred to in this Act as a way leave; or

b. a right of way created for the benefit of the public, referred to in section 145 of this Act as a communal right of way.

4.2.19 The Land Registration Act 2012

This is an Act of Parliament enacted to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes.

Section 6 of the Act states that;

(1) For the purposes of this Act, the Commission in consultation with National and County governments may, by order in the Gazette, constitute an area or areas of land to be a land registration unit and may at any time vary the limits of any such units.

(2) Every registration unit shall be divided into registration sections, which shall be identified by distinctive names, and may be further divided into blocks, which shall be given distinctive numbers or letters or combinations of numbers and letters.

(3) The parcels in each registration section or block shall be numbered consecutively, and the name of the registration section and the number and letter of the block, if any, and the number of the parcel shall together be a sufficient reference to any parcel.

(4) The office or authority responsible for land survey may, at any time, cause registration sections or blocks to be combined or divided, or cause their boundaries to be varied, and immediately inform the Registrar of the changes.

(5) Any order by the Commission under this section shall be published in the Gazette and in at least two daily newspapers of nationwide circulation.

(6) The land registration units shall be established at County level and at such other levels to ensure reasonable access to land administration and registration services.

4.2.20 Radiation Protection Act, Cap 243

The Radiation Protection Act, Chapter 243, aims to control the import, export, possession and use of radioactive substances and irradiating apparatus. Under this Act in section 9, a license is required to handle any radioactive substances or irradiating apparatus from the National Radiation Protection Board. Handling here includes the method of disposing of radioactive waste products, transportation of radioactive materials, storage, use and maximum working hours that employees are expected to work with radioactive materials. Under this Act also, institutions generating this category of waste shall be expected to apply for a license from the same board.

The provisions of this act will guide the proponent on the use of radiation and its control, if there will be use of any radiation apparatus.

4.2.21 Petroleum Act 2016

Current legislation regulating installations and using petroleum products is contained in the

Petroleum Act, Cap.116, which sets out numerous requirements relating to fire precautions. An effort to enact a new Petroleum Bill in 2016, which had more stringent environmental, health and safety provisions, was not successful.

The following Petroleum Rules are defined in the Petroleum Act:

- Storing petroleum products is prohibited within a municipality or a township in a building sides or roof of which are wholly or mainly constructed of inflammable material.
- Petroleum in bulk (must be stored in an installation, while petroleum not in bulk must be kept in a storage shed)

An application for the grant of a license is required to be accompanied by specifications and plans indicating the following:

- The premises to be licensed;
- The position of the premises in relations to adjoining property;

The position and capacity of all tanks, storage sheds and filling stations, the position of all buildings, structures or other works within the installation, and the manner in which the petroleum is to be stored;

- All lighting arrangements
- Containment should be provided where petroleum storage is above ground.

A licence is issued by the Minister for Energy is required, but must be approved by the local authority if the petroleum is to be stored within a municipality or a township.

Additionally, the Rules and conditions of the license are known to, and served by, all persons employed in or about the licensed premises, and that unauthorized persons do not have access to the licensed premises.

The project shall be constructed and operated according to rules of the petroleum Act in general. The rules are stipulated in the subsidiary legislation of the Act.

Section 5 states that the occupier of any premises in which petroleum is kept in contravention of any rules made under this Act shall be guilty of an offence.

Section 6 states that if any person to whom any license is granted under any rules made under this Act contravenes any of the conditions of license, he shall be guilty of an offence.

Petroleum rules, Part III Section 13(1) provides guidelines on storage of petroleum. According to the Section, no person shall store petroleum except in accordance with a license issued by the licensing Authority. Petroleum rules, Part III Sections 19 and 29 provide guidelines on storage sheds and associated installations.

According to Section 19(1), no person shall, in or near any storage shed or installation, do any act, which is likely to cause fire. Petroleum rules, Part III Section 20 provides guidelines on precautions against fire. According to Section 20(6), an efficient fire service shall be provided in every installation and the employees shall be instructed periodically in the use of various fire appliances.

Petroleum rules, Part III Section 22 specifies that the distances between tanks and between tanks and other buildings and between tanks and the boundaries of the installation shall, where the tanks are constructed below or partially below ground in accordance with the provisions of paragraphs (1) and (2) of rule 24 of the rules, and, in the case of tanks constructed above ground level the spacing shall be as specified in the schedule in Section

24.

4.2.22 The Energy (Licensing of Petroleum Retail Businesses) Regulations, 2011

This regulation Prohibits against construction or modify a petroleum retail dispensing site without a construction permit from the Energy Regulatory Commission as stated on section of 4. (1) of the Regulations;

3. (1). A person shall not construct or undertake modification of a petroleum retail dispensing site except in accordance with the Act, these Regulations and the terms and conditions of a valid petroleum retail dispensing site construction permit issued by the Commission or its agents.

The proponent is advised to acquire a petroleum retail dispensing permit from the Energy and Petroleum Regulatory Authority before commencement of operations.

4.2.23 Weights and Measures Act Cap 513

This is the principal Act dealing with weights and measures in Kenya, it defines the standards and units to be used and the regulations to be adhered to. Section 20 makes it an offence for any person to use or possess or control for use for trade a weighing or measuring instrument not constructed to indicate in terms of weight or measure as authorized by the Act. The next section (section 21) prohibits use for trade any weight, measure, weighing or measuring instrument which is false or unjust. It further requires that the weights, measures, weighing or measuring instrument used for trade be examined, verified, stamped or re-stamped at least once in every year- section 27(1) and a certificate of verification be issued -section 27(7). It is under the provisions of this Act that the dispensing pumps at petrol stations must be examined and verified for their accuracy at least once in a year. Failure to do so is an offence under the Act.

Section 153 of the Act requires that every dispensing pump be marked with the identity or grade of the product that it is meant to deliver, and if it be the price-computing type shall display the 'price per litre' on every display panel. Under section 173(1) the pump shall be provided with one or more plugs, seals or sealing material to protect all stops or other adjustable parts affecting the quantity delivered.

4.2.24 The National Sand Harvesting guidelines, 2007

In the exercise of the power conferred by section 42 (A) of the environmental Management and co-ordination Act, the Director General of the NEMA issues the sand harvesting guidelines 2007. The guidelines allow for formation of a Technical Sand Harvesting Committee (TSHC) which is guided by environmental considerations & Social considerations. In collaboration with the Riparian Resources Management Association (RRMA) the TSHC designates sand harvesting sites, controls sand harvesting in the sites, trade on sand and procedure for acquiring sand harvesting permits.

The proposed activities will involve use of sand, so the proponent will ensure that sand is sourced from TSHC designated sites and from registered sand traders.

4.3 Policy Framework

The policies that are relevant to the proposed project include the following:

4.3.1 National Environment Action Plan (NEAP), 1994

The Kenya National Environment Action Plan (NEAP) was enacted following Governments recognition of and concern for the negative impacts on ecosystems emanating from industrial,

economic and social development programmes that disregard environmental sustainability. As a result of its adoption and implementation, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP process, Integrated & Strategic Environmental Impact Assessments were introduced targeting the industries, business communities and local authorities.

4.3.2 Policy paper on Environment and Development (Sessional paper No. 6 of 1999)

The key objectives of the policy include:

i. To ensure that from the onset, all development policies, programmes and projects take environmental considerations into account.
ii. To ensure that an independent Environmental Impact Assessment (ESIA) report is prepared for any industrial venture or other development before implementation
iii. To come up with effluent treatment standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that requires "sustainable development'' approach. These issues relate to waste management and human settlement. The policy recommends the need for enhanced re-use/recycling of residues including wastewater, use of low or non-waste technologies, increased public awareness raising and appreciation of clean environment. It also encourages participation of stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others.

The proponent has commissioned a team of experts to carry out an Environmental and Social Impact Assessment study, prepare the report for submission to NEMA.

4.3.3 The Poverty Reduction Strategy Paper (PRSP), 2005

The PRSP has the twin objectives of poverty reduction and enhancing 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, through improving healthcare, energy provision and growth of business in the area will, contribute towards economic growth, as well as relieve the daily pressure of poverty for sustainable number of people by creating jobs; also enabling them reach the markets and suppliers on time.

4.3.4 Kenya Vision 2030

The Kenya Vision 2030 is the national long-term development blue-print that aims to transform Kenya into an industrial country whose citizenry shall be having high quality of life in a clean and secure environment by 2030.

The Vision comprises of three key pillars: Economic; Social; and Political. The Economic Pillar aims to achieve an average economic growth rate of 10 per cent per annum and sustaining the same until 2030. This is to be achieved by strengthening key sectors of the pillar where infrastructure is one of them due to its role of spurring economic development of the country. Infrastructural development is a key driver of economic development of the country in that it enables other key sectors of the economy such as tourism; agriculture and

manufacturing operate smoothly thereby making activities of these sectors easy and cheap to undertake. As such, the 2030 Vision on infrastructure aims at making Kenya to be a country firmly interconnected through a network of roads, railways, ports, airports, water and sanitation facilities, and telecommunications.

The policy identifies a number of challenges inhibiting the transport sector from performing its facilitative role in respect to national and regional economies. Some of these challenges include; poor energy accessibility, poor quality of transport services, unexploited regional role of the transport system, Urban Environmental pollution, Institutional deficiencies, inadequate human resource capacity. To address the above mentioned challenges, the Ministry came up with various interventions that have helped improve functionality and service delivery of the sector. Towards this end, a number of Authorities have been created to manage, develop, rehabilitate, and maintenance of various categories of roads such as rural, urban and highways.

The proposed project through facilitating improvement of transport along Nairobi-Garissa Highway & in the region will be synergetic in line with the vision 2030 policy paper.

4.4 National Guidelines and policies on Health Care Waste

4.4.1 Health Care Waste Management Strategic Plan 2015-2020

The National Health Care Waste Management Plan of Action is a document intended for use by health managers and programme officers across the health sector (including those in the private health sector). The purpose of developing this plan was to provide a tool that gives health managers guidance in planning, implementing and monitoring the activities of health care waste management in health facilities. This plan describes the situation of health care waste management on the basis of a survey which was conducted in order to document the situation of waste management in Kenya. A holistic approach has been recommended to include, clear delineation of responsibilities, occupational health and safety programmes, waste minimization and segregation. This document is designed to provide viable options to address the challenges encountered in planning for health care waste management in Kenya.

4.4.2 National Infection Prevention and Control Guidelines for Health Care Services in Kenya, 2010

These guidelines were formulated by the Ministry of Medical Services and Ministry of Public Health and Sanitation to provide comprehensive and standardized information regarding the prevention and control of transmissible infections. These guidelines are intended to act as a central reference for all health care facilities and healthcare workers. Additionally, these guidelines are intended to provide administrators and Health Care Workers with the necessary information and procedures to implement Infection Prevention Control (IPC) core activities effectively within their work environment in order to protect themselves and others from the transmission of infections. They provide information on the following topics:

- The infrastructure, equipment, and supplies that are necessary to implement standard and
- Additional (transmission-based) precautions for IPC
- Procedures for cleaning, disinfecting, and reprocessing reusable equipment
- Managing health care waste
- Protecting health care workers from transmissible infections
- IPC practices in special situations

4.5 International Policy Framework

Kenya is a signatory as well as a party to various international conventions, treaties and protocols relating to the environment which aims at achieving sustainable development. According to the Registrar of International Treaties and other Agreements in Environment (UNEP 1999), there are 216 treaties, 29 of which are of interest to Kenya. The country is a signatory to 16 such agreements, which range from use of oil, protection of natural resources and protection of the atmosphere. The agreements are both regional and international and became legally binding on Kenya upon ratification thereof by the rightfully designated Kenyan Authority. The agreements of interest to Kenya can be categorized as those for protecting natural resources, atmosphere and social wellbeing of man.

4.5.1 United Nations Convention to Combat Desertification (UNCCD) of 1994

Established in 1994, the United Nations Convention to Combat Desertification (UNCCD) is the sole legally binding international agreement linking environment and development to sustainable land management. The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found. The convention requires parties to take climate change considerations into account in their relevant social, economic and environmental policies and actions. The proponent has undertaken this ESIA with the aim of minimizing adverse effects of the proposed project on the economy, on public health and on the quality of the environment. The requirements of this convention can be militate against and to reduce impacts on climate change by growing trees suitable for the area to act as carbon sinks along the highway. The community members in the proposed project area depend majorly on wood and kerosene as their source of energy which are known to directly affect the ecosystem in terms of pollution and effects on water catchments. The project activities will involve use of automobiles that use fossil fuels that contribute to GHGs levels.

The proponent is advised to enhance the positive impacts of the project through engaging activities that control climate change for example developing tree planting programmes with the community members, schools and conserving the catchment through water conservation.

4.5.2 The World Commission on Environmental and Development (The Brundtland Commission of 1987)

The commission focuses on the Environmental aspects related to development and requires all development projects to be sustainable economically, socially and environmentally. The principle of the organization emphasize that development project should not have permanent negative on the biosphere and in particular the ecosystems.

The Project proponent will incorporate mitigation measures to ensure that the project impacts on the ecosystem are reduced. The ESIA consultants used participatory methods to involve the target group and concerned stakeholders in order to inform and enlighten them on the likely negative environment and social impacts in order for them to mitigation measures so as to ensure the proposed project is sustainable throughout its life span.

4.5.3 United Nations Framework Convention on Climate Change (UNFCCC), 1992

The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty addressing climate change, negotiated and signed by 154 states at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992. It established a Secretariat headquartered in Bonn and entered into force on 21 March 1994.

The UNFCCC seeks for the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic human-induced interference with the earth's climate system. Such a level should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Article 3(1) of the Convention states that Parties should act to protect the climate system on the basis of "common but differentiated responsibilities and respective capabilities", and that developed country Parties should "take the lead" in addressing climate change. Under Article 4, all Parties make general commitments to address climate change through, for example, climate change mitigation and adapting to the eventual impacts of climate change.

The proponent will engage in activities geared towards climate change mitigation. The proponent has an elaborate programme of integrating environmental reclamation and tree planting, promotion of renewable energy production, utilization and promotion.

4.5.4 Development Partners Regulations on Environmental and Social Management

The objective of Environmental and Social safeguard policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for project workers in the identification, preparation, and implementation of programs and projects. Operational policies have often provided a platform for the participation of stakeholders in project design and have been an important instrument for building ownership among local populations.

The proponent is committed to establishing, implementing and maintaining a sound environmental management system to ensure that its activities are environmentally acceptable and sustainable.

4.6 National Administrative Framework

4.6.1 The National Environment Management Authority

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and, co-ordination of all matters relating to the environment and to be the principal instrument of government in the implementation of all policies relating to the environment. The Authority shall review the study report for the proposed project, visit the project site to verify information provided in the report and issue in ESIA license if it considers that all the issues relevant to the project have been identified and mitigation measures to manage them proposed.

4.6.2 The National Environmental Complaints Committee

The National Environmental Complaints committee replaced the Public Complaints Committee. The functions of the National Environmental Complains Committee are: to investigate allegations or complains related to the environment: prepare annual reports on the state of the environment and undertake public interest litigation on behalf of the citizens in environmental matters.

4.6.3 County Environment Committee

The County Environment Committee shall- (a) Be responsible for the proper management of the environment within the county for which it is appointed; (b) Develop a county strategic

environmental action plan every five years for consideration and adoption by the County Assembly. Every County Environment Committee, in preparing a county environment plan, shall undertake public participation and take into consideration every other county environment action plan already adopted with a view to achieving consistency among such plans. The respective County Executive Committee members of every county shall submit the county environment action plan to the Cabinet Secretary for incorporation into the national environment action plan. (c) Perform such additional functions as are prescribed by the EMCA (Amendment) Act 2015 or as will from to time, be assigned by the county Governor by notice in the Gazette.

4.6.4 National Environmental Tribunal (NET)

The tribunal's principal function is to receive, hear and determine appeals arising from decisions of the National Environment Management Authority (NEMA) on issuance, denial or revocation of environmental impact assessment (EIA) licenses, among other decisions. If disputes with respect to the proposed project arise, the NET will function very much like a court of law.

4.6.5 Institution capability related to implementation of the proposed project

MCF programme on environmental conservation and protection includes the following:

- Environmental reclamation and tree planting campaigns; The proponent is committed to addressing the harsh climatic conditions which threaten child survival in their project locations through reclamation of MCF projects sites and promoting community tree planting campaigns. MCF project sites in MCF Ndalani and Yatta have emerged as an oasis within a semi-arid land. The proponent has established a tree nursery in MCF Yatta producing one million seedlings annually to facilitate tree planting campaigns.
- Through partnership with local communities and organizations, MCF produces and supplies several thousands of tree seedlings to various regions in Kenya. The proponent has previously received various awards including recognition from UNEP for practically championing the 2010 UNEP "Plant for the Planet – Billion Tree Campaign" as well as visits by delegates during the 2014 UNEP General Assembly held in Nairobi.
- MCF Renewable energy production, utilization and promotion Project; The proponent focuses initiating renewable energy projects both for institutional sustainability and promoting access to clean and affordable green energy sources by the poor households in neighborhood communities. The projects include biomass production, Biogas Plant development within MCF Ndalani, Solar energy access and energy saving cook-stoves production and promotion in neighborhood communities to improve living conditions for children and families.

MCF is fully committed to long-term environmentally sustainable development that is consistent with National and International standards. The proponent has a regulatory division which will ensure the compliance of all the regulatory requirements both nationally and internationally. The staff attached to this section will work in partnership with the contractor to co-ordinate and supervise the implementation of the Environmental Management plan throughout the project cycle. This will be achieved by ensuring that the relevant legal provisions, documented procedures, work instructions, EMS and QMS manuals are adhered to.

CHAPTER FIVE:

5.0. POTENTIAL SOCIAL AND ENVIRONMENTAL IMPACTS

5.1 Overview

This chapter outlines the potential negative and positive impacts that will be associated with the project. The impacts will be related to activities to be carried out during construction of the project and the operation stage of the project. The operational phase impacts of the project will be associated with the activities carried out within the premises. In addition, closure and decommissioning phase impacts of the project are also highlighted.

The impacts of the project during each of its life cycle stages (construction, operation and decommissioning) can be categorized into: impacts on the biophysical environment; health and safety impacts and socio-economic impacts.

5.2 Negative Environmental Impacts of Construction Activities

5.2.1 Extraction and use of construction materials

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

Mitigation

- Purchase all construction materials from NEMA Licensed Quarries.
- Properly demarcate the project area to be affected by the construction works to avoid spill over effects to neighbouring areas.
- Carry out all excavation works as instructed in the approved architectural plans for the building.

5.2.2 Dust emissions

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

Mitigation

- Implement a standard set of feasible dust control measures at the site such as:
- Covering all trucks hauling soil, sand and other loose materials and/or require these trucks to maintain at least two feet of freeboard;
- Watering all dust-active construction areas to suppress dust emissions; and
- Paving or applying water when necessary or applying non-toxic soil stabilizers on all unpaved access roads and parking areas.

5.2.3 Exhaust emissions

The trucks used to transport various building materials from their sources to the project site will contribute to increase in emissions of CO_2, NO_2 and fine particulate along the way as a result of diesel combustion. Such emissions can lead to several environmental impacts including global warming and health impacts. Because large quantities of building materials are required, some of which are sourced outside the County, such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent running of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

Mitigation:

Reduce exhaust emissions by implementing the following:

- Advice drivers at the site to minimize vehicle idling time;
- Properly tune all equipment and maintain them in good working conditions; and
- Properly plan the transportation of materials and ensure that vehicle fills are increased so as to reduce the number of trips done and the numbers of vehicles on the roads.

5.2.4 Biodiversity disturbance

The project will involve clearance of trees and shrubs to create room for facilities diversions. Such vegetation clearance will alter the ecosystems functionality in the project area by;

- Destroying life plants forms i.e. trees, shrubs, herbs and micro-flora e.g. bacteria, fungi
- Destroying habitats for meso-fauna e.g. squirrels, rabbits, birds, snakes, chameleons, frogs and toads.

Mitigation

- Ensure that any flora and fauna removal and disturbance is restricted to the actual project area to avoid spill-over effects to neighbouring areas and that the same are restored by:
    - ✓ Properly demarcating the project area to be affected by the construction works.
    - ✓ Strictly controlling construction vehicles to ensure that they operate judiciously and over designated areas to minimize destruction of vegetation.
    - ✓ Re-establishing vegetation in some parts of the disturbed areas through implementation of a well-designed landscaping programme by planting of ornamental trees, flowers and hedges.

5.2.5 Noise and vibration

The construction works, delivery of construction materials by heavy trucks and the use of machinery/equipment including bulldozers, generators, tippers and concrete mixers will contribute high levels of noise and vibration within the construction site and the surrounding area.

The effects of noise include:

- Noise interferes with communication and can lead to tinnitus (ringing in the ears);
- Nuisance;
- Fatigue and tiredness, reduced efficiency, low morale and severe and permanent loss of hearing which may persist for several hours due to prolonged exposure to noise;

- Deterioration of the environment within the project site and the surrounding areas through vibrations produced by heavy construction machinery;
- Weakening of adjacent buildings resulting into cracking of their walls by vibrations.

Mitigation

Adhere to the Noise Prevention and Control rule of 2005 legal notice No.25 as a subsidiary legislation to the Occupational Health and Safety Act (OSHA) of 2007 which requires putting in place measures that will mitigate noise pollution. Consider especially the rule which states that, "No worker shall be exposed to noise level in excess of the continuous equivalent of 90 dBA for more than 8 hours within any 24 hours duration".

a) Minimize noise at the site and in the surrounding areas through:

- Sensitization of truck drivers to switch off vehicle engines while offloading materials;
- Instructing truck drivers to avoid gunning of vehicle engines or hooting especially when passing through noise sensitive areas such as religious areas, hospitals and schools;
- Properly servicing and maintaining and tuning construction machinery such as generators and other heavy duty equipment to reduce noise generation; and
- Placing noisy equipment in sound proof rooms or in enclosures to minimize ambient noise levels.

b) Minimize the impacts of temporary construction noise and vibration by:

- Planning the construction work to take place only during the day when the neighbours are also at work.
- Maintaining reasonable working hours so as to reduce the number of complaints concerning noise from the workers and neighbours.
- Operating shorter shift periods for workers who come in direct contact with high concentrations of noise or other hazards.
- Posting notices at the construction site informing the public of the construction activities, time and day.
- Providing ear protective devices to prevent high frequency noise emitted by the high frequency machines during construction phase.

5.2.6 Risks of accidents and injuries to workers

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

Mitigation

- Have a fully equipped first aid kit at the site at all times and ensure that trained first aid personnel are available to handle any incidents due to pollution at site.
- Provide all construction workers with Personal Protective Equipment (PPE) including masks, goggles, scarfs, boots and overalls among other protective clothing as spelt out under section 101 (1) of OSHA 2007.

5.2.7 Increased soil erosion

Excavation works associated with this project may lead to increased soil erosion at the project site and release of sediments into the drainage systems. Uncontrolled soil erosion can have adverse effects on any local water bodies.

Mitigation Measure

- Ensure good landscaping to facilitate water percolation.
- Level all hilly areas to reduce acceleration of water downstream.
- Ensure all drainage systems are made of concrete.

5.2.8 Solid waste generation

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

Mitigation

- Prioritise waste recycling for recyclable materials.
- Contract a NEMA Licensed solid waste handler to handle all solid waste generated during construction.
- Ensure purchases meet demands to avoid wastages.

5.2.9 Energy consumption

The project will consume fossil fuels (mainly diesel) to run transport vehicles and construction machinery. Fossil energy is non-renewable and its excessive use may have serious environment implications on its availability, price and sustainability.

The project will also use electricity supplied by Kenya Power & Lighting Company (KPLC) Electricity in Kenya is generated mainly through natural resources, namely, water and geothermal resources.

Mitigation

- There will be need to use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability.
- Ensure energy savings bulbs and machines are used during construction.
- Ensure appliances using electricity and are not in use are switched off.

5.2.10 Water use

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

Mitigation

- Water should be used sparingly
- Ensure water harvesting techniques are put into consideration.
- Create awareness on the need of conserving water and switching off pipes when not in use.

5.2.11 Social disturbance

The construction works may cause disturbance to the local population with interactions of non-local workers with residential communities. The movement of trucks and other equipment in the project area during the works implementation will cause noise and dust if the works will be in dry weather. This noise and dust may also affect the schools in the vicinity of the construction works.

Mitigation

- Ensure all operations and movements of materials and trucks are done during day time.
- Reduce intervals of lorries' movements through ensuring haulage trucks with adequate capacities are used for movement of materials.

5.2.12 Spread of HIV & AIDs

The social interactions between the locals and non-local work force may cause spreading of diseases especially HIV & AIDs and the Covid-19 pandemic.

Mitigation

- Providing awareness on HIV/AIDs to workers and community members.
- Provide condom dispensers that should be refilled on time.

5.2.13 Increased insecurity

As a result of influx of the people in the area; workforce of non-locals and rising of illegal structures for vending food stuffs, social drinks will create a good environment where crime is likely to thrive.

Mitigation

- Ensure that all the site areas are well fenced
- Ensure that security lights are provided during night falls.
- Ensure that all access points are monitored.

5.2.14 Soil compaction

As machines and people move on ground the soil is compacted. Compaction has the undesired effect of hindering air and water penetration beneath the soil surface and thus limiting aerobic activities of soil dwelling organisms. This may have negative consequences

on soil productivity on a localized scale. Compaction also enhances run-off during the rainy season resulting into soil erosion.

Mitigation

- Strictly control construction vehicles to ensure that they operate judiciously and over designated areas to reduce soil compaction.
- Rip off any compacted areas after construction to allow aeration of soil and ease infiltration of water into the soil.
- Transition phase from construction to operation

During the transition phase from the completion of the development to the start of operations, the following will be done:

a) Remove any wastes from the site;
b) Extend sanitary and waste collection facilities at the site;
c) Rehabilitate any areas adversely affected by the construction through spillages of pollutants: liquids, chemicals, cement and paint among others at the site and any other areas disturbed as a result of the construction outside the site.
d) Plant grasses and ornamental trees at the site.
e) Put up fencing around the site for protection from intruders and unauthorized persons and ensure privacy.

5.3 Positive Environmental Impacts of Construction Activities

5.3.1 Creation of temporary employment opportunities

Several employment opportunities will be created for construction workers during the construction phase of the project. This will be a significant impact since unemployment is currently quite high in Yatta Sub County and the surrounding areas.

5.3.2 Provision of market for supply of construction materials

The project will require supply of large quantities of construction materials most of which will be sourced locally in Yatta Sub county and the surrounding areas. This provides ready market for construction material suppliers such as quarrying companies, hardware shops and individuals with such materials.

5.3.3 Increased business opportunities

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

5.3.4 Skill transfer

The incoming skilled and semi-skilled work force will provide for transfer of skills to the area residents and vice versa also true.

5.3.5 Improved Infrastructure

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

5.3.6 Generate revenue to the County and National governments

The construction process will generate revenue to both the local and County governments from Cess payments for the construction materials at the County government cess points as well as through payment of income tax and other taxes by the proponent and workers.

5.4 Negative Environmental Impacts of Operational Activities

5.4.1 Water resources; supply and use

Hospitals consume a lot of water due to the need for hygiene and the various activities that are conducted. The volumes of water used are highly dependent on the size of the hospital since the bigger the hospital, the more activities and spaces for cleaning thus more water as compared to a smaller hospital. Water use is driven by the number of inpatients and outpatients, equipment used, facility size, number and types of services, facility age and maintenance requirements. Other contributors include steam sterilizers, autoclaves, medical processes, heating ventilation and air conditioning (HVAC), sanitary, x-ray equipment, laundries and food services. It is recommended that all these areas be evaluated to identify activities to help reduce water consumption.

Water will be sourced from the approved sources i.e. the existing borehole. The projects operation will also bring in very large population which will have direct impact to the water supply (hence high water demand). However, to take care of potential problems, the following is recommended:

Mitigation Measures

- Avoid excessive use of the water.
- Roof catchments should be provided with gutters to facilitate collection of the run-off. This water should be stored for general use i.e. cleaning, fire-fighting etc. In fact, the water can be consumed after suitable treatment and approvals by relevant department.
- Sufficient Storage water tanks should be provided.
- The water supplier should ensure long lasting and reliable water supply within its jurisdiction.
- Provide notices and information signs to the involved stakeholders on means and needs to conserve water resource i.e. ‘KEEP/LEAVE THE TAP CLOSED’, ‘WATER IS LIFE. SAVE IT’ etc. this will awaken the civic consciousness of the community with regard to usage and management of the water resources.
- Install water conserving taps that turn-off automatically when water is not in use. The taps should have reduced hand-wash cycle.
- Encourage water reuse/recycling mostly during installation and occupation phases.

5.4.2 Waste water

Sewage is the used water or liquid waste of a community, which includes human and household wastes together with street-washings, industrial wastes such as ground and storm-water as may be mixed with it.

Effluent/sewage resulting from sanitary facilities and wastewater from washrooms is of significant importance to the environment. It must never come into contact with the surrounding i.e. water, soil, air etc. It must always drain effectively into the effluent treatment plant via well designed and laid pipe networks.

Sound sanitation should be ensured to influence prevention of the sporadic outbreak of diseases dangerous for the general health of the community (within the projected area), workers and the general public. Either controlling or eliminating such environmental factors that contribute in some form or the other to the transmission of the diseases can achieve this.

Wastewater from hospitals and petrol stations may also have more pollutants than the normal households. Presence of spilt oil and fuels, pharmaceuticals such as antibiotics, cleaning agents, and other environmental pollutants, could potentially affect the ability of microorganisms to break down and detoxify waste in sewage-treatment plants. Some wastewater streams may carry extraordinary types or amounts of pathogenic microorganisms and, therefore, may need to be segregated and isolated.

Effluent should be examined to determine if additional precautions need to be put in place (e.g., isolation wards). In hospitals with large radiological departments, highest percentage of organic halogen compounds in wastewater originates from X-ray contrast media containing iodine.

Mitigation Measures

- The Effluent Treatment system should be made of hard, strong, durable, smooth, impervious, and non-corrodible materials.
- Ensure oil water interceptors are put in place in all car wash areas as well as the petrol station and service bays.
- Sanitary facilities must be kept clean always.
- The design connections of the sewer line should consider the estimate discharges from individual sources and the cumulative discharge of the entire project i.e. it must have the capacity to consistently handle the loads even during peak volumes. The gradient should be sufficient to ensure and maintain maximum depth of flow.
- The trunk must be regularly monitored to avoid overfilling and overflowing. They must be checked regularly to monitor level of effluent and efficiency
- Branches should be streamlined in the direction of flow and there should be no right-angled junctions that would affect the flow of the effluent
- All drain pipes passing under building, driveway or parking should be of heavy duty PVC pipe tube encased in 150mm concrete surround
- All waste pipes must have cleaning roding eyes accessible from outside. i.e. free to every part of the system for inspection, cleaning and repair
- All manholes on drive ways and parking areas must have heavy-duty covers set and double sealed airtight; as approved by specialists. Hospital effluent treatment systems' substances that pose danger to humans and environment should be disposed off in non-waste water systems, unless evaluated otherwise.

- Wastewater sources should be determined, and potentially harmful substances identified that may contaminate the water (e.g. disinfectants cleaning agents, cytostatic and, antibiotic agents etc).
- Potential chemical users should review material safety data sheets to identify hazardous substances prior to their purchase and delivery to the hospital
- The process waste water resulting from the hospital may contain a wide variety of polluting components. Various methods will be applied for treatment of the waste water from the hospital such as: (i) physico-chemical treatment - based on pH-correction, sedimentation and neutralization (ii) evaporation in the waste incineration process line.
- Discharging concentrates of disinfecting and cleaning agents should be avoided. When possible, non-polluting, cost-saving, thermal disinfection should be used instead. Products having heavy metals as well as organic halogen compounds should be avoided or reduced.
- Wastewater discharge flow from the hospital should be subjected to neutralization or radioactive decontamination. Further, functional areas (e.g, laboratories, oncology, and pathology) should be carefully evaluated for opportunities to reduce discharge and improve quality. Random laboratory tests for the wastewater should be conducted for adherence to waste water regulation of 2006.

5.4.3 Solid Waste

Like in many establishments and human activities, hospitals, petrol stations and in general all facilities generate waste with the largest component being the general waste but with a small proportion of hazardous waste which where the main concern could lie. Hospital waste may be categorized into various categories such as household or general waste, genotoxic waste, hazardous waste, radioactive waste, infectious and chemical (including pharmaceuticals) wastes and sharps. Contaminated waste may pass on dangerous pathogens through ingestion, inhalation, skin cuts/abrasions and or through mucous membranes. Sharps may not only cause cuts and punctures but also infect these wounds if they are contaminated with pathogens. Because of this double risk of injury and disease transmission sharps are considered as a very hazardous waste class.

There is need to consider vectors such as rats, flies, cockroaches which feed on waste and thus may transmit pathogens.

On completion of the internal construction works, the sites will be generating waste products from various operations and activities. H*ouse refuse-r*emoval and disposal of house refuse comes under public cleaning and is very important and costly item on the budget. If it is not removed promptly away from the generation points, it accumulates in large heaps harbouring rats, flies and vermin which disseminate germs of disease. A good deal depends upon the mutual cooperation between the County Governments and the public.

Proper maintenance and use of dustbins is the key to the satisfactory solution of the problem of sanitary storage and collection of refuse without causing nuisance.

The problem of dealing with in house refuse resolves itself into four parts: *storage, collection, transportation and disposal*. Therefore, bins come in handy during storage and collection; both in the specific areas and on foot paths of the streets for the throwing of whatever rubbish such as paper wrappings, cigarette ends etc., into them instead of scattering them all over. Transportation of the collected waste need be simplified and finally, the use of sound method of waste disposal. The proponent should provide for dustbin cubicles in the project site to facilitate solid waste management.

Mitigation Measures

- Use of information on potential hazards as available from Material Safety Data Sheets (MSDS) provided by manufacturers or vendors on disposal. It is recommended that the management check with pharmaceutical companies for specific information on proper disposal of expired products. Pharmaceutical waste should be disposed of properly as per the Waste Regulations.

- Best practices should be adopted aimed at reducing waste. Ways of reducing waste include: serving non packaged food; recycling paper products and packaging; use of non-disposable, multi-use materials and use of electronic medical records system

- Disposal of radioactive waste should be strictly as set out in the regulations and as per the guidelines of the World Health Organization. It should be held under lead-shielded protection and where conditions warrant, should be allowed sufficient time for 'decay' with strict monitoring

- All hazardous waste should be handled and managed as per the Waste Regulations. Infectious, genotoxic wastes and sharps (including haematological waste, laboratory waste, human tissues etc) should be incinerated in a standard medical waste incinerator (on-site). Provisions of the Waste Regulations should be adhered to the letter- regarding handling, storage, transportation and final disposal. Incineration does not only reduce waste volume but also results in sterile ash as the end product

- The wastes should be properly segregated and separated to encourage recycling of some useful waste materials; Use of an integrated solid waste management system; through a hierarchy of options: source reduction, reuse, recycling, and disposal (sanitary land filling)

- The contractor or proponent should work hand in hand with private refuse handlers and the County government to facilitate sound waste handling, and disposal from the site. All wastes must be taken to the approved dumpsites.

- There should be several bins - The bins should have a close fitting cover, lest stray dogs might scatter the refuse. The receptacle(s) must be kept in a good condition, and sanitarily clean by frequent washing and disinfecting. The first action should be reduction of waste at source and all stakeholders must be encouraged and sensitised on reduction or waste. Biodegradable waste should be composted for use in the gardens. There should be several bins clearly labelled and colour coded to handle various categories of waste. Emphasis should be on reuse and recycling and any unrecyclable waste should be disposed to approved dump sites and as per the Waste Regulations

- In addition to the bins to be provided at various stations, the proponent should provide a number of dustbins strategically on the footpaths of the driveways for the pedestrians to throw whatever rubbish instead of scattering them on the road surface or compound. These bins should better be fixed to posts one or two feet above the ground so as not to be within reach of dogs and other scavengers etc.

- The collection should be made at least once in 24 hours, and it should be done in such a way as to minimize nuisance of smell and dust during filling into carts or vans or any employed (suitable) collection method. All the refuse collected from house to house must be carried away from the storage site to a safe place where it can be suitably disposed. Lastly, suitable and most effective method of disposal should be applied.

- Train or educate the involved stakeholders on the importance and means of waste (garbage)

management and handling especially during operation.

- Installation of the incinerator on the site to enhance disposal relevant material through burning. It is not advisable to just burn waste material on open areas. The incinerator will also cut costs payable to the contracted firm.

- The contractor or proponent should work hand in hand with NEMA, Ministry of Health and the County Government to facilitate Sound Waste management as per the prevailing regulatory provisions.

5.4.4 Public Safety, Traffic Flow, Occupational Safety and Health

All workplaces have their challenges on occupational health and safety depending on the nature of operations and activities carried out within the respective places. Petrol Stations, hospitals among others have their challenges and various stakeholders need to be protected. Since hospitals provide medical care which is curative and preventive in nature, the challenges are elevated by the fact that some of the diseases and conditions are infectious. All individuals exposed to hazardous health-care waste are potentially at risk, including those within health-care establishments that generate hazardous waste, and those outside these sources who either handle such waste or are exposed to it as a consequence of careless management. The main groups at risk are the following:

- Medical doctors, nurses, health-care auxiliaries, and hospital maintenance personnel;
- Patients in health-care establishments or receiving home care;
- Visitors to health-care establishments;
- Workers in support services allied to health-care establishments, such as laundries, waste handling, and transportation;
- Workers in waste disposal facilities (such as the incinerators), including scavengers.
- Workers on the filling station.
- Fuelling Customers.
- Road entry and exit may also be a risk if not properly designed and controlled. Traffic congestion is also a problem during operations because the proposed project shall definitely add daily traffic.

Other challenges arise in regard to wastes which may contain genotoxic waste, hazardous waste, radioactive waste, infectious and chemical (including pharmaceuticals) wastes and sharps. Contaminated waste may pass on dangerous pathogens through ingestion, inhalation, skin cuts/abrasions and or through mucous membranes. Sharps may not only cause cuts and punctures but also infect these wounds if they are contaminated with pathogens. Because of this double risk of injury and disease transmission, sharps are considered as a very hazardous waste class.

Mitigation measures

- Provide properly fitting Personal Protective Equipment (PPE) depending on tasks being performed to avoid injuries and illness

- Practical and very high standards must be set for handling and management of hazardous substances from procurement, handling, use and disposal. Information on potential hazards should be made available from Material Safety Data Sheets (MSDS) provided by manufacturers or vendors

- A written procedure for safely managing hazardous materials in the work place should include: work area and place of work/activity, substance description (chemical and synonym), environmental and human risks protective measures and handling instructions, emergency instructions and first aid proper disposal information

- Pharmacists, anaesthetists, and nursing, auxiliary, and maintenance personnel may be at risk of respiratory or dermal diseases caused by exposure to such substances as vapours, aerosols, and liquids. To minimize this type of occupational risk, less hazardous chemicals should be substituted whenever possible and protective equipment should be provided to all personnel likely to be exposed

- The requirements of the OSHA should be strictly adhered to, the Building Code and other relevant regulations must be adhered to particularly during maintenance or any construction works. Only specialised machine operators should operate machinery and specialised equipment and all moving parts should be provided with appropriate guards.

- Properly design to allow for deceleration and acceleration to the hospital. Clearly indicate direction of traffic throughout the project cycle.

- Internal driveways should also be erected with bumps to control speed and thus reduce potential accidents. There should be careful design and layout of the hospital entrance, providing adequate visibility
- Adapt effective emergency response plans throughout all the phases.

- Safety awareness may be gained through regular safety meetings, occupational health and safety training or personal interest in safety and health. This awareness will increase ability to respond if, some day in future, one is a bystander in an emergency.

- Sanitary facilities should be provided (for each sex where conditions warrant). Standard cleanliness of the facilities should be maintained.

- Local individuals preparing food for the workers at the site should be controlled to ensure that food is hygienically prepared.

- The hospital should initiate sensitization programs for various health and social issues such as drugs, alcohol, diseases etc. There should be training programs to facilitate this.

- Sound waste management.

- Public awareness campaigns on the prevention and management of prevalent diseases such as malaria, STDs and HIV AIDS and equipment of the proposed health centre to manage the same.

- Ensure (consistently) good water quality through regular water analysis to ascertain compliance to public health standards.

5.4.5 Accident prevention and Emergency Response Plan (ERP)

Emergencies and disasters are a reality of everyday life. Stakeholders must therefore be sensitized and prepared on how to react during all the phases. Absence of such plans may be risky since there would be no guidelines to handle or control emergencies if they occur. The proponent shall take all necessary steps to prevent accidents in the entire project cycle. All medical safety procedures should be followed while measures to prevent and manage fires are taken as discussed elsewhere in this report. For further management of any foreseeable

accidents, the proponent shall develop an ERP which is documented and all the stakeholders are provided with the requisite training and annual drills conducted.

The ERP shall typically contain all information on all likely types of emergencies likely to be encountered mainly emergencies, accidents and fires. The ERP shall include actions to be taken in case of emergencies and shall display emergency contacts (ambulance, doctors, police and fire engines) telephone list; simple instructions on do and don'ts in various emergencies such as fires, LPG incidents, armed robbery etc. On traffic safety, entry and exit points are provided with clear views. Bumps shall be erected to control speed along the driveway. The ERP shall also promote good neighbourliness which shall go a long way in emergency response. Such plans must be properly documented and made available to all. A fire assembly point must be identified and clearly marked for example.

5.4.6 Security

Security is a prerequisite for any development. The developments require tight security to ensure safety of all the stakeholders, machinery and equipment's; drugs and chemicals some of which may be harmful if in the wrong hands. Some protection is also required while in some areas and therefore access must be checked.

The area is well covered with communication facilities, which facilitate security to large extents. After the project is over, security guards and facilities should be provided.

Mitigation Measures

- The developments should be enclosed using suitable walls to beef-up security and to control movement within
- Security guards must always guard the gate to the facility to keep away the intruders and to control movement within and create order.
- Lighting as well as security alarms should be installed in strategic positions all over the buildings,
- The guards stationed at the gates should document movements in and out of the hospital.

5.4.7 Fire preparedness

Fire outbreaks can occur anywhere and thus the need to take precaution. Fire incidences usually subject detrimental effects to the environment. Fire causes both economic and social drawbacks. There are operations that are prone to such outbreaks at the filling station where flammable products are being sold. It is therefore always important to consider the issue of fire.

Mitigation Measures

- Potential causes of fire are many and varied electrical faults, smoking, gas leaks, carelessness etc. Fire incidences result to economic and social drawbacks. It is therefore always important to consider the issue of fire by bringing in the element of preparedness. In this regard, the design should provide and recommend implementation of fundamental firefighting measures and control facilities.
- Install an automatic fire alarm system for the entire project mostly on occupation, provide one 30m hose reel per floor and provide for adequate fire reserve water storage tanks with an automatic booster pump for hose reel and three 9kgs water or powder fire extinguisher for every floor and one per each fuelling pump.

- Provide appropriate Fire Hydrant Ring main with suitable outlet points.
- Install heat and smoke detectors on each floor
- Install manual electric break-glass fire alarm system with secondary power
- All installation to follow Fire Masters requirements approval.
- Conduct regular firefighting drills/simulations to sensitize workers/stakeholders and adapt an emergency response plan for the entire project during occupational phase.
- Ensure that all fire-fighting equipment are strategically positioned, regularly maintained and serviced.
- Provide fire hazard signs such as 'No Smoking' signs, direction to exit in case of any fire incidence and emergency contact numbers should be provided as well as the assembly points.
- Conduct regular firefighting drills within the site and adapt an Emergency Response Plan for the project (during construction and implementation stages)

5.4.8 Energy

Energy is a very important component in everyday life and it is a major cost particularly in hospitals. Energy is required for lighting, air conditioning and ventilation, water heating, powering machinery and equipment among other functions. Energy is required virtually everywhere.

Mitigation Measures

- Kenya Power should ensure uninterrupted power supply to the hospital as well as other facilities where power consumption is high.
- The proponent shall install a standby generator.
- Designing of the building to provide natural lighting, ventilation and space heating. hot water
- Inspecting or installing a combined evaluating energy-consumption profiles for heat and power system office equipment, motors, steam, services, etc.
- Inspecting and cleaning HVAC systems improving lighting efficiency improving heat insulation
- Replacement of incandescent (bulbs) with fluorescent lamps/energy saving bulbs/ led bulbs,
- Reducing overhead lighting,
- Installing motion-sensors on light switches,
- Incorporating monitoring of lighting-control settings and natural light (daylight) into new buildings or building renovations.
- Installation of solar panels for lighting and solar water heaters.

5.4.9 Air Quality

Petroleum Stations, Hospitals and Incinerators contribute to air pollution indirectly by using electricity from fossil-fuel generating plants (on-site), and directly, by burning fuel for space heating and hot water.

Emissions Caused by Sterilizers for Thermally Unstable Materials: The use of toxic and mutagenic ethylene oxide gas as a-cold sterilant should be minimized or eliminated. Sterilization using ethylene oxide gas, and formaldehyde gas is effective but environmentally hazardous, and a health risk for employees. Less hazardous alternatives, such as hydrogen peroxide or low-temperature plasma sterilization, are available and should be considered for use. If ethylene oxide gas is used, precautions should be taken to protect employees from

exposure. Several chemical engineering methods ―detoxify ethylene oxide gas emitted from sterilization processes. The most widely used is a catalytic reaction that converts ethylene oxide into CO_2 and H_2O. Another method, involving exhaust-gas scrubbing, uses sulfuric acid to convert ethylene oxide into the less harmful ethylene glycol, emitting only CO2, H2O, and low concentrations of H2O2 (max. 0.056 mg/m3).

Emissions Caused by Anesthetic Gases: The most commonly used inhalative anesthetic agents are nitrous oxide, halothane, enflurane, sevoflurane and isoflurane. Nitrous oxide (N2O), a breakdown-stable compound, reacts in the stratosphere with atomic oxygen to form NOx which, in turn, breaks down ozone. Halothane, isoflurane and enflurane are partially halogenated inhalation anesthetics with ozone breakdown potential, and atmospheric ―life spans of 0.7 years, 2.0 years, and 2.4 years, respectively. However, the life spans of these gases are much shorter than those of gases like chlorofluronated hydrocarbons (CFC) which may range from 76 years for CFC 11 to 140 years for CFC 12. A shorter atmospheric life span coupled with a chemical structure that results in substantial breakdown before reaching the stratosphere, means that halothane, enflurane, and isoflurane have a much lower ozone breakdown potential than CFC (e.g., CFC: 100 %, halothane: 36 %, enflurane: 2 %, isoflurane: 1 %). Some practical measures for reducing anesthetic gas emissions include: using vacuum (local exhaust) systems using no-mask anesthesia; if masks are required, use double masks checking appliances and connections regularly for leaks checking the tightness of the anesthesia appliances after each cleaning and after changing of hoses measuring room concentrations regularly for excessive emissions monitoring technical air units regularly to make sure they are working properly. It is also very important that the potential for employee occupational exposures be thoroughly assessed by qualified EHS personnel.

Other Atmospheric Emissions: Powder-based inhalers should be used instead of dosed aerosol dispensers with halogenated hydrocarbons. (Halogenated hydrocarbons are still used as propellants mainly in dispensers for broncholytic/antiasthmatic agents).

*Emissions Caused by Hospital Incinerators***:** Incineration may produce toxic air emissions by:

- Releasing the pollutants contained in the waste stream, such as mercury and other hazardous materials, and
- Creating new toxic compounds, such as dioxins, from the burning process itself. These toxic air emissions may potentially affect the local environment and, in some cases, the global environment. Incineration may also produce toxic ash residue as a by-product. The ash residue is often sent to landfills for disposal, where the pollutants can leach into groundwater. Waste treated by other methods and then landfilled may also produce potentially harmful leachate. Many, if not most, on-site medical waste incinerators not only burn infectious waste, but also readily recyclable items such as office paper and cardboard which could be profitably recycled. Incineration plants should be designed according to local regulations, employ current technology, and be built by a competent contractor

Emissions from the vehicle exhausts: such as sulphur dioxide, carbon monoxides and hydrocarbons can also affect air quality. The main component of diesel exhaust that has been identified as having an adverse effect on human health is fine particulate matter.

5.4.10 Noise and vibration

Noise is unwanted sound that can affect job performance, safety, and health. Psychological effects of noise include annoyance and disruption of concentration. Physical effects include loss of hearing, pain, nausea, and interference with communications when the exposure is severe.

During operation, noise will come from vehicles, and other operations within the site. Construction Machines generate/ produce a lot of noise. Hearing protection is thus essential when noise exposures cannot be controlled at their source.

Mitigation Measures

- Use suppressors or silencers on equipment or noise shields for instance corrugated iron sheet structures.
- Maintenance works should be carried out only during the specified time i.e. from 0800 hrs to 1700 hrs; when most of the neighbours will be at work.
- There should be no unnecessary horning of the involved machinery and vehicles.
- Workers should be provided with relevant personal protective equipment/ materials such as earmuffs and earplugs when operating noisy machinery and when in noisy environment.
- These provide a physical barrier that reduces inner ear noise levels and prevent hearing loss from occurring.

5.4.11 Fats and greases

With time when the project becomes operational, the kitchen will discharge waste water potentially laden with waste fats and greases from the food remains and dish washing. These may be of concern and have the potential to pollute soils and water.

Mitigation Measures

Install standard fat/grease traps in the channels leading from the kitchen. The traps must be regularly monitored for scheming and regular tests of sample waters to ensure compliance to set standards.

5.4.12 Creation of vector and rodents breeding grounds

If the project commences with no well-designed storm water drains, the rain water may end up stagnating and hence creating conducive breeding areas for mosquitoes and other water based vectors leading to transmission of human diseases like malaria and cholera. Poor solid waste and bush management practices may also lead to breeding grounds for pests such as rats and other scavenging animals. Disease vectors such as rats, flies, and cockroaches increase where refuse is exposed or uncollected and can be a hazard.

Mitigation Measures

a) Complete refuse collection and handling service is to be provided by the proponent so that this does not turn into being a health hazard.
b) Cover solid wastes and/or enclose solid waste collection areas in a wire mesh to prevent habitation by scavenging animals.
c) Proper management of waste water and storm water as outlined in the report.

5.5 Impacts Cross-Cutting between Construction and Operation Phases

5.5.1 Increased traffic flow

During the construction, there will be an influx of traffic to and from the proposed construction site. There will be increased movement for both vehicles and people on the existing access roads near the site. Vehicles especially those to be used in facilitating the construction work for example transportation of construction materials and/or construction workers or supervisors to the site. People coming to the site will include those seeking employment opportunities, workers, managers, environmental inspectors and suppliers of foodstuffs to the construction workers. Though increased traffic during construction is a short term impact, it has the effect of causing congestion on the access roads which may subsequently results in accidents on the roads.

During the operation phase, traffic flow will increase due to the increase in number of people visiting the premises and distribution and fuelling of vehicles in and out of the facility. These will include workers; visitors; customers and environmental inspectors among others. However, it is expected that traffic flow during the construction phase will be controlled and thus of no major concern.

Mitigation Measures

a) Provide for adequate space at the entrance/exit along the access road to give drivers enough room to manoeuvre into and out of the project site;
b) Provide for adequate parking spaces at the site;
c) Provide road signage to alert road users of the presence of the facility and check for incoming or out-going vehicles; and
d) Properly plan transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road.

5.5.2 Increased demand on water resource-use

During the construction phase, both the workers and the construction works will create additional demand for water. Water will mostly be used by the workers in cleaning, in mixing of concrete for construction works and for wetting surfaces, curing or cleaning completed structures. During operation, both workers and activities at the site will create additional demand for water. Water will mostly be used in general cleaning, preparation of meals and in discharge of wastes. The increased water-use may be a source of possible sources of conflicts with other members of the community.

Mitigation Measures

a) Consider the Water Act, 2016 and EMCA, cap 387 which govern water abstraction and use and require permits for abstraction of large volumes of water for commercial use.
b) Ensure that installation of water supply system follows local government requirements.
c) Consider rain water harvesting to have alternative water supply

5.5.3 Increased demand on energy resource-use

During the construction period, electricity may be required to run machines such as soil compacting machines and drills. Fuel will be required to run generators and construction vehicles. On completion, the project shall consume large amount of electricity for lighting due to the high number electric appliances required. This will include cooling system for short life products storage and bulbs. Since electric and fuel in Kenya are generated mainly

through natural resources, namely water and geothermal resources, increased use of electricity have adverse impacts on these natural resource bases and their sustainability. The management intends to put fluorescent tubes and energy saving bulbs for lighting purposes. It is the government policy to minimize energy consumption.

Mitigation Measures

- Minimize energy consumption by:
- Using energy efficient night-time lighting only at the premises;
- Provide light sensor switches to ensure outdoor lights are not used during daytime;
- Switching off all energy using equipment when not in use; and
- Installing alternative energy sources such as solar panels and automatic generators not only for power back-up but also to reduce dependency on electricity.
- The management of the station should be advised to adopt more energy efficient measures to reduce on power consumption which would translate to cost saving and less burden on the insufficient power supply system in the county.

5.6 Impacts during the Decommissioning Phase

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

5.6.1 Noise and vibrations

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

5.6.2 Dust and exhaust emissions

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

5.6.3 Solid wastes

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

5.7 Positive Beneficial and Social Impacts

The following benefits and socio-economic impacts are expected from the proposed development:

5.7.1 Improved security

Lighting up the proposed site after it starts operation will improve the security within the project area. Security for the operation within the facilities will further be enhanced by the security personnel to be deployed by the proponent after the commissioning of the facility for operations.

5.7.2 Increase in revenue

There will be positive gain in revenue system arising from the tax to be collected from the project proponent by the government.

5.7.3 Creation of employment opportunities

The proposed project will create numerous employment opportunities throughout the project cycle. During construction the contractor will deploy several workers on the site who will include a site manager, masons, security personnel and other ancillary staff. Employment opportunities are one of the long-term major impacts since people will be employed to work in the facility ranging from casual to permanent employees. These will involve security personnel, operation staff and people who will supply their commodities to the proposed development. Indirect employment will be created where suppliers of food stuffs and other goods and products will gain income by supplying their commodities at the site.

5.7.4 Improved living standards

The project will by extension help improve the living standards of those who will get employed and their households including those operating related businesses or suppliers of foodstuffs and construction material or operation equipment. Improved living standards have the positive impact of improving health which further is a measure against disease occurrences.

5.7.5 Optimal use of land

Construction of the proposed project shall greatly render land economically useful. Land is a scarce resource in Kenya and through construction of the proposed project, this will ensure optimal use of land to the great benefit of the country and its people.

5.7.6 Improved aesthetics

The proposed development if executed will improve the aesthetic value of the land in the area which will attract more private and local investors.

5.7.7 Provision of access to medical care

Good health is an asset. However, it is unfortunate that medical care may not promptly be available when required due to inadequacy in medical facilities and qualified personnel. The proposed hospital will help in bridging this gap.

5.7.8 Promotion of healthy competition and convenience

Being privately owned facilities, the services are more likely to be fair due to competition from other similar service providers. The location is convenient to the area residents and those within the radius.

5.7.9 Optimal utilization of the land

The operations have been confined on the two plot number thus maximizing the use of available spaces for productivity.

5.7.10 Land Value

The development will raise the land value in the area and beyond due to the nature of developments that will be coming up.

5.7.11 Promotion of development

The proposed project has the potential to influence the commercial trends in the area in various ways and in the long run the multiplier effect will lead to development and reduction of poverty. The proposed project shall contribute in overcoming the challenges of today‘s life including strategies for alleviating poverty and promoting sustainable development.

5.7.12 Creation of market for goods and services and secondary businesses

The proposed project shall consume various materials and equipment/facilities. Various professionals have and shall continue giving their services during the installation, operational and decommissioning phases and thus making livelihoods. Those doing commercial activities in the neighbourhood shall also have their market widened.

5.7.13 Economic returns and promotion of secondary business

Economic-investment by the proponent shall increase wealth. The project shall also create market for goods and services. Many secondary businesses are also likely to spring up. Other businesses will also come up in the neighbourhood when the project is complete that will be serving the workers in the different work stations.

5.7.14 Promotion of social cohesion

The development will bring together people with diverse traditions and culture. It will lead to promotion of cultural interaction.

5.8 Mitigation to Decommissioning Phase Impacts

a) The proponent should prepare and submit to NEMA a decommissioning report three months before decommissioning takes place.

b) The use of the site or the building may be changed to other appropriate uses after renovation, rehabilitation and some structural changes have taken place. These uses may include change into a go-down, a restaurant or shops.

c) The decommissioning and alternative land-use options will be facilitated by appropriate professional personnel incorporating environmental experts; local council planners; public works officers and public health officers among others.

d) Mitigation for decommissioning phase impacts will follow general guidelines discussed in this report.

CHAPTER SIX:

6. ANALYSIS OF PROJECT ALTERNATIVES

6.1 Overview

This section analyses the project alternatives in terms of site, technology scale and waste management options.

6.2 Proposed Project Alternatives

This ESIA project report has been prepared for submission to NEMA based on sound desktop and field studies made by the ESIA team. The findings and recommendations are based on the proposed site materials and the proposed technologies to be used in implementation of the proposed project. The proposed project alternatives are assessed on the basis of the proposed project alternative, relocation alternative, the No Action Alternative, alternative land use as well as waste management alternatives.

6.2.1 The proposed project alternative

This ESIA has been prepared for submission to NEMA; facts, findings and recommendations/ proposals of which are based on the proposed site, design, materials and proposed technologies. This helps in evaluating and examining the foreseeable effects of the project on the environment and therefore assisting in addressing how the proposed development has to ensure that all environmental measures are complied with during the premises preparation and during operational phase. The alternative consists of the proponent's/applicant's final proposal with the inclusion of the legal guidelines, regulations and procedures as stipulated in the EMCA, Cap 387 which aims at reducing environmental impacts to the maximum extent practicable. Appropriate Environmental Management Plans have been prepared as per the proposed project.

6.2.2 Relocation Alternative

Relocation option to a different site is an option for the project implementation. At the moment, the proponent has no alternative sites for relocation though can look for another site. Finding and acquiring similar property in a suitable place and completing official transaction on it may take a long period. Besides, there is no guarantee that such piece of land would be available and suitability is another very important factor, which cannot be ignored. While we appreciate that monetary costs should not be used to justify a wrong project, this would also attract extra costs in terms of money and time for example whatever has been done and paid to date would be a direct loss to the proponent. This may discourage both foreign and local investors especially in the health sector that has a big deficit. In consideration of the above concerns and assessment of the current proposed site, relocation of the project is not a viable option. The problem is further aggravated by the fixed characteristics of land and the bottlenecks of the planning policy.

6.2.3 The No Action Alternative

The No Action Alternative in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. The anticipated insignificant environmental impacts resulting from proposed project would not occur.

This option will however, involve several losses to both the project proponent/land owner and other stakeholders; society and government. The No Project Option is the least preferred

with reasons such that there will be no incremental medical facility, forfeiture of economic benefits that would accrue to the proponent, the public and the government, and it could also discourage investors wishing to invest in the health sector.

From the analysis, it becomes apparent that the No Project Alternative is not the appropriate alternative.

6.2.4 Alternative design, layout and technology

Various alternative designs and technology has been evaluated by the proponent and various professionals involved i.e. the architect, engineers, physical planner and surveyors. After extensive discussions and relevant considerations, the various options were assessed and the most optimal design and technology were agreed as per the proposed plans, materials and technology. There is the alternative design as to accommodate details and the size of the usable areas. These alternatives however shall call for little re-designing and could be worth further exploration.

6.2.5 Alternative land use

The proponent has an option to use the land for other purposes other than the proposed hospital and other supportive amenities, petrol station or commercial hub. The proponent may decide to use the buildings for commercial use such as a hotel, office block etc or even industrial or residential, may opt to sell the leasehold interest; or for the myriad of the alternative other land uses. This option however calls for change of use and whatever the type of project, it will still have its potential impacts some even worse than the proposed project depending on their nature for example industrial activity.

6.3 Analysis of Alternative Construction Materials and Technology

The proposed project will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. Equipment that saves energy and water will be given first priority without compromising on cost or availability factors. The facilities construction will be made using locally sourced stones, cement, sand (washed and clean), structural steel and fittings that meet the Kenya Bureau of Standards requirements.

The alternative technologies available include the conventional concrete, prefabricated concrete panels, or even temporary structures. These may not be desirable from a cost and durability perspective. The technology to be adopted will be the most economical and one sensitive to the environment.

6.4 Solid Waste Management alternatives

A lot of solid wastes will be generated from the proposed project. An integrated solid waste management system is recommendable. First, the proponent will give priority to reduction at source of the materials. This option will demand a solid waste management awareness programme in the management and the staff. Recycling and reuse options of the waste will be the second alternative in priority. This will call for a source separation programme to be put in place. The third priority in the hierarchy of options is combustion of the waste that is not recyclable and hazardous through the incinerator. Finally, the proponent will need to establish agreement with the Machakos County government to ensure regular waste removal

and disposal in an environmentally-friendly manner. In this regard, a NEMA registered solid waste handler would have to be engaged.

As the proponent is also proposing to undertake construction of the incinerator, incineration is the most practical and feasible option for solid waste for solid waste management considering the delineated options.

6.5 The comparison of alternatives

Under the proposed Development Alternative, the project would create a new level IV medical facility, petroleum station and a commercial centre and would provide employment directly and indirectly to the public over and above the services provided. Under the No Action Alternative, there would be no development at all. There would be no benefits from the site and neither would there be the insignificant environmental Impacts. Layout redesign may perhaps give an optimal design and should be explored for optimization of the benefits and environmental enhancement.

Provided the Environmental Impact mitigation measures are implemented as well as adoption of sound management practices, negative impacts will be avoided/minimized. However, commitments related to development alternative would ensure that potential impacts are minimized to levels of insignificance as envisaged in the EMP. After careful analysis, the proposed project alternative is the most preferred alternative owing to the benefits it will offer to the proponent, the community and the Country at large.

CHAPTER SEVEN:

7.0. PUBLIC PARTICIPATION

7.1 Overview

This chapter outlines actions undertaken to consult community members living near the Project, Project Affected People (PAP) and other concerned key stakeholders. The purpose of public consultation was to create awareness of the oncoming project, collect views on community concerns on the project, positive and negative effects of the project and how to mitigate them. It also presents major findings and outcomes of public consultations.

7.2 Data Collection Methodology

The ESIA study was carried out using various methodological approaches best suited to address the study objectives. Secondary data were reviewed and later deductions made in relation to project on focus. Primary data was collected by means of interviews to community members and administration of questionnaires to target respondents. Other methods used included collecting views in public baraza, photography and making observations on site.

7.3 Data Collection and Reporting

7.3.1 Key Informants

The data collection exercise was conducted between 5th and 15th August 2020 for respondents whereby questionnaires were administered to different categories of project stakeholders.

These included administrative officers; Chief Kithimani location, Sub chiefs of Kithimani and Ngoliba sub-locations in whose jurisdictions the developments will be.

7.3.2 Community Consultation

Community consultation was done in two ways, first by conducting direct interviews to randomly selected homesteads of residents living near the project & by holding a public consultation meeting.

Public consultation meeting for both locations was conducted on 14th of August 2020, with the meeting being done at the proposed site.

The objectives of public consultation meetings were to;

- ✓ To inform the public of the oncoming project and implementation methodology;
- ✓ To collect views residents on the oncoming project, problems they anticipate and how these can be mitigated;
- ✓ To gather information on likely impacts of the project as perceived by the locals.

7.4 Results for Public Consultations

From the meetings held, all those consulted were full of support of the oncoming project with some feeling that it had been long overdue. 100% of the people interviewed and those that attended the public barazas were in support of the project. The community welcomed the proposed project citing that the project will ease access to a better healthcare, fuelling point and a one stop shop. All respondents were also concerned of chances of local people getting employment opportunities on the project.

Both positive and negative impacts as expressed by the public are as presented below. Also the included are the proposed mitigation measures aimed at minimizing the negative impacts.

7.4.1 Key issues raised by community members:

a) Bumps to be erected along market places and near schools to curb over speeding by motorist during materials transportation.
b) Ensure there is employment of locals in the project.
c) To ensure that dust pollution is controlled during construction phase of the project.
d) To ensure that awareness is created on matters of health and safety especially on the spread of HIV and AIDs.
e) Ensure that all construction activities are being undertaken during the day time.

7.4.2 Positive issues raised by stakeholders for the project in the construction phase

- Creation of employment for those hired to work on the project. Most stakeholders felt the need of the contractor giving priority to the locals when employing and only outsourcing labour in fields where there are no professionals available locally.
- Boost of business for those who will offer food stuffs and other goods and services to the workers and the contractor
- Acquisition of technical knowledge for local people involved in the project especially those youths hired to handle the machinery.

7.4.3 Negative issues during construction phase

- Clearing vegetation will affect the environment resulting to soil erosion.
- Increase in the number of traffic accidents due to increased traffic.
- Increase in noise and dust levels from heavy truck during operation.
- Damping of excavated soil will result to waste lands
- Social interactions of locals with workforce's will increase social immorality like prostitution along the market centres, resulting in an increase in the incidence of STDs, including HIV/AIDS;
- It will increase crime rates and insecurity especially during construction.

7.4.4 Positive effects during operations

- Provision of access to a better health care system that won't be affected by Doctor's strike.
- Provision of a one stop shop- commercial hub where it will reduce time spent during shopping at the area market.
- Provision of fuelling points that will ease movement along the Nairobi-Garissa Highway.
- Boost for trade due to ease of access by visitors plying the Garissa road thereby bringing business to the area.
- The developments will increase land prices in the area.
- Increased incomes for those that will be working at the facilities will lead to improved living standards and consequent empowerment of community members.
- Improved opportunities for youth especially those in boda boda business through access of a fuelling point as well as influx of people in the area will become good business to them.
- Timely access to emergency facility during road accidents along the road.
- Access to social services.

7.4.5 Negative effects during project operations

- Ease of access by communities will lead to moral decay like prostitution leading to spread of STIs and HIV/AIDs.
- Solid wastes generation might spoil the aesthetic value of the lands nearby.
- Pollution of water sources from the effluents being generated from the facilities.
- Insecurity in the area due to increase in population.
- Risk of fire from the filling station.

7.5 Proposed Mitigation Measures to negative impacts both during and after construction

An environmental management plan (EMP) has been prepared to address all impacts identified by institutional respondents and community members.

Areas that require mitigation actions include: -

- Use of appropriate machines and regular maintenance of machinery to reduce noise and smoke emissions to the environment.
- Dust minimization by watering dusty areas.
- Have workers housed in campsite with perimeter walls and have security agents at camp's gate. Also have regular security agents' patrol on project area.
- Have visible warning signs indicating ongoing project works.
- Cut trees only where it is inevitable and support tree planting once the project is complete.
- Engage health workers to sensitize the community on dangers of HIV/AIDs and STIs.

CHAPTER EIGHT:

8.0. ENVIRONMENT AND SOCIAL MANAGEMENT PROGRAM

8.1 Overview

An Environmental & Social Monitoring Plan (ESMP) for a development project is used to provide a logical framework within which identified negative environmental impacts can be avoided, mitigated and monitored. In addition, the ESMP assigns responsibilities of actions to various actors and provides a timeframe within which mitigation measures and monitoring can be done. The ESMP is a vital output of an Environmental and Social Impact Assessment as it provides a checklist for project monitoring and evaluation. The ESMP outlined below will address the identified potential negative impacts and mitigation measures of the Project based on the chapters on Environmental Impacts and Mitigation Measures of the Negative Impacts.

8.2 Pre-Construction & Construction Phases ESMP

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the construction phase of the project are as outlined in the table below:

The key responsibilities regarding compliance to the above ESMP rest on the Contractor. However, it is important that the project proponent ensures adequate monitoring and evaluation for the Contractor for non-conformances.

8.3 Operational Phase ESMP

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the operational phase the project is outlined below.

8.4 Decommissioning Phase

In addition to the mitigation measures provided above, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the project have ceased. The necessary objectives, mitigation measures, allocation of responsibilities, time frames and costs pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the project are outlined in below.

Table 8-1: Construction Phase ESMP				
Objective/ Plan	**Recommended Mitigation Measures**	**Responsible**	**Timeline**	**Cost**
Increased exploitation of raw materials	Maximize sourcing of construction materials from suppliers who use environmentally friendly processes in their operations	Contractor	Throughout the construction period	**Nil**
	Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the amount necessary is ordered	Contractor	Throughout the construction period	**Nil**
	Ensure that damage or loss of materials at the construction site are kept minimal through proper storage	Contractor	Throughout the construction period	**Nil**
Run off and soil erosion	Apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil. E.g. silt traps, barriers, tree planting.	Contractor	Throughout the construction period	**100,000/=**
	Ensure that construction vehicles are restricted to existing graded roads to avoid soil compaction within the project site.	Contractor	Throughout the construction period	**50,000/=**
	Ensure that any compacted areas are ripped to reduce run-off	Contractor	6 Months	**100,000/=**
	Through accurate estimation of the sizes and quantities of materials required, order materials in the sizes and quantities they will be needed, rather than cutting them to size, or having large quantities of residuals.	Contractor	Throughout the construction period	**Nil**
Solid Waste Management	Ensure that construction materials left over at the end of construction will be used in other projects rather than being disposed off	Contractor	One-off	**Nil**
	Ensure that damaged or wasted construction materials will be recovered for refurbishing and use in other projects	Contractor	One-Off	**Nil**
	Utilize opportunities for donating recyclable/reusable or residual materials to local community, groups, institutions and individual local or home owners	Contractor	One-off	**Nil**
	Use of durable, long-lasting materials that will not need to be replaced often, thereby reducing the amount of construction waste generated over time	Contractor	Throughout construction period	**100,000/=**

	Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by the damage or exposure to the elements	Contractor	One-off	**20,000/ =**
	Purchase of perishable construction materials such as paints should be done incrementally to ensure reduced spoilage of unused materials	Contractor	Throughout the construction period	**Nil**
	Use construction materials that have minimal or no packaging to avoid the generation of excessive packaging waste	Contractor	Throughout the construction period	**40,000/=**
	Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers to reduce waste at the site	Contractor	Throughout the construction period	
	Dispose waste more responsibly by dumping at designated dumping sites or engaging the use of a registered waste disposal company on Machakos county government	Contractor/ Machakos County Government	Throughout the construction period	100,000/=
Air pollution	Sprinkle water on graded access routes each day to reduce dust generation by construction vehicles	Contractor	Throughout the construction period	**50,000/=**
	Sensitize truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading points and parking areas. Switch off vehicle engines at these points	Contractor	Throughout the construction period	30,000/=
	Ensure proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done per vehicle or the number of vehicles on the facilities	Contractor	Throughout the construction period	**20,000/=**
Noise Pollution	Sensitize construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.	Contractor	Throughout the construction period	**20,000/=**
	Sensitize construction drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as residential areas and schools	Contractor	Throughout the construction period	**20,000/=**

	Ensure that all generators and heavy duty equipment are insulated or placed in enclosures to minimize ambient noise levels.	Contractor	Throughout the construction period	**20,000/=**
	Ensure that construction machinery are kept in good condition to reduce noise generation	Contractor	Throughout the construction period	**20,000/=**
Depletion of energy resources	Ensure planning of transportation of materials to ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts	Contractor	Throughout the construction period	**30,000/=**
	Monitor energy use during construction and set targets for reduction of energy use.	Contractor	Throughout the construction period	**25,000/=**
Exploitation of water resources	Promote recycling and reuse of water as much as possible. Organize collection of rainwater on site.	Contractor	Throughout the construction period	**50,000/=**
Accidents	Ensure that provisions for reporting incidents, accidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO) are in place.	Contractor	continuous	**60,000/=**
Hygiene	Ensure that the premises are insured as per statutory requirements (third party and workman's compensation)	Proponent	annually	**50,000/=**
	Develop, document and display prominently an appropriate SHE policy for construction works	Contractor	One-off	**45,000/=**
	Provisions must be put in place for the formation of a Health and Safety Committee, in which the employer and the workers are represented	Contractor	One-off	**70,000/=**
	Suitable, efficient, clean, well-lit and adequate gender specific sanitary conveniences should be provided for construction workers	Contractor	One-off	**100,000/=**
Machinery Safety Injuries caused by machineries and equipment	Ensure that machinery, equipment, personal protective equipment, appliances and hand tools used in construction do comply with the prescribed safety and health standards and be appropriately installed maintained and safeguarded	Contractor	One-off	**80,000/=**
	Ensure that equipment and work tasks are adapted to fit workers and their ability including protection against mental strain	Contractor	continuous	**40,000/=**
	All machines and other moving parts of equipment must be enclosed or guarded to protect all workers from injury	Contractor	One-off	**50,000/=**

	Arrangements must be in place to train and supervise inexperienced workers regarding construction machinery use and other procedures/operations	Contractor	continuous	15000 per training
	Equipment such as fire extinguishers must be examined by a government authorized person. The equipment may only be used if a certificate of examination has been issued	Contractor	continuous	**40,000/=**
	Ensure that materials (cement bags, aggregates, bitumen drums) are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse	Contractor	Continuous	**100,000/=**
	Conduct sensitization campaign for the public on risks related to construction sites.	Contractor	Twice (before construction begins) repeated after 1 month	**100,000/=**
	Ensure that items are not stored/stacked against weak walls and partitions	Contractor	continuous	**30,000/=**
Poor storage of materials	All floors, steps, stairs and passages of the premises must be of sound construction and properly maintained.	Contractor	continuous	**40,000/=**
Emergencies	Design suitable documented emergency preparedness and evacuation procedures to be used during any emergency. Such procedures must be tested at regular intervals	Contractor	Every three months	**65,000/=**
	Ensure that adequate provisions are in place to immediately stop any operations where there is an imminent and serious danger to health and safety and to evacuate workers	Contractor	One-off	**35,000/=**
	Ensure that the most current emergency telephone numbers posters are prominently and strategically displayed within the construction site	Contractor	One-off	**15,000/=**
	Provide measures to deal with emergencies and accidents including adequate first aid arrangements	Contractor	continuous	**20,000/=**
	Sensitize the public on potential emergency situations	Contractor	Twice (before construction begins) repeated after 1	**40,000/=**
	Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.	Contractor	One-off	**70,000/=**

	Fire-fighting equipment such as fire extinguishers should be provided at strategic locations such as stores and construction areas.	Contractor	One-off	**50,000/=**
	Regular inspection and servicing of the equipment must be undertaken by a reputable service provider and records of such inspections maintained	Contractor	One-off	**235,000/=**
Accidents	Enough space must be provided within the premises to allow for adequate natural ventilation through circulation of fresh air	Contractor	One-off	**50,000/=**
	Well stocked first aid box which is easily available and accessible should be provided within the premises	Contractor	One-off	**50,000/=**
	Ensure that all chemicals used in construction are appropriately labelled or marked and that material safety data sheets containing essential information regarding their identity, suppliers classification of hazards, safety precautions and emergency procedures are provided and are made available to employees and their representatives	Contractor	One-off	**100,000/=**
	Keep a record of all hazardous chemicals used at the premises, cross-referenced to the appropriate chemical safety data sheets	Contractor	continuous	**30,000/=**
	There should be no eating or drinking in areas where chemicals are stored or used	Contractor	continuous	**10,000/=**
	Ensure that workers at the excavation sites and other dusty sites are adequately protected from inhalation of substantial quantities of dust through provision of suitable protective gear (e.g. nose masks)	Contractor	One-off	**70,000/=**
	Provide workers in areas with elevated noise and vibration levels, with suitable ear protection equipment such as ear muffs	Contractor	One-off	**50,000/=**
Provisions of PPE to Workers	Suitable overalls, safety footwear, dust masks, gas masks, respirators, gloves, ear protection equipment etc. should be made available and construction personnel must be trained to use the equipment	Contractor	One-off	**200,000/=**
Health	Ensure that construction workers are provided with an adequate supply of wholesome drinking water which should be maintained at suitable and accessible points.	Contractor	One-off	**35000/=**
	Signs such as “NO SMOKING” must be prominently displayed within the premises, especially in parts where inflammable materials are stored	Contractor	One-off	**50,000/=**

	Provide and maintain adequate and suitable accommodation for clothing not worn during working hours for construction employees	Contractor	One-off	**150,000/=**
	Provide and maintain, for the use of all workers whose work is done standing, suitable facilities for sitting sufficient to enable them to take advantage of any opportunities for resting which may occur in the course of their employment	Contractor	One-off	**60,000/=**
	All work places must be kept in a clean state, and free from effluvial arising from any drain, sanitary convenience or nuisance	Contractor	continuous	**50,000/=**
Sanitary	Accumulations of dirt and refuse should be cleaned daily from the floors, benches, staircases and passages	Contractor	Daily	**100,000/=**
	Ensure that conveniently accessible, clean, orderly, adequate and suitable washing facilities are provided and maintained in within the site	Contractor	One-off	**70,000/=**
Insecurity	Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the Construction site.	Contractor	continuous	**200,000/=**
	Conduct sensitization campaign for the public on risks related to construction sites.	Contractor	Twice (before construction begins) and a repeated after 1 month.	**100,000/=**

Table 8-2: Environmental & Social Management Plan during Installation and Operation Phase

Environmental/ Social Impact	Project phase	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and Mitigation	Estimated Cost (Kshs)	Monitoring means	Recommended frequency of monitoring and indicators
Energy resources	Installation	Ensure electrical equipment, appliances and lights are switched off when not being used Design to provide for adequate natural lighting	Proponent	-	Inspection/ observation/re cords	Daily
	Operation	Install energy saving bulbs at all lighting points instead of bulbs which consume higher electric energy Install solar systems to complement heating and lighting Encourage use of natural lighting during the day Sensitize workers to use energy efficiently by switching off when not in use Monitor energy use by setting targets for efficient energy use.	Proponent	500,000	Inspection/ observation/re cords	Daily
Fats and grease		Construct and ensure sound working of fats/grease traps along the drains leading from kitchen	Proponent	5,000 monthly	Inspection	Weekly
Air pollution	Operation	Use of environmentally friendly alternatives Encourage use of clean fuels	Contactor	50,000	Inspection/ observation	Daily

Oil pollution	Operation	Proper storage, handling and disposal of oil and oil wastes. Maintain plant and equipment to avoid leaks Maintenance of equipment should be carried out in off the site Ensure sound working of oil interceptors along the drains leading from car wash and parking bays	Contractor	5,000 monthly	Inspection	Daily
Water Sources	Operation	Management of water usage. Avoid unnecessary wastage Construct water reservoirs and rainwater harvesting systems Supplement water supply with water from other sources with necessary approvals recycling of water where possible Install water conserving taps that turn off automatically when water is not being used. Make use of roof catchments to provide water i.e. for general purpose	Proponent	50,000 monthly	Inspection/ observation	Random

Public health and occupational safety	Operation	Train staff/workers on occupational health and safety Provide full protective gear & workmen's compensation cover in addition to the right tools and operational instructions & manuals. Adopt sound waste management system to ensure proper solid waste disposal and collection facilities. Adopt sound housekeeping practices Engage the services of qualified personnel and/or ensure training Ensure use of standard materials and to the specifications. Avoid undesirable, substandard, hazardous or unauthorized materials and products Sensitized staff on social/health issues such as drugs Ensure machinery and equipment servicing and maintenance as per schedules & legal requirements Provide material safety data sheets Post clear warning signs e.g. 'No unauthorized use of machines' & equipment, ensure there are guards on moving parts e.t.c Ensure adherence with the legal requirements of OSHA Act. Sensitize stakeholders on environmental management	Proponent	250,000	Observation	Daily

Record Keeping	Operation	Collection and analysis of relevant environmental data of the site Ensure good maintenance of all systems Institute appropriate monitoring procedures and guidelines on environmental performance. Establish an environmental audit protocol and schedule as per the ESIA/Audits regulations. Encourage workers and tenants' participation in environmental conservation aspects.	Proponent/ contractor	30,000 annually	Inspection	Monthly
Internal Audits	Operation	Monitoring will involve measurements, observations, evaluations, assessment of changes in water quality, waste management, Noise levels, contractor safety etc	Proponent/ contractor	60,000 annually	Inspection	Random
Fire safety and preparedness	Operation	Conduct training on firefighting, evacuation and emergency response Adapt effective emergency response plan Maintain/service firefighting machinery regularly Provide emergency numbers at strategic points Sensitize the residents on fire risks i.e. conduct regular fire drills	Proponent	100,000 annually	Observation	Random
Security	Operation	Provide security guards and facilities during the entire project cycle	Contractor	30,000 monthly	Observation	Daily

Waste Management	Operation	Strictly abide by the provisions of the Water Act & the Environmental Management (Water Quality) Regulations; and Waste Management Regulations Waste management installations (e.g. Sewers) be isolated from public water pipes to avoid contamination of the later, Ensure all-water interceptor is well fitted from the fore court to the car wash and service bays. Incorporate suitable facilities for collection, segregation and safe disposal of solid wastes such as bins, placenta pit etc Dustbin cubicles must be protected from animals and rain Bins should be regularly cleaned and disinfected. The bins to be colour coded Provide possibilities for waste recycling options - in-house and offsite. Ensure a continuous review of waste management procedures with changing technology and regulatory changes.	Proponent	30,000 monthly	Observation	Daily
Wastewater	Operation	Explore installation of a suitable wastewater treatment system Monitoring of the effluent to ensure compliance and remedial action	Proponent	100,000	Laboratory tests observation	Weekly

Table 8-3: Environmental & Social Management/Monitoring Plan for The Decommissioning Phase

Expected Negative Impacts	Recommended Mitigation Measures	Responsibility Party	Time Frame	Cost (ksh)
1. Construction machinery/structures and wastes				
Scraps and other debris on site	• Use of an integrated solid waste management system i.e. through a hierarchy of options: • Wastes generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures. Disposal locations will be selected by the contractor based on the properties of the particular waste stream. • All equipment, and tools that will not be used for other purposes should be removed and recycled/ reused say in other projects • Where recycling/reuse of the machinery, equipment, implements, structures, tools and other waste is not possible, the materials should be disposed to approved dumpsites.	Contractor, Proponent	One-off	500 ,000

Potential Pollution	• procedures for finding contaminated material during excavations will be established • covering and damping of excavated materials • appropriate storage of contaminated material if found. Ground contamination and storm water contamination will be limited on site by proper handling and storage of materials and equipment.	Contractor, Proponent	One-off	250,000
2. Rehabilitation of the buildings				
damage to floors, walls & ceiling	• Repair and maintenance works • Re-painting	Contractor, Proponent	One-off	1,000,000
Restoration of site	• Monitoring and inspection of the area for indications of leakages will be conducted and appropriate measures taken to correct any occurrences; • Carry out soil tests foe contaminants & if need be scoop out any contaminated soils and replace with uncontaminated soil from another source Comprehensive Landscaping	Contractor, Proponent	One-Off	2,000,000
3. Safety of the project				
Occupational hazards	• Ensure that safety measures have been effectively integrated and positioned in respective areas of the project to control and manage fire outbreaks • Staircases and other hazardous areas is suitably protected say using strong rails to avoid occurrence of incidences	Contractor, Proponent	One-off	50,000
4. Safety and Social-Economic impacts				

• Loss of income • Reduced ability to support dependants • Loss of quality of life • Loss of benefits i.e. medical, insurance cover etc	• The safety of the workers should surpass as a priority of all other objectives in the decommissioning project • Adapt a project – completion policy: identifying key issues to be considered. • Assist with re-employment and job seeking of the involved workforce. • Compensate and suitably recommend the workers to help in seeking opportunities elsewhere. • Offer advice and counselling on issues such as financial matters. Encourage workers to register with retirement benefits scheme of their choice	Contractor, Proponent	One- off	3,500,000

CHAPTER NINE:

RECOMMENDATION AND CONCLUSION

From the foregoing the following conclusions are made:

No serious and adverse objections were received from the communities occupying the surrounding area. The facilities will also lead to economic improvement to people living around the facilities profile. It is therefore considered suitable for the local area.

The proposed project has actively involved the key stakeholders who did not object the development. Thus the success of the implementation project can be guaranteed.

The proposed project does not pose adverse socio-economic impacts and is an initiative towards improving health care, energy and commercial services in the area.

In conclusion, the study recommends timely implementation of the project with strict adherence to the proposed Environmental Management and Social Management Plans.

The project benefits have been identified to outweigh the negative impacts for which a mitigation plan has been prepared. Further, the proponent has carefully considered and applied acceptable local and international standard/regulations at all stages of project planning and would thus qualify for funding.

Recommendations

Following the impact analysis presented in the previous sections, here below are the recommendations.

1 The Proposed project to be implemented in compliance with the relevant legislation and planning requirements.
2 The proponent must ensure that the impacts are kept to a minimum level.
3 A clear environmental and social management plans that have been developed must be enforced.
4 The proponent should ensure implementations of the mitigation guideline provided in the ESMP in collaboration with the Contractor.
5 The Resident Engineer for the project needs to make progress reports indicating the implementation of the plans.

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APPENDICES

1 Proponent's Change of Land use
2 Site plan layout
3 Approved plans for the level (IV) hospital
4 Approved plans for the commercial hub
5 Approved plans for the petroleum station
6 Approved plans for the waste water management system
7 Approved plans for the incinerator
8 Certificate of incorporation for MCF
9 Land ownership documents
10 Proponents KRA Pin
11 Certificate of practise for the ESIA Firm
12 Experts Practising Certificates

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PICTORIALS

PROPOSED SITE OUTLOOK

PROJECT ACCESS SITE ACCESS ROAD- THIKA – GARISSA HIGHWAY

TREE LINE PLANTED AROUND PROJECT SITE

THE DEVELOPER ADDRESSING THE COMMUNITY DURING THE PUBLIC BARAZA

COMMUNITY MEMBERS DURING THE PUBLIC BARAZA

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