ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED CONSTRUCTION OF USED OIL RECYCLING PLANT

Situated on Plot LR No.20470 in Mavoko Sub County, Machakos County (GPS coordinates-1.40399^{0}, 36.994308^{0,} at 1530masl).

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JULY 2024

FACT SHEET

Assignment Name	Environmental And Social Impact Assessment Study Report for the proposed used oil recycling plant in Katani, Mavoko Subcounty, Machakos County.
Description of project	The project will involve the construction of a building to house the processing plant equipment and the installation of the machinery and equipment. The plant will contain the boundary wall, gated, water source and storage, offices, sanitation facilities, weigh bridge, paved walk ways, and offloading area.
Location	Situated on Plot LR No. 20470 in Mavoko Sub County, Machakos County
GPS coordinates	GPS coordinates-1.40399^0, 36.994308^{0,} at 1530masl
Name and Address of the Proponent	**Viraj Industries Ltd.** P.O Box 87834, Mombasa G.P.O Telephone: +25476886043, Email: viradiyat8@gmail.com
Assignment date	July 2024
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ACKNOWLEDGEMENT

The consultant is grateful to the proponent for commissioning us to conduct this Environmental and Social Impact Assessment study in respect of the proposed project. We would like to further acknowledge with great appreciation the people of Katani Location who participated in the public consultation process and for their cooperation throughout the exercise.

DECLARATION

This ESIA study report was done in accordance to the requirements of the Environmental (Impact Assessment and Audit) Regulations, 2003, pursuant to The Environmental Management and Coordination Act, (EMCA) 1999 Rev. 2015 and acceptable international standards.

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ABBREVIATIONS AND ACRONYMS

EA	Environmental audit
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GDP	Gross Domestic Product
GOK	Government of Kenya
HIV/AIDs	Human Immunodeficiency Virus/ Acquired immune deficiency syndrome
KFS	Kenya Forest Service
NEAP	National Environment Action Plan
NEMA	National Environmental Management Authority
NO_X	Nitrous Oxide
SO_x	Sulphur Oxide
WRA	Water Resource Authority

EXECUTIVE SUMMARY

I. Overview

The proponent contracted the consultant to carry out an environmental and social impact assessment (ESIA) for the proposed used oil recycling plant in Katani Location Mavoko Subcounty in Machakos County. The ESIA examined the potential impacts the project may have on the environment as well as options for mitigating and or optimizing these impacts.

The Kenya government policy on all new projects requires that an Environmental and Social Impact Assessment (ESIA) study is carried out at the project planning stages to ensure that significant impacts on the environment are taken into consideration. The proposed used oil recycling plant is one of the projects listed under the second schedule of the Environmental Management and Coordination Act (Cap 387) that should undergo an ESIA.

II. Objectives

The ESIA was conducted mainly to comply with the existing environmental legislation primarily EMCA Cap 387, and Environmental (Impact Assessment and Audit) Regulations 2003 among others. Specifically, the study sought to:

- Identify possible impacts of the proposed project on the environment;
- Evaluate alternatives to the proposed project;
- Predict likely changes on the environment as a result of the development;
- Propose mitigation measures for the significant negative impacts of the proposed project on the environment;
- Generate baseline data for monitoring and evaluation impact, including mitigation measures during the project cycle; and,
- Highlight environmental issues with a view to guiding policy makers, planners, stakeholders and government agencies to make environmentally and economically sustainable decisions.

III. Tools applied

The ESIA study team used a combination of tools to gather pertinent information for the study:

- Transect Walk at the proposed project site;
- Documents review;
- Interviews and;
- Photography.

IV. Potential Impacts

Construction of used oil recycling plant has got direct and indirect interactions with the environmental and social setting of the affected areas. The anticipated impacts of the proposed project on the environmental elements are both positive and negative. The magnitude of each impact is described in terms of being significant, minor or permanent, short-term or long term, specific (localized) or widespread, reversible or irreversible. The assessment criteria for the significant impacts are as shown in the table below:

Impacts on or due to	Remarks
Generation of solid and liquid wastes	The construction and operation phase of the plant will lead to generation of wastes from the civil works and the materials involved in the processes. These wastes include: plastics, metal shavings, wood shavings, food wastes, plants, gases (Carbon, Nitrous and Sulphurous Oxides), fumes (from glues and other hydrocarbons), stone shavings, ceramics, bricks, glass, cardboard, soil, cement, asphalt, sand, concrete, paper, paints, sealants, adhesives, fasteners, construction effluent (grey water).
Noise Pollution	During construction, running engines, and hooting of construction vehicles, and Communication from workers may generate noise and vibration that may have negative effect to the neighbourhood. This will however be very minimal and will be restricted to the construction stage of the project.
Increased pressure on utilities/services	The processes and activities involved in the construction of the project would place added pressure on infrastructure services and utilities such as roads, water, drainage and energy. This may contribute to service disruptions since the utility and service requirements of this stage are intensive. This impact is made more probable due to the challenges faced in the county to provide these services and compounded by the growth of the population.
Traffic	In construction phase, the murran road leading to the site will serve the additional vehicles used for the transportation of materials, equipment and staff to the site. Heavy trucks have the risk of causing accidents due to their limited maneuverability but also place added pressure on the roads and can lead to failure (cracks and potholes). This is failure is however a combination of factors including: - The total of trips of heavy trucks - The strength of the roads in context of carrying the heavy loads, and; - The resilience of the roads towards weathering.

Water quality pollution	Discharging effluents into the environment can contaminate surface waters, soil and underground water due to leak or oozing of raw materials or products. Such a condition could be occurred due to tanks' or pipelines' leak. Used oil (used a raw material), petroleum oils and grease used in vehicles and construction machinery may spill or leak on/into the ground hence into the soil or water system within the neighbourhood. The Athi river is approx. 4km from the site.
Air/Dust Pollution	During construction, dust and exhaust emission from the construction activities and machinery, may Pollute the ambient air. Also, the earth road leading to the site will generate a lot of dust due to increased traffic.
Soil erosion	Earth works during project construction usually influence soil erosion. By incorporating appropriate soil conservation measures and proper drainage facilities both during construction and operation phases of the project, soil erosion will be completely minimized.
Public Health	During the construction process, there will be health threats to workers on site.

V. Conclusion

The ESIA study revealed that the proposed project has got both socioeconomic and environmental benefits and costs. It emerged that the benefits exceed the costs. Also, all the identified environmental impacts can be mitigated to a level of minimum or no significance throughout the project cycle. Further, none of the potential impacts would result to permanent irreversible damage on the ecosystem components.

VI. Recommendations

Environmental monitoring is essential to track and sustain the effectiveness of the mitigation measures proposed in this report. An environmental monitoring plan has been prepared as part of the ESMP. The focus areas of monitoring cover air, noise, traffic management, water and energy resources, occupational health and safety, as well as local employment and economic impact of the project during construction and operation phases. The burden of implementing the mitigation measures largely lies with the Project Contractor under supervision by the Proponent. Key observations are that most adverse impacts are short term and will disappear once civil works ends. The construction contract for the proposed project should bear relevant clauses binding the Contractor to institute environmental mitigation as recommended in this study.

INTRODUCTION

1.1 Background

The proponent is proposing to set up a **USED LUBRICANT OIL RECYCLING PLANT** on plot No. 209/11957 in Katani Location, Mavoko Subcounty in Machakos County. The plant will compose of above ground storage tanks, parking area: truck loading bays; potable and fire water extinguisher tanks; an administration office, operations office, changing room and; drainage works and interceptors.

1.2 Project activities

1.2.1 Activities during Construction Phase

The proponent intends to develop the proposed project site in an acceptable national environmental and safety standards.

The following will be the activities to be undertaken during this phase.

- Paving of access road;
- Establishing work camps, site offices, storage yards, availability of workforce;
- Clearance of vegetation;
- Site development (cut and fill, grading, slope protection);
- Equipment foundation (concrete placement);
- Construction of infrastructure;
- Construction of other infrastructures like drainage and storm water control measures, internal road, and lighting;
- Installation of equipment and steel structures;

1.2.2 Activities during Operation Phase

The facility operation will include the following:

Collection of Waste Oil by Oil Tankers

- Petroleum products loading, off-loading, treatment and storage.
- Removal of impurities like water through condensation and decantation and where possible oil and water interceptors, further processing including use of chemicals will be applied where necessary in processing the waste oil;
- Storage and delivery/transportation of the oil to and from clients and any other related activities.
- Required oil tanker with a truck to collect from various garages and companies and service station.

Used oil recycling process

1.3 ESIA objectives

The objective of the study is to carry out an Environmental and Social Impact Assessment (ESIA) of the proposed project in accordance with the Environmental Impact and Audit Regulations 2003 and the international guidelines for ESIA and submit report to NEMA for approval. On the social impact assessment, it includes; carrying out a social-economic and social environmental status analysis through a baseline survey and prepare an Environmental and Social Management Plan (ESMP).

Under the Second Schedule of the EMCA, an ESIA is mandatory for a project that is outside the character of its surroundings. The purpose of an ESIA is to provide information to regulators, the public and other stakeholders to aid the decision-making process. The objectives of an ESIA are to:

- Define the scope of the project and the potential interactions of project activities with the environment (natural and social);
- Identify relevant national and international legislation, standards and guidelines and to ensure that they are considered at all stages of project development;
- Provide a description of the proposed project activities and the existing environmental and social conditions that the project activities may interact with;
- Predict, describe and assess impacts that may result from project activities and identify mitigation measures and management actions to avoid, reduce,

remedy or compensate for significant adverse effects and, where practicable, to maximize potential positive impacts and opportunities; and

- Provide a plan for implementation of mitigation measures and management of residual impacts as well as methods for monitoring the effectiveness of the plan

1.4 Project location

The proposed used oil recycling plant will be located on Plot LR No.20470 in Katani Location, Mavoko Sub County, Machakos County (GPS coordinates-1.40399^0, 36.994308^{0,} at 1530masl).

Google Map of the proposed site.

Proposed site showing the project foot print

1.5 Scope of the EIA Study

The study was conducted to identify the proposed project implementation activities in order to identify the associated potential positive and negative impacts in order to formulate the necessary mitigation measures at an early stage. The negative and positive impacts of the project activities were assessed in form of benefits and losses to the community and in the light of the mitigation measures before the decision are made on the way forward. The decision to approve the project implementation or not, lies with NEMA.

The EIA study included assessment of impacts of the project during construction, operation and decommissioning activities on the following:

- Physical environment;
- Flora and Fauna;
- Land use;
- Social economic aspects; and
- Public and occupational health and safety.

The study assessed the impacts of the proposed development on the environment in accordance with EMCA Cap 387 and covering the following:

- Baseline information;
- Activities of the project;
- Design of the project;
- Materials to be used;
- Methodology;
- Assessment of potential environmental impacts of the project and mitigation measures;
- Economic and social impacts to the local community and mitigation measures;
- Health and safety measures; and
- Environmental management and monitoring plan.

1.6 EIA Guiding Principles

The EIA guiding principles for Environmental and Social Impact Assessment followed during the study are:

(i) It requires that all environmental concerns must be accounted for in all development activities;
(ii) It encourages public participation in all stages of proposed project development.
(iii) It increases the ownership and sustainability;
(iv) It also recognizes the role of social and cultural principles traditionally used in the management of the environment and natural resources;
(v) International cooperation in the use and wise management of shared resources.
(vi) Intra-generation and inter-generation equality;
(vii) Polluter-pays principle; and
(viii) The precautionary principle.

1.7 Terms of Reference

The environmental consultant was commissioned by the proponent to undertake an Environmental and Social Impact Assessment (ESIA) study for the proposed construction used/waste oil recycling plant and to prepare a report for consideration by the National Environmental Management Authority (NEMA) and subsequent authorization to implement the proposed project.

The guidelines to conducting an ESIA as per Environmental (Impact and Audit) regulations 2003, applied in addition to terms of reference between the proponent and the environmental expert.

1.8 Approach and Methodology

The approach and methodology were expected to achieve the overall project objectives as outlined in the Terms of Reference document for providing services under the tasks to be undertaken. The methodology is based on the available information and our relevant experiences gained through heavy involvement in identical assignments.

1.8.1 Understanding the Project Site

The first step in environmental assessment of the proposed project was to understand the proposed project based on existing site conditions and also analyse the direct and indirect environmental impacts which are important in determining the scope and depth of the study.

1.8.2. Scoping of the EIA Study

During this Scoping, the ESIA Consultant reviewed all the relevant available documents on project activities and components from the proponent. The Consultant also reviewed all the available and relevant environmental guidelines and recognized legislation and standards on ESIA.

In this ESIA Study, scoping of key environmental and social issues was undertaken with a view of determining the key issues and questions that this study assessed and key issues that might affect the detailed design of the project. These were to include a preliminary analysis of potential key direct and indirect impacts of the Project and environmental and social conditions in the potentially affected areas. The ESIA Consultant used this as a starting point for further refining the scope of the environmental and social studies through a consultative process.

This scoping study delivered the following:

a) Proposed physical limits for the ESIA study area, appropriate to the issues;
b) Proposed time frame for the ESIA Study;
c) List of key stakeholders, initial consultations and analysis of findings;
d) Key potential impacts and the types and levels of impacts to be assessed in the ESIA; and.
e) Review of information on the existing environment, recommendations for appropriate methods of survey/data collection to establish environmental conditions.

1.8.3. Data Collection

Required data is gathered based on the activities and main components of the project as well as characteristics of the study area which was done through desk and field study.

1) Desk Study

- ✓ Review of environmental laws, regulations and standards, all environmental Acts, laws and regulations of Kenya and national and World Bank standards, related to the project and potential pollutions were reviewed. In addition, national protected areas were analysed to see if it was affected by the project.
- ✓ Search in reputable internet websites
- ✓ Getting data and information from proponent about designs of the project and maps of the area. A description of the project was done in the report and all project activities during construction and operation phases separately with emphasize on destructive activities on environmental parameters were identified.

2) Field Study

The visits were made to identify and study the environment of the project from the important viewpoints such as flora and fauna species and habitats. To identify the fauna species and collecting sufficient data from the site, the study area was evaluated on the basis of the existing land.

Collecting the data and information on the basis of the desk and field studies, leads to perfect understanding of the rules, regulations and standards of the environment and the organizational structure of the related organs, as well as the project and its components, the existing status of the project area environment comprising physical-chemical, biological-ecological and economical-social and cultural parameters.

3) Public Consultation and Participation

Throughout the study period, the Consultant made site visits to hold interviews with the stakeholders. The consultancy team in close consultation with the Proponent shared the project information in terms of its implementation and predicted impacts.

The Public Consultation and Participation was intended to achieve the following:

- ✓ Inform members of the public about the proposed Project;
- ✓ Identify local concerns/problems in order to address them in the ESIA Study Report;
- ✓ Allow for a wider discussion on environmental and social issues;
- ✓ Improve on the mitigation measures to the proposed project; and.
- ✓ Provide some form of quality control to the ESIA process through acceptance by members of the public and other stakeholders.

The Public Consultation and Participation meetings was held during the fieldwork period to capture the most critical concerns/impacts of the proposed project.

1.8.4. Environmental Baseline Study

Baseline information was provided based on the gathered data in desk and field studies. Baseline study is a survey about present status of the environment of the project. In this step, physio-chemical, biological-ecological and sociological characteristics of the environment were studied.

The main parameters of physical study included:

- ✓ Meteorology (main factors of climate and air quality).
- ✓ Topography and landscape.
- ✓ Geology (mostly in terms of potential effect on ground water).

The main parameters of bio-ecological study included:

- ✓ Flora.
- ✓ Fauna (important and threatened fauna species, biodiversity).
- ✓ Habitats (habitat types, vulnerable habitats and protected areas).

The main parameters of sociological study included:

- ✓ Social criteria (population, education);
- ✓ Economic criteria (employment, economic activities, land use, infrastructure); and,
- ✓ Cultural criteria (language, religion, cultural heritage).

1.8.5. Environmental and Social Impact Assessment

The approach of ESIA study is:

- ✓ To determine all positive and negative environmental impacts of the project for construction and operation phases separately, analysis and assessment,
- ✓ Environmental and Social Management Plan (ESMP) including mitigation plan.

As an initial step, the possible environmental impacts (negative and positive) in construction and operation phases were identified and classified based on the recognition of the environment, project activities.

After identifying the impacts, the best assessment method was selected based on the project characteristics, scale of work, availability of data and information and time schedule of the study; and impacts were assessed and analysed through a proper assessment method.

PROPOSED PROJECT DESCRIPTION

1.9 Project location

The proposed used oil recycling plant will be located on Plot LR No.20470 in Katani Location, Mavoko Sub County, Machakos County (GPS coordinates-1.40399^{0}, 36.994308^{0,} at 1530masl).

The map below shows the location of the proposed wareouse project.

Map showing the proposed site (Source: Google).

1.10 Site Ownership and Zoning

The proposed project site is registered in the name of the proponent *(Refer to the ownership documents attached in the appendix).* The land use in area is for commercial purposes and suits the proposed development.

1.11 Project Cost

The total project cost will be Forty-Five million, Five hundred and Thirty-Seven thousand Five hundred and Twenty (45,537,520.00) Kenya shillings.

1.12 Description of used oil recycling process

The proponent intends recycle used Lubricating Oil. Distillation done to produce re-refined base oil suitable for use as this process is very similar to the process undergone by virgin oil.

2.4.1 Pre-treatment or Dewatering

Pre-treatment of used oil involves removing any water within the oil, known as dewatering. One way of doing this is by placing it in large settling tanks, which separates the oil and water. Dewatering is a simple process relying on the separation of aqueous and oil phases over time under the influence of gravity. The used oil is allowed to stand in a tank (raw waste oil) and free water drops to the bottom where it can be drained, treated and discharged appropriately to sewer or stormwater depending on quality and local regulations.

2.4.2 Filtering & Demineralization

The purpose of filtering and demineralization is to remove inorganic materials and certain additives from used oil to produce a cleaner burner fuel or feed for re-refining. The dewatered used oil is transferred to a reaction tank and reacted with Sulphuric acid and surfactant the n heated and stirred. This allows the mixture to separate into two "phases" i.e. oil and aqueous phase. The contaminants accumulate in the aqueous phase and settles at the bottom of the tank and drained off as slurry. The slurry is then dried off and disposed. The demineralized oil is filtered to remove suspended fine particles and run off to storage as a clean burner fuel. It can be further diluted with a lighter petroleum product (called cutter stock) to produce a range of intermediate to light fuel oils depending on the fuel viscosity requirements of the burner.

2.4.3 Distillation

Distillation (or Fractionation) is the physical separation of components of lubricating oil by boiling range. Depending on the type of distillation, the boiling ranges can produce gases and gasoline at the lower boiling points with heavy lubricating oils being distilled at higher boiling points. Distillation is the core process for a facility capable of producing re-refined base-oils to virgin base-oil quality.

2.4.4 Vacuum Distillation:

Vacuum distillation is considered the key process in used oil re-refining. If atmospheric distillation is utilized, the oil from the atmospheric distillation column is the feedstock for the vacuum distillation column. In vacuum distillation, the feedstock can be separated into products of similar boiling range to better control the physical properties of the lube base stock "distillate cuts" that will be produced from the vacuum tower products. The major properties that are controlled by vacuum distillation are viscosity, flash point and carbon residue. The viscosity of the lube-oil base-stock is determined by the viscosity of the distillate in terms of its relative viscosity separation, e.g. light, medium and heavy oil. The used oil feedstock (usually from the atmospheric distillation unit) is heated in a furnace and flows as a mixture of liquid and vapour to the heated vacuum distillation column where the vapour

portion begins to rise and the liquid falls. Steam can be added to assist vaporization. As the hot vapours rise through the column they cool and some condense to a liquid and flow back down the column. Similarly, some of the downward flowing liquids are re-vaporized by contacting the rising hot vapours. Special devices in the column allow this upward flow of vapours and downwards flow of liquids to occur continuously. At various points in the column, special trays are installed which permit the removal of the liquid from the column

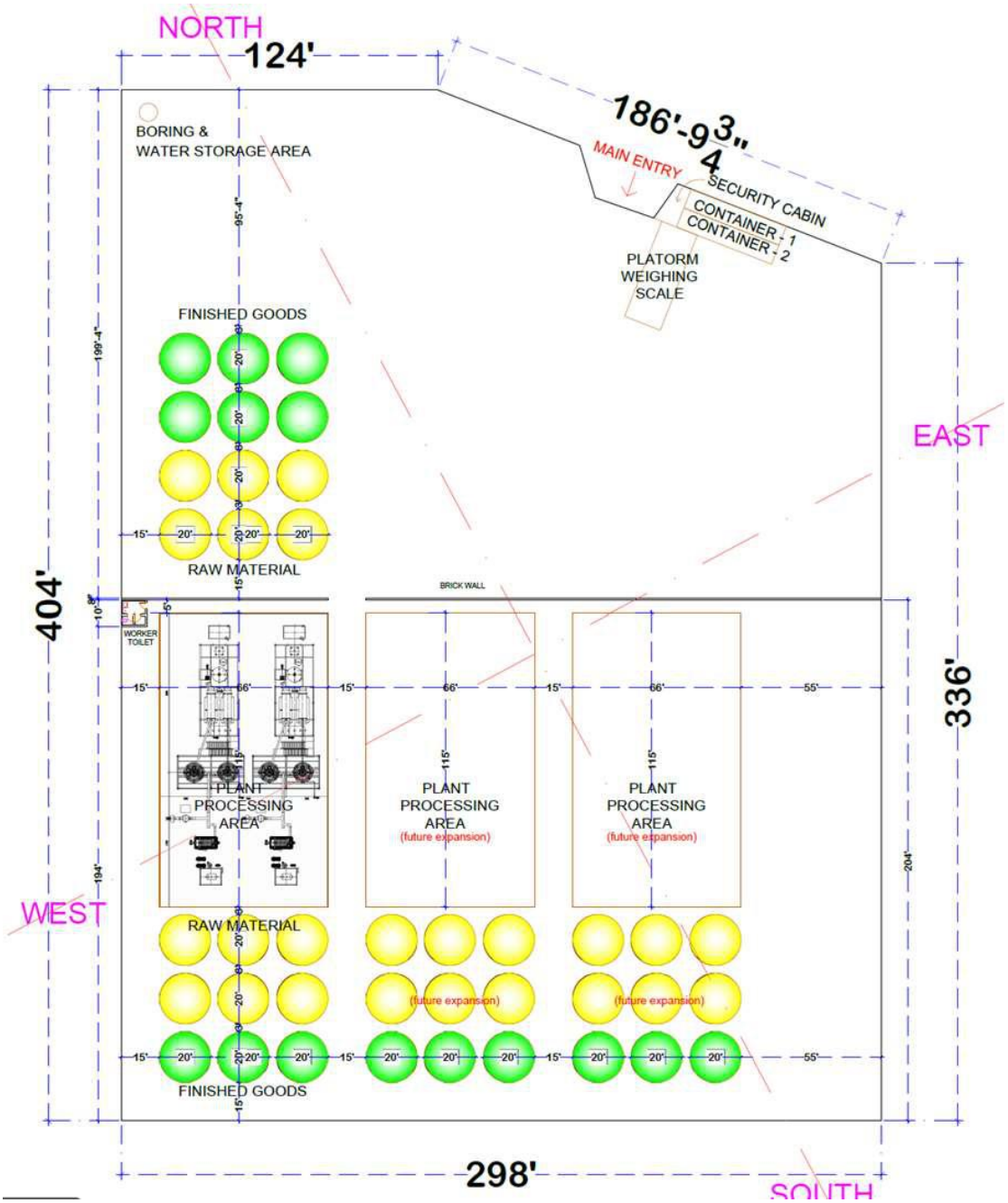
1.13 Project design

1.13.1 Project Components

The project will essentially involve the construction of used oil recycling plant. Detailed scope of work for the project is as follows.

1.13.2 Project Design

The project will involve the construction of a building to house the processing plant equipment and the installation of the machinery and equipment. The plant will contain the boundary wall, gated, water source and storage, offices, sanitation facilities, weigh bridge, paved walk ways, and offloading area. As shown below is the layout of the project.



Layout of the proposedproject.

1.14 Project Activities

Construction of used oil recycling plant will typically involve the following major activities:

- Paving of access road;
- Establishing work camps, site offices, storage yards, availability of workforce;
- Clearance of vegetation;
- Site development (cut and fill, grading, slope protection);
- Equipment foundation (concrete placement);
- Construction of infrastructure;

- Construction of other infrastructures like drainage and storm water control measures, internal road, and lighting;
- Installation of equipment and steel structures;

All such construction activities will be carried out by competent personnel obtained through tendering process to ensure the set quality and standards.

1.15 Materials and other Utilities during construction activities

Construction materials/aggregates such as cement, sand and gravel will be procured locally.
During the construction phase, work camps as well as storage yards for construction material, fuels and lubricants will be established apart from workshops, offices and accommodation for staff etc. for a period of 2 months.

A construction camp may accommodate workers who will need water supply, wastewater discharge and treatment systems, waste disposal facilities, as well as health care facilities.
Generally, a work camp will be used only for few months during the construction period.

1.16 Construction Machines/Equipment

The main construction machines/equipment required for construction are given below.

Machines/Equipment Type	Machines/Equipment Type
Trucks	Excavator, JCB
crane	Welding machine
Concrete mixing machine	Pokelain for earth excavation
Self-Loader Concrete Mixer	Light truck
Form boxes/Chimneys	Dewatering Pump (5 HP and above)
Turn table	Water tank truck
Hammers, spanners (both flat and ring), round files, flat files, screw drivers, cutting pliers, steel and metallic tapes, hacksaw frame and blades, deadments, scaffolding, sling, etc.	Cutting machine
	Diesel engine generator
	Walkie talkie set
	Tents, buckets, water drums, camping cots, table, chair, battery operated lamps

1.16.1 Decommissioning

Decommissioning is the last phase of project life. It involves terminating project activities and operations and rehabilitation site to or close to its original state.
The project proponent will be required to prepare a decommissioning plan on how the proposed used oil recycling plant and its housing would be dismantled and demolished if need arises and how the site would be rehabilitated to its original state or close to original state.
Any areas disturbed would be restored to pre-project conditions and/or to conditions acceptable to NEMA.

Environmental and social impacts associated with the decommissioning process would be minimised through the implementation of an environmental and social management plan (ESMP).

Considerations

In decommissioning the proposed used oil recycling plant, there are two main options that could be considered. These are:

i. Either to sell the facility intact or;
ii. Remove all installed equipment and close operations.

In the event that project operations must come to a close, then the following would be done: -

- Dismantling of the equipment.
- Laying off employees.
- Emptying of the storage tanks and chambers.
- Removal of electrical and water infrastructure.
- Demolition of structures.
- Sampling of soils and ground water.
- Site rehabilitation.
- Disposal of land.

i) *Dismantling and disposal of the Equipment*

Equipment to be dismantled will include computer systems, air conditioners and generator.
The mode of disposal will depend on the functionality of the equipment at the time of decommissioning.
Some equipment will be sold or retained for future use.
Those which will be grounded would be sold as scrap or spare parts for reuse.

ii) Laying Off Employees

Employees would need to be informed in advance of the closure so as to be mentally prepared to face the new way of life.
Where possible the proponent would be required.
to enter into a buy-off scheme with similar business establishments or if not the case, pay them their work /terminal benefits according to labour laws.

iii) Emptying and Disposal of Storage Facilities

When emptying the storage facilities, caution would be taken on environmental and safety issues.

Some of the facilities would be sold to other companies with similar undertakings and the remaining ones given out to local workshops.

iv) Removal of Electrical and Water supply Installation Infrastructure.

Relevant departments within Machakos County government must be involved in the removal exercise. These would include Kenya Power & Lighting and Water & Sewage service providers.

v) Demolition of Structures on Site

An interested investor would enter into a dialogue with the proponent on which the with a view to selling the structures to him/her.

If this will not be possible then the structures including the used/waste oil recycling plant components, office block, toilet, concreted yard and washrooms would be dismantled and demolished.

The following would be taken into consideration: -

- All employees involved in the demolition exercise must be in proper protective gear;
- Demolition should be done during day time only;
- Care must be taken to avoid destruction of trees and other vegetation on site during the exercise; and,
- Waste resulting from demolition must be disposed of at designated waste disposal sites through NEMA licensed waste handlers.

The proponent will need to follow the safety guidelines issued in the Kenya gazette supplement No. 18, Legislative supplement No. 13, Legal Notice No. 40, parts IX and X during the demolition process.

vi) Site rehabilitation

- Once demolition is completed, rehabilitation of affected site should be undertaken to its original state or close to original state.
- Site rehabilitation will include the following: -
- Septic tanks must be emptied first;
- Levelling the ground;
- Test and analysis of soil from site before rehabilitation begins. If found to be contaminated, then decontamination exercise must be carried out.
- Re-vegetation as may be agreed upon by the land owner.

1.16.2 Waste generated by project activities

The table below show the summary of waste generated by the activities undertaken during the project phases.

Types and treatment/disposal of wastes

Waste	Types	Treatment/ Disposal
Oil/grease	Oil spills	Interceptor
Solid Waste (Degradable)	Packaging, office waste and food remains	Collected in waste bins then disposed at an authorized dumpsite
Solid Waste (Non-Degradable)	Topsoil	Re-used for landscaping Backfilling material in the borrow pits.
	Scrap metals	Sold to Recyclers
	Tins, glasses and plastics	Collected in waste bins then disposed at authorized dumpsite. These could also be used recycled
	Debris (concrete and asphalt)	Re-used in construction
Liquid waste	Sewage	Septic

POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Regulation 18 (1) (b) of the Environmental (Impact Assessment and Audit Regulations) 2003 require an environmental assessment study report to, among others; include a concise description of national environmental legislative and regulatory framework. This chapter presents a review of the current policy, legal and regulatory framework applicable to environmental management of the proposed project, both at local and international levels.

1.17 Policy Framework

3.1.1. Environmental Policy

Sessional Paper No. 6 of 1999 on Environment and Development since adoption by parliament in 1999 has been in use and influenced the formation of EMCA in 1999. However, since it has been surpassed by time it is therefore under revision to comprehensively cover areas that were previously left out to augment it. The revised draft of the National Environmental Policy, dated April 2012, sets out important provisions relating to the management of ecosystems and the sustainable use of natural resources, and recognizes that natural systems are under intense pressure from human activities particularly for critical ecosystems including forests, grasslands and arid and semi-arid lands.

The objectives of the Policy include developing an integrated approach to environmental management, strengthening the legal and institutional framework for effective coordination, promoting environmental management tools, supporting the implementation of the Forests Act 2005, and developing national standards and appropriate forest-based development mechanisms in emerging carbon markets.

3.1.2. Kenya's Vision 2030

Vision 2030 aspires to transform Kenya into a newly industrialized middle-income country by 2030. The blueprint recognizes that Kenya is a water scarce country and further that the economic and social development envisaged in the vision 2030 will require more high-quality electricity supplies. Regarding environment, the Vision states that Kenya aims to be a nation living in a clean, secure and sustainable environment by 2030. The goals for 2012 are: (i) to increase forest cover from less than 3% at present to 4%; and (ii) to lessen by half all-environment related diseases. Specific strategies involve: promoting environmental conservation for better support to the economic pillar flagship projects and for the purposes of achieving the Millennium Development Goals (MDGs); improving pollution and waste management through the design and application of economic incentives; and the commissioning of Public-Private Partnerships (PPPs) for improved efficiency in electricity delivery.

1.18 Legislative Framework

3.1.3. The Constitution of Kenya

Article 42 of the Bill of Rights of the Kenyan Constitution provides that every Kenyan has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures.

Part 2 of Chapter 5 of the Constitution is dedicated to Environment and Natural Resources. Article 69 in Part 2 provides that the State shall among others.

Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits.

3.1.4. Energy Act 2019

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

3.1.5. The Environmental Management and Co-ordination Act, 1999

The main objective of EMCA and the related Regulations is to provide for the establishment of an appropriate legal and institutional framework including procedures for the management of the environment in Kenya. The Act further aims to improve the legal and administrative co-ordination of the diverse sectoral initiatives in the field of environment so as to enhance the national capacity for its effective management. In addition, The Act seeks to harmonize all the 77-sector specific legislation touching on the environment in a manner designed to ensure protection of the environment. This is in line with national objectives and sustainable development goals enunciated in Agenda 21 of the Earth Summit. As such, in terms of environmental management, EMCA provides a comprehensive and an appropriately harmonized legal and institutional framework for the handling of all environmental issues in Kenya and supersedes all sectoral laws.

Some key Sections of the Act relevant to the proposed project are:

Section 3 – Entitlement to Clean and	The project shall maintain a clean and healthy environment and the proponent and its contractors has a duty to safeguard and enhance environmental management in accordance with

Healthy Environment.	sub-sections 1, 2, 3, 4, and 5.
Section 50 – Biological Diversity	The project shall ensure that at the operation phases, conservation of biological diversity shall be observed as prescribed in (a) to (g) of this section.
Section 51 & 52 – Biological resources	The project shall enforce all measures to ensure conservation of biological resources both *in situ* and *ex situ* to ensure species threatened with extinction are protected.
Section 78 – Air quality	The proponent shall enforce air quality standards and be maintained as per NEMA's Standard and Enforcement Review Committee requirements.
Section 87 – Handling and Disposal of Wastes	The proponent shall adhere to the disposal of wastes requirement in such a manner as not to cause pollution to the environment or ill health.
Section 102 – Excess Noise	Noise during construction of the project especially from the construction vehicles and machinery is prohibited and shall be maintained to the desirable levels as is also pointed out in Cap 394.

The subsidiary legislations under EMCA 1999 are discussed in detailed as follows:

1.18.1.1 Environmental Management and Co-ordination (Water Quality) Regulations 2006:

The Water Quality Regulations provide for the protection of lakes, rivers, streams, springs, wells, and other water sources. The regulations also stipulate that all industries should refrain from any actions, which may directly or indirectly cause water pollution. All industries are therefore required to refrain from discharging effluent into water bodies. This regulation gives a minimum distance from a water body for which any development may be undertaken and as such affect the proposed projects with regards to the choice of the route.

Compliance with this legislation

- The proponent shall strictly adhere to the provisions and requirements of these regulations. He must ensure all applicable water standards are observed to ensure clean, safe water for all purposes.

- The proponent shall carry out an initial environmental audit after the first year of operation. The report shall include analysis of effluent as stipulated in the second schedule of this legislation.

1.18.1.2 Environmental Management and Co-ordination (Waste Management) Regulations 2006:

The Waste Management Regulations sets out standards for handling, transportation and disposal of various types of wastes. The regulations stipulate the need for facilities to undertake, in order of preference, waste minimisation or cleaner production, waste segregation, recycling or composting. These regulations provide guidelines on how to store, transport and dispose any wastes generated during the construction. Some of these wastes may fall under the hazardous wastes category and thus require disposal arrangements.

Compliance

The proponent will ensure that all waste are segregated before being transported to a designated waste treatment facility by a contracted NEMA licensed waste transporter.

1.18.1.3 Environmental Management and Coordination (Conservation of Biodiversity, Access to Genetic Resources and Benefit Sharing) Regulations 2006:

The Conservation of Biodiversity Act Sections 5-9 provides for the protection of endangered species, creation of an inventory, and monitoring of their status, protection of environmentally significant areas, provision of access permits, material transfer agreements and benefit sharing. These regulations guide the construction of the project with a view to avoiding areas of environmental significance and protection of endangered species.

1.18.1.4 Environmental Management and Co-ordination (Noise and Excessive Vibrations) Regulations 2009:

The regulations define noise as any undesirable sound that is intrinsically objectionable or that may cause adverse effects on human health or the environment. The regulations prohibit any person from making or causing to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

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

1.18.1.5 Environmental Management and Co-ordination (Fossil Fuel Emission Control) Regulations 2006:

The Fossil Fuel Emission Control Regulations provide for acceptable emission standards in Kenya. Section 4 of the regulations state that any internal combustion engine for motor vehicles and generators must comply with the emission standards

provided for in the First Schedule of those regulations. Hence, anyone who operates such engines whether on the road, street, public highway or any premises, which emits smoke in excess of the emissions standard in the First Schedule contravenes the regulations and is liable to prosecution. Section 8 provides that any person intending to use any fuel catalysts other than those permitted by the authority to disclose it and seek prior approval. Establishments (including construction sites) that use generators as alternative sources of energy must take account of the regulation on the emission standards.

1.18.1.6 Environmental Management and Coordination (Air Quality) Regulations, 2008:

These regulations provide for the safeguarding of the ambient air quality and give guidelines to prevent and control air pollution. The first and seventh schedules of the regulations provide a list with associated emission limits of prohibited, controlled, and un-controlled air pollutants. The regulations also give ambient air quality tolerance limits. The regulation is relevant to the construction works (including transportation).

1.18.1.7 Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009.

These regulations provide for the protection of all wetlands on both private and public land. The regulations provide for sustainable exploitation of wetlands and are aimed at maintaining both the wetlands and hydrological, ecological, social and economic functions and services.

1.18.1.8 The Environmental Impact Assessment and Audit Regulations 2003 (Legal Notice No. 101) Regulation 24 – EIA Licence: -

Environmental Impact License shall be issued after the authority approves the study report under regulations 23 and shall be issued in form.

Regulation 28 – false or incorrect information: -Substantial change or modification and when project poses an environmental threat or revelation that information or data given by the license were false, incorrect or intended to mislead.

Regulation 24 – Annual Environmental Audit: - Annual environmental auditing after presentation of an EIA study report shall be undertaken by the licensee to ensure the implementation of environmental management plan is audited on regular basis, an audit report submitted to NEMA annually and ensuring that the criteria to audit is based on environmental management plan developed during the EIA process or after the initial audit.

Regulation 40 - Monitoring changes after project implementation.

Monitoring by NEMA and Lead Agencies shall be done to establish any possible changes in the environment and their possible impacts, immediate and long-term

effects of its operations, identify and determine parameters and measurable indicators and conduct changes that occurred after implementation.

1.18.2 Sustainable Waste Management Act

The Sustainable Waste Management Act, No.31 of 2022, was signed into law on 7th July 2022. It was developed by the Ministry of Environment and Forestry as a step towards implementation of the Ministry's National Sustainable Waste Management Policy which came into force in February 2021. NEMA's role is to regulate, sensitize the public and enforce legislation in consultation with County governments, issue licenses except where County governments have jurisdiction, conduct research and training on waste management and maintain a national database containing information reflecting the status of waste and waste management in Kenya. They also have the mandate to enforce, monitor, investigate and report on compliance and with this mandate comes the power to enter premises of any private entity and make a n enquiry relating to compliance. County governments' functions are to: Establish the financial and operational conditions for devolved waste management; Enact sustainable waste management legislation and align it with the Act; Establish waste recovery facilities, recycling facilities and sanitary landfills for the disposal of recoverable waste; Incentivise the collection and separation of waste at source in neighbourhoods and informal settlements; Ensure that cities plan for waste management facilities as part of city expansion; Prepare a county waste management plan and quarterly monitoring reports for cities, urban areas, municipalities and administrative units; Submit annual reports to NEMA and County Assembly on the implementation of the county waste management plan; and Maintain data on waste management service provision by waste management service providers and share the information at least once a year through the national waste information system to be developed by NEMA.

Private Sector entities are, generally, expected to have 3-year waste management plans and submit annual monitoring reports to NEMA.

They are also obligated to identify and eliminate potential negative impacts of their product; enable the recovery and reuse of the product where possible; reclaim and recycle; incorporate environmental concerns in the design, process and disposal of the product as well as collect and segregate hazardous from non-hazardous waste prior to disposal. Disposal should be done in a facility provided by the county government or NEMA. During disposal, they should transfer the waste to a person licensed to transport and dispose of the waste and clean up and restore the site they were using to its natural state. When it comes to their business premises, they Private Sector entities should provide waste segregation receptacles for organic, plastic and general dry waste.

1.18.3 The Climate Change Act No. 11 of 2016

The Climate Change Act came into force in 2016. The main objective of the Act is to govern the development, management, implementation and regulation of mechanisms to enhance climate change resilience and low carbon development for the sustainable development of Kenya. The Act is to be applied to all sectors of the economy by both the national and county governments. Specifically the Act is to be applied to ensure among other objectives: Mainstreaming of climate change responses into development planning, decision making and implementation; building resilience and enhancing adaptive capacity to the impacts of climate change; formulation of programmes and plans to enhance the resilience and adaptive capacity of human and ecological systems to the impacts of climate change; and, mainstreaming and reinforcing climate change disaster risk reduction into strategies and actions of public and private entities.

1.18.4 The Water Act 2016

The Act stipulates that a permit shall be required in all cases of proposed diversion, abstraction, obstruction, storage or use of water, with minor exceptions relating to use for domestic purposes (Section.36). Under the Water Act (General) Rules, it is stated that any rights acquired under the permit are subject to the Public Health Act and the Malaria Prevention Act, in addition to the Water Act itself.

1.18.5 Workmen Injury Benefit Act (WIBA) 2007

WIBA policy covers employees of the Insured whilst on duty and engaged in the execution of the Insured's business and/or any project undertaken by the insured against accidental bodily injury, disablement, death or occupational illness.

1.18.6 The Occupational Safety and Health Act, 2007

This Act of Parliament was enacted to provide for the health, safety and welfare of persons employed in workplaces and for matters incidental thereto and connected therewith. Part II of the Act provides the General duties that the occupier must comply with respect to health and safety in the workplace. Such duties include undertaking S&H risk assessments, S&H audits, notification of accidents, injuries and dangerous occurrences.

Compliance

- The proponent will appoint a reputable contractor who will be responsible for enforcing the requirements during construction and subsequent repairs and maintenance after project completion.
- They will make provision for the health, safety and welfare of persons employed in plant and other places of work. Ensure that every work place shall be kept in a clean state and free from effluvia, arising from any drain, sanitary convenience or nuisance.

- Avail fire extinguishers, which shall be adequate and suitable in case of fire out breaks. Provide adequate means of escape in case of fire outbreak for the employees.
- Ensure factory workers are in any process involving exposure to wet or to any injurious or offensive substance, suitable protective clothing must be provided.
- The proponent shall ensure that the factories and other places of work abstract is displayed at a strategic place within the factory premises

1.18.7 The County Government Act, 2012

It affirms that every municipal council has the power to establish and maintain sanitary services for the removal and disinfection, or otherwise dealing with or kinds of refuse and effluent, such as spent oil, and where any such services is established, to compel the use of such services by persons to whom the services is available

Section 166 – empowers the local authority to be responsible for local planning and development control in the city.

Compliance with this legislation

- The proponent is obligated to comply with EIA study report proposed potential mitigation measures in the EMP.
- Adhere to all directives from the County Government of Nairobi as they may arise during the full cycle of the project

1.18.8 Public Health Act (cap 242)

This legislation requires that Local Authorities now County Government take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable for injurious or dangerous to human health. Part IX section 115 states that no person shall cause nuisance or condition liable to be injurious or dangerous to human health. Part XI section 129 of the Rules states in part "It shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes, and purifying such supply so polluted". Section 130 provides for making and imposing on local authorities and others the duty of enforcing rules in respect of prohibiting use of water supply or erection of structures draining filth or noxious matter into water supply as mentioned in section 129.

Compliance

- The proponent will ensure solid waste shall be handled by a professional NEMA Approved garbage collector on regular basis and disposed appropriately as per the waste regulations.
- Sanitary facilities shall be in conformity with MOH standards and installation of standard fittings. Liquid wastes shall be contained in a waste treatment plant.

1.18.9 The Penal Code (CAP 63)

Section 191 of the Penal Code states that any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons/institution in dwellings or business premises in the neighbourhood or those passing along public way, commit an offence.

Compliance

The proponent will ensure using appropriate technology, foul air which affects the health of other persons will not be released into the environment, Further they will for the purpose of trade or otherwise, using any appropriate systems and technology, ensure there is no loud noise or offensive awful smell in such places and circumstances that may annoy any considerable number of persons in the exercise of their rights.

BASELINE ENVIRONMENTAL CONDITIONS

1.19 Introduction

This chapter discusses the physical environment and socio-economic set up within Proposed project area. The details of the information were largely based on the available data.

The proposed used oil recycling plant will be situated on Plot LR No. 20470 in Katani Location, off Mombasa Road, Mavoko Sub County, Machakos County.
The baseline information on physical, biological socio-economic and cultural aspects are important for overall assessment of the existing environmental conditions of project area.

1.20 Physical environment

The baseline information on physical, biological socio-economic and cultural aspects are presented below;

1.20.1 Climatic Conditions

Mavoko area lies so close to the Equator but being 1680m above sea-level, its temperatures are altitude-modified tropical, but not torrid. The mean annual temperature is 17° C and the mean daily maximum and minimum temperature are 23°C and 12° C respectively, On the other hand, the mean annual rainfall is 1080 mm falling in two distinct seasons: the long rains from March to May and the short rains from mid-October to December. The Northern and Western areas have a high rainfall; the East and South a low rainfall. The average annual temperatures of the area range from 18 to 20°C, with average minima and maxima of 12–14 and 24 – 26°C, respectively. The warmest period occurs from January to March. Average potential evaporation is between 1,550 and 2,200mm per year.

1.20.2 Geology and Soils

Athi River area predominantly comprises of tertiary rocks (Ngong volcanic) overlaying Precambrian basement rocks, which is exposed in small area in upper reaches of the Kitengela River. In the north, from Nairobi national park and eastwards are the Nairobi phonolites, in the west are the Mbagathi Phonolite Trachytes and to the East are Athi tuffs. These rocky basements are usually very important for providing strong foundations for buildings.

The soils covering the area have greatly been influenced by the underlying basement rock system. Most parts of the area are covered by thin black cotton soils which is a great impediment to urban development and construction in particular. On the site of

the proposed project, the soil is sandy to clay soils. This can comfortably support the proposed project development.

1.20.3 Average Daily Temperatures

The average daily temperature throughout the year varies slightly from month to month with average temperatures of around 17°C during the months of July and August to about 20°C in March. But, the daily range is much higher, with the differences between maximum and minimum temperatures each day around 10°C in May and up to 15°C in February. Between the months of June to September, southeast winds prevail in the coastal parts of Kenya and last up to several days without a break. The clouds cause day temperatures to remain low and most times the maximum temperature stay below 18°C. The minimum temperatures also remain low during cloudy nights, usually hovering around 8°C and sometimes even reaching 6°C. Clear skies in January and February also bring colder nights. The highest temperature ever reached in Nairobi was 32.8°C and the lowest was 3.9°C.

1.20.4 Average Humidity Values

Because of Nairobi's location just south of the equator in combination with humid air pumped in from the Indian Ocean, the humidity values for each day are generally on the higher end This is not to say that values are always high, since the easterly winds coming off the Indian Ocean tend to keep the temperatures standard throughout the country; therefore the —warm sticky feeling is usually not associated with Nairobi as much as one would think. In the summer to autumn months of January to April, relative humidity values have been known to plummet to anywhere from 10% to 20%. The typical day, humidity-wise, starts off with nearly saturated in the morning hours, and steadily decreases throughout the remainder of the day.

1.20.5 Average Rainfall

With these routinely high relative humidity figures, it is not surprising that the climate is one that produces much rain annually. In fact, from the past 50 years, the expected amount of rain could be anywhere in the range of 500 to 1500 mm, with the average ringing in at 900 mm. The majority of these rainfall figures crash down in Nairobi in one major and one minor monsoon seasons respectively. The major monsoon season occurs within the months of March to May, and is called the —Long Rains by the locals. The minor monsoon seasons emerges within the October to December Months, and is called the —Short Rains‖ by the citizens. That is what the meteorologists as a whole know about the monsoon seasons. What they do not know is exactly when these seasons will start. There is usually not an indication of when these rainy seasons will start, since it is difficult to determine when one starts and when the other finishes. Consequently, one may think there is only one rainy season when looking at the annual rainfall amounts

1.20.6 Average Winds

Winds along the surface are predominantly easterly throughout the entire year. They are shifted to northeast between October and April, and they are shifted southeast between May and September. Right before the —Long Rains season, the strongest winds occur, reaching speeds of 20 to 25 miles per hour. During the rest of the year, winds are usually at speeds of 10 to 15 miles per hour. During the night, the winds are calm.

1.20.7 Average Sunshine

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

1.20.8 Air quality within the area

The Proposed Used Oil Recycling Plant site located in Plot LR No.20470 in Mavoko Sub-county, Machakos County. The locations were as in table 1 below.

Table 1: Description of measurement locations

LOCATION	POINT COORDINATES	DESCRIPTION
MP 1: Main Gate	1°24'14.89"S 36°59'39.31"E	• The point is located at the main entrance of the proposed site.
MP 2: Boundary Next to Neighbour	1°24'16.69"S 36°59'39.35"E	• The point is located inside the proposed site bordering the neighbour on the South.
MP 3: *Boundary Next to Cow Shade*	1°24'17.57"S 36°59'37.66"E	• The point is adjacent to the cow shed inside the proposed site on the West
MP 4: Boundary Next to Stone Crusher	1°24'14.28"S 36°59'37.49"E	• The point is located at the boundary next to the stone crusher wall.

The Ambient Air Quality Measurement average summary results for particulate matter TSP, PM_{10}, $PM_{2.5}$, and pollutant gases measurement concentrations have been

presented in tables below. Detailed reports are appended to this report as Appendix I and II.

Particulate Matter Result Analysis

Table 2: TSP, PM_{10} and $PM_{2.5}$ Analysis Result

Description	Units	Parameters		
		TSP	PM_{10}	$PM_{2.5}$
MP 1	$\mu g/m^3$	56.31	33.36	15.72
MP 2		62.73	37.22	20.07
MP 3		71.27	41.39	16.6
MP 4		61.92	36.99	18.84
EMC (Air Quality) Regulations, 2014	$\mu g/m^3$	**200**	**100**	**75**

From the results analysis in table 3 above TSP, PM_{10} and PM $_{2.5}$ for the 4 sampling points recorded concentrations within the Environmental Management and Co-ordination (Air Quality) Regulations, 2014.

Graphical Results Presentation for Particulate Matter

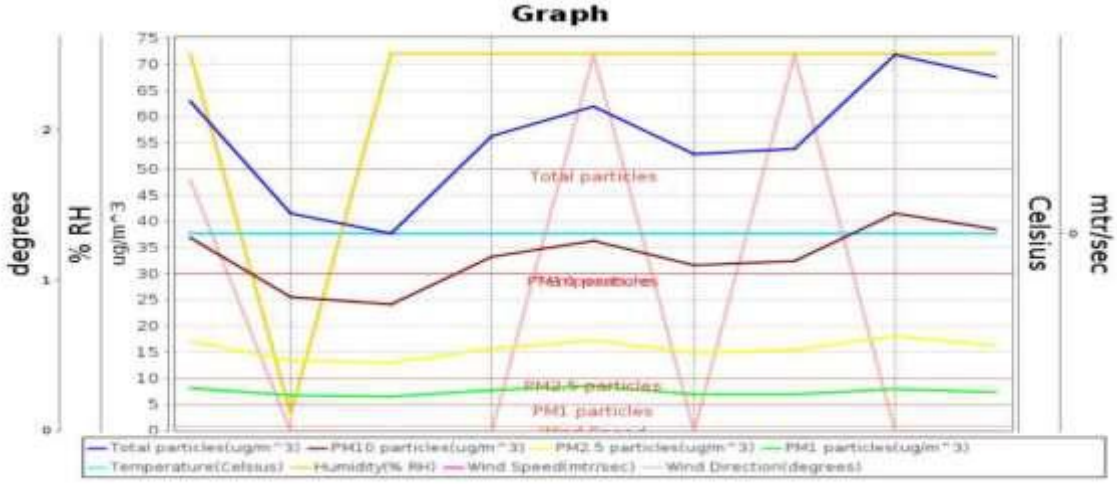


Figure 1: Particulate MP 1: Main Gate

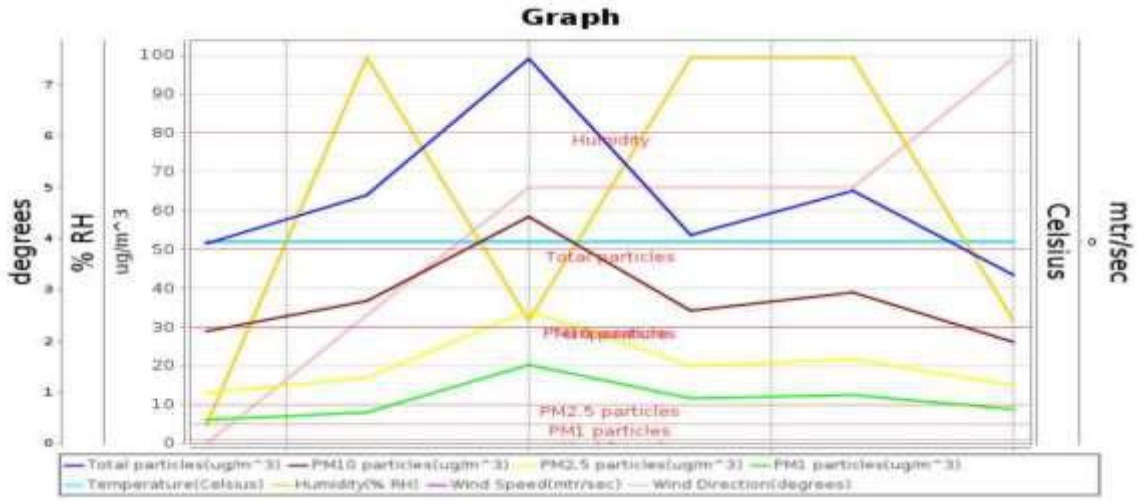


Figure 2: Particulate MP 2: Boundary Next the Neighbour.

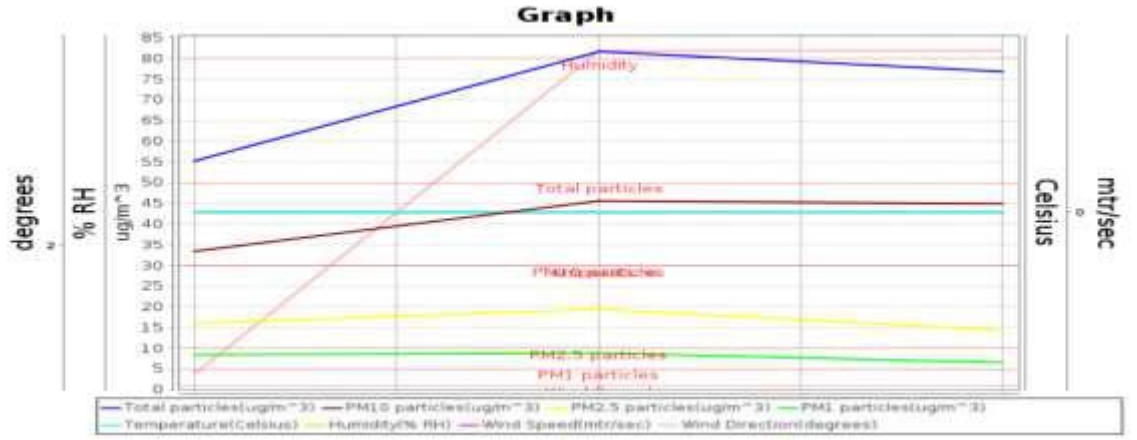


Figure 3: Particulate MP 3: Boundary Next the Cow shade.

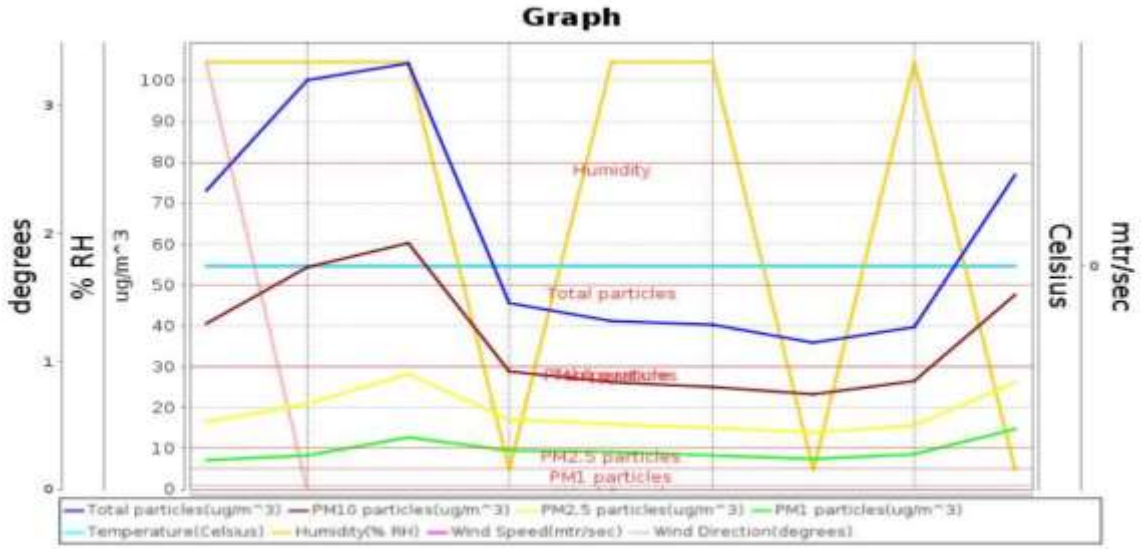


Figure 4: Particulate MP 4: Boundary Next the Stone Crusher.

Gaseous Result Analysis

Table 3: O_3, CO, NO_2 H_2S, Total VOCs and SO_2 Analysis Result

Description	Parameters					
	O_3 $\mu g/m^3$	NO_2 $\mu g/m^3$	SO_2 $\mu g/m^3$	H_2S $\mu g/m^3$	CO g/m^3	Total VOCs
MP 1	39.73	0.24	BDL	BDL	0.57	39.49
MP 2	38.6	15.46	BDL	BDL	0.69	46.54
MP 3	37.84	3.79	BDL	BDL	0.57	44.28
MP 4	22.47	8.1	BDL	BDL	0.65	41.45
EMC (Air Quality) Regulations, 2014	**120**	**80**	**80**	**150**	**2.0**	**600**

From the table above the gaseous Concentration results for the O_3, CO, NO_2, H_2S, Total VOCs and SO_2 were within the limits of EMC (Air Quality) Regulations, 2014 for all the Monitoring points.

1.2 Graphical Results Presentation for Gaseous Concentrations

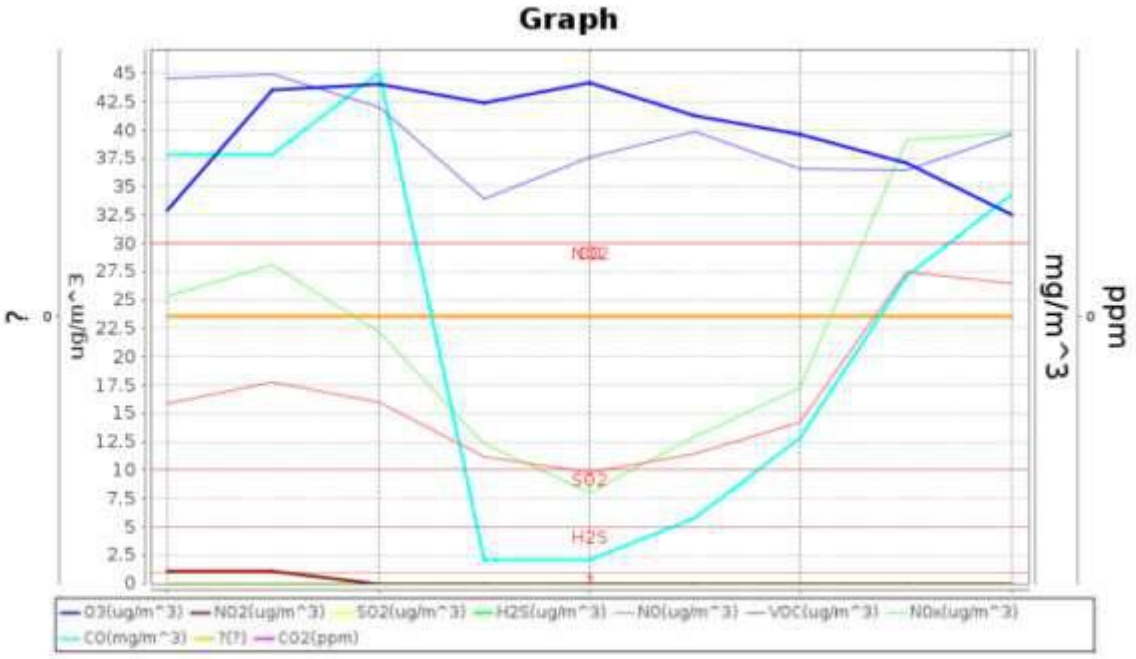


Figure 5: Gas MP 1: Main Gate

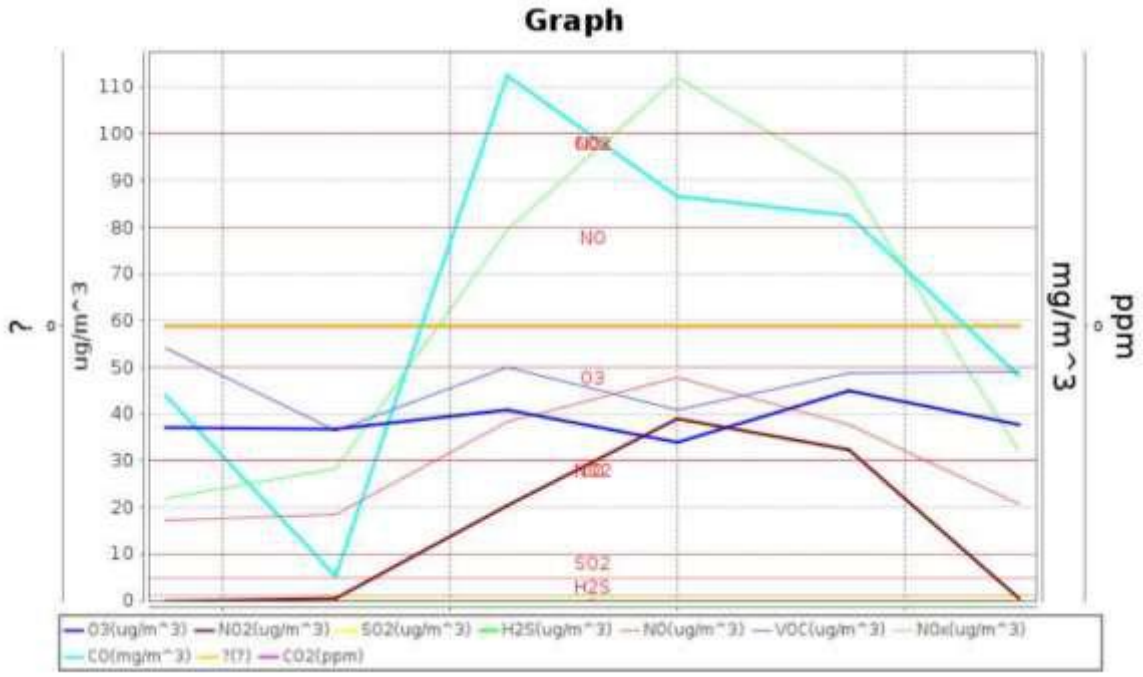


Figure 6: Gas MP 2: Boundary Next the Neighbour.

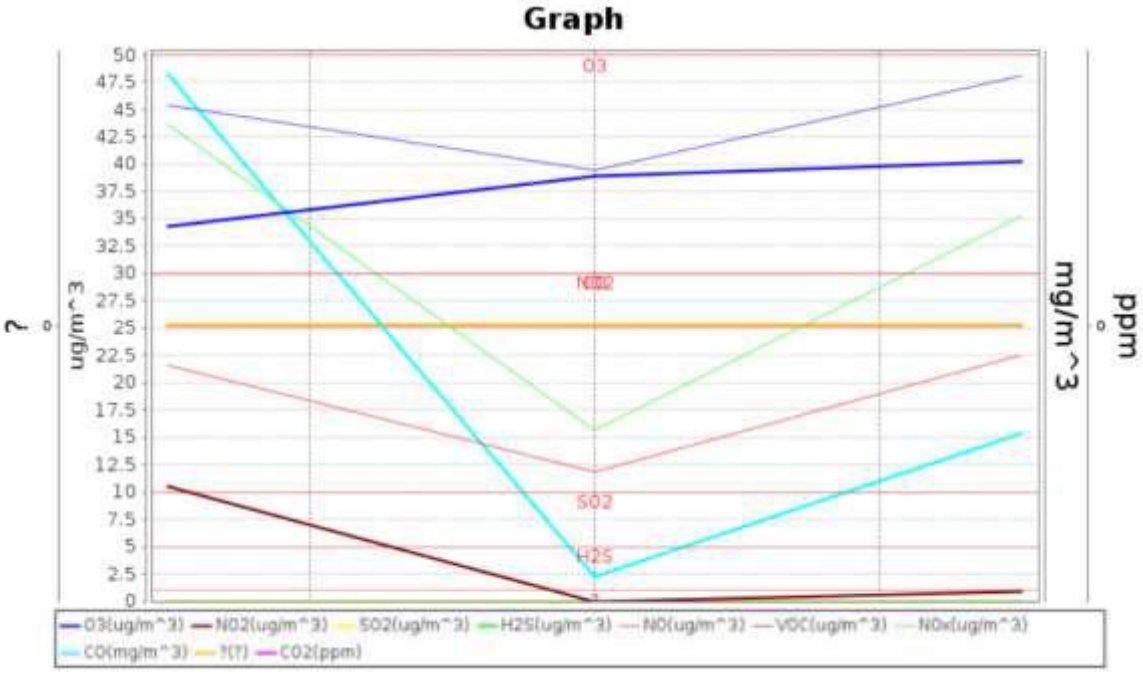


Figure 7: Gas MP 3: Boundary Next the Cow shade.

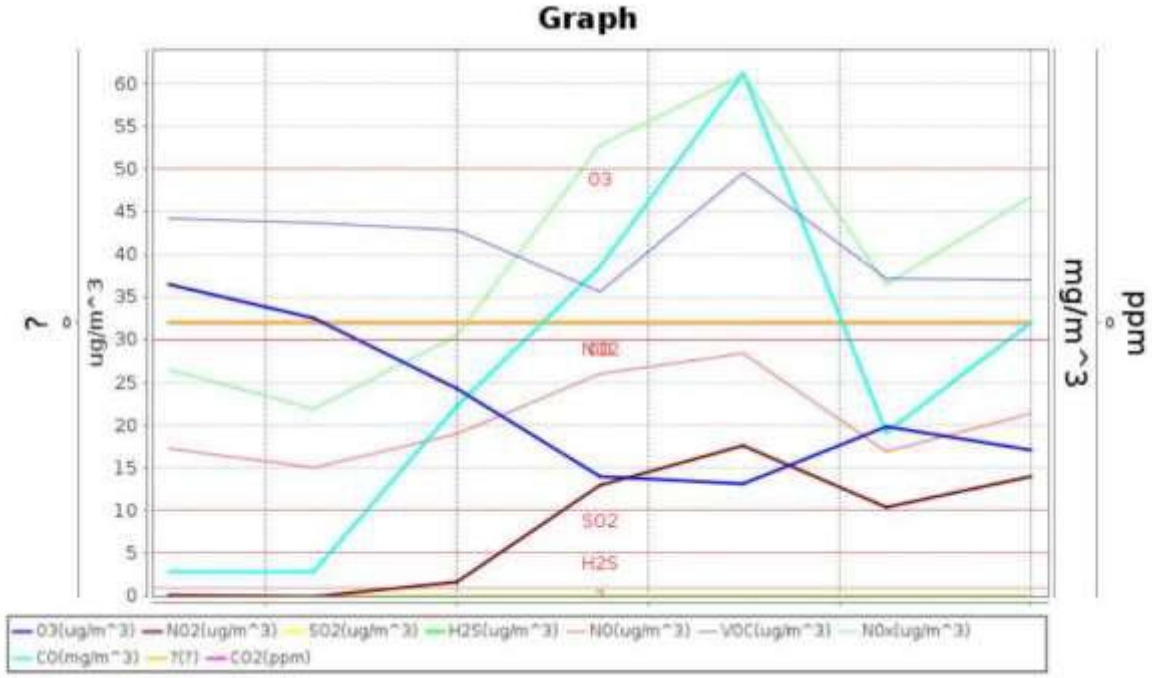


Figure 8: Gas MP 3: Boundary Next the Stone Crusher.

Based on the findings of the baseline ambient air quality assessment, the 4 measuring points had their concentration within the Environmental Management and Co-ordination (Air Quality) Regulations, 2014, for all selected monitored parameters. It is recommended that, Viraj Industries to carry out ambient air quality measurement after the plant installation to ensure continued compliance.

1.20.9 Noise levels

The noise levels (LAeq) for each measurement location are as indicated in Tables 5 below. The additional parameters recorded during the measurements, such as the Lmax, Lmin, L10, L50 and L90.

Measurements were undertaken during both diurnal and nocturnal schedule i.e. (day: 06:01 a.m. - 8:00 p.m. (Leq. 14h); night: 8:01p.m.-6:00a.m. (Leq. 10h). The measurement results are expressed as follows:

- Lmax, Maximum sound pressure level obtained during the measurement period
- Lmin, Minimum sound pressure level obtained during the period of measurement
- Leq, Value of A-weighted sound pressure level of a continuous steady sound that, within a specified interval, has the same mean square sound pressure as a sound under consideration whose level varies with time.

Table 4: The results of Diurnal Environmental Noise measurements in dB(A)

Point	LA min	LA max	LA 10	LA 50	LA 90	LA peak (Max)	LAeq	IFC/World Bank	EMC Legal Notice 2009
MP 1	51.2	75.4	60.4	53.0	50.6	91.4	**52.9**	**55**	**55**
MP 2	51.1	74.2	61.8	52.8	51.8	93.9	**52.3**		
MP 3	51.4	69.6	62.5	53.6	52.1	84.8	**53.6**		
MP 4	51.0	79.9	61.0	54.3	53.4	93.6	**54.0**		

The results presented in table 5 above shows that all Noise measurement points had their diurnal schedule measurements below the IFC/World bank guidelines and Environmental management and co-ordination Act (LN. 61 of 2009).

DIURNAL NOISE 1/3 OCTAVE BAND GRAPH LOGS

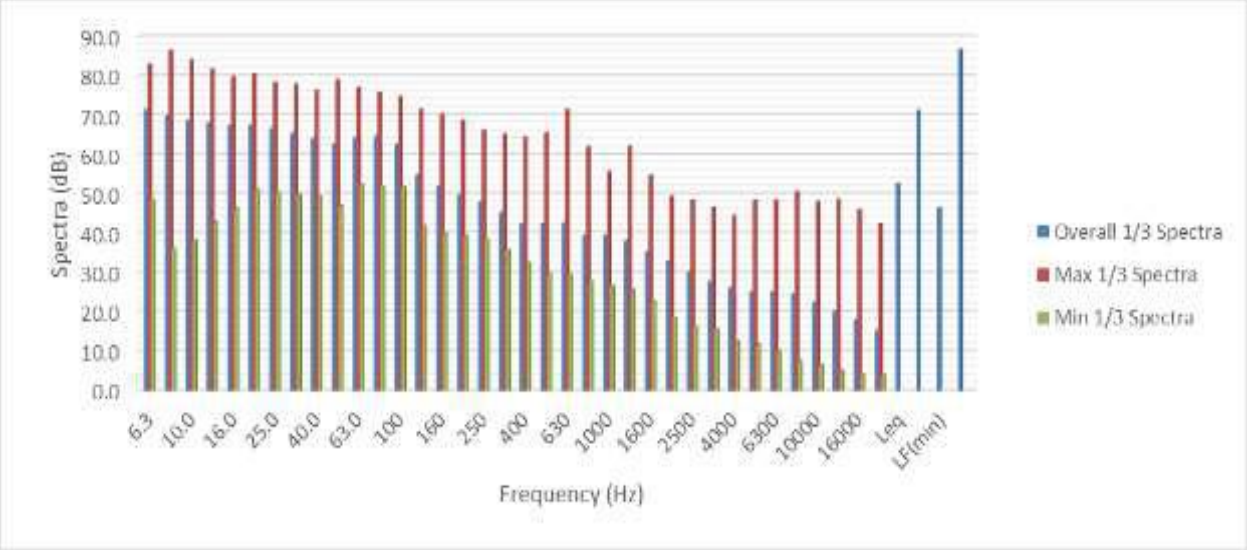


Figure 0-9: Spectra vs Frequency for Point1

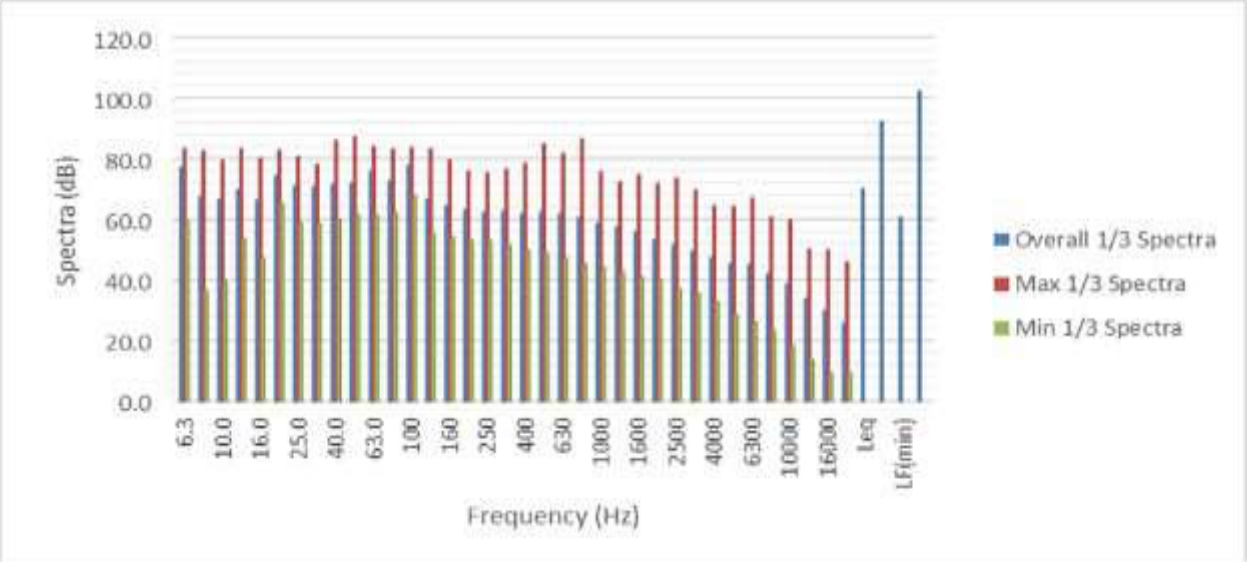


Figure 0-10: Spectra vs Frequency for Point 2

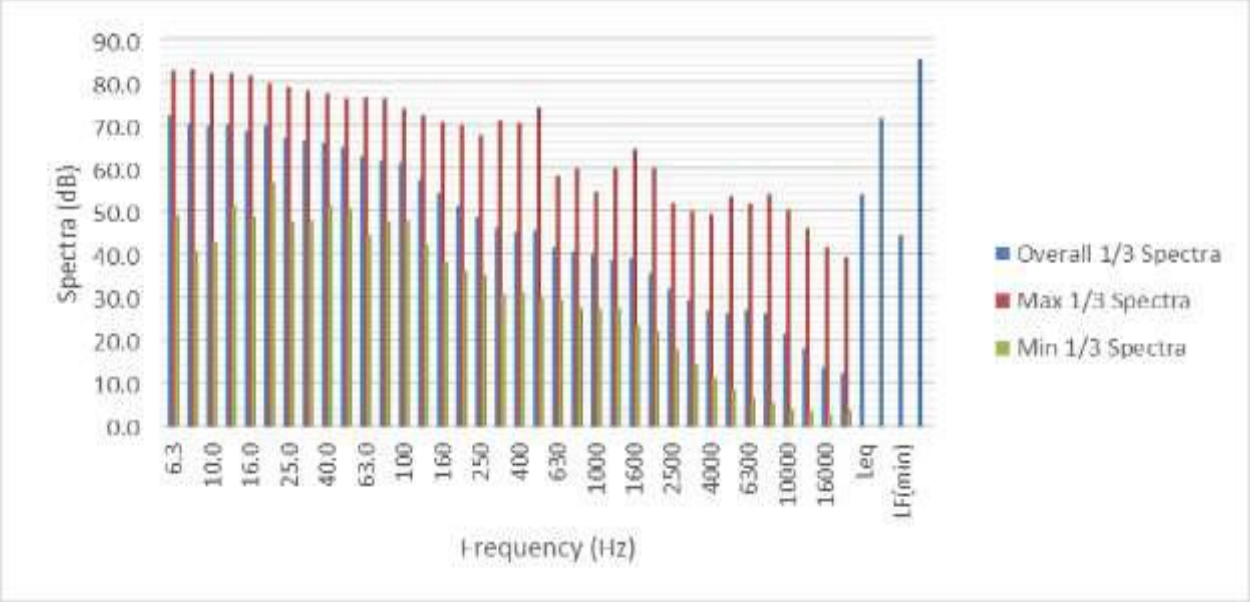


Figure 0-11: Spectra vs Frequency for Point 3

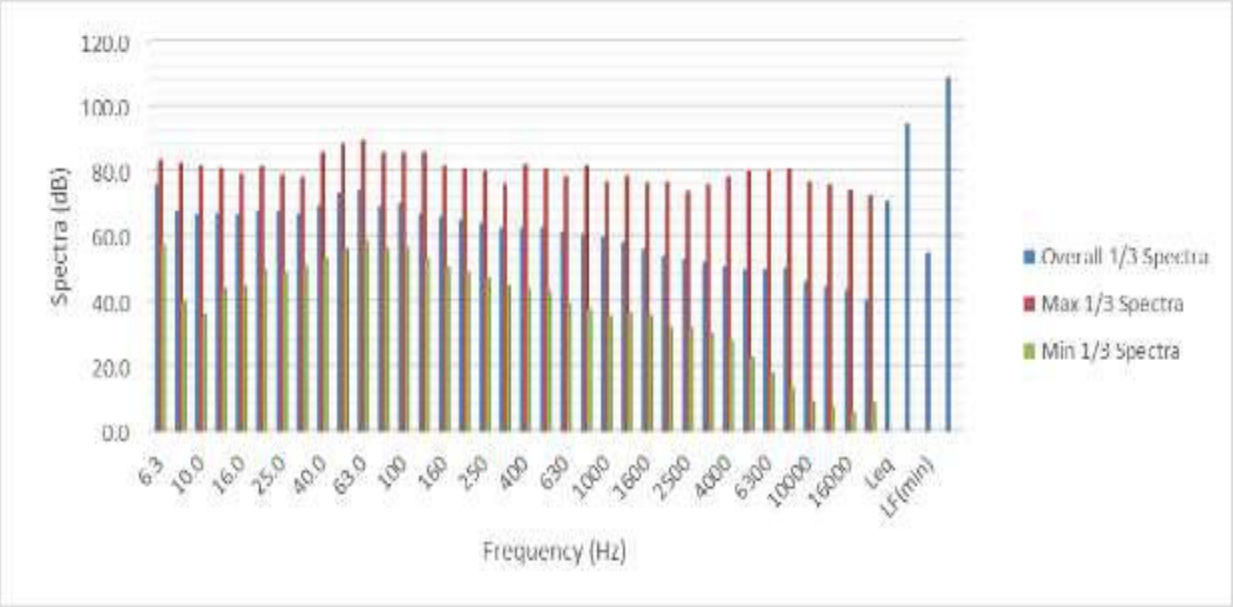


Figure 0-12: Spectra vs Frequency for Point 4

Noise monitoring was conducted at 4 preselected locations within the project boundary to determine and characterize existing ambient noise levels. The noise levels in all of the measured diurnal points were within the IFC/World bank guidelines and Environmental management and Co-ordination Act (LN. 61 of 2009.

It is worth noting that the environmental noise at all monitoring locations was generally similar in character, with the main noise sources from neighbourhood Stone crusher plant Noise.

1.20.10 Physical and 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 dominate vegetation is grasslands and some sparse acacia trees. The areas within the County are predominately plains include Mutituni, Mwala, Mua, Iveti Hills and Kathiani.

1.21 Biological environment

1.21.1 Flora and fauna

The proposed site is undeveloped parcel of land with grass and shrubs. The photo below shows the proposed site and its environs.

Shrubs and grass within proposed site.

Sheep grazing in open fields near proposed site.

1.21.2 Ecological Conditions

Machakos County is the home for Yatta plateau which is situated within the Yatta Sub County which Sub County has a land mass of 1.057 Km2 thus the second biggest Sub County. This 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 Km^2.

1.22 Existing development in the neighborhood

The neighbourhood where the parcel is located is characterized quarry activities, stone crushing site, grazing fields and sparce population settlements

Selected photos of the proposed site neighbourhood

Stone crushing site

Non-operational school structure

Proposed project area

Residential buildings near proposed site

1.23 Social, cultural, and economic characteristics

The major economic activities in the area and its environs include agriculture, stone mining & stone quarries, commercial and residential set up. The proposed project area is surrounded by quarry activities including building stone cutting and stone crushing facilities.

Stone crushing site

1.24 Population and demographic information

As per 2019 KNBS data, the population of Mavoko is 81,302. Mavoko is situated in Machakos District some 25 km south east of Nairobi. It has an estimated population of 65,000 and is popularly known as Athi River. Mavoko appears to offer a good opportunity for the expansion of the Nairobi Metropolitan Region and therefore, the area is of strategic importance.

1.25 Literacy level

The Kenya Vision 2030 has identified the education sector as key to providing skills necessary for the attainment of the social and economic goals. Hence this indicator is quite critical. Literacy level is 87% against national rate of 82.9.

1.26 Economic activities

1.26.1 Manufacturing and Industry

Mavoko hosts a significant number of manufacturing plants and industrial parks. The Athi River region is known for its cement factories, such as East African Portland Cement Company, Bamburi Cement, and Savannah Cement.

Other manufacturing activities include the production of steel, paper, plastics, and chemicals. The Export Processing Zones (EPZs) in the area also contribute to the industrial output, providing goods for both local and international markets.

1.26.2 Construction and Real Estate

The construction sector is booming in Mavoko due to its proximity to Nairobi and the increasing demand for residential, commercial, and industrial properties. There are numerous housing developments, office buildings, and retail complexes being built.

Infrastructure projects, such as roads and bridges, are also significant contributors to the local economy, driven by both government and private sector investments.

1.26.3 Transport and Logistics

Mavoko's location along major transport corridors, including the Nairobi-Mombasa Highway and the Standard Gauge Railway (SGR), makes it a crucial logistics hub. The area serves as a key point for the distribution of goods to and from Nairobi and other parts of Kenya. The logistics and warehousing sector are expanding, with several companies setting up distribution centers in Mavoko.

1.26.4 Agriculture

Although Mavoko is becoming increasingly urbanized, agriculture remains an important economic activity in the surrounding areas. Small-scale farming, including horticulture, dairy farming, and livestock rearing, supports the local economy.

The fertile lands along the Athi River are suitable for growing vegetables, fruits, and other crops, which are supplied to local markets and Nairobi.

1.26.5 Retail and Commerce

The retail sector in Mavoko is growing, with numerous shops, supermarkets, and markets serving the local population. Shopping centers and malls are also emerging to cater to the increasing urban population.

The growth of the middle class in the region has spurred demand for various consumer goods and services.

1.27 Land and land use

Mavoko, also known as Athi River, has undergone significant changes in land use patterns due to urbanization and industrial growth.

The land use in Mavoko is characterized by a mix of residential, commercial, industrial, agricultural, and recreational zones.

1.28 Employment

As of 2023, the employment situation in Mavoko, is shaped by its rapid urbanization and industrial growth. The area hosts several industrial zones, including the Athi River Export Processing Zone (EPZ), which has become a significant source of employment. The EPZ currently employs about 50,000 people, with plans to increase this number significantly through infrastructure improvements like the new railway siding project aimed at boosting local manufacturing and export activities.

1.29 Energy Sources

The power (electricity) is accessible through connection to the Kenya Power distribution grid and can be connected to the site. A standby generator is also available to cater for periods when there are interruptions in the power supply.

1.30 Surface water Drainage

The proposed development will increase paved area resulting in increased surface water discharge. The proponent will construct drainage channels to absorb the increased water discharge and direct it to the recommended area.

The proponent will also construct an interceptor for treatment of effluents before discharge to environment.

1.31 Utilities and Services

Water supply

The site will be connected to Mavoko Water and Sewerage Company among other service providers available during construction and operation.

Solid waste Disposal

The proposed project will generate fair amounts of solid waste. The proponent will engage a licensed waste handler to dispose the waste at the recommended site by the Machakos County government.

Electricity and Telecommunications Services

The area is served with electricity power line serving the area. The area is also well served by the Telkom, Safaricom, and Airtel telephone providers.
The site is closer to Kenya power and lightening national grid.

PUBLIC CONSULTATION AND PARTICIPATION

1.32 Introduction

This chapter outlines the key issues raised by the public on the proposed project.
The findings indicated that the stakeholders support the project as long as they are involved and fully sensitized on the same.

1.33 Objectives of Public Consultation

The need for public consultations as required by EMCA was to:

- Disseminate and correctly inform the stakeholders about the project, its key components, location and expected impacts.
- Awareness creation on the need for EIA.
- Gather comments, concerns and suggestions of the interested and affected parties.
- Ensure that the concerns of the stakeholders were known to the decision-makers early enough.
- Incorporate the information collected into the ESIA study

The purpose for such a process was to identify the positive and negative impacts and subsequently promote and mitigate them respectively. It also helped in identifying any other miscellaneous issues which may bring conflicts in case project implementation proceeded as planned.

1.34 Response from the stakeholders

The consultant engaged the neighbours and interested parties in the proposed project through a public baraza held on 10th July 2024 near the proposed project site their views, comments and concerns were documented in minutes and questionnaires administration.




Public engagement and participation

The table below shows the responses.

No.	*Name*	*ID/Phone Number*	*Concerns*	*Response*
1.	Follett Moi	32797744 *(0741540920)*	Inquired if the plant will have effluent discharge to the environment. Cabon monoxide emissions	Sewage & waste water from the kitchen to be discharged into the septic tanks. Surface runoff and other suspected contaminated water to be channelled to oil/water interceptor before discharge to the environment. Stuck emissions will be managed through installation of fume arrestors and air quality monitoring.
2.	Wickliff Ogando	32221209 *(0713713866)*	What are the direct benefits of the project to the community.	Several workers including casual labourers, and engineers are expected to work on the project

No.	*Name*	*ID/Phone Number*	*Concerns*	*Response*
				during the construction period. Semi-skilled, unskilled labourers and formal employees are expected to obtain gainful employment during the period of construction.
3.	Carolyne Mbithe	*33454460* *(0746104228)*	How will the proponent manage dust from heavy transport vehicles movement. Management of accidents and road damages	The contactor shall ensure dust and air pollution through continuous water sprinkling on access roads during construction. Limiting speed and putting up safety signages for heavy vehicles operation near the site to prevent accidents. The contractor will be required to maintain the roads evidently damaged during construction and operation of the project. The proponent and contractor will be expected to fully implement the ESMP prepared in the ESIA report for the proposed project.
4.	Kenajo	10435602 *(0722959270)*	What is the quantity of emissions from boilers during operation and its impacts to the local residents.	Fume arrestors to be utilized to control and minimize emissions during operation that, the arrestors convert fumes to liquid state for efficient management. Proper pipework during installation will also be done during installation of the plant.
5.	Madam (Preferred nickname)	-	There are residential structures near the proposed site and the residents might be affected by the project impacts.	All complaints are documented and presented in report for NEMA to make final decision. If approved, the consultant will have documented all the possible project impact and provide mitigation measures, the proponent with the contractor shall implement them throughout the project cycle. Further, a gazette Notice will be circulated to collect further complaints and views.
6.	Jacinta Kinyanjui	33123072 *(0708298200)*	What are the procedures for getting jobs from the project	Upon project approval, by authorities, the proponent will advertise the job vacancies and welcome all the applicants for interviews and analyse based on their merits.
7.	Felix Kalembo	35005890	Noise pollution, dust emissions and traffic	The contractor during construction shall operate only during peak hours

No.	*Name*	*ID/Phone Number*	*Concerns*	*Response*
		(0717844179)	congestion	during the day only (8AM- 5MP). Heavy traffic will be experienced and limited to raw material delivery.
8.	Ann Mutava	27985097 (0725108558)	The project safety of people living near the project site	Upon approval, the proponent will conduct periodic risk assessments prior and during project construction. The contractor shall engage site Health and safety advisor to ensure safety of both the workers and the locals. The proponent will install appropriate and sufficient fire detection systems and fighting equipment. Additionally, all the employees will be trained on occupational safety and fire safety.

1.35 Summary of issues raised by the stakeholders

Organizations had some reservations about the project and raised the following anticipated negative impacts:

(i) The project will result in increased traffic hence, delay in movement.

(ii) Noise pollution from machineries is expected to emerge during the construction phase. This would disrupt the quite environment.

The following suggestions were raised as part of mitigation measures by the stakeholders:

i. The contractor should ensure that noise pollution is controlled. Minimal levels of noise should be maintained to avoid nuisance.
ii. The project construction period should be shortened.
iii. The contractor should ensure that no waste is dumped in the neighbourhood of project site.
iv. The contractor should ensure proper environmental management practices are put in place.
v. Emissions from the plant operation to be arrested and air quality monitoring be implemented.
vi. All oil spills and other effluents from the facility should be arrested and disposed as guided by NEMA.

1.36 Conclusion

The issues raised by the stakeholders and many others foreseeable impacts have to be adequately addressed by the proponent. The proponent should ensure time to time engagement with the community throughout the construction and operation project phases for concerns and mitigate timely any negative impact from affecting the neighboring facilities operations.

PROJECT ALTERNATIVES

1.37 Introduction

Regulation 16 (b) of Environmental (Impacts assessment and Audit) Regulations, 2003, requires identification and analysis of project alternatives while undertaking an ESIA. The best feasible alternative should be selected based on least negative impacts and cost-benefit analysis. This section analyses the project alternatives in terms of site, technology and waste management options.

1.38 The proposed project construction alternative

The EIA Project report has been prepared for submission to NEMA; facts, findings and recommendations/proposals of which are based on the proposed site, 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 must ensure that all environmental measures are complied with during the preparation, construction and 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 Plan have been prepared as per the proposed project.

1.39 Site Selection / relocation option

Relocation option to a different site is not an option available for the project implementation as this purchased the parcel of land with the intention of setting up the proposed project.

1.40 "No project" alternatives

Under the "No Project" alternative, the proposed project shall not be constructed.

This will mean the used oil recycling plant project will not be developed, and the proposed site will not be utilized. The 'No Project Option' is the least preferred from the socioeconomic and partly environmental perspective due to the following factors:

- No employment opportunities will be created for local citizens who will work in the project and after the development of the proposed project,
- Industrial development in the area will be limited and thus loss of local and national government.
- Development of infrastructural facilities will not be undertaken, e.g., Road networks, water connection etc.

From the analysis above, it becomes apparent that the 'No Project' alternative is not attractive to the traders, local people, and the proponent.

1.41 Alternative design, 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. The project will be made using locally sourced materials that meet the Kenya Bureau of Standards requirements.

The construction materials have been selected in consideration of the following advantages:

- Use of recycled materials
- Reduction in noise levels at construction sites
- Reduction in the amount of construction waste
- Reduction in transport cost
- Reduction in site disturbance
- Savings in construction time and cost.

1.42 Solid waste management alternatives

A lot of solid wastes will be generated from the proposed project, which could be detrimental to the environment. An integrated solid waste management system has been recommended to mitigate any impacts of solid waste generated from the project during construction and operation of the proposed project. 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. Finally, the proponent will ensure regular waste removal and disposal in an environmentally friendly manner. This is the most practical and feasible option for solid waste management considering the described options.

1.43 Comparison of Alternatives

From the above discussion, alternative technologies have been considered and their relative merits discussed. The proposed project is therefore appropriate to the extent that it will improve the existing market and great more opportunities for local people. It will also lead to creating employment for more people during construction and operation stage.

POTENTIAL IMPACTS AND MITIGATION MEASURES

1.44 Introduction

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 and the operation phases 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.

1.45 Approach

The process involved in assessing the potential impacts of the project used the following steps:

Prediction: What will happen to the environment as a consequence of the project?

Evaluation: will it have beneficial or adverse effects? How big is the change expected to be? How important will it be to the affected receptors?

Mitigation: if the impact is of concern, can anything be done to avoid, minimize, or offset the impact? or to enhance potential benefits?

Assessment of Residual impact: After mitigation, is the impact still of concern?

1.46 Positive impacts during construction phase

1.46.1 Creation of employment

Both during construction and operation of the proposed project, many people within the project area will get employment opportunities for both professionals and unskilled workers. Several workers including casual labourers, and engineers are expected to work on the project during the construction period. Semi-skilled, unskilled labourers and formal employees are expected to obtain gainful employment during the period of construction. With labour intensive construction technologies, the project will provide employment for youths and provide support to the Government of Kenya initiatives on creation of jobs.

The creation of employment opportunities is beneficial both from the economic and social point of view. Economically, it means abundant unskilled labour will be used in civil works and transport of construction materials. Socially these people will be engaged in productive employment and minimize social ills like alcohol abuse. This

positive social change in the social behaviour will be one of the anticipated transformational indicators in the project area.

1.46.2 Increased income to suppliers and transporters of construction materials

Transporters, suppliers of construction materials and other service providers are likely to benefit during the construction phase of the proposed project. Income earned will contribute towards economic development through tax remittance.

1.46.3 Stimulation of business activities in the neighborhood

As a result of spill-over effects brought about by increased spending power by the workers, local businesses will enjoy increased sales thus enhancing the living standards of the operators.

1.46.4 This is also likely to spur the local development.

The workforce will create demand for goods and services in the neighborhood and hence more businesses are likely to come up as a result of competition to meet the increasing demand.

1.46.5 Additional revenue to the government.

Once implemented, the proposed project will increase revenue to the central government and Machakos County Council. This will be in form of permits, license fees, income tax and other government taxes.

1.47 Potential negative impacts and mitigation measures during construction phase

1.47.1 Increased Traffic

Delivery of construction materials to the construction site has the potential of interfering with the smooth flow of traffic along the access roads leading to the site. This can result to road accidents, waste of time for other road users and increased fuel use for vehicles held in a jam.

Proposed Mitigation Measures

i. Use of appropriate traffic signs

The main contractor shall be required to post at the entrance to the site, appropriate traffic signs and notices including 'slow down, heavy vehicles turning'.

ii. Controlling traffic flow

Vehicles delivering materials to the site should be directed by the security guards and/or appointed flag men.

iii. Scheduling of deliveries

Delivery of materials to the site should be scheduled at times of light traffic load to minimize chances of congestion and/or accidents

iv. Maintaining a record of incidents and accidents at the site

The main contractor should maintain a record of accidents and incidents at the site. Based on this record, incidents and accidents should be investigated and appropriate actions taken.

v. Provision of designated parking

Trucks delivering construction materials are to be parked inside the yard to prevent obstruction.

vi. Define speed limit

Speed limit within the project area to be defined and enforced and any driver found not complying to be warned.

1.47.2 Noise Generation

Noise is unwanted sound - the wrong sound at the wrong time or place. Use of earth moving equipment during construction phase will be associated with noise emission that has the potential of interfering with the activities of people nearby. Besides this, unnecessary hooting of motor vehicles can also be a source of noise. This sound may become noise, especially in the evening and during normal sleeping hours. Noise generated during the construction phase of the proposed project will have the potential of creating nuisance to neighbours to the site.

The neighbours may suffer loss of enjoyment of their property or worse, their health may suffer due to loss of sleep or due to anxiety. Noise emitted above the recommended limit, can also result to hearing impairment.

Machines may get noisier because of the following reasons:

- Worn or chipped gear teeth – will not mesh properly. The shiny wear marks are often visible on the teeth.
- Worn bearings - bearing wear creates vibration and noise, as flat spots or cracks appear in the balls.
- Slackness between worn or loose parts – causes rattling noises, squealing from slack drive belts, "piston slap" in motors, air leaks, etc.
- Poor lubrication – causes squeaking noises due to friction or impact noise in dry and worn gears or bearings.
- Imbalance in rotating parts – imbalances with fan impellers or motor shaft will show up as excess vibration.
- Obstruction in airways - a build-up of dirt or a bent/damaged piece of metal in an airway or near a moving part, e.g., a bent fan guard, can cause whistling or other "air" type noises.
- Blunt blades or cutting faces - blunt or chipped saw teeth, drill bits, router bits etc, usually make the job noisier as well as slower.

- Damaged silencers - silencers for air-driven machines or mufflers for engines may become clogged with dirt, rusted out or damaged, so losing their ability to absorb noise and;
- Removal of noise-reducing attachment like mufflers, silencers, covers, guards, vibration isolators etc. which reduce noise.

Proposed Mitigation Measures

Increased attention to maintenance of tools and equipment will reduce worksite noise levels. Maintaining the plant and equipment in good order not only increases its life, but makes it safer to use and quieter. In many cases, a noise hazard will be created or made worse by lack of maintenance. Parts may become loose, creating more noise because of improper operation or scraping against other parts. Grinding noises may also occur as the result of inadequate lubrication. It is especially important to provide proper maintenance of noise control devices which are added or built into machinery. Loose and worn parts should be fixed as soon as possible.

Machines or equipment should be inspected to find out if there are any problems starting to appear. Check for signs of wear or if the machine's performance is down. Some problems will appear as looseness or increased vibration. Listen for new noises, especially tonal ("whining") sounds, repeated impacts, or high frequency ("screech") sounds. Also, slipping belts will cause a screech at start-up, while a damaged bearing may appear as a "clunk" during run-down. Ideally, the worksite should have a system in place for checking and servicing the various machines and power tools.

Other measures for noise reduction include reduction of idling time of vehicles which are not in use, warning drivers to avoid unnecessary hooting of vehicles, enclosure of noisy equipment with temporary barriers and carrying out construction activities between 8.00 a.m and 5.00 p.m. However, good planning and design of operations and activities, and a common-sense consideration of others should avoid most noise problems.

Where high noise levels exceeding 85 dB(A) cannot be avoided, workers should be provided with appropriate hearing protectors and their use enforced.

1.47.3 Dust Emissions

During site preparation, transportation of construction materials (such as cement, sand and ballast) to the site, offloading of the materials and concrete mixing, there will be the potential for dust emission. Dust or particulates released into the air can cause significant environmental impacts such as soiling of property or surfaces, impaired visibility and personal discomfort (for example, gritty eyes). In addition, dust has the potential of creating nuisance and respiratory ailments to construction staff and the

neighbours to the site. The construction staff will be much affected by dust as opposed to the road users and the people staying or working in the neighbourhood.

Proposed Mitigation Measures

Dust emission can be managed by implementing the following mitigation measures

i. Enclosing the concrete mixer

Temporary enclosure of the concrete mixer incorporating dust nets can reduce the amount of cement particles released into the atmosphere.

Providing workers with personal protective equipment:

Workers on site should be issued with personal protective equipment including dust masks, coveralls and eye goggles to avoid inhalation of dust particles.

ii. Use of water sprays

Water sprays should be applied on all exposed earth surface as frequent as possible. This will suppress emission of dust particles to the atmosphere. Earth mounds should also be sprayed with water to reduce the quantity of air blown particles.

iii. Enclosing the construction site with perimeter fence

The proposed site has been enclosure entirely with 3m high concrete perimeter fence, this will greatly reduce wind-blown dust emission to the neighbouring developments.

iv. Covering of trucks transporting loose materials

All trucks transporting loose materials like sand to and from the site should be covered with canvas to prevent the materials from being blown by wind.

1.47.4 Exhaust Emissions

Fuel powered construction equipment including bull dozers, excavators, graders and trucks emit pollutant fumes into the atmosphere as a result of combustion of hydrocarbon fuels. This condition worsens especially when the equipment is not serviced on a regular basis.

The exhaust fumes comprise of carbon dioxide, carbon monoxide, nitrogen oxide as (NOx) and Sulphur dioxide as (Sox).

Such emissions are potentially hazardous to workers and the public because they have a potential of contributing to respiratory ailments.

Carbon dioxide and nitrous oxide (N_2 O) significantly to the greenhouse effect. In addition, combination of nitrogen and Sulphur oxides (NOx and Sox) with atmospheric water vapour results to formation of acid rain.

NOx and SOx when combined with water vapour, form nitric and sulphuric acids that return to the earth as acid rain, snow or fog. This contributes to the acidification of soils and surface water bodies. Acid rain threatens biodiversity and also causes damage to buildings.

Proposed Mitigation Measures

Gaseous emissions can be controlled by ensuring that all fuel powered construction equipment is serviced and maintained on a regular basis.

- *Spillage of Hazardous Materials*

There is a likely hood that fuel for emergency purposes will be stored at the construction site. In addition, minor servicing of equipment including oil change might be undertaken at the site. Refueling of construction equipment and oil change can result to accidental spillage of fuel or oil onto the ground surface.
Other potential sources of spillage include paints stored on site in bulk.
This has the potential of causing soil and surface water contamination.

Mitigation Measures

- Document spill prevention procedure & response plan.
- Major maintenance operations to be carried out offsite.
- Maintain appropriate spill response kits at the site.
- Use of drip trays for minor servicing of equipment.
- Hazardous materials to be stored in closed containers placed on water proofed surface and protected from direct sunlight and rainfall.
- Minimize the quantity of hazardous materials stored at the site.

Action to be taken in the event of spillage should include.

- Taking immediate steps to avoid the spillage spreading and contaminating a wider area;
- Keeping other people and vehicles away from the site;
- wearing protective clothing appropriate to the use of the hazardous material involved;
- Soaking up the hazardous material with absorbent material such as dry sand, soil or wood shavings in the case of a liquid, and removing the contaminated matter with a brush and shovel and storing securely in a bag to be disposed of safely
- If there is a risk of the spillage becoming airborne, some damp sand should be scattered before attempting to decontaminate;
- Decontaminating any remaining traces of spillage including that on vehicles or equipment by washing down and draining the contaminated water to a safe place, or soak-up; bathing or thoroughly washing immediately afterwards.

Elevated and overhead work

Elevated and overhead work during construction phase of the proposed project will entail construction of the walls, erection of the roofs on buildings, fixing of windows, and finishing.

Workers operating at height have the potential of accidental falling on the ground surface or concrete floor hence exposing themselves to injuries. Falling objects from high levels have also the potential of causing injuries to staff and/or visitors to the site.

Proposed Mitigation Measures

- Provide safety nets/traps prior to commencing work at height.
- Use of appropriate notices and signage to warn workers against falling objects.
- Restrict access to the site by unauthorized personnel.
- Ensure statutory inspection of all lifting equipment (Chain blocks and cranes).
- Ensure cranes are operated only by trained and experienced personnel.
- Lifting equipment should not be overloaded.
- Provide safety harnesses and scaffolding while working at high levels.
- Provision of appropriate personal protective equipment (helmets, safety boots, coveralls).
- Provide appropriate number of first aid kits which should be restocked on regular basis.
- Adequate number of workers to be trained on first aid administration.
- Names of trained first aiders to be conspicuously displayed at the site.
- Maintain a record of incidents & accidents on site.
- Document the procedure for working at heights.

1.47.5 Fire

Fire at the construction site is likely to occur as a result of an electric fault or poor storage of fuel within the site. Fire has the potential of causing loss of life and/or property.

Proposed Mitigation Measures

- Provide appropriate firefighting equipment.
- Train workers on firefighting.
- Ensure inspection of the fire equipment.
- Designate a smoking zone.
- Post No smoking signs at the storage area for the fuel and/or oil.

1.47.6 Solid waste generation and disposal

The construction phase of the project will generate wastes such as fugitive soil, debris, cement bags, plastic containers, metal end cuts especially at steel section, stripped off vegetation, plastic bags, all of which will need to be disposed of as per the NEMA guidelines on waste management.

Solid waste has the potential of causing aesthetic degradation and nuisance to employees and visitors around and within the construction site. They are also capable of blocking storm drains thereby causing localised flooding.

This impact is short term. However, the disposal mechanism of the wastes can have long term consequences.

Mitigation measures

- All solid waste will be collected at a central location at site and will be stored temporarily until removal to an appropriately permitted disposal site by county government.
- No dumping within the surrounding area is to be permitted. Where potentially hazardous substances are being disposed, a chain of custody document should be kept with the environmental register as proof of final disposal.
- Waste generated at the site should be segregated by the contractor and disposed of in a suitable manner into different waste streams (including general and hazardous waste). Wherever possible recycling should be carried out.
- Provide suitable, segregated and well labelled solid waste containers to proper disposal of the wastes.
- Reuse of topsoil for landscaping of the site.

Occupational health and safety risks

General health and safety risks associated with the proposed project include poor workmanship on the part of the workers and their employer (Contractors).
Poor workmanship has the potential of causing injuries and to the worst extent loss of life.

Proposed Mitigation Measures

- Construction of a site office for coordinating construction activities.
- Appoint a responsible person to be oversee all health and safety issues.
- Document appropriate emergency response procedures.
- Conduct mandatory safety inductions for all visitors to the site.
- Document and display at the site emergency phone contacts of the nearest ambulance service provider, police post and dispensary.
- Obtain indemnity cover for all the workers on site.
- Provision of wholesome drinking water to workers.
- Use of permits to work for critical tasks such as electrical installations and hot works (welding).
- Maintain a register of workers on site.
- Designate an emergency assembling point.

- Hold pre-job safety meetings with the hired workers to discuss safety issues pertinent to the job, such as site-specific emergency plans and job-specific hazards.
- Hold toolbox and monthly meetings to discuss general safety concerns, review incidents, and determine actions needed to implement job safety.

1.47.7 Soil erosion

The activities involved in the site preparation and excavations of the foundation may have a major negative short-term impact on soil. This is due to the excavation works and removal of vegetation from the area which will leave considerable areas of soil exposed to the elements, which may result in soil erosion.

Mitigation measures:

- Install appropriate drainage systems to direct water away from slopes;
- Avoid as far as possible the traversing of bare soil by vehicles to reduce soil compaction;

1.48 Potential negative impacts and mitigation measures during operation phase

Potential negative impacts during operation phase of the project are those associated with fire, general safety, spillage of materials, increased traffic, direct contact with hazardous materials and waste disposal as discussed below:

1.48.1 Fire outbreak

Collection of recycled oil by trucks from the site has the potential of causing fire where this is not properly handled. Fire can cause loss of life and/or property.

Proposed Mitigation Measures

- Smoking and use of naked flame within the site should be prohibited using appropriate signs.
- Provide suitable and adequate number of firefighting equipment at strategic points within the facility and ensure they are maintained in good working order for use during emergencies.
- Document and display at strategic points, emergency fire evacuation procedures.
- Designate a fire assembling point at a safe place.
- Provide at least two sand buckets at the oil storage area.
- Train staff on firefighting techniques to ensure adequate preparedness in times of fire emergencies.
- Maintain a well-stocked first aid kit at the facility and ensure it is located at an easily accessible place.
- Train staff on basic first aid techniques and ensure they undertake refresher course at defined intervals.
- Annual fire audit to be carried out and recommendations implemented
- Conduct regular fire drills.

1.48.2 Occupational Safety and Health Risks

General safety and health risks during operation phase are those to do with security, operation of equipment and storage of recycled oil. The risks have the potential of resulting to damage to equipment, injuries and loss of property and/or life.

Proposed Mitigation Measures

- Employ security guards from reputable firms.
- Maintain at the site standard first aid kits.
- Train adequate number of staff on basic first aid administration.
- Carry out annual statutory health and safety audit.
- Train staff on equipment operation.
- Establish a workplace Health and Safety Committee where the number of employees exceed twenty (20).
- Register the facility as a workplace.
- Carry out health and safety committee meetings on a regular basis.
- Enclose the site with a concrete perimeter wall incorporating steel gate.

1.48.3 Waste Generation and Disposal

The type of waste that will be generated during operation phase of the facility include sewage, oily rags, empty plastic containers, oily water, and assorted office waste. Indiscriminate disposal of the various waste streams has the potential of contaminating surface water and soil resources and causing aesthetic degradation. Sewage has also the potential of impacting negatively on public health.

Mitigation measures

- Contract a NEMA licensed waste handlers to collect oily water from the facility for appropriate disposal.
- Provide staff with personal protective equipment including coveralls, safety boots and gloves.
- Oily rags to be accumulated safely for collection and incineration by NEMA licensed incinerator operators.
- Provide suitable and well labelled solid waste containers.
- Proper segregation of solid waste.
- Contract a licensed solid waste transporter.
- Sewage & waste water from the kitchen to be discharged into the septic tank.
- Regular inspection of the sewer line for blockages.
- Contract a NEMA licensed sewage exhauster to exhaust sewage from the septic tank prior to overflowing onto the ground surface.
- Implement an oil skimming programme for oil/water interceptors to ensure normal functioning.

- Carry out water quality test for waste water discharged from the decanting chambers through the oil/water interceptor at least once in a period of six months to ensure the effluent complies with the standards for discharge into the environment.

1.48.4 Spillage and/or leakage of materials

Accidental spillage or leakage of oil during offloading, storage in tanks and loading on trucks has the potential of causing direct contamination of soil resources and indirect contamination of surface water resources through storm water runoff.

Proposed mitigation measures

- Train staff on spill response and management
- Document and display at the site emergency response procedures and plan for spillage incidents.
- Provide suitable spill response kits at strategic positions within the facility for
- containing spillage.
- Appropriate siphoning equipment is to be used for transferring recycled oil from storage tanks onto tankers to avoid oil spills.
- Transportation tankers and reception/storage tanks will be checked for any leakages at the start of operations and the necessary precautions taken.
- Impervious surfaces to be well maintained at all places likely to receive spills chambers to facilitate proper management of spillage.

Actions to be taken in the event of spillage include:

- taking immediate steps to avoid the spillage spreading and contaminating a wider area;
- Keeping other people and vehicles away from the site;
- Wearing protective clothing appropriate to the use of the hazardous material involved;
- Soaking up the hazardous material with absorbent material such as dry sand, soil or wood shavings in the case of a liquid, and removing the contaminated matter with a brush and shovel and storing securely in suitable container for appropriate disposal;
- If there is a risk of the spillage becoming airborne, some damp sand should be scattered before attempting to decontaminate;
- Decontaminating any remaining traces of spillage including that on vehicles or equipment by washing down and draining the contaminated water through an oil interceptor.
- Bathing or thoroughly washing immediately afterwards.

1.48.5 Direct contact with hazardous materials

Staff handling waste oil and/or processed oil during offloading from and loading on trucks respectively have the potential of suffering from occupational ailments as a result of continual inhalation of fumes and/or as result of the materials coming into direct contact with their skin.

Proposed mitigation measures

The facility manager will be required to implement the following measures:

- Provide all workers handling hazardous materials with personal protective equipment including gloves, coveralls, and safety boots and enforce use of the same throughout the operation phase of the project.
- Provide adequate sanitary facilities including bathrooms.
- Maintain at the site, a file on material safety data sheets for all the hazardous materials handled at the site. Such data sheets contain essential detailed information regarding the identity and classification of the product, the hazards it presents and the appropriate safety precautions and emergency procedures.
- Employees will need to undergo an initial medical examination to provide baseline information on their health status and then have periodical medical check-ups to determine presence of any health risks.
- Train staff on safe handling and storage of oil. The facility manager shall ensure that workers prior to commencement of new assignments have received adequate training and information enabling them to understand the hazards of work and to protect their health from hazardous ambient factors that may be present.

  The training must adequately cover:
  a. knowledge of materials, equipment, and tools;
  b. known hazards in the operations and how they are controlled; c) potential risks to health;
  c. precautions to prevent exposure;
  d. hygiene requirements;
  e. wearing and use of protective equipment.

1.49 Decommissioning Phase

Potential Negative Impacts and Mitigation Measures During Decommissioning Phase
The environmental aspects associated with decommissioning phase of the proposed project include dust, noise, waste generation, handling of hazardous materials, and general health and safety aspects. Mitigation measures for dust, noise, general health and safety risks have been covered under section 8.2.1 and 8.2.2 above. The procedure to be followed during decommissioning is provided under section 2.2.3 of the report.

1.50 Cumulative impacts

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important based on scientific concerns and/or concerns of affected traders or/and stakeholders.
Cumulative impacts can only occur where, following the implementation of mitigation, significant residual impacts are predicted by the ESIA process.

The cumulative impacts considered in this project include the following;

- Air quality,
- Water quality,
- Waste management
- Noise impacts
- Traffic
- Social economics

1.50.1 Assessment of the impacts

The ESIA assessment looked at the likelihood of an impact having a residual impact that can build up or interact with other impacts from other market projects after the implementation of the mitigation measures proposed in this report. The impact was then rated likely or unlikely.

Residual cumulative impact of air quality

No significant local air quality effects are predicted following the good construction practice, which incorporates the implementation of the identified mitigation measures in the ESMP.

Phase	Significance (Pre- mitigation)	Residual Significance (Post-mitigation)
Construction	minor	negligible
Operation	minor	negligible

Residual cumulative impact of water quality

No significant impacts on the local water environment are predicted with the implementation of proposed mitigation measures, interaction of the impacts to produce cumulative impact is negligible.

Phase	Significance (Pre- mitigation)	Residual Significance (Post-mitigation)
Construction	minor	negligible
Operation	minor	negligible

Residual cumulative impact of Waste management

In waste management, cumulative impact to the waste services could be impacted if mitigation measures are not implemented and the impact significance could be minor. Therefore, following the implementation of mitigation measures cumulative impact are localised and impossible to spread and combine to produce any significant cumulative impact

Phase	Significance (Pre- mitigation)	Residual Significance (Post-mitigation)
Construction	minor	negligible
Operation	negligible	negligible

Cumulative impact on socio economic

Cumulative impacts on socio economic as a result of the used oil recycling plant being developed is likely to have positive impacts to the socio economics of the area. Some of the benefits include the following;

- Increased number of people employed in the building sector as casual/permanent during the construction and operation, business stimulation in the neighbourhood, security improvement and increase land value.

1.50.2 Conclusion

The possibility of the anticipated impact is unlikely to produce any cumulative impacts.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

1.51 Introduction

The purpose of the following Environmental and Social Management Plan (ESMP) for the proposed project is to initiate a mechanism for implementing mitigation measures for the potential negative environmental impacts and monitor the efficiency of these mitigation measures based on relevant environmental indicators. The EMP identifies certain roles and responsibilities for different stakeholders for implementation, supervision and monitoring.

The objectives of the ESMP are:

- To provide evidence of practical and achievable plans for the management of the proposed project.
- To provide the Proponent and the relevant Lead Agencies with a framework to confirm compliance with relevant laws and regulations.
- To provide community with evidence of the management of the project in an environmentally acceptable manner.

Conversely, Environmental monitoring provides feedback about the actual environmental impacts of a project. Monitoring results help judge the success of mitigation measures in protecting the environment. They are also used to ensure compliance with environmental standards, and to facilitate any needed project design or operational changes. A monitoring program, backed up by powers to ensure corrective action when the monitoring results show it necessary, is a proven way to ensure effective implementation of mitigation measures. By tracking a project 's actual impacts, monitoring reduces the environmental risks associated with that project, and allows for project modifications to be made where required.

This ESMP is prepared for the three project stages where potential significant negative impacts manifest. These are:

i. Construction Phase ESMP;
ii. Operation Phase ESMP; and,
iii. Decommissioning Phase ESMP.

1.52 Environmental and social management plan

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
CONSTRUCTION PHASE					
❖ **Dust**	- Adverse human health - Soiling of neighbouring properties. - Nuisance to neighbours - Impaired visibility.	• Frequent watering of all exposed earth surfaces.	50,000	Main Contractor for Civil Works	Throughout construction phase.
		• Enclosure of the concrete mixer with dust nets.	50,000	Main Contractor for Civil Works	Throughout construction phase.
		• Cover trucks with canvas to prevent loose materials from being blown by wind.	50,000	Main Contractor for Civil Works	Throughout construction phase
		Concrete mixer to be positioned away from major work areas and perimeter fence.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Providepersonal protective equipment including dust masks, eye goggles and coveralls.	150,000	Main Contractor for Civil Works	Throughout construction phase
❖ Dust	Adverse Human health Soiling of neighbouring properties Nuisanceto neighbours	• Limit drop heights of sand and soil.	Nil	Main Contractor for Civil Works	During loading and offloading

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
	Impaired visibility	• Construction materials to be stockpiled and protected from wind erosion.	Nil	Main Contractor for Civil Works	Throughout construction phase
❖ Noise	Adverse Human health Nuisance to the public	• Use of ear protectors by workers exposed to noise hazard >85 dB(A)	100,000	Main Contractor for Civil Works	Throughout construction phase
		• Recondition engine exhaust systems	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Proper engine tune-up	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Establish inspection and maintenance program for equipment and tools	Nil	Main Contractor for Civil Works	Throughout construction phase

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		• Post appropriate notices to warn drivers against unnecessary hooting	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Reduction of idling time of equipment and vehicles.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Construction activities to be scheduled between 8.00 a.m. and 5.00 p.m.	Nil	Main Contractor for Civil Works	Throughout construction phase
❖ Exhaust emissions from equipment & vehicles	Adverse Human health Contribution to Greenhouse effect (global warming) Nuisance to workers and neighbours	• Recondition engine exhaust systems.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Properengine tune-up	Nil	Main Contractor for Civil Works	Throughout construction phase

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		• Establish inspection & maintenance program for equipment.	Nil	Main Contractor for Civil Works	Throughout construction phase
❖ Spillage of hazardous materials like lubricants and fuel	Ground water contamination through leaching Contamination of surface water through storm water run-off Soil contamination	• Document spill prevention procedure & response plan.	Nil	Main Contractor for Civil Works.	Throughout construction phase
		• Off-site maintenance of fuel powered equipment and vehicles.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Maintain spill response kits at the site.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Use of drip trays when carrying out minor servicing of equipment.	Nil	Main Contractor for Civil Works	Throughout construction phase

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		• Hazardous materialsto be storedin closed containers and placed on water proof surface	50,000	Main Contractor for Civil Works	Throughout construction phase
❖ Spillage of hazardous materials like lubricants and fuel		• Strict SOPs in handling of the products. • Minimizethe quantityof hazardous materials stored at the site.	Nil	Main Contractor for Civil Works	Throughout construction phase
❖ Waste disposal	Groundwater contamination through leaching of the leachate.	• Provide suitable and well labelled solid waste containers.	10,000	Main Contractor for Civil Works	Prior to commencement of construction work
	Surface water contamination through run off Aesthetic degradation Nuisance to workers and neighbours Clogging of storm drains Soil contamination	• Proper segregation of waste generated.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Reduce generation of solid waste at the source.	Nil	Main Contractor for Civil Works	Throughout construction phase

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		• Reuse of top soil for landscaping of the site.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Empty packaging materials like cartons and cement bags should be piled in a safe place and sold or issued out for reuse	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Sell scrap metals to licensed dealers	Nil	Main Contractor	Throughout construction phase
		• Other solid waste to be collected by licensed waste handlers for appropriate disposal.	4,000 per month	Main Contractor for Civil Works	Throughout construction phase
❖ Waste disposal		• Provisionof sanitary facilities for use by workers	80,000	Main Contractor for Civil Works	Prior to inception of construction phase

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
❖ Fire	-Loss of property and/or life	• Provide appropriatefirefighting equipment	40,000	Main Contractor for Civil Works	Prior to commencement of construction works
		• Train workers on fire fighting	20,000	Main Contractor for Civil Works	Prior to commencement of construction works
		• Ensure inspection of the fire equipment	10,000	Main contractor for civil works	During construction phase
		• Designate a smoking zone	Nil	Main contractor for civil works	Prior to commencement of civil works
		• Post No smoking signs at the storage area for the fuel and oil.	Nil	Main contractor for civil works	Prior to commencement of civil works

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
❖ Elevated & Overhead Works	Injury to workers	• Provide appropriate number of standard first aid kits	20,000	Main contractor for civil works	Prior to commencement of civil works
		• Adequate number of workers to be trained on first aid	20,000	Main contractor for civil works	Prior to commencement of civil works
❖ Elevated & Overhead Works	Injury to workers	• Names of trained first aiders to be conspicuously displayed at the site.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Maintain a record of incidents & accidents on site.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Document the procedure for working at heights.	Nil	Main Contractor for Civil Works	Prior to commencement of construction works

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		• Provide safety nets/traps.	30,000	Main Contractor for Civil Works	During construction works
		• Use appropriate safety signage to warn workers.	2,000	Main Contractor for Civil Works	Prior to major civil works
		• Restrict access to theconstruction site by unauthorized individuals.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Statutory inspection of all lifting equipment (Chain blocks and cranes).	40,000	Main Contractor for Civil Works	Throughout construction phase
		• Cranes should be operated by trained & experienced personnel	Nil	Main contractor for civil works	Throughout construction phase

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
❖ Elevated & Overhead Works	Injury to workers	• Adhere to the safe load of lifting equipment.	Nil	Main contractor for civil works	Throughout construction phase
❖ General Health andSafety Aspects	Injury to worker Loss of life Damage to property	• Construction of a site office for coordinating construction activities.	200,000	Main Contractor for Civil Works	Throughout construction phase
		• Appoint health and safety personnel.	Nil	Main Contractor for Civil Works	Prior to commencement of construction works
		• Document emergency response procedures	Nil	Main Contractor for Civil Works	Prior to commencement of construction works
		• Conduct mandatorysafety inductions for all visitors to the site.	Nil	Main Contractor for Civil Works	Any time visitors access the site
		• Document and display at the site emergency phone contacts for external emergency service providers.	Nil	Main Contractor for Civil Works	Prior to commencement of construction works

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
❖ General Health andSafety Aspects	Injury to worker Loss of life Damage to property	• Obtain indemnity cover for all workers on site.	500,000	Main Contractor for Civil Works	Priorto commencement of construction works
❖ General Health andSafety Aspects	Injury to worker Loss of life Damage to property	• Provisionof wholesome drinking water to workers.	10,000 per month	Main Contractor for Civil Works	Throughout construction phase
		• Use of permit to work for critical tasks.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Hold toolbox and monthly meetings to discuss general safety concerns, review incidents, and determine actions needed to implement job safety.	Nil	Main Contractor for Civil Works	Throughout construction phase
		• Maintain a register of workers on site.	Nil	Main Contractor for Civil Works	Throughout construction phase

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		• Designate an emergency assembling point.	Nil	Main Contractor for Civil Works	Prior to commencement of construction works
		• Establish a health and safety committee where appropriate.	Nil	Main Contractor for Civil Works	Prior to commencement of construction works
❖ Increased traffic	-Nuisance to neighbours -Violation of traffic rules	• Schedule delivery of materials to the site during periods of light traffic.	Nil	Main Contractor for Civil Works	Throughout construction phase
❖ Increased traffic	-Nuisance to neighbours -Violation of traffic rules	• Install appropriate traffic signs.	3000	Main Contractor for Civil Works	Throughout construction phase
		• Define speed limits within the site.	Nil	Main contractor for Civil Works	Throughout construction phase
		• Maintain a record of incidents and accidents.	Nil	Main contractor	Throughout construction phase

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		• Control traffic flow to and from the site	Nil	Main Contractor for Civil Works	During delivery of materials
OPERATION PHASE					
Disposal of waste	▪ Contamination of soil. ▪ Adverse human health. ▪ Aesthetic degradation. ▪ Ground water contamination. ▪ Surface water contamination	• Provide suitable and well labelled solid waste containers.	15,000	Project proponent	Throughout operation phase
		• Proper segregation of solid waste	Nil		
		• Sell scrap metals to licensed dealers.	Nil		
		• Implement an oil skimming programme for oil/water interceptors to ensure normal functioning.	3,000 per month		
		• Carry out water quality analysis for effluent discharged from oil/water interceptors.	2,000		
Disposal of waste	Contamination of soil Adverse human health Aesthetic degradation	• Oily rags to be accumulated safely for collection and incineration by NEMA licensed incinerator	200,000 per annum	Project proponent	Throughout operation phase

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
	Groundwater contamination Surface water contamination	operators.			
		• Sewage & waste water from the kitchen to be discharged into the septic tanks.	Nil	Project proponent	Throughout operation phase
		• Contract a NEMA licensed sewage exhauster to exhaust sewage from the septic tank prior to overflowing onto the ground surface.	15,000 per trip	Project proponent	Throughout operation phase
		• Contract a NEMA licensed solid waste transporter.	5,000 per month	Project proponent	Throughout operation phase
		• Disposeof oily water via licensed handlers.	15,000 per month	Project proponent	Throughout operation phase
Fire	Loss of life and/or property L	• Provision of firefighting equipment.	50,000	Project proponent	Prior to commencement
		• Regular inspection and servicing of fire prevention equipment	10,000 per annum	Project proponent	At least once in a period of six months
		• Post fire emergency evacuation procedures at strategic points.	Nil	Project proponent	Prior to commencement of operations
		• Establish a firefighting team and have them trained.	40,000 for training	Project proponent	Upon commissioning of the project

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		• Carry out annual statutory fire safety audit.	80,000	Project proponent	During project operation
		• Use of appropriate signage to prohibit smoking & naked flames.	2,000	Project proponent	Prior to project operation
		• Provide at least two sand buckets at the oil storage area.	1,000	Project proponent	Prior to project operation
		• Maintaina standard first aid kit on site	10,000	Project proponent	Prior to project operation
		• Train staff on basic first aid techniques and ensure they undertake refresher.	50,000	Project proponent	Throughout project operation
		• course at defined intervals.			
		• Designate an emergency assembling point.	Nil	Project proponent	Prior to project operation
		• Conduct regular fire drills.	5000	Project proponent	At least once in a period of 12 months
General safety aspects	Loss of property Injury to staff Damage to equipment	• Employ security guards from reputable firms	30,000 per month	Project proponent	Throughout operation phase
		• Carry out annual statutory health & safety audit.	60,000		
		• Train staff on equipment operation.	Nil		

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		• Establish workplace Health and Safety Committee were appropriate.	Nil		
		• Register the facility as a workplace.	5000		
		• Provide first aid training	20,000		
		• Carry out health and safety committee meetings.	Nil		
Spillage and/or leakage of materials	-Direct contamination of soil resources -Indirect contamination of surface water resources	• Train staff on spill responseand management.	30,000	Project proponent	Throughout project operation
		• Document and display at the site emergency response procedures and plan for spillage incidents.	Nil		
		• Providesuitable spill response kits at strategic positions within the facility for containing spillage.	30,000 per annum		
Spillage and/or leakage of materials	-Direct contamination of soil resources -Indirect contamination of surface water resources	• Document and maintain at the site procedure for offloading, loading and storage of oil.	Nil	Project proponent	Prior to commencement of operations
		• Regular inspection of transportation tankersand reception/storage tanks for leakages.	Nil	Project proponent	Throughout operation phase
		• Provision of secondary containment for the used oil	100,000	Project proponent	Prior to commencement of

Environmental Aspect	Potential Environmental Impact	Mitigating Measures	Estimated Cost (Ksh)	Responsibility	Time Frame
		storage tanks& the recycling processes.			operations
		• Provide impervious surfaces at all places likely to receive spills.	250,000	Project proponent	Prior to project operation
Direct contact with hazardous materials	Adverse human health	• Providepersonal protective equipment including gloves, coveralls, air respirators and safety boots.	100,000 per annum	Project proponent	Throughout operation phase
Direct contact with hazardous materials	Adverse human health	• Maintain atthe site,afile on material safety data sheets for all the hazardous materials handled at the site.	Nil	Project proponent	Throughout project operation
		• Train staff on safe handlingand storage of hazardous materials.	50,000 per annum	Project proponent	Prior to commencement of the project
		• Initial & periodic medical examination of staff.	2,000 per staff	Project proponent	Prior and during project operation

1.53 Environmental and social monitoring

1.53.1 Overview

The overall objective of environmental monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable response to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the EMP.

Environmental monitoring program will operate through the pre-construction, construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significant assessment.

Monitoring should be undertaken at a number of levels. Firstly, it should be undertaken by the contractor at work sites during construction, under the direction and guidance of the Supervision consultant who is responsible for reporting the monitoring to proponent. It is recommended that the contractor employ local full time qualified environmental inspectors for the duration of the Contract.

Environmental monitoring is also an essential component of project implementation. It facilitates and ensures follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Monitoring includes:

- Visual observations;
- Selection of environmental parameters;
- Sampling and regular testing of these parameters

Periodic ongoing monitoring will be required during the life of the Project and the level can be determined once the project is operational.

1.53.2 Internal Monitoring

It is the responsibility of the proponent to conduct regular internal monitoring of the project to verify the results of the contractor and to audit direct implementation of environmental mitigation measures contained in the EMP and construction contract clauses for the project. The monitoring should be a systematic evaluation of the activities of the operation in relation to the specified criteria of the condition of approval.

The objective of internal monitoring and audit will be:

- To find out any significant environmental hazards and their existing control systems in force.
- Meeting the legal requirements as stipulated in the Environmental Management & Coordination Act, EMCA Cap 387.

The responsibility for mitigation monitoring during the operation phase will lie with the Environmental Section of the proponent. Environmental monitoring of the following parameters is recommended as a minimum for the Project.

Noise Levels Monitoring

Although noise during construction is expected to be a problem, periodic sampling of Contractor equipment and at work sites should be undertaken to confirm that it is not an issue. Noise level monitoring could be supplemented by consulting with stakeholders in the first instance to identify the level of monitoring required.

Air Quality Protection

The contractor shall monitor wind velocity and site dust levels during earthmoving activities. The contractor shall also monitor emissions from vehicles. If excessive dust is generated, the contractor shall immediately water down areas generating dust or, if this is not effective, cease the activities generating dust. Stop all excavation work if wind threshold velocity has been exceeded.

Soil Erosion Monitoring

The excavation of earth will exacerbate soil erosion. It will, therefore, be the responsibility of the contractor's environmental inspectors to ensure the implementation and effectiveness of erosion control measures. Focus should be given to work sites where soil is disturbed and its immediate environ.

Monitoring of accidents/safety

The contractor's safety and health officer must make sure that appropriate signs are posted at appropriate locations/positions to minimise/eliminate risk. The proponent will have overall responsibility to oversee that all environmental measures are put in place and that regulations are enforced. The construction supervision consultant should assist the proponent in this process in order to make sure that contractors fulfil the environmental requirements.

The following parameters could be used as indicators:

- Presence of posted visible signs
- Level of awareness of communities pertaining to dangers/risks
- Accident reports. Records on actual accidents associated with the project could be compiled.

Waste Management Monitoring

The contractor shall regularly monitor the management of wastes to ensure that;

- All stored waste shall be contained within construction sites;
- *Solid waste:* all site waste is to be collected and disposed of in an approved site. Where possible segregation of waste (paper, glass, metal) should be undertaken and recycling opportunities identified.

Workforce Training

The contractor shall ensure that all workers have been inducted. The contractor shall regularly monitor that occupational health and safety requirements are implemented. The client representative shall audit that all requirements are met. Where occupational health and safety requirements are not being implemented, relevant workers shall immediately be trained and instructed to implement these requirements.

1.53.3 External Monitoring and Evaluation

The Consultant recommends that a consultant (Environmental Auditor) should be hired to carry out Annual Environmental Audits in line with NEMA requirements. NEMA has the overall responsibility for issuing approval for the Project and ensuring that their environmental guidelines are followed during Project implementation. Its role therefore is to review environmental monitoring and environmental compliance documentation submitted by the implementing authorities and they would not normally be directly involved in monitoring the Project unless some specific major environmental issue arises.

The proponent through the consultant will therefore provide NEMA with reports on environmental compliance during implementation as part of their annual progress reports and annual environmental auditing reports. Depending on the implementation status of environmentally sensitive project activities, NEMA will perform annual environmental reviews in which environmental concerns raised by the project will be reviewed alongside project implementation.

Table 8.1: Monitoring plan

Environmental Component	Parameter	Standard	Location	Frequency	Duration	Supervision
Noise levels	Noise levels on dB (A) scale	NEMA guidelines on Noise (LN 25) <75dB	Construction site and the surrounding	As directed by the supervision consultant	Readings to be taken at 15 second interval for 15 min every hr and then averaged	Supervision Consultant/ contractor
Soil Erosion	Turbidity in stormy water	NEMA guidelines	Construction site	During and after the rainy seasons		Supervision Consultant / contractor
Waste Handling	Water quality	NEMA guidelines	Construction site	weekly		Consultant
Rehabilitation of work sites	Monitoring to ensure all work sites are progressively rehabilitated	EMP	Construction site	As required		Supervision Consultant/ contractor
Accidents	Safety training for workers, accident reports,	EMP	Construction site	continuous		Contractor
Health and safety	Signs &, posters, health awareness lectures,	EMP	Construction site	continuous		Contractor

CONCLUSIONS AND RECOMMENDATIONS

1.54 Conclusions

The ESIA study revealed that the proposed project has got both socioeconomic and environmental benefits and costs. It emerged that the benefits exceed the costs. Also, all the identified environmental impacts can be mitigated to a level of minimum or no significance throughout the project cycle. Further, none of the potential impacts would result to permanent irreversible damage on the ecosystem components.

1.55 Recommendation

Environmental monitoring is essential to track and sustain the effectiveness of the mitigation measures proposed in this report. An environmental monitoring plan has been prepared as part of the ESMP. The focus areas of monitoring cover air, noise, traffic management, water and energy resources, occupational health and safety, as well as local employment and economic impact of the project during construction and operation phases. The burden of implementing the mitigation measures largely lies with the Project Contractor under supervision by the Proponent. Key observations are that most adverse impacts are short term and will disappear once civil works ends. The construction contract for the proposed project should bear relevant clauses binding the Contractor to institute environmental mitigation as recommended in this study.

It is the duty of the Proponent to carry out annual environmental audits once it has been commissioned. This will be in compliance with the Environmental Management and Coordination Act, EMCA Cap 387 and the Environmental Impact Assessment and Audit Regulations, Legal Notice No. 101 of 2003.

APPENDICES

- ✓ Project drawings and layout details
- ✓ Minutes of public participartion
- ✓ Sample questionnaires and list of people consulted
- ✓ Proof of land ownership
- ✓ Lead Expert license
- ✓ Soil analysis test report
- ✓ Bills of Quantities
- ✓ Baseline Ambient Air Quality Report
- ✓ Baseline Ambient Noise Report

Project drawings and layout details