ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED PRIVATE ASBESTOS DISPOSAL SITE (LAND FILL) ON L.R. 10531, KAKUZI-MITUMBIRI WARD, GATANGA SUB-COUNTY, MURANG'A COUNTY

GPS Co-ordinates: ***01^0 02'49.8" S, Longitude 37^0 07'56.3'E.***

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DOCUMENT AUTHENTICATION

This document has been prepared in accordance with Environmental (Impact Assessment and Audit) Regulation, 2003 and submitted to the National Environmental Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Amendment Act 2015. We the undersigned, certify that the particulars in this report are correct and righteous to the best of our knowledge.

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EXECUTIVE SUMMARY

Introduction

The Proponent **Jali Ecosystems Limited** of **P.O Box 46624-00100, Nairobi** has proposed to establish a private asbestos landfill on Land Reference Number 10531, located along off the Thika –Garissa Highway, Kakuzi/Mitumbiri Ward, Gatanga Sub-County, Murang'a County. The landfill for Asbestos Containing Materials (ACM) is on a 2 acre land leased by the proponent. The site has a disused quarry that was initially used as machine cut stone quarry since 2018. The quarry has been mined to a maximum of 3m from the ground surface. The quarry was abandoned after exhausting the top softer tuffs and on reaching the more compact trachyte awaiting rehabilitation.

The proposed site is located approximately 1.3Km from the nearest human settlement near the Salvation Army residential areas, Officers Training College (OTC) and Del Monte pineapple plantation. The surrounding land is mainly quarry areas with over 1000 acres of active and abandoned quarry sites.

The proposed asbestos landfill is a privately owned disposal facility leased to the proponent by Priand KK Logistics for a period of ten years to undertake rehabilitation of the quarry by backfilling with the asbestos containing material as per the National Guidelines on Safe Management and Disposal of Asbestos

The site location has a well vegetated corridor of indigenous vegetation that shelters the site from wind blowing dust as trucks access the site. The proponent will put in place operational controls including limiting vehicle access and speeds to the site, wetting operational areas, and minimizing operations of the disposal facility during unfavorable wind conditions.

The proponent will ensure continuous monitoring of surface water and ground water to determine if the site operation has any environmental impacts. The site will also establish environmental and safety management systems to support operations.

The Safety and Health management at the site will be focused on limiting exposure of operations personnel, contractors, visitors and the public from exposure to airborne asbestos fibres. The site will be secured by a 2m perimeter stone wall and a lockable gate limiting access to landfill

personnel. A wash down area will be provided for all asbestos transporting trucks leaving site while ensuring appropriate signage will be placed at the entrance and throughout site warning of asbestos hazards.

Once the waste operations cease the site will be re-vegetated after closure limiting access and any human activities such as construction and pitting. The proponent is expected to maintain warning signs, fence and gate to prevent vandalism.

Asbestos and asbestos containing materials are classified as hazardous waste materials and as such the disposal facility requires the operator, being a proponent of such project to apply for and obtain an Environmental Impact Assessment (EIA) license from National Environment Management Authority (NEMA) before they can finance, commence, proceed with, carry out, execute, or conduct any undertaking.

Environmental Impact Assessment, (EIA) has been identified as a key process for predicting and assessing the potential environmental and social impacts of a proposed project, evaluating alternatives, designing appropriate mitigation, management, and monitoring measures. Early identification of possible development impacts to the environment and human populations enhances and promotes environmental sustainability as anthropogenic factors are balanced with natural environmental needs. It is a requirement by the National Environment Management Authority (NEMA) under the Environmental Management and Coordination Act (EMCA), CAP 387 and the Environmental (Impact Assessment and Audit) Regulations of 2003, Laws of Kenya for projects of such nature to undergo an environmental impact assessment (EIA) process.

Consultancy Organization

The project proponent appointed Ematech Solutions Ltd, a private Firm of Experts duly registered by National Environment Management Authority (NEMA) to carry out an Environmental and Social Impact Assessment of the proposed Private Asbestos disposal site and prepare a study report for the National Environment Management Authority (NEMA). This is in line with the Environmental Management and Coordination Act, CAP 387 and the Environmental (Impact Assessment and Audit) Regulations. The study was carried out between September 2020 and November 2020. Over this period, a number of valuable data pertaining to

the project's design, description, technology and legal framework, stakeholders input and foreseen impacts were collected and analyzed.

Table 1; List of Experts involved in the ESIA study

NAME	Qualification
Dr. Patrick C. Kariuki	PhD, Geosciences and Geoinformation scientist Lead Expert (NEMA Reg. No. 7870
Festus M. Mutiso.	PhD.(Submission stage), Environmental Management, EIA Lead Expert and Social Expert NEMA Reg. No.6467
Esther W. Macharia	Bsc. Environmental Conservation and Natural Resource Management, EIA Expert NEMA Reg. No. 8265
Nicholas M. Ndiba	Diploma in Environmental Science and Technology Public Participation
Angelica K. Mwalya;	Public Participation consultant and reporting

Project Description

The proposed asbestos landfill site is located approximately 1.3Km from any human settlement. The site is a disused quarry within a 2 acre piece of land whose larger land use is mainly quarrying activities. The quarry has been mined to a maximum of 3m from the ground surface. The proposed designs of the project comprises the construction of a 2m perimeter wall with a lockable gate limiting access and prevent vandalism, a jet wash area for trucks, sanitary facilities, car park, access road and disposal pits.

Policy and Legal Framework

This report has been prepared as per the legal requirement of the Environmental Management and Coordination Act (EMCA) Cap 387.Other relevant Policy, Legal and Regulatory framework reviewed include;

- Constitution of Kenya,2010
- Kenya Vision 2030

- The Environmental (Impact Assessment and Audit)Regulations, 2003
- Environmental Management and Coordination (Waste Management) Regulations, 2006.
- Environmental Management and Coordination (Water Quality) Regulations, 2006
- Environmental Management and Coordination (Air Quality) Regulations 2013
- Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009) Regulations, 2006
- Environmental Management and Coordination (controlled substances) Regulations, 2007)
- Environmental Management and Coordination (Conservation of Biodiversity and Resources Access to Genetic Resources and benefit sharing) Regulations, 2007)
- Public Health Act Cap 242
- Occupational Safety and Health Act, No. 15 of 2007
- The Local Government Act, Chapter 265
- Lands Act,2012
- Physical Planning Act, (Cap 286)
- Traffic Act (Cap 403)
- Occupation Safety and Health Act (OSHA),2007
- HIV/AIDS Prevention and Control Act (2006)
- Work Injury and Benefit Act (WIBA),2007
- The County Government Act,2012
- Water Act, 2016
- Water resources management rules,2007
- Factories and Other Places of Work (Hazardous Substances) Rules, 2007
- The Factories (Building, Operations and Work of Engineering Construction) Rules, Legal Notice No. 40 of 1984
- National Land use policy session paper No.1 of 2017
- National Environment Policy,2013
- National Guidelines on Safe Management and Disposal of Asbestos

Public consultation and participation

Public and stakeholder consultations were held during the scoping studies as shown in chapter 6. Some of the issues raised were:

- Proper measures should be put to enhance security of asbestos site and prevent unauthorized persons and to restrict movement
- Proper measures should be taken to minimize air pollution
- The workers removing the asbestos must have the appropriate Personal protective equipment
- Appropriate measures should be taken to manage all the waste water from the project
- When employment opportunities arise, locals should be given the first priority
- Proper measures should be taken to deal with solid waste disposal
- Any debris (broken pieces) should be collected in a sealed polythene woven bag or any other air tight container
- Disposed material to be one metre below ground level.
- Disposal site should be fenced off appropriately and the gate locked.

Potential Impacts and Mitigation Measures

The main objective of this assessment was to identify significant potential impacts anticipated from the proposed development project on the environment and social aspects with a view to establishing appropriate recommendations on ensuring that the proposed project takes into consideration appropriate measures to mitigate any adverse effects to the environment. The following table is summary of the anticipated environmental impacts.

Table 2; Summary of Environmental and Social Impacts

Potential Impacts	**Proposed Mitigation Measures**
Loss of Biodiversity	• Only minimal bush clearance should be allowed • Re-vegetate exposed areas to minimize soil erosion. • Minimal disturbance especially of the indigenous vegetation within the boundary wall of the proposed site • Maintain and enhance vegetation buffers around the site during operation.
Impacts on Air Quality	• Install signs to limit vehicle speed at the site • Train site workers on dust minimization techniques, and removal and handling of asbestos • ACM must not be compacted before it is covered with soil, and must not come into contact with any earth moving equipment at any time. • A wash down area will be provided for all trucks leaving the disposal site. • Avoid re-use or recycling of asbestos containing materials • Trucks carrying dusty material to be covered with canvas sheet. • Cease construction activities which generate excessive dust until effective

	control measures are implemented. • Fence off/barricade the site with stone wall prior work to minimize spread of dust to the immediate neighbourhood. • Securely cover skips containing dusty wastes where possible. • Use dust nets at high levels • Regular servicing and maintenance of equipment. • Establish a regular inspection program for equipment • After the structural rehabilitation is complete the area will be progressively rehabilitated by planting of local native trees as each level is complete. • Site irrigation system established to allow adequate wetting of operational surfaces
Impacts on water Quality	• Disposed material to be one metre below ground level. • The depth of the disposal pit shall be as deep as practically possible to accommodate more asbestos waste but at least one (1) metre above water table. • Cover asbestos pit with 500 gauges double wrapped polythene sheet and fill the pit with layer of soil up to the ground level • ACM must not be compacted before it is

	covered with soil, and must not come into contact with any earth moving equipment at any time. • First 25 m of access from main road to be sealed. • Vehicle speeds on the access roads will be limited to 10 km/h to minimise the possibility of wheel generated dust. • A wash down area will be provided for all trucks leaving the disposal site.
Noise and Vibration	• Avoid construction activities during the night. • Normal hours of operation to be maintained. Operation to be between 7:00am to 6:00pm. • Regular servicing and maintenance of construction equipment. • Install silencers to curb excessive noise • Use of ear protectors by workers in noisy areas. • Establish an inspection program for equipment. • Avoid leaving vehicles and other equipment idling for prolonged periods. • Sensitize drivers to avoid unnecessary noise making and hooting
Occupation Safety and Health Concerns	• Provide workers with appropriate Personal Protective Equipment (PPE)

	such as coveralls, respirators, boots. • All operations personnel will be trained in the proper management of asbestos materials and emergency response procedures. • Appropriate hazard signage installed at site • Warning notices stating **"Asbestos hazard area, keep out"** shall be placed at the disposal site. These signs, with lettering of minimum 150mm in height, are to be placed so that they are clearly visible. • Incident register to be maintained and all incidents reviewed annually • Complaints registered to be maintained and all complaints reviewed annually. • Develop an Asbestos Emergency Response Procedure.
Waste Management	• Provide adequate personal protective equipment to all the workers. • Provide an adequate number of waste receptors showing names of various waste streams at strategic points within the institution. • Ensure there is proper waste segregation. • Avoid undue accumulation of waste. • Train workers on waste management. • Institute waste reduction/minimization

	strategies within the institution • Lined pit that does not reach the water table • Disposed material to be one metre below ground level. • Disposal site should be fenced off appropriately and the gate locked
Transmission of sexually transmitted diseases and HIV/AIDS. Gender-based violence (GBV) and sexual exploitation and abuse (SEA)	• Provide employment for locals, which control influx. • Enforce occupational health, safety and hazard control on site • Workers sign a code of conduct. • Issues of occupation, safety and health addressed in the tool box meeting. • Inform local communities of major activities in advance • Screen the health of potential workers for communicable diseases as part of the recruitment process. • Undertake background checks of potential workers about any past involvement in GBV/SEA related offenses • Provide the workforce with access to primary healthcare on site, including prescriptions, prophylactics, condoms and basic testing for TB etc. • Provide awareness training to the workforce, in particular regarding the

	transmission of STDs, and traffic safety awareness, • Develop and enforce a strict code of conduct for workers to regulate behavior in the local communities • Prepare local communities for any large influx of workers by developing community-policing systems.
Security	• The site will be secured by construction of a 2m perimeter wall round the site complete with a lockable gate • Full time motion activated video surveillance will be installed to record vehicle access.
Transportation of asbestos	• transport asbestos waste to a disposal site that is authorized by NEMA • Vehicle speeds on the access roads will be limited to 10 km/h to minimise the possibility of wheel generated dust. • Line transporting vessel with a 500 gauge double wrapped plastic sheet with every seam sealed with a tape and covered. • labeled transporting vessel "Danger - Contains Asbestos Fibres. • Ensure transport vessel has the identity of the hazardous waste, the name, physical address and telephone contact of the generator of waste. Waste bags and

	stacks should be gently loaded into transportation vessel • Enlighten the drivers on the importance of observing traffic rules. • Discourage driving while drunk. • Install signs to prohibit obstruction. • Discourage overloading. • Ensure use of insured and roadworthy vehicles. • Discourage use of mobile phones while driving. • Enforce use of safety belts even on short distances. • Train drivers on road safety. • Truck loads to be kept within designated load limits and load covers to be used always.

A range of mitigation measures have been proposed to mitigate against each of the anticipated negative impacts.

Environmental Management Plan

Best practice in the establishment of an asbestos disposal site, will ensure environmental management will be achieved through implementation of a detailed Environmental Management Plan (EMP). The contractor and the proponent will be responsible for environmental management and related social components.

The EMP covers all necessary steps to mitigate negative impacts during all the phases of the project.

Conclusion and Recommendations

The EIA Study was carried out based on field assessments and public consultations with the stakeholders who are likely be affected by the proposed project in compliance with environmental policies, Environmental Management and Coordination Act, 1999 the Environmental (Impact Assessment and Audit) amendment Regulations, 2015.

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ACRONYMS

%: Percentage

^{0}C: Degrees Celsius

ACM: Asbestos Containing Material

AIDS: Acquired Immune Deficiency Syndrome

ASL: Above Sea Level

dBA: A-Weighted Decibels

EIA : Environmental Impact Assessment

EIA: Environmental Impact Assessment

EMCA : Environmental Management and Co-ordination Act

EMP: Environmental Management Plan

Ha: Hectares

ILO: International Labour Organization

NEAP: National Environment Action Plan

NEMA: National Environment Management Authority

OEL: Operational Exposure Limit

PPE: Personal Protective Equipment.

1.0 INTRODUCTION

1.1 Background of the Project

Asbestos is a natural mineral, which in all its mineralogical varieties has fibrous morphology (actinolite, amosite, anthophillite, chrysotile, crocidolite, and tremolite). It has been used all over the world dating back to the time of the ancient Persians, Greeks, and Romans. The usefulness of asbestos as an insulating material was recognized by the Egyptians and mentioned by Pliny in Roman times, but large-scale production of asbestos began only in the late nineteenth century
It is characterized by high resistance to heat, as well as chemical and biological agents, abrasion, and wear. Asbestos is an environmental carcinogen, asbestos fibers, when mechanically disturbed, divide longitudinally, generating even thinner fibers (fibrils), which, when inhaled, may be responsible for fibrotic (asbestosis) or neoplastic processes (mesothelioma, lung cancer)

All forms of asbestos have been judged to be carcinogenic by the World Health Organization's International Program on Chemical Safety and International Agency for Research on Cancer, and in the United States by the Environmental Protection Agency, the National Institute for Occupational Safety and Health, and the National Toxicology Program. The carcinogenicity of asbestos was reviewed at an International Agency for Research on Cancer (IARC) meeting in March 2009 by a group of scientists who concluded that all forms of asbestos (chrysotile, crocidolite, amosite, tremolite, actinolite, and anthophyllite) are associated with an increased risk of mesothelioma and lung, laryngeal, and ovarian cancers.

1.2 Worldwide use and Ban of Asbestos

Worldwide consumption of asbestos has changed dramatically over the past century. The consumption of asbestos greatly increased from the 1920s until its peak in the 1980s. Worldwide consumption rates continued to drop until the late 1990s when they stabilized at roughly 2 million metric tons per year, approximately half of what it was during the peak consumption in the 1980s. The drop in consumption after the 1980s coincided with efforts in Western Europe and North America to limit asbestos use and, perhaps as importantly, with demonstrated liability of the manufacturers for cancers due to asbestos exposure.

However, during this same time period the consumption of asbestos by countries in Eastern Europe, South America, and Asia has increased. The leading consuming nations since 1995 was Russia and China, but substantial amounts had also been consumed in Brazil, Thailand, Kazakhstan, India, Ukraine, and Iran. The upward trend that can be seen in India had continued and in 2010, had reached approximately 420,000 metric tons, making India the second largest consumer after China. Russia was the largest worldwide producer of asbestos in 2011 followed by China, Brazil, Kazakhstan, and Canada.

Many of Africa's developing nations still produce and/or use asbestos for industrial purposes. The fibers are cheap, durable and readily available; as a result, many manufacturers still use asbestos to insulate and strengthen their products.

Since Denmark became the first country in the world to regulate their asbestos industry, 54 countries have enacted a national ban on the fibers. In 2005, Egypt enacted Africa's first asbestos ban. The Minister of Foreign Trade and Industry prohibited Egyptian companies from importing or manufacturing asbestos, as well as all forms of asbestos products.

Despite technical difficulties, the process of replacing asbestos with safer materials is well worth a try in developing countries, to stop further release of asbestos fibres into the environment. Aggressive marketing of chrysotile asbestos is continuing in these regions after shrinkage of the market due to restrictions and bans imposed on the use of asbestos in many developed regions where its use is down to insignificant level. In the Asian continent, China and India are emerging as the major users of asbestos. There is enough evidence to link chrysotile with pulmonary fibrosis and lung cancer in humans, even at low levels of exposure, hence the need to apply the Precautionary Principle for phasing out its use globally.

Due to not so developed occupational safety and Health systems in developing countries and difficulties in early detection of pulmonary malignancy related to asbestos, the statistics remain sketchy. This is hampering efforts to create pressure on policy makers and to counter the propaganda of the asbestos industry.

In Kenya, Asbestos was a material of choice in the construction industry in the 1960s and 1970s A number of facilities including food manufacturing industries as well as residential homes used asbestos roofing material due to its durability and fire resistance characteristics. These roofing materials have deteriorated over time requiring their replacement with more environmentally safe materials necessitating their removal and disposal.

Kenya banned the use of asbestos in 2006, but nearly all government institutions, including educational facilities and residential estates built in the 1950s and 1960s, have asbestos roofs. These roofs are now ageing, and spreading the dust that causes mesotheliomas, as well as lung and oesophageal cancers.

Due to the lack of appropriate and licensed disposal facilities and the increased demand for the safe disposal, the National Environment Management Authority NEMA as the principal environmental regulator found it prudent to inform the public and manage asbestos material by formulating operational guidelines. The development of these Guidelines on Safe Management and Disposal of Asbestos has been necessitated by the need to safeguard human health and environment from adverse impacts related to asbestos materials.

According to the Legal Notice No. 121 of the Environmental Management and Coordination (Waste Management) Regulations, 2006, wastes containing asbestos in the form of dust or fibres are classified as hazardous wastes. In addition, the Legal Notice requires that hazardous waste be disposed off in a specific manner as approved by the National Environment Management Authority (NEMA).

This guideline is one of the tools for environmental management in Kenya under the Environmental Management and Coordination Act (EMCA), 1999 and the Environmental Management and Coordination (Waste Management) Regulations, 2006.

Under the legal notice No. 31 of the Environmental Management and Coordination Act (EMCA), 1999 No. 8, the proposed project is categorized as hazardous waste disposal facility under the second schedule which requires any person, being a proponent of such project to apply for and obtain an Environmental Impact Assessment (EIA) license from NEMA before they can

finance, commence, proceed with, carry out, execute, or conduct any undertaking. The proponent therefore, contracted a registered EIA Firm of Experts to undertake this study in order to comply with this requirement, and has produced this Environmental and social Impact Assessment Study Report which includes an Environmental Management Plan as required by NEMA.

1.3 Project Location

The proposed project involves an establishment of a private asbestos landfill with an effort to rehabilitate a dis-used quarry with safe disposal of asbestos materials as following the National Guidelines on Safe Management and disposal of Asbestos as per the Environmental Management and Coordination Act (EMCA), 1999 and the Legal Notice No. 121 of the Environmental Management and Coordination (Waste Management) Regulations, 2006.

1.4 Scope of the EIA Study

The NEMA Regulations requires that all new projects, programmes or activities requires that an environmental and impact assessment to be carried out at the planning stages of the proposed undertaking to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the project. The scope of this EIA study covered:

- Description of the proposed project;
- The baseline environmental conditions of the EIA study area;
- Provisions of the relevant environmental legislations;
- Public consultation through public interviews and administration of questionnaires;
- Prediction of any adverse impacts to the environment arising from the proposed project;
- Appropriate mitigation measures; and
- Provision of an Environmental Management Plan.

The output of this work led to this comprehensive Environmental Impact Assessment Project Report for purposes of obtaining an EIA licence.

1.5 Objectives of the EIA Study

The objectives of the EIA study are:

- To fulfill the legal requirements as outlined in Section 58 to 67 of the Environmental Management and Coordination Act (EMCA) and Part I and II of the EIA/Audit Regulations, 2003;
- To obtain background biophysical information of the site and legal and regulatory issues associated with the proposed project;
- To access and predict the potential impacts during site preparation, construction and operational phases of the proposed project;
- To propose mitigation measures for the potential adverse environmental impacts and safety risks;
- To allow for public participation; and
- To prepare an EIA Report including an Environmental Management Plan.

1.6 Terms of Reference (ToR) for the EIA process

The study report has managed to achieve the ToR based on the Environmental (Impact Assessment and Audit) Regulations, 2003. Approved by NEMA on 13th October 2020, (NEMA/TOR/5/2/173) According to the Regulations, the study Report contains description of the following:

- Description of the nature of the proposed project;
- The location of the project including the physical area that may be affected by the project's activities;
- The activities that shall be undertaken during the project construction, operation and decommissioning phases;
- The project budget;
- The design of the project;
- Public participation and stakeholders engagement; views and inputs
- The potential environmental impacts of the project and the mitigation measures to be taken during and after implementation of the project;
- Environmental management plans for proposed adverse environmental impacts.

1.7 Methodology

The EIA study was carried out based on desk review, field assessments and public consultations with the community who are likely to benefit from the project, the project affected persons and relevant County and National Government institutions.

1.7.1 Desk review

A desktop study was conducted to review available published and unpublished reports, development plans and maps in order to compile relevant baseline biophysical and socio-economic information about the study area. The biophysical information was compiled on environmental aspects such as Topography, Climate, Soils, Water Resources, land use and flora.

1.7.2 Field visits

Field visits were conducted in the study area in order to collect site-specific information on the biophysical and socio-economic environment and to crosscheck the secondary data. While at the site, environmental data were recorded and potential impacts identified.
In addition, environmental features relevant to the study were noted and photographs taken as record of key features.

1.7.3 Public consultation

Public consultations were undertaken through interviews. The consultations were meant to give an indication of whether the proposed project is welcome and the immediate perceptions that the affected parties associate with it.

1.8 Reporting and documentation

A comprehensive EIA Project Report containing the findings has been compiled in accordance with NEMA guidelines for consideration and approval. In preparing the Project Report, the EIA team paid attention to the following issues as specified in the second schedule of the Environmental (Impact Assessment and Audit) Regulations, 2003:

- Ecological considerations including: Biological diversity, sustainable use, and ecosystem maintenance;
- Landscaping including: visual impacts (features, removal of vegetation, etc.),

- Compatibility with surrounding area, and social amenity
- Land use including: effects of proposal on current land uses and land use potentials in the project area, patterns/drainage systems.

2.0 BASELINE INFORMATION

2.1 Topography

Murang'a County where the project is located lies between 3,353m above sea level, in the West along the slopes of Aberdare Mountains and 914m ASL in the East. The County's geology and basement system comprises of volcanic rocks of the Pleistocene age and Achaean rock type respectively. The study area is within the Eastern part composed of the rocks of the basement system. Porous beds and disconformities within the volcanic rock system form important aquifers, collecting and moving ground water, thus regulating water supply from wells and boreholes.

The site lies at an altitude of about 1460m amsl, on a gently undulating terrain sloping towards the Chania River to the south. The drainage of the area is controlled by the Chania River which flows towards the southeast. The headwaters of the regional watershed are formed by the southern reaches of the Aberdares ranges. The investigated site is covered by reddish brown lateritic soils developed from weathering and erosion processes of the volcanic rocks in the area.

2.2 Climate

The County has three climatic regions: The western region with an equatorial type of climate, the central region with a sub-tropical climate and the eastern part with semi-arid conditions. Long rains fall in the months of March, April and May. April reliably records the highest amount of rainfall. The short rains are in the months of October and November. The Western region covering Kangema, Gatanga, and higher parts of Kigumo and Kandara, is generally wet and humid due to its proximity to the Aberdare Ranges and Mt. Kenya. The Eastern region, covering the lower parts of Kigumo, Kandara, Kiharu and Maragua constituencies receive less rain and crop production requires consistent irrigation.

2.3 Hydrology

Ground water in this region is supplied by a number of aquifers; in fluviatile orlacustrine deposits intercalated in most formations or between the principal lava flows. Theharder tuffs and lavas yield little or no water due to their generally impervious character. Inaddition, all faults fissures and joints may carry water. From the geological study, there were nofractures or faults

observed in the area but minor structures are expected to occur. Thesefractures either act as preferred conduits of water or if filled with impervious materials, act asdeterrents to groundwater flow. Vertical groundwater flow is hindered by the compact lavas occurring in the area and absence of major faults and fractures to aid in the movement.

Groundwater in volcanic rocks is limited to fractures and erosion levels (Old Land Surfaces) within the volcanic succession. Lavas are generally not water bearing because of theirunfractured and impervious character. The volcanic succession in the area consists of lateric soils underlain by tuffs and trachytes. The tuffs form the first layer and have been extensively exploited for building stones.

The trachytes underlying the tuffs are generally more compact and impervious. The depth to the aquifers is variable.

The shallow aquifer as determined from the geophysical survey occurs at depths of >18m. The aquifer is expected to occur below a compact tuff formation and thus direct recharge from precipitation in the area is unlikely. The main aquifer occur at depths >100m.

2.4 Groundwater Recharge

The mechanism of recharge (and the rate of replenishment) of the confined aquifers which underlie the area, has not been fully established. However a broad pattern of recharge can be described. The two possible recharge mechanisms are direct recharge at the surface and indirect recharge via faults and/or other aquifers. Direct recharge from rainfall through infiltration of precipitation into the ground via weathered and fractured zones may be hampered by the thin lateritic soil cover as well as the compact trachyte underlying the tuffs. The volcanic aquifers are most likely recharged indirectly through lateral groundwater flow. The movement of water within the aquifers follows gravity, so water travels from the upper areas of the Aberdares Ranges in the west and percolates through successive formations to south and east. Some of the rainwater is also conducted underground by local faults.

2.5 Geology and Soils

The geology of the County consists of volcanic rocks of the Pleistocene age and basement system rock of Achaean type. Volcanic rocks occupy the western part of the county bordering

the Aberdares while rocks of the basement system are in the eastern part where the project site is located. Porous beds and disconformities within the volcanic rock system form important aquifers, collecting and moving ground water, thus regulating water supply from wells and boreholes.

The investigated area lies on Pliocene to Miocene volcanic material overlying Basement System rocks at greater depths. Lateritic, red to brown volcanic top soils are dominant which have resulted from the weathering of volcanic rocks. In the investigated area, the volcanics comprise of the Kerichwa Valley Tuffs, Nairobi phonolites, Athi tuffs and Lake Beds with chart band. At greater depths, the Kapiti phonolites and the Basement System rocks are expected though not exposed in the investigated area.

The investigated site is covered by redish brown lateritic soils developed from weathering and erosion processes of the volcanic rocks in the area.

2.6 Vegetation

The vegetation at the investigated area is mainly composed of tropical to semi-arid vegetation comprising luxuriant grass and acacia trees. Most of the surrounding area comprises the Del Monte Plantation with expansive fruit farming.

The predominant vegetation along the proposed study site include; *lantana camara*, *Tithonia diversifolias*,*Croton macrostychus*, *Solanum incanum*, *Euphorbia candelabrum*, *Ricinus communis, Acacia sp,* and variety of grass species among others. The study area is also dominated by variety of birds, insects and rodents.

Table 3; List of species found within the study area

	
Plate 1: Species of *lantana camara* bushes along the access route to the proposed site	**Plate 2:*Tithonia diversifolias* bushes along the proposed site**

	
Plate 3: *Solanum incanum* at the spoil area of the quarry site.	**Plate 4:*Ricinus communis* adjacent the proposed site.**
	
Plate 5: Isolated *Euphorbia candelabrum* along the access route to the proposed site	**Plate 6: Isolated species of *Croton macrostychus* across the proposed site.**
	
Plate 7: *Acacia sp* scattered across the proposed study site.	**Plate 8: Grass species within the abandoned quarry pits**

2.7 Land use

Land in Murang'a County is classified into freehold or leasehold land. Freehold land is held by an individual for an unspecified period of time while leasehold land is given by the government to and individual or organization over a specified period of time.

The study will present details of the land ownership, lease agreements and surrounding land use. It will identify the main land use activities in the study area such as land for agriculture, minning, residential/commercial development and how they have impacted the landscape over time.

3.0 PROJECT DESCRIPTION

3.1 Project proponent

The Proponent **Jali Ecosystems Limited** of **P.O Box 46624-00100, Nairobi** has proposed to establish a private asbestos landfill on Land Reference Number 10531, located along the Thika – Garissa Highway, Kakuzi/Mitumbiri ward, Gatanga Sub-County, Murang'a County.

The proposed asbestos landfill is a Privately owned disposal facility leased to the proponent by Priand KK Logistics for a period of ten years to undertake rehabilitation of the quarry by backfilling with the asbestos containing material as per the National Guidelines on Safe Management and disposal of asbestos. Priand KK Logistics have committed to taking over responsibilities- **SEE AGREEMENT ON THE APPENDIX IV ATTACHED**

3.2 Project Location.

The Proposed Private asbestos disposal site (landfill) is located On Plot L.R No. 10531 in Kakuzi/Mitumbiri Ward, Gatanga Sub County Murang'a County. The site is situated in Murang'a County although the entire parcel also lies towards Kiambu County; which is a highly industrious town. The project area is accessible from the Thika Super-Highway Class A104 via Thika town and then via Class C road in Makongeni area.The site is located approximately 3km off the Nairobi - Garissa Highwpay at BAT junction. The nearest major town is Thika town in Kiambu County. The distance from Nairobi to Thika is 42 km while that from the Thika to the site is about 3.5 km. the proposed site is located on **GPS coordinates latitude *01^0 02'49.8" S, Longitude 37^0 07'56.3'E* at an elevation of 1460m amsl.**

Plate 9: Location of the proposed site (source; Google maps accessed on 19th November,2020)

The Landfill for Asbestos Containing materials (ACM) is on a 2acre land leased by the proponent. The site has a disused quarry that was initially used as machine cut stone quarry since 2018. The quarry has been mined to a maximum of 3m from the ground surface. The quarry was abandoned after exhausting the top softer tuffs and on reaching the more compact trachyte awaiting rehabilitation.

The proposed site is located approximately 1.3Km from the nearest human settlement near the Salvation Army residential areas, Officers Training College (OTC) and Del Monte fruit Plantation. The surrounding land is mainly quarry areas with over 1000 acres of active and abandoned quarry sites.

The proposed project involves an establishment of a private asbestos landfill with an effort to rehabilitate a dis-used quarry with safe disposal of asbestos materials as following the National Guidelines on Safe Management and disposal of Asbestos as per the Environmental Management

and Coordination Act (EMCA), 1999 and the Legal Notice No. 121 of the Environmental Management and Coordination (Waste Management) Regulations, 2006.

3.3 Project Design

The proposed asbestos landfill site is located approximately 1.3Km from any human settlement. The site is a disused quarry within a 2 acre piece of land whose larger land use is mainly quarrying activities. The quarry has been mined to a maximum of 3m from the ground surface. The proposed design of the project comprise the construction of a 2m perimeter wall with a lockable gate limiting access and prevent vandalism, a jet wash area for trucks, sanitary facilities, car park, access road and disposal pits on either side of the road within the disposal site.

The proposed site has a shallow aquifer that occurs at depth of 18 to 40m. The excavation of pits shall be at least one (1) metre above water table. The pits shall be lined with a 130mm thick concrete prior to disposal of the asbestos. The asbestos will be lowered gently into the disposal pits avoiding dropping from heights to avoid breakage. The pit shall then be covered with polythene paper followed by 6 inch layer of soil until the pit is full or the waste is finished. This shall also ensure that the level of the access route is compacted to the same height as the filled pits on either side. The pit shall be considered full when the asbestos waste is one meter below the ground level or the asbestos waste is exhausted. The pits will later be covered with 500 gauges double wrapped polythene sheet and fill the pit with layer of soil up to the ground level.

All transportation vessels, re-useable containers or any other similar article which have been in contact with asbestos waste shall be cleaned at the disposal site. The proponent will ensure progressive replanting of native species and encourage vegetation growth to mitigate potential dust and noise emissions. The final rehabilitation of the quarry will include planting of trees at the landfill site once the operation ceases. This will result in a permanent and stable native vegetation community on currently disturbed surfaces. The waste generator shall notify the Authority in writing on completion of disposal of asbestos waste.

3.4 Project cost

The proposed project will be funded by the proponent up to a total cost of two million Kenyan Shillings **(Khs.2, 000,000.00)**

3.5 Disposal Site

Disposal of asbestos must be at a site; Designated by the local authorities and licensed by NEMA; privately owned disposal facility licensed by NEMA; Designated by the waste generator (on-site disposal).

Where a designated site by the local authorities or privately owned facility does not exist the waste generator shall identify an appropriate site, undertake an EIA and be duly licensed.

- The optimal distance of the disposal pit shall be as far as practicable from the nearest human settlement and as it shall be determined by the Ministry of Public Health and Sanitation.
- A lined pit that does not reach the water table or according to other standards that may be approved by NEMA.
- Disposed material should be one metre below ground level.
- Disposal site should be fenced off appropriately and the gate locked.
- The waste generator shall notify the Authority on commencement of disposal activities.
- Asbestos materials must not be reused or offered for sale.
- All asbestos sheets and the debris should be wrapped before it is hauled to the disposal site or transfer station in a covered vehicle.
- Asbestos waste must be disposed of at approved disposal sites only.
- The depth of the disposal pit shall be as deep as practically possible to accommodate more asbestos waste but at least one (1) metre above water table.
- The asbestos should be lowered gently into the disposal site and should not be dropped from any height to avoid breakage.
- When all available asbestos has been lowered into the pit, cover with polythene paper followed by 6 inch layer of soil. Continue doing this until the pit is full or the waste is finished.

- The pit shall be considered full when the asbestos waste is one meter below the ground level or the asbestos waste is exhausted.
- After the pit is full, cover with 500 gauges double wrapped polythene sheet and fill the pit with layer of soil up to the ground level.
- Disposal site should be completely fenced off with at least chain link and a lockable gate which shall be locked at all times. The fence should be at least one (1) metre from the edge of the pit.
- Warning notices stating "Asbestos hazard area, keep out" shall be placed at the disposal site. These signs, with lettering of minimum 150mm in height, are to be placed so that they are clearly visible.
- The disposal site should be maintained including the warning signs, the fence, the gate among others to prevent vandalism and interference
- Human activities which might interfere with the buried asbestos waste such as construction and pitting should not be allowed at the disposal site.
- The waste generator shall notify the Authority in writing on completion of disposal of asbestos waste.

4.0 ENVIRONMENTAL POLICY, LEGISLATION AND REGULATORY FRAMEWORK

4.1 POLICY FRAME WORK

4.1.1 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 semiarid 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 Act2005, and developing national standards and appropriate forest-based development mechanisms in emerging carbon markets.

Relevance

This ESIA study has developed an ESMMP for the project which should be implemented to mitigate the resulting impacts during the construction and implementation phases of the project.

4.1.2 Land Policy

The National Land Policy in Chapter 3 under section 3.4, Environmental Management Principles, provides for the policy actions for addressing the environmental problems such as the degradation of natural resources, soil erosion, and pollution of air, water and land. The policy advocates for environmental assessment and audit as a land management tool to ensure environmental impact assessments and audits are carried out on all land developments that may

degrade the environment and take appropriate actions to correct the situation. Public participation has also been indicated as key in the monitoring and protection of the environment.

Section 3.4.3.3 advocates for the Implementation of the polluter pays principle which ensures that polluters meet the cost of cleaning up the pollution they cause, and encourage use of cleaner production technologies.

In section 131 (d) the government undertakes to provide mechanisms for resolving grievances arising from human/wildlife conflicts for sustainable management of land based natural resources.

Relevance;

The proposed works shall implement the ESMMP from this environmental assessment to ensure that all the rivers and streams within the project area are not polluted by the subsequent activities during construction and operational phases.

4.1.3 National Policy for Disaster Management in Kenya 2009

The policy sets out the goal and objectives of Disaster Management (DM) in Kenya, arrangements for effective management, roles and responsibilities of different stakeholders at different levels. It provides an implementation framework and guiding principles for (DM).

The overall goal of the policy is to "build a safe, resilient and sustainable society", incorporating the following objectives:

(a) To establish a policy/legal and institutional framework for management of disasters, including promotion of a culture of disaster awareness and for building the capacity for disaster risk reduction, at all levels;

(b) To ensure that institutions and activities for disaster risk management are coordinated, focused to foster participatory partnerships between the Government (including mainstreamed and emergency disaster-related activities by sectoral Ministries) and other stakeholders, at all levels, including international, regional, sub- regional Eastern African, national and sub-national bodies;

(c) To promote linkages between disaster risk management and sustainable development for reduction of vulnerability to hazards and disasters;

The project will achieve policy goal of building a safe, resilient and sustainable society.

Relevance

The proponent has undertaken the risk assessment for the proposed asbestos disposal site and will ensure training of workers and sensitization to general risks and prevention measures while operating the facility.

4.1.4 National Disaster Response Plan, 2009,

The plan seeks to ensure that disaster preparedness for response is carried in a coordinated and collaborative manner, ensuring the greatest protection of life, property, health and environment."

The plan establishes a system of operating procedures associated with day-to-day operational response to emergencies by relevant actors when disasters occur.

The plan contains hazard specific and departmental or thematic contingency plans and emergency procedures in the event of a disaster, and provides for carrying out of those responsibilities such as Effective early warning linked to early response and relief; and early recovery linked to longer-term development after disaster.

Relevance

There shall be standard procedures for operation within the disposal site to evade disasters and prevent damage to properties, environmental degradation and loss of life.

4.1.5 Constitution of Kenya

Article 24, Part 1, Article 14, Part 2, Fourth Schedule provides that "Disaster management" is included as a function of both the national and county governments. Article 42 of Bill of Rights of the Kenyan Constitution provides that every Kenyan has a 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 legislation and other measures.

Part II of Chapter 5 of the Constitution (Environment and Natural Resources), (I) the State clearly undertakes to carry out the following:

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
- Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- Encourage public participation in the management, protection and conservation of the environment; Protect genetic resources and biological diversity;
- Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and

Part (II) "Every person has a duty to cooperate with state organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

Chapter 5 on Land and Environment Emphasizes on the following:

- Land use and management shall by law benefit local communities
- Community land is protected from encroachment by State.
- Law shall protect Rivers, forests and water bodies.
- Equitable access to land.

The constitution of Kenya provides for sound management and sustainable development of all of Kenya's projects, both public and private investments. It also calls for the duty given to the

Project proponent to cooperate with State organs and other persons to protect and conserve the environment.

Relevance

This study report has been prepared in accordance to the EIA Regulations that predict environmental impacts and formulate mitigation measures to avert environmental degradation.

4.1.6 Kenya Vision 2030

Kenya Vision 2030 is the current national development blueprint for period 2008 to 2030 and was developed following on the successful implementation of the Economic Recovery Strategy of Wealth and Employment Creation which saw the country's economy back on the path to rapid growth since 2002. Gross Domestic Product (GDP) growth rose from 0.6% to 7% in 2007, but dropped between 1.7% and 1.8% in 2008 and 2009 respectively.

The objective of the Vision 2030 is to "transform Kenya into a middle income country with a consistent annual growth of 10% by the year 2030". One of the aims is to make Kenya to be a nation that has a clean, secure and sustainable environment by 2030. This will be achieved through promoting environmental conservation to better support the economic pillar.

Kenya's transformation into a middle-income country will be achieved by bringing and improving basic infrastructure and services namely: roads, street lights, storm water drains, footpaths, and water and sanitation facilities among others.

Relevance

The Kenyan Vision 2030 is anchored on several foundations one of them being improving sanitation with the aim of ensuring the country attains a clean, secure and sustainable environment. The proposed development will provide a regulated asbestos disposal site that will encourage removal and replacing of hazardous roofing sheets and ACM with clean technology used in construction of residential and commercial areas.

4.2Regulatory Framework

Environmental Management and Coordination Act, 1999 section 91 (1-7) The EMCA, 1999 requires the Authority to categorize hazardous wastes on the recommendation of Standards

Enforcement and Review Committee (SERC) and to issue guidelines and Regulations for the management of each category of hazardous wastes. The categorization has been done under the EMCA (Waste Management) Regulations, 2006, while these guidelines provide for safe management of asbestos and its wastes.

4.2.1 Environmental Management and Coordination Act, 2015 (EMCA)

The EMCA provides for the undertaking of Environmental Impact Assessment (EIA) of all projects listed under schedule II with the likelihood of causing adverse potential impacts on the environment.

The Act Empowers the Authority to:

- Issue permits to the person responsible for undertaking any enterprise, construction or development of a prescribed category in a prescribed location
- Request information or documents as the Authority thinks fit
- Request an Environmental Impact Assessment (E.I.A) containing such information as may be prescribed
- Request information on pollution control facilities
- Revoke or suspend permits.

Relevance;

The proponent has acquired the services of an Environmental Firm of Experts registered by NEMA to undertake an Environmental and Social Impact Assessment for the proposed Private asbestos landfill.

4.2.2 Environmental Impact Assessment and Audit Regulations,2003

The Environmental Impact Assessment and Audit Regulations state that the Regulations shall apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the EMCA….."

Regulation 4(1) further states that:

''…no proponent shall implement a project likely to have a negative environmental impact; or for which an environmental impact assessment is required under the Act or these Regulations unless an Environmental Impact Assessment has been concluded and approved in accordance with these Regulations.

Relevance

This report has been compiled in compliance with these Regulations. The proponent will undertake monitoring of the project during construction phase in line with the legislation as well as conduct Annual Environmental Audits thereafter.

4.2.3 Environmental Management and Coordination, (Conservation of Biological Diversity (BD) Regulations 2006

These Regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which includes conservation of threatened species, inventory and monitoring of biodiversity and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties.

Relevance

The proponent will ensure the project is in line with this Regulation and that clearance of the vegetation will be limited to the areas within the proposed site while re-vegetating the rehabilitated areas with indigenous trees.

4.2.3 Environmental Management and Co-ordination (Water quality) Regulations, 2006

These Regulations apply to drinking water, water used for industrial purposes, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife, and water used for any other purposes.

Section 4(1) states that every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of the Act.

Part (2) under section 4 prohibits persons to throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution. Standards for Sources of Domestic water

Section 5 of the Regulation set standards for sources of domestic water. All sources of water for domestic uses shall comply with the standards set out in First Schedule of these Regulations.

Table 4; Quality standards for sources of domestic water

(r. 5)

FIRST SCHEDULE

QUALITY STANDARDS FOR SOURCES OF DOMESTIC WATER

Parameter	Guide Value (max allowable)
pH	6.5 – 8.5
Suspended solids	30 (mg/L)
Nitrate-NO3	10 (mg/L)
Ammonia –NH3	0.5 (mg/L)
Nitrite –NO2	3 (mg/L)
Total Dissolved Solids	1200 (mg/L)
Scientific name (E.coli)	Nil/100 ml
Fluoride	1.5 (mg/L)
Phenols	Nil (mg/L)
Arsenic	0.01 (mg/L)
Cadmium	0.01 (mg/L)

Lead	0.05 (mg/L)
Selenium	0.01 (mg/L)
Copper	0.05 (mg/L)
Zinc	1.5 (mg/L)
Alkyl benzyl sulphonates	0.5 (mg/L)
Permanganate value (PV)	1.0 (mg/L)
Nil means less than limit of detection using prescribed sampling and analytical methods and equipment as determined by the Authority. And any other parameters as may be prescribed by the Authority from time to time	

Under section 6 of these Regulations, the Act emphasizes on the need for the Protection of Lakes, Rivers, and Streams, springs, Wells and other water sources

It further prohibits that

No person shall:

(a) Discharge, any effluent from sewage treatment works industry or other point sources into the aquatic environment without a valid effluent discharge license issued in accordance with the provisions of the Act.

(b) abstract ground water or carry out any activity near any lakes, rivers, streams, springs and wells that is likely to have any adverse impact on the quantity and quality of the water, without an Environmental Impact Assessment license issued in accordance with the provisions of the Act; or

(c) Cultivate or undertake any development activity within a minimum of six meters and a maximum of thirty meters from the highest ever recorded flood level, on either side of a river or stream, and as may be determined by the Authority from time to time.

Relevance

The proposed project will generate some waste water from jet washing areas for the trucks leaving the disposal site and in sanitary facilities. The proponent will ensure waste water discharged will comply with these Regulations.

4.2.4 Environment Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

These Regulations aim at ensuring the maintenance of a healthy environment for all people in Kenya, the tranquility of their surroundings and their psychological wellbeing by regulating noise levels and excessive vibration.

The Regulations elevate the standards of living of the people by prescribing acceptable noise levels for different facilities and activities. The Regulations prescribe the maximum permissible noise levels from a facility or activity to which a person may be exposed to; provide for the control of noise; and provide for mitigating measures for the reduction of noise.

The maximum permissible noise levels are based on the various zones as outlined in the Regulations.

These Regulations apply even to work places and do not negate the Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005.

These Regulations prohibit production of any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

Any person who is likely to be involved in activities that emit noise or excessive vibrations beyond the permissible levels must obtain a license or a permit respectively from the authority.

Noise Pollution; Section 3(1) of the Regulation stipulates that; except as otherwise provided in these Regulations, no person shall make or cause to be made any loud, unreasonable,

unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

Section (2) further states that; in determining whether noise is loud, unreasonable, unnecessary or unusual, the following factors may be considered-

(a) Time of the day;

(b) Proximity to residential area;

(c) Whether the noise is recurrent, intermittent or constant;

(d) The level and intensity of the noise;

(e) Whether the noise has been enhanced in level or range by any type of electronic or mechanical means; and,

(f) Whether the noise can be controlled without much effort or expense to the person making the noise.

Excessive vibrations; Section 4 (1) stipulates that except as otherwise provided in these Regulations, no person shall

(a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or

(b) Cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source;

Part (2) further states that any person who contravenes the provisions of this Regulation commits an offence.

Permissible noise levels; No person shall make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property.

The table below shows the permissible noise levels as set in the first schedule of these Regulations.

Table 5; Maximum permissible noise levels

FIRST SCHEDULE **MAXIMUM PERMISSIBLE NOISE LEVELS**					
Zone		*Sound Level Limits dB(A)*		*Noise Rating Level (NR)*	
		(Leq,14 h)		*(Leq,14 h)*	
		Day	Night	Day	Night
A	Silent Zone	40	35	30	25
B	Places of worship	40	35	30	25
C	Residential; Indoor Outdoor	45 50	35 35	35 40	25 25
D	Mixed residential with some commercial and places of entertainment	55	35	50	25
E	Commercial	60	35	55	25
Time Frame Day: 6.01 a.m. – 8.00 p.m. (Leq, 14 h) Night: 8.01 p.m. – 6.00 a.m. (Leq, 10h)					

The table below shows maximum permissible noise levels for construction sites within the facility as per the second schedule of these Regulations

Table 6; Maximum permissible noise levels for construction sites

SECOND SCHEDULE **Maximum Permissible Noise Levels For Constructions Sites (Measurement taken within the facility)**			
Facility		Maximum noise level permitted **(Leq) in dB(A)**	
		Day	**Night**
(i)	Health facilities, educational institutions, homes for	60	35

	disabled, etc		
(ii)	Residential	60	35
(iii)	Areas rather than those prescribed in the (i) and (ii)	75	65
Time Frame Day: 6.01 a.m. – 6.00 p.m. (Leq, 14 h) Night: 6.01 p.m. – 6.00 a.m. (Leq, 14h)			

Relevance;

The contractor and the proponent will ensure compliance with the above Regulations during constructions works and operational stages for machineries and haulage of asbestos materials to the asbestos disposal site.

4.2.5Environmental Management and Coordination (Waste Management) Regulations, 2006.

Asbestos has been classified as hazardous waste under the Waste Management Regulations, 2006;

1) Every person who generates toxic or hazardous waste shall treat or cause to be treated such hazardous waste using the classes of incinerators prescribed in theThird Schedule to these Regulations or any other appropriate technology approved by the Authority.

2) Any leachate or other by-products of such treated waste shall be disposed of or treated in accordance with the conditions laid down in the license or in accordance with guidelines issued by the Authority in consultation with the relevant lead agency.

3) In issuing a licence for the disposal of waste, the Authority shall clearly indicate the disposal operation permitted and identified for the particular waste

Relevance

All form of wastes generated from the proposed construction and operational stages will be deposited as per the above Regulation.

4.2.6 Public Health Act Cap 242 Sections 11-13

An Act of Parliament to make provision for securing and maintaining health. Section 13 states that it shall be the duty of every health authority to take all lawful, necessary and under its circumstances reasonably practicable measures for preventing the occurrence or dealing with any outbreak, or prevalence of any infections, communicable or preventable diseases or conditions to safeguard and promote the public health and to exercise the powers and perform the duties in respect of the public health conferred or imposed on it by this Act or by any other law.

The Public Health Act Cap 247, Section 3 gives provisions for use of poisonous substances.

It refers to Regulations for protection of persons against risk of poisoning, imposing restrictions or conditions on the importation, sale, disposal, storage, transportation or use of poisonous substances. This Act also requires persons concerned with importation, sale, disposal storage, transportation or use of poisonous substances to be registered and licensed and provides measures for detecting and investigating cases in which poisoning has occurred.

The Public Health Act Sec 126 A, empowers municipal councils, urban and area councils to make by laws for all or any of the following matters with regards to buildings for - controlling the construction of buildings and the materials to be used in the construction of buildings;

Preventing the occupation of a new or altered building until a certificate of the fitness thereof for occupation or habitation has been issued by such local authority. To compel owners to repair order to demolish unsafe, dangerous or dilapidated buildings.

The Act further gives the municipal Urban or area councils power to require removal or alteration of work in certain cases the local authority may by notice to the owner either require him to pull down or remove the work, or if he so elects to comply with any other requirements.

Relevance;

The proponent has conducted this ESIA inorder to obtain license of operating a hazardous facility from NEMA which shall be regulated as per the set out laws within the Government of Kenya.

4.2.7 The Occupational Safety and Health Act, No. 15 of 2007

The purpose of the Occupational Safety and Health Act (OSHA) is to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces and to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes.

Though not explicitly provided, the act and the rules made there under have various sections on hazardous materials that apply to Asbestos.

The OSHA stipulates that an employer shall not require or permit his employee to engage in the manual handling or transportation of a load which by reason of its nature is likely to cause the employee to suffer bodily injury.

It also states that any person supplying, distributing, conveying or holding in chemicals or other toxic substances shall ensure that they are packaged, conveyed, handled and distributed in a safe manner so as not to cause any ill effect to any person or the immediate environment.

Relevance*;*

The proponent will ensure the facility operates within the conditions stipulated under this Act while ensuring prevention and control of hazards to employees at the workplace.

4.2.8 The Factories and Other Places of Work (Hazardous Substances) Rules, 2007

Asbestos has been listed as a hazardous substance and its threshold limit values given, therefore these rules apply to all workplaces where asbestos is present.

4.2.9 The Factories (Building, Operations and Work of Engineering Construction) Rules, Legal Notice No. 40 of 1984

The Factories (Building, Operations and Work of Engineering Construction) Rules, Legal

Notice No 40 of 1984, rules 20 and 21 prohibit any inhalation of dust and fumes. In any building operation or work of engineering construction where dust or fumes likely to be injurious to the health of persons employed are given off

Relevance;

The proponent shall ensure that all reasonably practicable measures shall be taken to prevent the inhalation of dust or fumes by the person employed by ensuring adequate ventilation or providing suitable respirators at the place where the operation or work is carried on.

4.2.10 The Local Government Act, Chapter 265

Section 160 (a) of The Local Government Act, Chapter 265 empowers every municipal council, town council and every urban council to establish and maintain sanitary services for the removal and destruction of, or otherwise dealing with, all kinds of refuse and effluent and, where any such service is established, to compel the use of such service by persons to whom the service is available.

Section 201(1) – (4) expands the jurisdiction of local authority to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of the health, safety and well-being of the inhabitants of its area or any part thereof and for the good rule and government of such area or any part thereof and for the prevention and suppression of nuisances. The by-laws so made may control, regulate, prevent, prohibit or compel certain activities to be undertaken and prescribe offences in case of contraventions.

Relevance;

The proponent is expected to ensure the construction and operation of the facility is in line with this Act

4.3 Institutional Framework

4.3.1 National Environment Management Authority

The Authority is established to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment. Its mandate includes implementation of Legal Notice no. 121 on Environmental Management and Coordination (Waste Management) Regulations, 2006 which stipulates the disposal of Hazardous waste such as asbestos.

4.3.1 Local Authorities

The ministry of local government is charged with the responsibility of providing guidance, supervisory sand monitoring services of local authorities in matters of infrastructure development and service delivery including solid waste.

4.3.2 Directorate of Occupational Safety and Health Services

The department is mandated to implement all rules pertaining to the protection and prevention of workers from occupational hazards and ensure safe working environment. The Directorate implements the OSHA, 2007 and various rules made there under.

4.3.3 Ministry of Public Health and Sanitation

The mandate of MoPHS is to support the attainment of the health goals of the people of Kenya by implementing priority interventions in public health, guided by the strategic framework provided from the medium-term Plan 2008-2012 and the wider health sector.

The ministry is involved in prevention of communicable and non-communicable diseases, health promotions, and curative services at all levels.

The department of environmental health and sanitation aims to reduce disease burden arising from environmental pollution, by preventing disease transmission from general environmental health pollutants.

4.3.4 Covid 19 Protocals

COVID-19 is a highly infectious disease caused by a newly discovered type of corona virus that originated from China in December 2019. On 11th March 2020, the World Health Organization (WHO) declared the outbreak of COVID-19 as a pandemic. The first case of COVID-19 was reported in Kenya on 13th 2020. Symptoms of COVID-19 as per the WHO include, Fever, Tiredness, Dry cough, Shortness of breath, Aches and pains, Sore throat, Diarrhea, nausea or a runny nose in some instances.

The proponent will ensure employees; follow the Covid -19 rules by Regular hand washing with soap and water for at least 20 seconds which is the most effective hygiene practice to prevent the spread of Covid-19. Use alcohol –based hand sanitizer if soap and water are not available. Avoid touching face and avoid contact with people who exhibit symptoms of COVID-19, Individuals to main a social distance of 1.5m while in public places.

Employees, visitors, and contractors will be required to have a mask that is covering the mouth and nose appropriately. The mask must be three layered for maximum protection. Employees will be required to submit themselves daily to a temperature test.

5.0 ANALYSIS OF ALTERNATIVES

5.1 Introduction

The Environmental Impact Assessment Study should identify and assesses alternatives to the proposed development/project. Only the best alternative (one with the least adverse impacts) should be selected based on less negative impacts and cost-benefit analysis. An important alternative to be analysed always is the "no project". This is a very important analysis because it helps the proponents measure the impacts from the project against those which would have taken place without the project.

5.2 No Project alternative

The no-action alternative is often defined by the baseline information and is crucial in the assessment of impact because other alternatives are weighed with reference to it.
This alternative would mean that the project does not proceed.
Without the project, the environmental situation will neither improve nor can we say that it will necessarily deteriorate. The No Project Alternative option in respect to the proposed project implies that the status quo be maintained. This means the proponent would not invest in the proposed project. In general, the No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:-

- The economic status of Kenyans and the local people would remain unchanged;
- No employment opportunities would be created for Kenyans who would work in the proposed project area;
- There shall be no NEMA licensed Asbestos landfill in the area to safely dispose off asbestos from people's houses and institutions whose buildings still contain asbestos materials.

5.3 The proposed development alternative

Under the proposed development alternative, the proponent would commission EIA consultants to conduct an EIA study for the proposed project. The EIA report would be submitted to NEMA for review and approval. In issuing a license, NEMA would approve the

Proponent's proposed project, provided all environmental measures are complied with during the operation phases. This alternative consists of the applicant's final proposal with the inclusion of mitigation of environmental impacts as stipulated in the EIA Regulations to the maximum extent practicable.

5.5 Alternative site/location

This would involve relocation of the proposed project to another site other than the present proposed site. Such a move would have several implications both for the proponent and the recipient environment.
Some of the implications may include:-

- Costs of purchasing land/renting new premises;
- Destruction of the new environment should the alternative site be pristine.

The proposed site is located within a 1000 acres land whose main activity is quarrying of stones.

- The site is far away from any form of residence.
- The site is served with access route to the site.

5.6 Analysis of alternative materials and technology

The proposed project will employ the use of locally and internationally accepted materials and equipment to achieve public health, safety, security and environmentally aesthetic requirements. Equipment that saves energy and water will be given first priority without compromising on cost or availability factors. It is for the aforementioned reasons that the proponent has engaged Sustainability Consultants – to make this development as green as possible.

5.7 Solid waste management alternatives

The proposed project will generate considerable amounts of solid wastes during disposal of asbestos. An integrated solid waste management system is recommended.
The proponent will give priority to reduction of the materials at source. This option will demand a solid waste management awareness program to be effected by the management and the entire workforce. In addition to that, recycling, reuse and composting of waste will be an alternative in priority. This issue calls for a source separation programme to be put in place. The proponent

management should introduce separate and adequately marked skips/ dustbins for sorting the recyclable wastes, organic matter and the other waste.

6.0 PUBLIC PARTICIPATION

6.1 Introduction

This chapter describes the process of the public consultation followed to identify the key issues and impacts of the proposed project. Views from the local residents, surrounding institutions and development partners who in one way or another would be affected or rather interested in the proposed project were sought through interviews as stipulated in the Environment Management and Coordination Act, 1999.

6.2 Objectives of the Consultation and Public Participation

The objective of the consultation and public participation was to:

1) Disseminate and inform the stakeholders about the project with special reference to its key components and location.

2) Gather comments, suggestions and concerns of the interested and affected parties.

3) Incorporate the information collected in the ESIA study.

In addition, the process enabled:

1) The establishment of a communication channel between the general public and the team of consultants, the project proponent and the government.

2) The concerns of the stakeholders to be known to the decision-making bodies at an early phase of project development.

6.3 Methodology used in the CPP

The Consultation and Public Participation (CPP) Process is a policy requirement by the Government of Kenya and a mandatory procedure as stipulated by EMCA 1999 (2015, Amendment Act) section 58, on Environmental Impact Assessment for the purpose of achieving the fundamental principles of sustainable development. The public consultation exercise was conducted in October and November, 2020. The exercise was conducted by experienced registered environmental experts. The following methods were used in consultation and public participation.

6.3.1 Key informant interviews, discussions and questionnaires

The purpose for such interviews was to identify the positive and negative impacts and subsequently promote proposals on the best practices to be adopted to mitigate the likely negative impacts. It also helped in identifying any other miscellaneous issues which may bring conflicts in case project implementation proceeds as planned. Project coordinator, land owner, hydrogeologist and key community leaders were involved in key informant interviews. Household questionnaires were administered to household heads in the proposed project site and its environs. A total of 45 questionnaires were administered to capture the household information and project positive and negative impacts (see the attached questionnaires).

6.3.2 Public consultative meeting

A public meeting was held at the proposed project site environs (See the attached programme of public meeting) on 26th October 2020. The public meeting brought together the local community leaders, land owner and members of the general public from the villages in the neighbourhood of the proposed project site. A total of 30 participants were involved in the public meeting (See the attached public meeting attendance register). Plate 9 below shows the participants during the public consultative meeting.

Plate 9: Public consultative meeting at the neighbourhood of the proposed project site

The participants raised their queries, views and opinions concerning the proposed project. The consultant responded to issues/concerns raised as outlined in Table 7 below and as contained in the annexed minutes of the public consultative meeting.

Table 7; summary of issues raised during the public meeting

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
1.	*What will happen to quarry workers at the site*	▪ One of the residents raised concerns over what will happen to quarry workers currently using the quarry pit to be used as a landfill. ▪ The representative of the land owner informed the participants that the land owner has already engaged the quarry owner who had leased the quarry. Plans have been made to re-allocatethe affected parties a new site within the expansive 1000 acre parcel of land.
2.	*Job creation*	▪ Concerns were raised over whether the proposed project will create jobs for the local residents ▪ The consultant informed the participants that a number of job opportunities will arise during construction and operation phase of the proposed landfill. In case of job opportunities, the local people will be given the first priority
3.	*When is the project likely to start*	▪ The consultant informed the participants that it is not possible to know the exact time the project will start since NEMA license should be issued before the project starts.

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
4.	*Safety of the local people*	▪ Some participants expressed concern over the safety of the local people and as such they wanted to know the measures that have been put in place ▪ The consultant informed the participants that the landfill will be lined with heavy duty PVC to ensure no percolation of water occurs. Further, the two acres where the landfill will be situated will be secured by a perimeter fence to keep off intruders. ▪ Additionally, the landfill will be constructed in accordance with NEMA guidelines for asbestos disposal sites to ensure the safety of the local people.
5.	*Type of dumpsite*	▪ Some participants wanted to know the difference of the proposed landfill and other open dump sites ▪ The consultant informed the participants that the proposed landfill will not be an open dump site. No waste will be allowed to leave the landfill. The waste will be disposed in layers of at least 30cm deep then covered by a layer of soil before another layer of waste is put. Further, the disposal of asbestos at the landfill will strictly follow NEMA guidelines for disposal of such waste.
6.	*What happens when the landfill is full*	▪ One of the participants expressed concern over what will happen once the identified landfill is full and whether they will start using other quarries as

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
		landfills ▪ The consultant informed the participants that NEMA will only license the currently identified site. In case the landfill is full, the proponent cannot start using the other quarries as landfills unless he seeks licensing from NEMA
7.	*Who will be responsible for the management of the landfill*	▪ Some participants wanted to know who will be managing the landfill ▪ The consultant informed the participants that the landfill will be managed by Jali Ecosystems Limited, which is a private company licensed by NEMA to handle and dispose asbestos. ▪ The company has leased the proposed landfill site from the land through Priand KK Logistics.
8.	*Why was the current site selected for the landfill*	▪ Concerns were raised over why the land owner selected the current quarry site for the landfill ▪ The land owner representative (Major Kang'ara) and the village elder (Mr. Benson) informed the participants that the current site was selected due to the fact that the quarry has been exhausted and as such no meaningful stone quarrying can take place at the site ▪ Further, the site was ideal since it is far from human habitation and water bodies

6.3.3 Key stakeholders consultative meetings

Two key stakeholders meetings were held at the proposed project site and its environs. The first key stakeholders' meeting was held on 19/10/2020 at the quarry site. This meeting brought together representatives from the local community leaders, land owner, quarry owners and their workers. The aim of the meeting was to get the opinions of the quarry owners and their workers since they are the immediate neighbours to the proposed project site. A total of 31 participants were involved in the first key stakeholders meeting (See the attached programme of the meeting and attendance register). Plate 10 below shows the participants during the first key stakeholders' consultative meeting.

Plate 10: First key stakeholder's consultative meeting at the quarry site

The participants raised their queries, views and opinions concerning the proposed project. The consultant responded to issues/concerns raised as outlined in Table 8 below and as contained in the annexed minutes of the first stakeholders' consultative meeting.

Table 8; summary of issues raised on the first Key stakeholder's meeting

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
1.	*Risk of water pollution*	▪ One of the participants raised concerns over possible water pollution

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
		▪ The hydrologist informed the participants that hydrogeological surveys have been done and results of the survey shows that nearest shallow aquifer is more than 18m while the main aquifer occurs at a depth of more than 50m. As such, there is no risk of likelihood of leachate or wastewater from the landfill infiltrating and contaminating the underground aquifers ▪ Further, the consultant informed the participants that the landfill will be lined with heavy PVC to ensure that no leachate or wastewater from the landfill infiltrates into the underground water aquifers ▪ Additionally, the ESIA report has put in place adequate mitigation measures to ensure both surface and underground water resources are not affected by the proposed project.
2.	*The area to be affected by the landfill*	▪ Some participants wanted to know the size of the landfill ▪ The consultant informed the participants that the landfill will occupy one quarrying pit. The landfill will occupy an area approximately 2 acres. The pit in the 2 acres has been exhausted and as such will be rehabilitated by using the waste. Once the landfill is full, it will be covered using appropriate top soil and appropriate vegetation planted.
3.	*Loss of livelihoods*	▪ One of the participants expressed concerns that the quarrying pits are their source of livelihood and if they are used as dumping sites, they will lose their livelihood sources. ▪ The consultant informed the participants that only one pit will

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
		be used as a landfill. The quarry pit has also been exhausted and as such does not contain meaningful rocks that can be extracted. ▪ Additionally, the construction activities for the landfill will also create other sources of employment opportunities for the local people.
4.	*Will all the quarrying pits be backfilled using waste*	▪ One of the participants expressed concerns over whether all the quarrying pits will be backfilled ▪ The consultant informed the participants that only one quarry pit has been identified for backfilling using asbestos waste. ▪ The land owner representative informed the participants that one of the NEMA conditions in the quarrying EIA license was to ensure that all the quarry pits are backfilled once the quarrying is over. As such, at a certain point, all the quarrying pits will be backfilled.
5.	*Source of soil for backfilling the quarries*	▪ Some participants expressed concerns over the source of soil for backfilling the quarries ▪ The consultant informed the participants that the NEMA license holder for the quarry is expected to get the backfill material regardless of its source provided that the quarries are backfilled in accordance with NEMA conditions ▪ The land owner representative informed the participants that debris, waste/rejected soil and rocks from the quarrying pits can form part of the backfill materials.

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
6.	*Rehabilitation of quarry sites*	▪ The land owner representative informed the participants that they have a duty to ensure that all quarry sites are rehabilitated through backfilling of the quarry pits and planting of appropriate vegetation. Backfilling the identified quarry pit with waste and covering it with top soil followed by planting of appropriate vegetation is one way of rehabilitating the quarry pit.
7.	*Job creation*	▪ The land owner representative informed the participants that additional jobs will be created at the proposed project site. Such jobs will be given to the local people in the proposed project site environs.

The second key stakeholders meeting was held on 3/11/2020. The meeting brought together management of Del Monte, local leadership and land owner. The aim of the meeting was to get the opinions of the management of Del Monte since they are part of the immediate neighbours to the expansive parcel of land. A total of 8 participants were involved in the second key stakeholders meeting (See the attached programme of the meeting and attendance register). Plate 11 below shows the participants during the second key stakeholders' consultative meeting.

Plate 11: Second key stakeholders' consultative meeting at Del Monte

The participants raised their queries, views and opinions concerning the proposed project. The consultant responded to issues/concerns raised as outlined in Table 9 below and as contained in the annexed minutes of the second stakeholders' consultative meeting.

Table 9; summary of issues raised on the second key stakeholder's meeting

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
1.	*Where the asbestos to be disposed will come from*	▪ One of the participants raised concerns over where the asbestos will come from ▪ The consultant informed the participants that normally, each County is supposed to have a disposal site for its waste. However, we lack asbestos disposal sites in Kenya and the proposed landfill will be among the very few NEMA licensed asbestos disposal site ▪ Further concern was expressed that the Jali Ecosystem Limited which is seeking the licensing of the proposed landfill will be in business and as such there is likelihood of

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
		asbestos from other counties being disposed at the site ▪ The participants were of the opinion that the source of asbestos to be disposed at the proposed landfill should be made clear.
2.	*What are the experiences over similar projects in Kenya*	▪ One of the participants wanted to know the experiences over the similar projects in Kenya ▪ The consultant informed the participants that the asbestos was banned in Kenya in 2006 unlike in developed countries that imposed the ban in 1970s. Since the ban and development of NEMA asbestos disposal guidelines, the country has not made meaningful progress in getting NEMA licensed asbestos landfills. As such, such projects are very rare in the country despite the huge amounts of asbestos that require disposal in Kenya.
3.	*Is asbestos biodegradable*	▪ One of the participants wanted to know if asbestos is biodegradable ▪ The consultant informed the participants that one of the challenges with asbestos is its inability to biodegrade once in the environment. ▪ Due to this challenge burial of the waste preferably in a landfill is the best disposal method.
4.	*Risk of children picking the asbestos from the landfill*	▪ One of the participants expressed concerns over likelihood of children picking the asbestos from the landfill and probably playing or selling it to outsiders

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
		▪ The consultant informed the participants that the landfill will be secured by a perimeter fences ▪ Further, precautionary signages indicating hazardous waste will be posted at the landfill ▪ Additionally, the disposal of the asbestos will strictly follow NEMA asbestos disposal guidelines where after every layer of asbestos is disposed into the landfill, it is supposed to be covered by a layer of soil thus avoiding exposure of the asbestos
5.	*What type of trees will be used to rehabilitate the landfill*	▪ The participants expressed concerns over the type of trees to be used to rehabilitate the landfill once it is full. ▪ The consultant informed the participants that in rehabilitation, it is always advisable that the native species are used since they have been tested and found to survive in the locality. ▪ Some participants were of the opinion that community members maybe tempted to plant fruit trees such as avocados (*Persia americana*). However, the consultant reminded them that this will be a private landfill and as such the land will not be accessible to members of the local community.
6.	*Depth of soil*	▪ One of the participants was concerned over the depth of the soil that should be used to cover the landfill before rehabilitation using trees. ▪ The consultant informed the participants that only suitable top soil should be used. The depth of the soil should be based on the fact that some trees are deep rooted and as such adequate

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
		depth should be ensured.
7.	*What will happen if the pit fills with water*	▪ One of the participants expressed concern over what will happen if the pit fills up with storm water and overflows ▪ The consultant explained that apart from lining the landfill with heavy duty PVC to prevent water infiltration, measures will be put in place to ensure surface run-off does not make its way into the landfill. ▪ The participants were of the opinion that this concern needs to be adequately addressed since such overflow may pollute surface water bodies
8.	*Will the land be used for other uses in future*	▪ One of the participants wanted to know if the land owner will ever put the land to another use ▪ The land owner representative explained that Salvation Army (land owner) allocates its land for different uses and as such the two acres have been set aside to be used as a landfill ▪ Further, the consultant informed the participants that once the asbestos is disposed at the landfill, it should remain there undisturbed and as such the two acres should never be used for other uses.
9.	*Leakage of wastewater from the landfill*	▪ One of the participants was of the opinion that accidental leaks of wastewater may occur from the landfill thus endangering the lives of the locals ▪ The consultant explained that disposal of asbestos is highly regulated by NEMA and all NEMA guidelines will be

S/N	KEY ISSUES RAISED	RESPONSES/OPINIONS
		followed to avoid such accidental leaks. ▪ Further, the ESIA report has adequate mitigation measures to address such likelihoods of leaks ▪ Further, Del Monte Agricultural Manager noted that asbestos does not dissolve in the soil and possess danger when the dust is in the air according to EPA. Additionally, EPA recommends each layer of asbestos to be covered by at least 30inches of soil for safe disposal
10.	*Take cautionary measures*	▪ One of the participants noted the need to take precautionary measures in disposal of asbestos to ensure we don't transfer the asbestos problems from our roofs to the disposal sites
11.	*Control of the sources of asbestos in the disposal site*	▪ One of the participants was of the opinion that should the landfill be licensed, the source of asbestos to the disposal site should be regulated
12.	*Need to rehabilitate the quarry site*	▪ Participants noted that there is need to rehabilitate the quarries in Salvation Army parcel of land
13.	*Need for a site visit*	▪ The participants were in agreement that the team visits the site

The Del Monte management made a site visit to the proposed site the day after the meeting. The field visit by Del Monte management representatives noted that the proposed project site is generally well vegetated, far from human habitation and approximately 500m away from River Chania. They concluded that generally, the site is ideal for the proposed project.

7.0 ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

7.1 Introduction

This chapter highlights the potential impacts that the proposed project may incur to the environment. It further suggests mitigation measures for the expected negative impacts of the proposed project. Potential impacts and possible mitigation measures have been analysed.

7.2 Positive Impacts

7.2 1 Safe disposal of hazardous waste

Asbestos has been used in a wide range of manufactured goods, including roofing materials, ceiling and floor tiles, paper and cement products, textiles, coatings and friction products such as automobile clutch, brake, transmission parts and sewer pipes. When used due to its resistance to fire or heat, it is woven into fabrics or mats while when used for building material such as roofing sheets, it is often mixed with cement. Due to damage, disturbance, or deterioration over time, the material releases fibres into the air. Exposure to air containing the fibres increases the risk of inhaling the fibres and developing the associated diseases.

There is increased removal and disposal of asbestos roofing materials due to global awareness of its negative health effects that may cause serious chronic health problems such as asbestosis, lung cancer and mesothelioma which causes long term serious social, economic and emotional problems.

The National Guidelines on safe management and disposal of asbestos is one of the tools for environmental management in Kenya under the Environmental Management and Coordination Act (EMCA), 1999 and the Environmental Management and Coordination (Waste Management) Regulations, 2006.This guideline provides direction for safe management of Asbestos waste and shall be the main regulatory reference material for Asbestos waste disposal. The private asbestos regulated land fill under this guideline will provide a safe site for disposal of asbestos materials.

7.2.2 Clean technology

With the global awareness of negative health effects of asbestos, most buildings are now replacing the asbestos building materials with alternative safe construction technologies that reduce or optimize the use of natural resources whilst simultaneously reducing the negative effects of asbestos technology. The need to enhance clean technology and environmental sustainabilility in construction industry such as water efficient technologies; rain water harvesting, use of eco friendly biodegradable materials that easily breaks down without release of toxins; use of biodegradable materials for building foundation, walls, insulators and paints, use solar powered roof tops has forced many premises to opt to remove ACM in buildings. A major setback has always been a safe site to dispose asbestos. This has posed a great challenge forcing people to still work and live under such buildings that over time cause serious chronic health problems. With the regulated private asbestos landfill in place, environmental sustainability can be achieved with a ready disposal site for such ACM materials.

7.2.3 Restoration of degraded Quarry sites

The private asbestos land fill is on a disused quarry initially used to excavate construction materials and has since been abandoned with deep excavated pits. Quarrying activities trigger the progressive demise of the excavated sites, which slowly degrade causing habitat fragmentation, loss of biodiversity and resources depletion. After the completion of excavation activities, if the site is solely left for natural recovery, natural dynamics processes are only able to reinstate the prior prevailing conditions and ecological functions after a period which might exceed 25 years (Khater, 2010).Quarries represent extreme cases of degradation characterized by complete removal of vegetation cover and profound landform modifications. By the end of the excavation operations, and in the absence of any rehabilitation, quarries are left to undergo sustained degradation towards increased ecosystem deterioration, surface runoff, accelerated erosion and reduced natural recharge.

The proposed landfill is aimed at restoring the degraded quarry sites and allowing them recover to its former state.

7.2.4 Stabilization of steep slopes

Abandoned quarries present challenges for restoration of these degraded habitats. Quarry cliff face is a unique and extreme habitat that is often unsuitable for plant growth and is associated with increased soil erosion and physical safety hazards due to the steep slopes and lack of plant colonization. Rehabilitation of the quarry is mainly focused on the quarry floor where the site is left to undergo a natural restoration which is a very slow process, requiring possibly hundreds of years, to fully reclaim.

The proposed landfill will make use of the excavated and abandoned quarry pits by filling it with asbestos materials disposed as per the set guidelines. The materials once full will be covered with a layer of top soil which eventually reduce and completely levels off the steep cliffs that poses physical and safety hazzards.

7.2.5 Creation of Employment

The proposed establishment of the asbestos disposal site will create employment during construction of perimeter wall and throughout operational stages for disposal activities.

7.2.6 Re-vegetation

The National Guidelines on safe management and disposal of asbestos requires a licensed waste disposer to cover the disposal materials with a layer of soils. Efforts to restoring degraded sites should allow for a fully functioning ecosystem with abiotic and biotic interactions. The soil layer will be deep enough to support regrowth of vegetation that would have taken several years to establish on these degraded sites.

7.3 Anticipated Negative Impacts and Mitigation Measures

7.3.1 Air emissions

Asbestos waste and ACM have fibres that can escape into the atmosphere and dispersed to the neighbouring areas and surface water by wind

7.3.1.1 Potential effects

Health effects of asbestos exposure

Inhalation of asbestos fibres is the type of exposure that is most likely to cause adverse health effects for people that causes lung cancer and mesothelioma. Fibres below three micro-metres in diameter are referred to as respirable, meaning that they may enter the deepest parts of the lung.

Larger fibres are deposited in the nose and major airways, and are cleared by normal physiological processes; however, smaller fibres are generally deposited in the minor airways and airspaces (alveoli). Generally, fibres below three micro-metres in diameter and greater than eight micrometres in length are potentially carcinogenic, and the risk of cancer increases as fibre diameter decreases.

The risk of cancer is also greater with increased exposure to asbestos, and vice versa critically. The amount of asbestos a person is exposed to varies according to how many fibres are in the air and how long a person inhales the air containing the fibres. Health problems are usually related to the amount and length of time of exposure to asbestos.

Exposure risks

The proposed landfill site is located in a private land that is limited to public access. The over 1000 acres of land has minimal residential area as the land mainly compose of quarrying activities that operate during the day. Most of the quarry operators within the vicinity of the project area reside away from the working area. The possible residential areas near the site are approximately 1.2Km away from the proposed site. The risk of exposure to the surrounding community is not considered to be significant.

7.3.1.2 Mitigation measures

Current site conditions

- Location of the proposed site is within the quarry sites away from residential areas
- The area has established native vegetation. Vegetation is known to have a significant scavenging effects upon airborne particles
- The presence of tress will reduce the speed of wind from the site reducing community exposure to asbestos fibres.

Proposed mitigation measures

- Install a metrological station to monitor the speed and direction of wind
- Limit disposal operations during high winds.
- The trees lining the access road on both sides, and lining the disposal site should be maintained and managed to ensure they continue to provide a wind break and assist in scavenging any airborne fibres.
- Landfill design-The landfill design will result in the majority of surfaces being buried within the landfill. This will limit the ability of surface being exposed to asbestos.
- All surface waters will be passed through a large sediment collection pond.
- **Vehicle access**-Vehicle access will be upgraded to improve visibility
- **Covers**-Stockpiles of suitable cover materials will be held to ensure that ACM can be effectively covered.
- **Water**-Water for wetting materials and washing vehicles will be continuously available from a primary storage of elevated high capacity tanks to provide irrigation water by gravity to the operation site.
- **Drainage**-All surface drainage will be diverted through a sump on the active disposal surface prior to passing through the water supply area.
- **Site security** – The site will be fenced and locked,
    - Restricting vehicle access to the site.
    - Only authorized persons will be allowed at any time.
    - Access will be controlled with access codes and
    - Installation of CCTV to monitor activity within the site.

- **Vehicle speed** - Speed limits for heavy vehicles will be restricted to 10 km/hr on approach and exit from the site.
- **Signage –** appropriate signs will be placed across the site including access point identifying hazards and controls.
- **Wind –** discourage disposal works and deliveries of materials during elevated wind speeds.
    - Allow for disposal contracts which will include conditions that allow for the closure of the site due to weather conditions.
- **Hours of operation** - restrict the disposal operation within 6:00am to 6:00pm.
- **Incidences-**record all incidences and work-related hazards in an incident report and actions taken to prevent recurrence.
- **Monitoring** - Wind conditions will be monitored continuously and the operations shut down if unsuitable.
    - Install an alternative source of energy such as solar to enhance monitoring
- **ACM Control –** The site manager will program deliveries and stop deliveries if operations are not meeting the required standards. He will oversee deliveries on site and sign off at the end of each day that he has checked the ACM area and all material is covered and the site is safe for the end of the working day.
- **Emergency preparedness and response** - Improvements to the site emergency response will be implemented to ensure that sufficient water, cleanup and recovery equipment is available in an emergency.

7.3.2 Water quality

The proponent shall install Diversion drains around the landfill site to minimize the amount of surface water entering and potentially being contaminated.

Regular monitoring of near surface water, river and stream to mentain water quality and avert pollution.

Wash down design

The design of the Wash down and spraying of trucks will be at the discharge point so that runoff goes into the soak drain.

The soak drains holds and controls flow from the disposal area, allowing sediment to settle and be covered in the fill process. The water will then pass to the flush tanks for settling before passing to the settling ponds.

The proponent will Recycle water for the spray system should the buffer tank level be elevated. In the event of an emergency such as truck carrying asbestos overturning, the operators in their PPE would immediately spray the area to prevent fiber emission and move the material into the burial site to be covered. When an emergency occurs the recycle water system will be isolated immediately to allow any solid material that is washed into the buffer tank to settle before the recycle system is restarted.

7.3.2.1 Potential effects

Uncontrolled surface water discharges from the landfill site could result in suspended sediment concentrations.

The source of sediment could be from road surfaces, exposed banks and operational areas of the landfill site.

7.3.2.3 Mitigation measures

- Deliveries that are suspected of containing contaminated materials, other than ACM will not be accepted at the site.
- Confirmation of material composition and properties will be undertaken on a case by case basis by analysis of materials prior to delivery.
- All site drainage from the waste depot that can be contaminated with sediments during rain events will pass through flush tanks.

7.3.3 Groundwater and River contamination

Recent studies have shown that asbestos fibres have capacity to travel through soil and contaminate ground water.

The topography of the proposed site is slightly slopping towards the Chania River. Any potential contaminants are likely to migrate towards the Chania River.

Ground water and river water monitoring should be conducted above and below the landfill site.

7.3.3.1 Potential effects

The proposed landfill operations have potential to pollute River Chania.

7.3.3.2 Mitigation measures

- All materials to be brought onto site will require evidence of providence and if considered to be a contamination risk will be required to provide analysis indicting no contamination of other sources including metals and hydrocarbons.
- The installation of surface water drainage system will divert water around the landfill and direct all incident waters to a sediment trapping system. This reduction in water into the landfill zone will reduce ingress/entry of potential leachate.
- Maintain level of restricted access to reduce instances of illegal dumping.
- Prohibit storage of fuel or oil at the active waste disposal area.
- The depth of the disposal pit shall be as deep as practically possible to accommodate more asbestos waste but at least one (1) metre above water table.
- The asbestos should be lowered gently into the disposal site and should not be dropped from any height to avoid breakage.
- When all available asbestos has been lowered into the pit, cover with polythene paper followed by 6 inch layer of soil. Continue doing this until the pit is full or the waste is finished.
- The pit shall be considered full when the asbestos waste is **one meter** below the ground level or the asbestos waste is exhausted.
- After the pit is full, cover with 500 gauges double wrapped polythene sheet and fill the pit with layer of soil up to the ground level.
- Monitor ground water quality and reduce metal concentration while improving long term chemical stability

7.3.4 Noise pollution

The proposed disposal site is located in a zone with a low density housing environment. The nearest noise receptor (residential and commercial zones) is located approximately 1.2Km from

the proposed site. The possible impacts of noise are to the quarry operators and the areas along the access route to the site being affected by transportation of waste to the site.

The proposed operations will be within the maximum permissible levels (45 dB(A) limits) not to be exceeded at the nearest residence.

The proponent will regulate noise levels as per the Environment Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009**.**

7.3.4.1 Potential effects

Considering the location of the facility in terms of proximity to residences, predominant wind direction and topography and the types of equipment to be used the risk of nuisance noise emissions is not considered to be significant. Maximum noise contributions from vehicles is expected to be present for a very short periods of time when delivering the ACM.

Potential source of noise will be mainly from excavators and trucks delivering materials to the site.

7.3.4.2 Mitigation measures

- Plant and maintain vegetation cover
- Erect a perimeter wall 2m high round the disposal site
- Restrict operational hours within hours provided in the Environment Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009**.**
- Allow only one truck on site at a time, and requiring queuing trucks to wait with their engines turned off.

7.3.5 Biodiversity and natural values

Existing conditions

The proposed site has minimal vegetation cover as the site is a disused quarry as it was initially use for extraction of construction stones. The surrounding environment is dorminated by

Lantana Camara and a few scattered species of *Croton macrostychus*, *Tithonia diversifolias*, *Solanum incanum*, *Euphorbia candelabrum*, *Risinus sp* among others.

7.3.5.1 Potential effects

The proposed project will affect the vegetation around the quarry site during the construction of the perimeter wall. Only a few of the grass species within the quarry site will be uprooted as there is little regrowth.

7.3.5.2 Mitigation measures

- Progressive rehabilitation of the landfill with replanting of native species
- Prepare revegetation and weed management plans
- The proponent will ensure replanting and encourage vegetation growth on the boundaries of the site to mitigate potential dust and noise emissions.
- The final rehabilitation of the quarry will include planting of trees at the landfill site once the operation ceases. This will result in a permanent and stable native vegetation community on currently disturbed surfaces

7.3.6 Greenhouse gases and ozone depleting substances

Greenhouse gasses considered in potential emissions includes carbon dioxide and nitrous oxide, which will be emitted when fuels are burnt in diesel powered machineries

7.3.6.1 Mitigation measure

- Schedule delivery of materials by trucks to the site
- Prohibit idling of vehicles while awaiting clearance to or from the site.
- Encourage vegetation buffer along the access routes and round the site that act as carbon sinks.

7.3.7 Visual effects

This proposed site offers the natural advantage of having limited visibility to the local area and residents.

The site is on a slightly sloping land towards chania River and does not provide topographical barrier to areas adjacent the River.

7.3.7.1 Mitigation measures

- Construct a perimeter wall 2m high round the landfill
- Maintain and replant vegetation cover round the site

7.3.8 Safety and Health issues

OH&S management at the site will be focused on limiting exposure of operations personnel, contractors, visitors and the public from exposure to airborne asbestos fibres.

Health monitoring includes a medical examination to provide an initial baseline medical assessment. Health monitoring must include the following

- consideration of the worker's demographic, medical and occupational history
- consideration of records of the worker's personal exposure, and
- a physical examination of the worker with emphasis on the respiratory system,

7.3.8.1 Mitigation measures

- The site will be secured by a 2m perimeter wall and a lockable gate limiting access to Landfill personnel.
- All ACM arriving at site should be fully enclosed and secured.
- A wash down area will be provided for all trucks and vehicles leaving site.
- Stockpiled materials will be available on site to cover materials once arrived.
- Water will be available to treat materials arriving on site to ensure that they are adequately wetted.
- Irrigation systems will be available to wet disposal areas.

- Placing appropriate signage at the entrance and throughout site warning of asbestos hazards.
- Implement ambient air quality monitoring during operation and integrated with environmental monitoring.
- Training in asbestos hazards and procedures to mitigate exposure risks will be provided to operators and visitors.
- An emergency response plan will be prepared to specifically address an event resulting in accidental spill of ACM.
- Personnel health monitoring programs will be implemented and records to be maintained management Personal Protective Equipment. Suitable PPE will be made available at site including disposable coveralls, respirators and gloves.

8.0 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

8.1 Overview

This Environmental Impact Assessment Project Report complies with the requirements of the Environmental Management and Co-ordination Act (EMCA) 2015 and takes into consideration the applicable local and international standards and best practices.
As a requirement in EMCA, the report should provide for a detailed Environmental Management Plan (EMP).

The EMP presented in this chapter summarises the key impact elements identified and the remedial measures, the actions to be taken by various parties and the monitoring activities. An indication of the time scale for implementation and cost involved is also provided. The EMP can be further expanded during implementation with documented procedures and guidelines for work practices so as to be as responsive to the situations that various Contract Parties will encounter. The parties should formulate procedures and practices and maintain records as required by the Act (EMCA, 2015).

The implementation of the EMP should be done within the provisions of the law and for the ultimate benefit of the stakeholders in the project area. The effectiveness of the EMP shall be monitored and assessed during formal inspections and at the end of the project when an overall audit of the works shall be carried out.

Table 10; Environmental Management and Monitoring Plan

Project Activity	**Impact**	**Mitigation measures**	**Monitoring indicators**	**Budget (KES)**	**Responsible party**	**Time Frame**
Actual removal of asbestos						
construction o f perimeter wall, and disposal pits,	Disposal of asbestos containing materials from demolitions	• Dispose all asbestos containing materials according to NEMA requirements and guidelines	• The ESMP • Number of holding days	200,000	Proponent /contractor	During construction works
	Construction Works Noise Auditory Nuisance	• Restrict noisy construction activities to normal working hours (8am - 5pm). • Inform local residents and neighboring agencies beforehand • noise protection gear for workers • All construction equipment should be regularly inspected and serviced. • Use of ear protectors (ear	• Posters / public notices • noise protection gears • well maintained equipment	10,000	Contractor	During construction works

		plugs/muffs) by workers • Recondition engine exhaust systems • Engine tune-up • Establish inspection program for equipment				
	• Public health, occupational safety and health, and security	• Fence off the site to keep off intruders. • Train staff/workers on occupational safety and health. • Provide full protective gear & workmen's compensation cover in addition to the right tools and operational instructions & manuals during construction. • Ensure use of standard construction materials and to the specifications. Avoid undesirable, substandard, hazardous or unauthorized materials during construction & maintenance.	• Complaints on health, safety, and security aspects • Special focus on material sites and the project site	15,000	Proponent /contractor	During construction works

		• Sensitized staff on social/health issues such as drugs. • Ensure machinery and equipment servicing and maintenance as per schedules & legal requirements. • Post strategically the Factories and Other Places of Work Act Abstract. • Post clear warning signs e.g. 'No unauthorized use of machines', ensure there are guards on moving parts etc. • Provide fully equipped First Aid kits & train staff on its use. • Ensure adherence with the legal requirements- OSHA, 2007. • Sensitize construction workers on environmental management. • Deploy security personnel(s) at the entrance to the construction area to monitor how construction				

		workers move in and out of site. Materials/equipment moving in and out should also be recorded				
	Emissions	• Use of respirators by workers • Recondition engine exhaust systems • Engine tune-up • Establish inspection program for equipment/incinerator	• Air Quality	20,000	contractor	
	• Road safety issues	• Enforce speed limits for construction vehicles especially along roads leading to the site even within the hospital. • Provide bill boards at the site/entrance to notify motorists about the development. • Provide safe entry and exit points	• During the construction phase by traffic and roads department/transporters			

	Solid waste generation	• A site waste management plan • Any vegetation and combustible waste must not be burned on the site. • Reusable inorganic should be stockpiled away from drainage features and used for in filling where necessary and/or possible. • Unusable construction waste must be disposed of at an approved disposal site. • Provide solid waste receptacles and storage containers, • Make arrangements for the daily collection of litter from the site	• Dust bins/pits • toilets • waste collection schedule	15,000	Contractor	During construction works
	Dust emissions	• Covering of all haulage vehicles carrying blocks, sand, aggregate and cement • Stockpiles of fine materials (e.g. sand and ballast) should be wetted or covered with tarpaulin	• Covered sand, cement, soils; • Dust masks, • Minimal staff/people in dust prone areas	10,000	Contractor/ Proponent	During construction works

		during windy conditions. • Access roads and exposed ground must be wetted in a manner and at a frequency that effectively keeps down the dust. • Workers in dusty areas on the site should be issued with dust masks during dry and windy conditions • Removing vulnerable people from the construction sites; • Reduction of congestion of human population;				
	Generation of exhaust and gaseous emissions	• Minimize operation of worn out equipment • Ensure proper repairs on equipment Proper engine tune up • Regular inspection and maintenance of construction equipment • Reduce machines and vehicles	• Regularity of maintenance and checks • amount of fuel used, • state of equipment and machinery	10,000	Contractor	During construction works

		idling time • Avoid burning of solid waste at the site • Keep fuel usage at a minimum				
	Increased water demand	• Providing adequate water storage reservoirs at the construction site to meet project needs during periods of high demand externally and refill • Implementing appropriate water conservation measures	• Number of water storage tanks • boreholes/individual water supply • water conservation strategies	30,000	Proponent	During construction works
	Accidents and other occupational health	• Provide workers with Protective Personal Equipment (PPEs) • Ensure occupational safety measures are upheld, including a First Aid Box • Train workers on occupational safety and Health • Proper signs on site to warn workers of safety requirements • Display in the site telephone	• Number of ear plugs and protective clothing bought • Medical records	20,000	Proponent/ Drilling Contractor	During construction works

		numbers of ambulances • Provide safe scaffoldings and railings at heights				
	• Storage and handling of hazardous materials	• Obtain material safety data sheets for all hazardous materials and products handled at the site • Obtain personal protective equipment for the workers responsible for handling hazardous materials • Train the workers on safe handling procedures	• Material Safety Data Sheet	55,000	Contractor/proponent	construction & operational
	Emergency response	• Keep a record of the public emergency service telephone numbers including: Police Fire brigade Ambulance services • Document an emergency response procedure • • Train staff on emergency	• Safety response	50,000	contractor	

		response				
	Socio-economic issues Labor influx Social relationships and contacts during construction; Safety issues; Social related infections associated with interactions including HIV/AIDS and other communicable diseases.	• Ensure at least 60% of the casual employment is drawn from the local communities, • Consult with neighborhoods on activities affecting them and collaborate mitigation; • Ensure effective signage and information to road users when transporting materials; • The contractor to establish and manage initiatives on social mitigation measures. • Incorporate HIV/AIDS and communicable diseases control program as part of the construction deliverables. • Enforce occupational health, safety and hazard control on site. • Inform local communities of major activities in advance.	Trends in socio-economic dynamics • Trends in HIV/AIDS cases in the area,	50,000	Proponent contractor	

		• Screen the health of potential workers for communicable diseases as part of the recruitment process. • Undertake background checks of potential workers about any past involvement in any offenses. • Provide the workforce with access to primary healthcare on site, including prescriptions, prophylactics, condoms and basic testing for TB etc. • Provide awareness training to the workforce, in particular regarding the transmission of STDs, and traffic safety awareness, • Develop and enforce a strict code of conduct for workers to regulate behavior in the local communities, • • Prepare local communities for				

		any large influx of workers by developing				
			OPERATIONS PHASE			
	Air quality	• Install a meteological station to monitor the speed and direction of wind • Limit disposal operations during high winds. • The trees lining the access road on both sides, and lining the disposal site should be maintained • All surface waters to be passed through a large sediment collection pond. • Vehicle access to be upgraded to improve	• Periodic acessment of air quality • Monitoring records • Incidence register • Vegetation cover	70,000	Contractor Proponent OHS officer	Operational stages

		visibility • Stockpiles of suitable cover materials to be held to ensure that ACM can be effectively covered. • Water for wetting materials and washing vehicles to be continuously available • All surface drainage to be diverted to a common water collection point • The site will be fenced and locked, • Speed limits for heavy vehicles will be restricted to 10 km/hr on approach and exit from the site. • Appropriate signs will be placed across the site including access point identifying hazards and				

		controls. • discourage disposal works and deliveries of materials during elevated wind speeds. • restrict the disposal operation within 6:00am to 6:00pm. • record all incidences and work related hazards in an incident report and actions taken to prevent recurrence.				
	Water quality	• Avoid receiving contaminated materials with heavy metals . • Prohibit storage of fuel or oil at the active waste disposal area. • The depth of the disposal pit shall be at least one (1) metre above water table.	• Drainage channels along the proposed site • Deliverly records	50,000	Proponent OHS officer Site supervisors	

		• The asbestos should be lowered gently into the disposal site and should not be dropped from any height to avoid breakage. • cover the pits with polythene paper followed by 6 inch layer of soil. Continue doing this until the pit is full or the waste is finished. • The pit shall be considered full when the asbestos waste is **one meter** below the ground level or the asbestos waste is exhausted. • After the pit is full, cover with 500 gauges double wrapped polythene sheet and fill the pit with layer of soil up to the ground level.				
	Noise pollution	• Plant and maintain vegetation cover	• Environmental quality trends	50,000	Proponent Site	During construction

		• Conducyt Noise surveys • Erect a perimeter wall 2m high round the disposal site • Restrict operational hours within hours provided in the Environment Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. • Allow only one truck on site at a time, and requiring queuing trucks to wait with their engines turned off. • Provide workers with PPEs	• Annual Environmental Audits • Noise records		supervisors	works
	Biological diversity	• Progressive rehabilitation of the landfill with replanting of native	• Re-growth of vegetation	30,000	Proponent	Throughout project cycle

		species • Prepare revegetation and weed management plans • The final rehabilitation of the quarry will include planting of trees at the landfill site once the operation ceases. This will result in a permanent and stable native vegetation community on currently disturbed surfaces	• Number of trees planted			
	waste management	• Inform cleaning and disposal workers of their responsibilities in terms of the EMP. • Ensure that all waste removal workers comply with the Waste Regulations of 2006.	• Number of bins present • Waste collection documents	15,000	Contractor/Proponent	During operational works

		• Collect waste paper generated at the work site in scrap paper bins. • Notify the waste paper removal worker/contractor when temporary scrap paper storage area reaches capacity, for removal of the scrap paper to a recycling facility. • Place all general / domestic waste in refuse bins.				

	Fire Hazards	Install firefighting equipment prior to operation of the project premises. • Ensure firefighting equipment are inspected and serviced at least twice in a period of one year. • Identify and mark conspicuously an emergency assembling point.	• No. of firefighting equipment • Condition of firefighting equipment • Emergency assembling points	15,000	Proponent	Production/ operational phase
	Increased pressure on water Possible Overexploitation or depletion of water resources	• Monitor water usage • Ensure efficiency in proponents' household by minimizing unnecessary wastage • Collect surface water along the drainage and recycle for wetting surfaces	• Amount of water used • Water storage facilities • Water usage and levels monitoring records • Trainings on water use efficiency • Water harvesting facilities	20,000	Proponent	Through operation phase

		• Initiate and train both the workers on techniques and skills to harvest rain water				
	Increased pressure on infrastructure	• Regular maintenance of access roads to the site in collaboration with the county government	• State of access roads to construction site	20,000	Proponent	Through operation phase
	Visual Impacts	• Construct a perimeter wall 2m high round the landfill • Maintain and replant vegetation cover round the site	• reg-rowth of trees and native vegetation	20,000	Contractor Proponent	During operational stages
	Occupational Safety and Health	• Develop and strategically display an OHS policy. • Ensure the OHS policy is implemented. • Provide staff with appropriate PPEs and	Complaints on Safety and Health	50,000	Proponent OHS officer	Throughout project cycle

		enforce their use. • Conduct regular first-aid training of first aiders. • Conduct regular training of staff on OHS. • Provide an adequate number of well-stocked first aid kits. • The site will be secured by a 2m perimeter wall and a lockable gate limiting access to Landfill personnel. All ACM arriving at site should be fully enclosed and secured. • A wash down area will be provided for all trucks and vehicles leaving site. • Stockpiled materials will be available on site to cover materials once				

		arrived. • Water will be available to treat materials arriving on site to ensure that they are adequately wetted. • Irrigation systems will be available to wet disposal areas. • Placing appropriate signage at the entrance and throughout site warning of asbestos hazards. • Implement ambient air quality monitoring during operation and integrated with environmental monitoring. • Training in asbestos hazards and procedures to mitigate exposure risks will be provided to				

		operators and visitors. • An emergency response plan will be prepared to specifically address an event resulting in accidental spill of ACM. • Implement Personnel health monitoring programs maintained management Personnel • Protective equipment Suitable PPE will be made available at site including disposable overalls, respirators and gloves.				
	•Indiscriminate disposal of waste	• Segregate waste into various waste streams • Implement procedures for the management of various categories of	Complaints on Safety and Health	30,00	proponent	

		waste including temporary storage, transport and final disposal or selling to licensed scrap dealers. • Transport waste from the site for appropriate disposal in accordance with Environmental Management and Coordination (Waste Management) Regulations, 2006				

Decommissioning and rehabilitation Plans

Potential post-closure uses

- Once the waste depot operations cease at this site, it is proposed that the site will be revegetated after closure.
- All transportation vessels, re-useable containers or any other similar article which have been in contact with asbestos waste shall be cleaned at the disposal site.
- The disposal site should be maintained including the warning signs, the fence, the gate among others to prevent vandalism and interference.
- Human activities which might interfere with the buried asbestos waste such as construction and pitting should not be allowed at the disposal site.
- The waste generator shall notify the Authority in writing on completion of disposal of asbestos waste.

Final Rehabilitation

- Compaction and capping; Compaction and capping will be implemented in a progressive manner during the life of the waste depot.
- A 100mm (min) layer of topsoil and will be placed as a growing media.
- After the structural rehabilitation is complete the area will be progressively rehabilitated by planting of local native trees as each level is complete.
- Removal of structures ; Once all operational site activities cease,
- Fencing and some warning signage will remain to ensure adequate site security, to reduce the proponent's risk level with unauthorized entry.
- Commitment - After the structural rehabilitation is complete the area will be progressively rehabilitated by planting of local native trees
- Maintenance -A post-closure maintenance program will be developed to ensure that environmental damage does not occur after closure.
- Maintenance activities will include;
    - ✓ Maintaining design contours (i.e. fill addition or topsoil in depressions).
    - ✓ Sealing surface cracks.
- Reporting; a rehabilitation completion report will be submitted to NEMA once all rehabilitation works are completed.

Summary of Asbestos landfill Operations

Notification

- Notify the site operators on time of any disposal of materials at least within 24 hours
- Operations to be between 7:00am to 6:00pm

Landfill preparation

- Provision of PPEs to workers; Disposable coveralls, gloves and respiratory
- remove unnecessary personnel out of site
- Ensure signage in place
- Ensure availability of An excavation pit to accommodate the volume of material
- Availability of water for wetting materials and surfaces

Transportation of ACM

- All trucks transporting the Asbestos materials should be Licensed by NEMA
- ACM will only be accepted at the Landfill Facility under the following conditions of
- entry:
- the ACM shall be separated from any other waste
- ACM must covered leak proof vehicle
- Must be contained in double wrapping plastic

Unloading/disposal

- All ACM must be wrapped and sealed in plastic and remain sealed when off loaded.
- All workers must wear protective clothing
- The waste must be unloaded in a manner so as to avoid breaking, creation of dust
- and in a manner which prevents the rupture of bundles
- If the plastic wrapping breaks open during tipping, the area must beimmediately sprayed with low pressure water to reduce dust
- The asbestos are lowered slowly to the lined pit and covered with a layer of soil until the pit is full
- Re-vegetation with native plants

9.0 CONCLUSION AND RECOMMENDATIONS

Asbestos is a hazardous material with extremely fine fibres and can remain suspended in air for hours. If handled without caution, it may cause serious chronic health problems such as asbestosis, lung cancer and mesothelioma. There is increased removal and disposal of asbestos roofing materials due to global awareness of its negative health effects, deterioration of asbestos sheets over time and increased drive towards roof water harvesting. The removal and disposal of asbestos has not been done in accordance with any guideline. In order to increase awareness and to reduce or eliminate the risk of exposure to asbestos fibres and thus the risk of disease, a consistent approach to management of asbestos especially handling, demolitions, renovations and disposal.

This ESIA study report has proposed adequate mitigation measures to potential environmental and social impacts relating to the operation of the landfill. With the available monitoring plans proposed, the Environmental experts found the site suitable for the activity and should be licensed on condition the proponent should adhere to EMP and comply with all statutory requirements for handling and disposal of Asbestos including ensuring that all vehicles transporting asbestos are Licensed by NEMA.

The following recommendations are made with respect to the implementation of the proposed Project

i. The waste generator shall notify the Authority on commencement of disposal activities.
ii. All asbestos sheets and the debris should be wrapped before it is hauled to the disposal site or transfer station in a covered vehicle.
iii. The depth of the disposal pit shall be as deep as practically possible to accommodate more asbestos waste
iv. The asbestos shall be lowered gently into the disposal site and should not be dropped from any height to avoid breakage.
v. The waste generator shall notify the Authority in writing on completion of disposal of asbestos waste.

10.0 REFERENCES

Government of Kenya (1999): Population and Housing Census (CBS)

Government of Kenya, (1999).The Environment Management and Coordination Act, 1999. Nairobi County: Government Printer.

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khater, C., A. Martin, and J. Maillet. 2003. Spontaneous vegetation dynamics and restoration prospects for limestone quarries. Applied Vegetation Science 6:199–204.

11.0 APPENDICES

- ✓ **Geophysical and hydrogeological Report**
- ✓ **Risk assessment Report**
- ✓ **TOR Approval**
- ✓ **Copy of land ownership documents**
- ✓ **Copy Registration Certificate**
- ✓ **Copy of KRA PIN**
- ✓ **NEMA Expert licenses**
- ✓ **Public participation questionnaires**
- ✓ **Minutes of the stakeholders meeting**
- ✓ **Attendance list for stakeholders meeting**
- ✓ **Design of the proposed landfill**

FORM 7 (r.15(2))

nema
mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/12669

Application Reference No: NEMA/EIA/EL/16858

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in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **5/11/2020** Expiry Date: **12/31/2020**

Signature…..

(Seal)
Director General
The National Environment Management Authority

P.T.O.

FORM 7 (r.15(2))

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/12205

Application Reference No: NEMA/EIA/EL/15552

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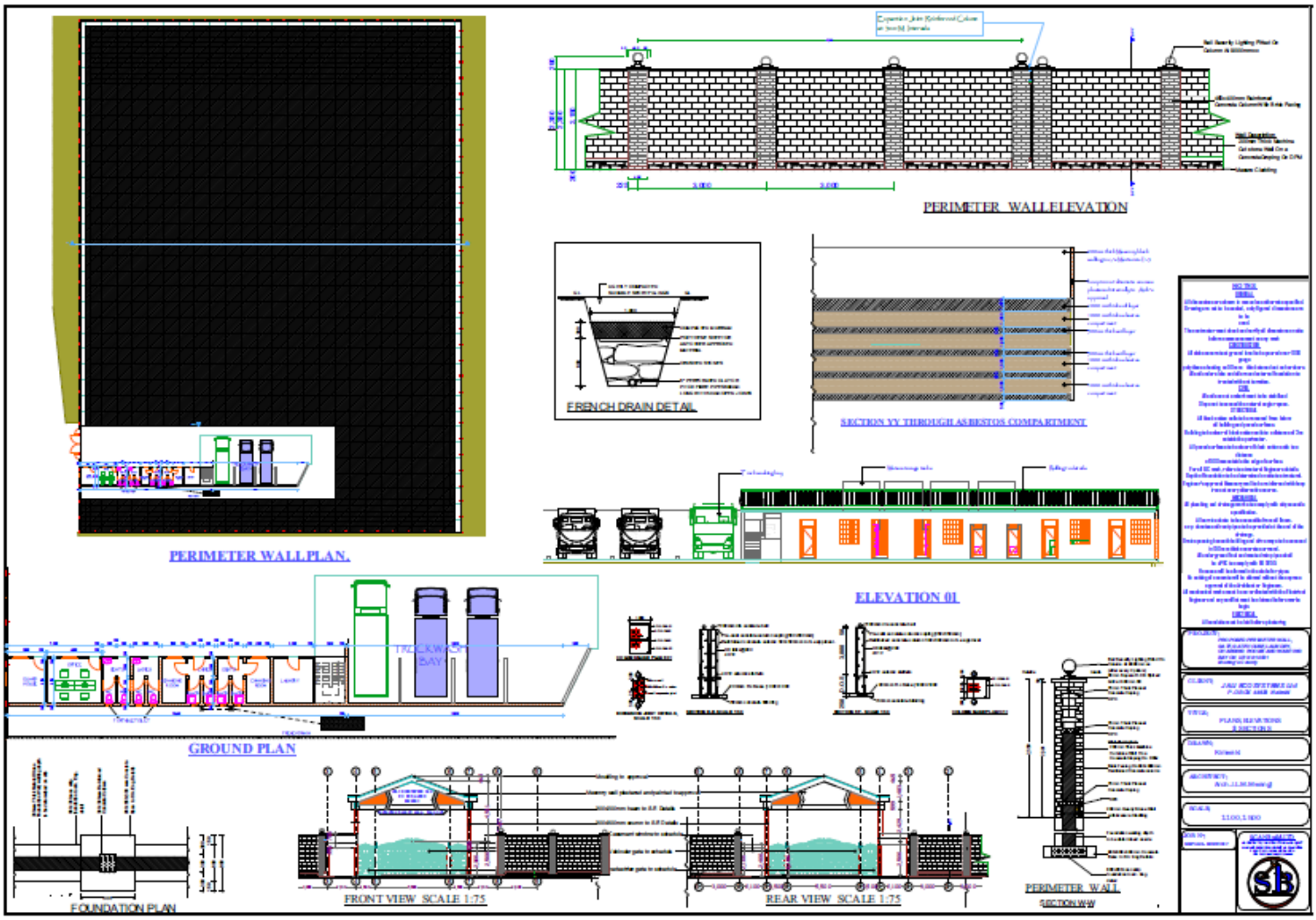
in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **2/26/2020** Expiry Date: **12/31/2020**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.


PERIMETER WALL ELEVATION
FRENCH DRAIN DETAIL
SECTION YY THROUGH ASBESTOS COMPARTMENT
PERIMETER WALL PLAN.
ELEVATION 01
GROUND PLAN
FOUNDATION PLAN
FRONT VIEW SCALE 1:75
REAR VIEW SCALE 1:75
PERIMETER WALL
SECTION WW