ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED ASBESTOS DISPOSAL SITE ON PLOT NO. KWALE/SHIMONI ADJ./552 SITUATED AT FIKIRINI VILLAGE IN KWALE COUNTY

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CERTIFICATION

Certification by the Lead EIA/EA Expert

We hereby certify that this Environmental Impact Assessment study report has been done under our supervision and that the assessment criteria, methodology and content reporting conform to the requirements of the Environmental Management and Coordination Act Cap. 387 and Legal Notice No. 101 of 2003 (Environmental Impact Assessment and Audit Regulations).

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Certification by Proponent

This Environmental Impact Assessment study has been undertaken under my authority and shall implement the mitigation measures proposed and undertake to implement further instructions as NEMA may deem appropriate in relation to the findings and from time to time as inspections may inform.

Signature: ……*Date:* ……..

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ACKNOWLEDGEMENTS

Many people have directly contributed to this Environmental Impact Assessment exercise. It would be impossible to thank each and every one of them individually. The consulting team hopes that its efforts in rendering the collective findings of this exercise will do justice to the many who assisted and facilitated this work.

The team must however acknowledge the logistical support provided by the proponent. We also recognize all project stakeholders and neighbours for agreeing to participate in the public consultative process. To all who helped and have not been mentioned individually, kindly accept our sincere thanks.

EXECUTIVE SUMMARY

This Environmental Impact Assessment (EIA) study was conducted for and on behalf of the proponent in compliance with the Environmental Management and Coordination Act Cap. 387 which requires that EIA study be carried out for activities such as the proposed. Provisions of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003 also dictate the submission of such an assessment to the National Environment Management Authority (NEMA). The proposed project requires EIA study report so that all the anticipated impacts can be screened and examined to detail as dictated on second schedule of Legal Notice (LN) No. 101 of 2003.

The proponent is proposing to establish and operate an asbestos disposal site on Land Reference (LR) No. Kwale/Shimoni Adj/552 situated at Fikirini in Kwale County. The land parcel covers an approximated area of 4.25 acres and lies within geo-reference points: -4.612167, 39.344833 (4°36'43.8"S 39°20'41.4"E). Asbestos material shall be disposed of in pits with dimensions of 7m x 2.5m x 4m (LWH) and shall bear 130mm thick concrete lining/wall and a base of similar thickness. All the pits shall be lined with water proof sheeting before asbestos material is disposed of. A 500 gauge double wrapped polythene sheet is recommended. The proposed 4m depth for the disposal pits is by way too far from the water struck level that was estimated at 20m below ground level after geophysical investigations coupled with hydrogeological information. Disposed asbestos material shall be at least 1m below the ground level.

Asbestos is classified as hazardous in the fourth schedule (Y36) of The Environmental Management and Coordination (Waste Management) Regulations – LN No. 101, 2006. Asbestos is a group of six fibrous minerals that occur naturally in metamorphic deposits located around the world. Of the hydrous magnesium silicate variety, the six types include tremolite, actinolite, anthophyllite, chrysotile, amosite and crocidolite. The major producers of asbestos include Canada, Kazharkstan, Ukraine, Russia, India, South Africa and Zimbabwe. Asbestos used to be mined in Kenya in the past but was stopped. Asbestos is a chemically inert mineral that is fire resistant and does not conduct heat or electricity thus making it a commonly used insulator. It has high tensile strength, insoluble and odourless. Due to these properties, 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.

Asbestos is a hazardous material with extremely fine fibres and can remain suspended in air for hours. Studies have shown that if handled without caution, asbestos may cause serious chronic health problems such as asbestosis, lung cancer and mesothelioma. The diseases cause long term serious social, economic and emotional problems. When left intact and undisturbed, asbestos materials do not pose a health risk. It becomes a problem when, 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. In Kenya 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. It is for these reasons that the proponent saw an opportunity to offer solution for safe disposal of the hazardous material whilst making money.

The assessment examined the potential impacts of the proposed project on the immediate surroundings with due regard to all the phases of construction through to operation and decommissioning. It encompassed all aspects pertaining to the physical, economical, ecological, socio-cultural, health & safety conditions at the site and its environs. The assessment was based on laid down scientific qualitative procedures with the most

recent methodologies and analysis required in EIA and strictly adheres to the relevant legislative framework.

Both positive and negative impacts will result from the design, implementation, operation and possible decommissioning of the disposal site. The environmental impacts arising from the project have both ecological and socio-economic dimensions. The overall aim of the project is ensuring an environmentally friendly development by planning around and utilizing the existing resources. The following are some of the potential negative impacts attributed to the project:

- Destruction of physical environment and loss of bio-diversity;
- Asbestos-exposure related health conditions;
- Contamination of ground and surface water;
- Occupational health and safety hazards; and,
- Visual intrusion;

The following mitigation measures are recommended:

- Landscaping of disturbed areas and controlling of earthworks to prevent compacting the loose soils;
- Provision of Personal Protective Equipment (PPE) to all workers at the site and enforcement of their use;
- Fencing off the site appropriately and limiting access to informed personnel/visitors;
- Keen adoption of the national guidelines on safe management and disposal of asbestos published by NEMA, 2013;
- Implementation of best management practices and use best available technology for pollution control;
- Strict adherence to the provisions LN No. 121, 2006; and,
- Development of pollution of prevention plans.

Further appropriate mitigation measures have been proposed and elaborate Environmental Management Plan (EMP) outlined in this EIA study report. All the negative impacts will be mitigated to the highest degree.

An extensive public consultation process was engaged in gauging the sentiments of a variety of stakeholders in the development of this project. Besides the fact that this is a regulatory requirement under the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003, it was an excellent opportunity to offer the public an opportunity to ventilate their fears and concerns. Public participation was implemented using semi-structured interview strategy, questionnaires and a consultative meeting. The public participation process engaged for this exercise demonstrates overall acceptance of the project by the respondents.

The proposed project is considered important as it will offer a safe disposal site for asbestos waste that is considered hazardous. The proposal is in line with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006 and has adopted the National Guidelines on Safe Management and Disposal of Asbestos by NEMA (2013). On the basis of the evaluation of the development proposal, this EIA study presents significant impacts that need to be adequately mitigated. However with appropriate impact mitigation as proposed herein, the project will not occasion environmentally significant negative impact that could lead to environmental degradation on an appreciable scale.

The proponent should be favored with EIA license subject to the conditions that NEMA may impose during

the decision making process. The proponent should however use the EMP as monitoring and evaluation tool to submit an Environmental Audit (EA) report to NEMA annually or as may be directed by the Authority without fail and seek license to Own/Operate a Waste Treatment Plant/Disposal site to comply with Regulations 11, 24 & 25 of the Environmental Management and Coordination (Waste Management) Regulations, 2006.

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ABBREVIATIONS AND ACRONYMS

ASAL	Arid and Semi-Arid Land
CGK	County Government of Kwale
DOHS	Directorate of Occupational Health and Safety
EA	Environmental Audit
EDL	Effluent Discharge License
EIA	Environmental Impact Assessment
EMC	Environmental Management and Coordination
EMCA	Environmental Management and Coordination Act, Cap. 387
EMP	Environmental Management Plan
ESMPs	Environmental and Social Management Plans
GPS	Global Positioning System
HCVs	Heavy Commercial Vehicles
KPLC	Kenya Power and Lighting Company
KWAWASCo	Kwale Water Sewerage Company
LN	Legal Notice
LWH	Length Width Height
mm	Millimetres
MSDS	Material Safety Data Sheet
NCA	National Construction Authority
NEC	National Environmental Council
NEMA	National Environmental Management Authority
Nos.	Numbers
OHSMS	Occupational Health and Safety Management System
PPE	Personal Protective Equipment
SERC	Standards and Enforcement Review Committee
WARMA	Water Resource Management Authority

1.0 INTRODUCTION

1.1 Background Information

For a long time, the world over, policy makers have been directing all their efforts in economic development without due regard to the nature of the resource base on which the economic development depend on. As a result, there has been unprecedented environmental degradation, during project implementation and operation stages, due to lack of integration of environmental concerns into the project design, planning and management, thereby resulting into unsustainable development. To ensure sustainability and revitalization of the degraded environment, all proposed development projects' activities and their subsequent operations are now required to be critically examined to evaluate the impacts (both positive and negative) they would have on the environment before they are implemented and to enhance Sustainable Environmental Management as well as controlling and revitalizing the much – degraded environment.

Some of the Environmental Management tools used to achieve this is EIA, done before the implementation of a new project and an Environmental Audit (EA) done on existing projects. All these are emphasized in Cap. 387. An EIA identifies both negative and positive impacts of the proposed project, how it affects people, their property and the general environment. Environmental Experts registered by NEMA should conduct the EIA and EA studies. Appendix 1 includes the experts' practicing licenses.

The proponent is proposing to establish and operate an asbestos disposal site on LR No. Kwale/Shimoni Adj/552 situated at Fikirini in Kwale County. Waste disposal works, including commercial asbestos disposal are listed under the Second Schedule (12k) of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya as high risk and should therefore undergo EIA Study process. To fulfill this legal requirement, the proponent contracted EIA experts to carry out the EIA Study.

1.2 Overview of Asbestos

Asbestos is a group of six fibrous minerals that occur naturally in metamorphic deposits located around the world. Of the hydrous magnesium silicate variety, the six types include tremolite, actinolite, anthophyllite, chrysotile, amosite and crocidolite. The major producers of asbestos include Canada, Kazharkstan, Ukraine, Russia, India, South Africa and Zimbabwe. Asbestos used to be mined in Kenya in the past but was stopped. Asbestos is a chemically inert mineral that is fire resistant and does not conduct heat or electricity thus making it a commonly used insulator. It has high tensile strength, insoluble and odourless. Due to these properties, 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.

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. The diseases cause long term serious social, economic and emotional problems. When left intact and undisturbed, asbestos materials do not pose a health risk. It becomes a problem when, 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.

1.3 Asbestos Disposal in Kenya

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.

Asbestos is classified as hazardous in schedule IV of LN No. 121 – Environmental Management and Coordination (Waste Management) Regulations 2006. The project will thus follow such provisions as well as in the national guidelines on safe management and disposal of asbestos published by NEMA, 2013. According to the Guidelines, disposal of asbestos must be at a site;

- Designated by the local authorities and licensed by NEMA;
- Privately owned disposal facility licensed by NEMA; and.
- Designated by the waste generator (on-site disposal).

The proponent has seen an opportunity to offer solution for safe disposal of the hazardous material by coming up with a privately owned disposal facility.

1.4 Project Location and Neighbourhood

1.4.1 Project Location

The proposed project will be undertaken on LR No. Kwale/Shimoni Adj./552 situated at Fikirini Village, Tswaka Sub–location in Kwale County. The land parcel is estimated at 4.25 acres and lies within geo-reference points: -4.612167, 39.344833 (4°36'43.8"S 39°20'41.4"E).

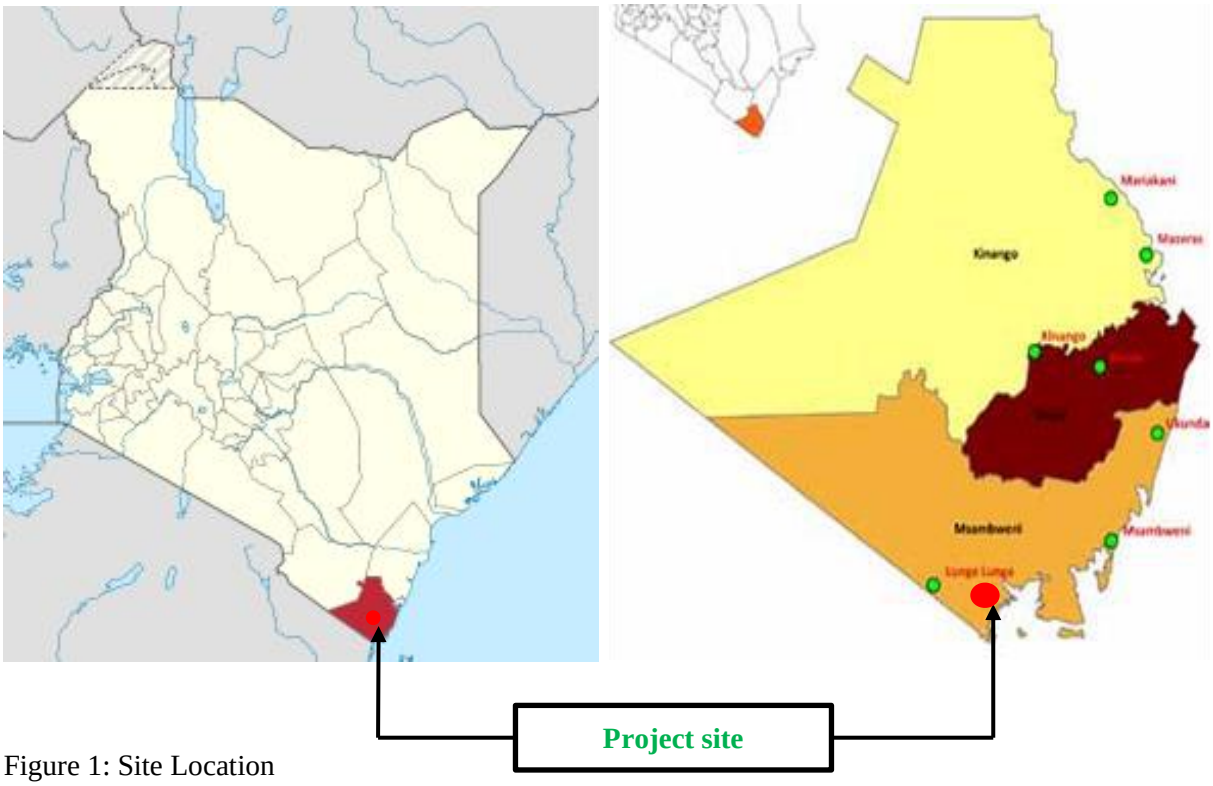

Figure 1: Site Location

1.4.2 Site and Neighbourhood

The site is situated about 2Km from Fikirini shopping centre and about 80Km from Mombasa Town. The nearest establishments including Mzizima CDF dispensary and a farm house among others are more than 500m away. Three Sisters Giant Caves complex which is about 15 kilometres from the Kenana-Shimoni junction, is situated about 1.6Km from the site. A detailed location map has been appended to this report.

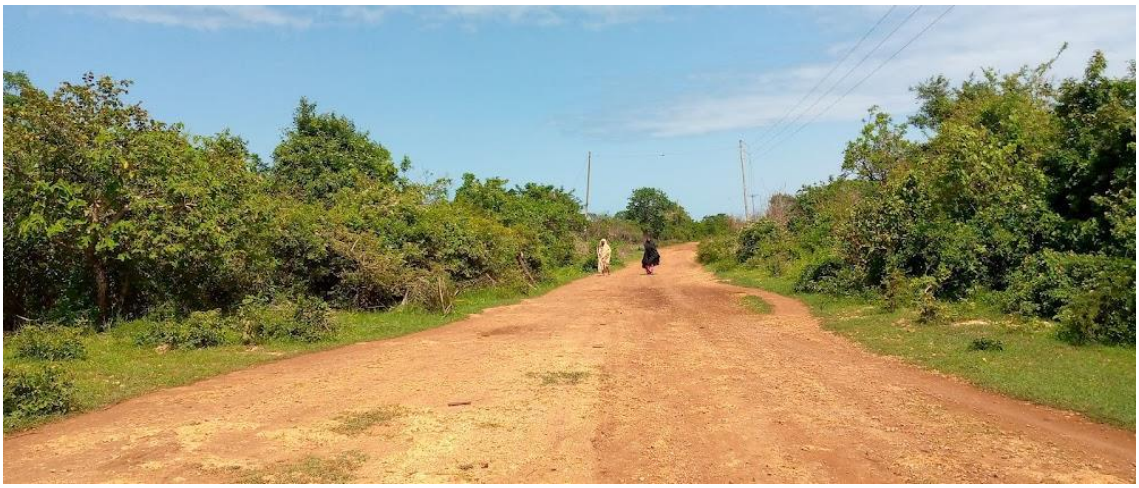

Figure 2: Site access road (Author, 2022).

Figure 3: Site location with reference to Mzizima dispensary (Google Maps, 2022).

Figure 4: Site location with reference to the nearest farmhouse (Google Maps, 2022).

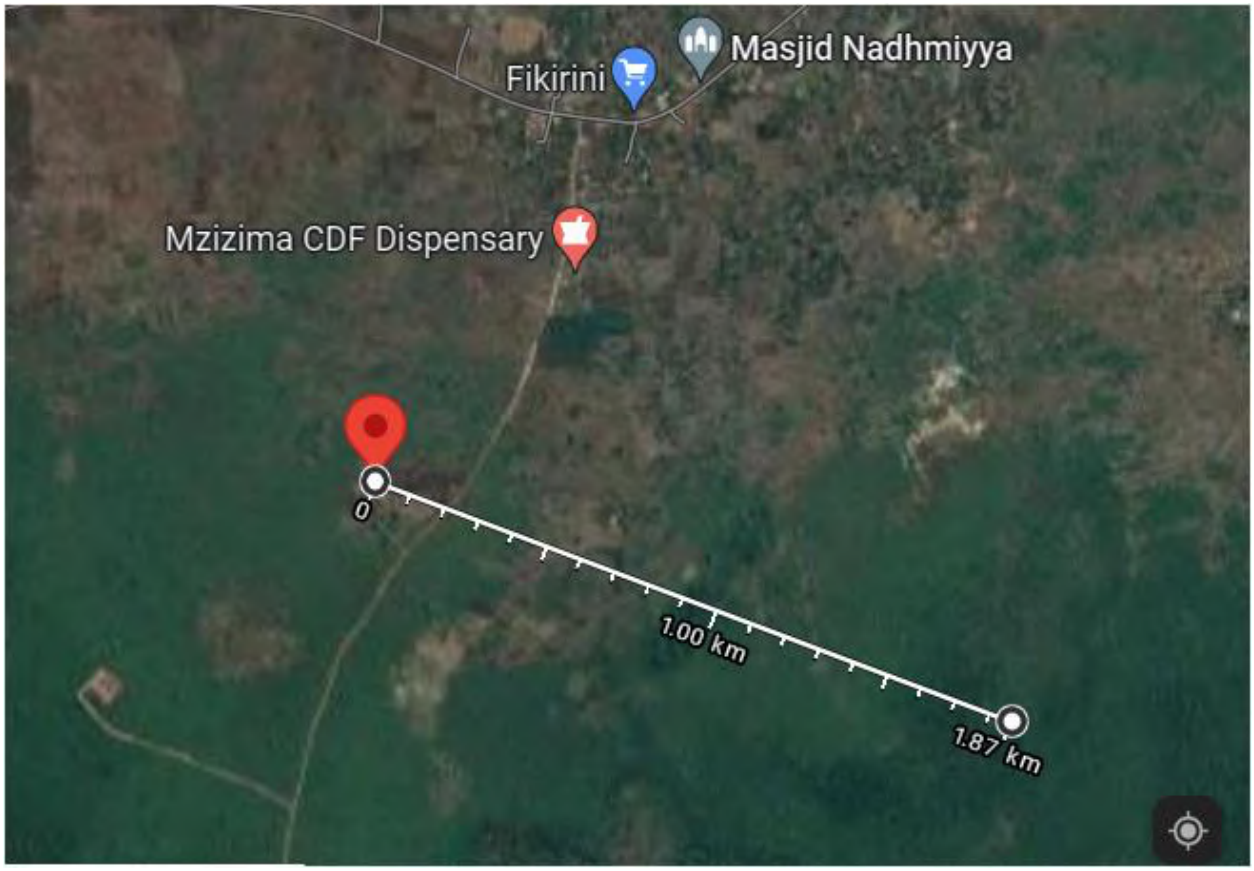

Figure 5: Site location with reference to Three Sister Cave (Google Maps, 2022).

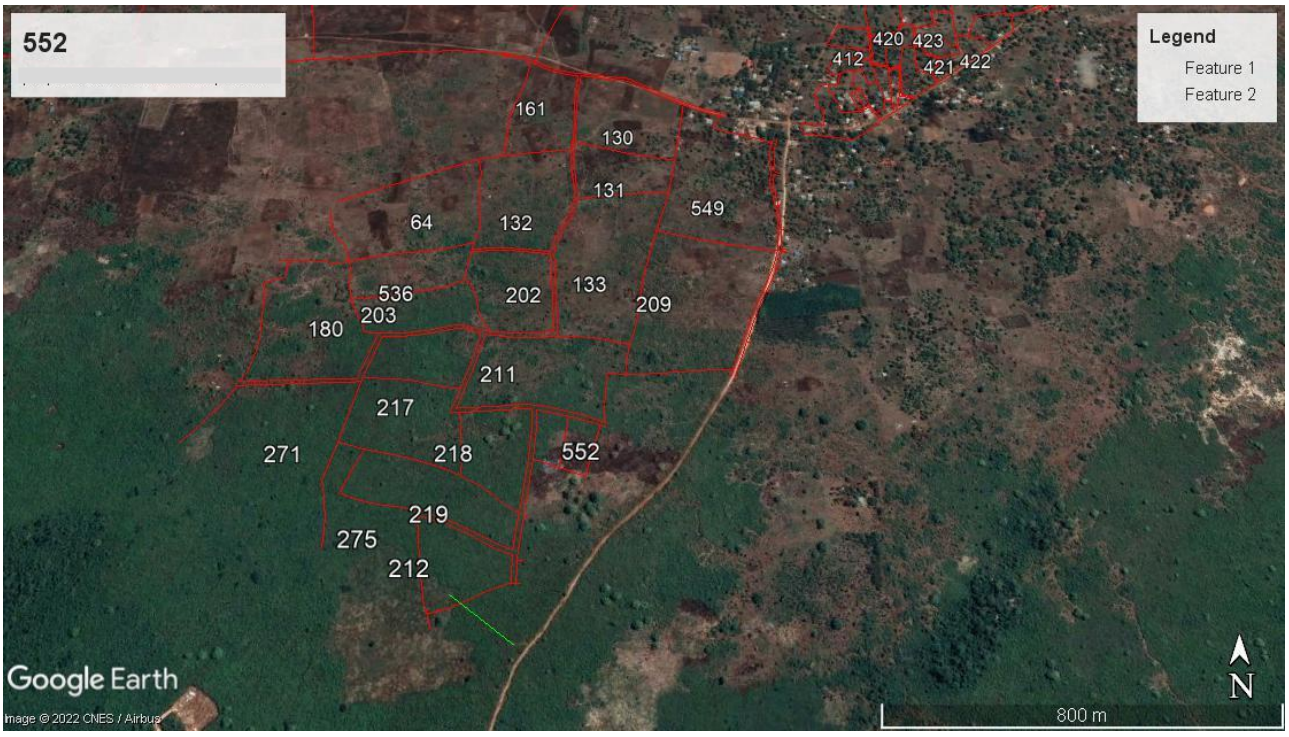

Figure 6: Location of LR No. 522 (Google Maps, 2022).

1.4.3 Site Status

The site has not been developed and has been utilized by domestic browsing animals. Although the entire land is rich in vegetative cover,. Generally mature trees are countable and will be preserved during project implementation. Thorny shrubs form dominant vegetation cover. The site access road is motorable.

Figure 7: A section of the project site.

1.6 Project Design and Components

The proposed project will involve construction and operation of an asbestos disposal site at Fikirini in Kwale County. The scope of the proposed project will involve fencing the entire land parcel with 8 feet high chain link fence. The site will also have a lockable gate that will be manned 24/7. The project will also feature the following components:

- Asbestos material shall be disposed of in pits with dimensions of 7m x 2.5m x 4m (LWH) and shall bear 130mm thick concrete lining/wall and a base of similar thickness. All the pits shall be lined with water proof sheeting before asbestos material is disposed of. A 500 gauge double wrapped polythene sheet is recommended. The proposed 4m depth for the disposal pits is by way too far from the water struck level that was estimated at 20m below ground level after geophysical investigations coupled with hydrogeological information.
- Site office with washrooms on a single floor as indicated on the appended architectural drawing;
- A septic tank – soak pit system for waste water management; and,
- A $5m^3$ overhead water storage tank to be replenished by Kwale Water Sewerage Company (KWAWASCo) or by bowsers.

1.7 Project cost

The proposed development will require large capital outlay to commission and thus the proponent has sourced enough funds. This is to ensure that the project is commissioned within the intended time. The project implementation cost is estimated at Kshs. 11,354,323.00. The proponent will pay 0.1% of the total project as EIA revenue fees i.e. Kshs. 11,354.32.

1.7 Study Approach and Methodology

1.7.1 Introduction

The methods adopted for preparing the ESIA study report were guided by the Third Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. The consultants prepared a scoping report and Terms of Reference (TORs) as required under Regulation 11 of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003 and submitted them to NEMA for consideration for approval.

1.7.2 Data Collection

A site visit was undertaken in May 2022 for purposes of area reconnaissance, assessing the baseline

environmental conditions of the proposed project site and screening of environmental risks associated with the proposed development as well as the applicable environmental safeguards and standards. An environmental screening criterion was informed by the Second Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. As per this schedule, the issues considered by the experts included ecological impacts, socio-economic issues, landscape changes, land use character and water.

1.7.3 Baseline monitoring on environmental media

Hydrogeological assessment to determine groundwater conditions within the study area (site) was undertaken by Alexander Nzomo in May, 2022. The study was deemed important to determine the level of water table and suitability of the proposed site for implementation of the proposed project. The national guidelines on safe management and disposal of asbestos published by NEMA, 2013 recommend disposal of asbestos material at least 1m above the water table. The geophysical investigations coupled with hydrogeological information indicated that the approximate water table (water struck levels) is 20m below ground level within the locality. A hydrogeological assessment study report under reference SN00726052022 has been appended to this EIA study report.

1.8 Analysis of Alternatives

1.8.1 Introduction

Investigating the available alternatives to the development proposal is an important aspect of the EIA process that could invariably help in mitigating the impacts predicted in the preceding chapters of this report. In this analysis, the consultant considered alternatives on the following basis:

- The arguments for or against the implementation of the project i.e. the "No" versus the "Yes" project alternatives;
- Siting of the project;
- Technological alternatives; &,
- Scale and extent.

1.8.2 The 'No Project' Alternative

This alternative is the best in terms of mitigating the anticipated environmental challenges of the project since it maintains the status quo of the environmental conditions of the project area. However it does not add value to the status of the piece of the land under consideration. This alternative will in addition deny the proponent, contractors and other workers a reliable income; deny the government revenue from the tax obtained on materials and licenses related to construction/installation and operation of the facility. Further, this alternative will not offer solution to sound disposal of asbestos material that has been ubiquitous in the country despite being hazardous.

1.8.3 The "Yes Project" Alternative

This option is considered as the most viable because of the following reasons:

- The project will offer sound solution to asbestos disposal as per the National Guidelines on Safe Management and Disposal of Asbestos, (NEMA, 2013).
- The proposed development will largely contribute to employment creation and revenue to the government.
- The proponent will accrue profits from the investment;
- The proposal is consistent with the existing land use character of the area;
- It will provide income to the government and other business ventures.

1.8.4 Siting Alternatives

Siting alternatives would be considered under the following assumptions:

- That the space proposed for the project is insufficient for the scale and extent of the project;
- The site is close to a household;
- The project is incompatible with the existing land use systems of the area; &,
- The site hosts sensitive ecosystems and the anticipated impacts cannot be reasonably mitigated.

Since the above concerns are not applicable to the proposed project site, it is deemed suitable for the proposed project site. Choosing another site is negated by the requirement for additional capital and the availability of suitable land for the development in the event that the capital is available.

1.8.5 Technological Alternatives

The assessment of technological alternatives is limited due to asbestos being a hazardous substance. The asbestos materials shall be disposed of in underground concrete confinement. The confinement shall have a maximum depth of 4m below the ground level. For the proposed development, we further recommend that all handling and disposal methods to be as per the NEMA guidelines of 2013.

1.8.6 Project Scale and Extent

The scale and extent of the project is considered adequate given the availability of sufficient space upon which the project will be implemented.

2.0 BASELINE INFORMATION OF THE PROJECT AREA

2.1 Introduction

The following baseline information details on environmental, ecological and bio-physical characteristics of the site. It is expected that it will provide for a benchmark for continued monitoring and assessment of the impact of the proposed activities on the environment.

2.2 Topography, geological features and soils of the proposed site

Kwale County has four major topographical features; the coastal plain, the foot plateau, coastal uplands and Nyika plateau. Geologically the area consists of shales and sandstones overlain by sands and corals. Only the shales represent a source of salinity. So both surface and ground water of the area are of good quality. Most parts have a high rainfall pattern but because of the fairly flat terrain, inland drainage is less dense and ground water flow is slower. Soils in the County vary with topography and geology of the area. Within the project site, the soils have formed on lagoonal deposits and coral reef limestone. Their composition ranges from sand, clay, loam alluvial deposits and complexes of those composites. The soils are poorly drained, very deep, excessive saline, olive to greenish grey, loam to clay and often contain sulphuric material.

2.2.1 Hydrogeology

The hydrogeology of any area is intimately related to the geology: the occurrence of groundwater being a function of recharge, porosity, permeability and gradient. With the exception of recharge (which is essentially a meteoric factor), all the other indicators are a reflection of the geological make-up of an area (Todd and Mays, 2005). This section examines the geology of the area to some detail, and is based on studies conducted by Horkel et al., (1984) and Caswell and Baker, (1953) coupled with field observations. There are a number of productive boreholes within the study area, an indication that ground water prospects in the area is fairly good water prospects.

Table 1: Neighboring boreholes within 8 Km radius (Nzomo, 2022)

ID	OWNER	WARD	LOCALITY	COMP DATE	TD (m)	WSL (m)	WRL (m)	YIELD (m3/h)
C 7606	M.O.W.DM	L-lunga	NGULUKU	28/03/1988	42	24	17	6
C 4166	M.O.W.D	L-lunga	S. COAST	26/08/1975	36	10	5	6
C 7586	M.O.W.D	L-lunga	KIDOMAYA	14/12/1987	32	24	21	---
C 7588	M.O.W.D PERANI	L-lunga	BONDENI	23/02/1988	30	24	4	3
C 4354	SCH.	L-lunga	LUNGALUNGA	16/06/1977	100	5	3	11
C 7589	M.O.W.D	L-lunga	LUNGALUNGA	01/03/1988	28	18	5	2
C 7590	M.O.W.D	L-lunga	LUNGALUNGA	14/03/1988	27	18	7	0
C 7959		L-lunga		01/03/1988	28	18	5	2
C 7603	M.O.W.D	L-lunga	KIDOMAYA	15/01/1988	35	30	18	2
C 7604	M.O.W.D MKUYUNI	L-lunga	MATARONI	03/02/1988	33	30	20	2
		AVERAGE			**39.1**	**20.1**	**10.5**	**3.4**

2.2.2 Regional Geology

The geology of Kenya's coastal strip was determined by the rifting and break-up of the Palaeozoic Gondwana continent. Jurassic rifting of a Permo -Triassic basin filled with terrestrial clastic material into a pre-marine basin on the eastern edge of the African plate. These clastics are generically the same as

Southern Africa's Karoo sediments. Reworking and uplift led to the deposition of marine and peri-marine sediments, culmination in an erosive hiatus from Cretaceous to mid-Neogene times (the Pliocene). Fresh uplift led to the deposition of fluviatile pebble beds, gravels and sands of the Magarini Formation on older competent sediments. At Pleistocene times, sea level changes led to transgressions and regressions, leaving behind raised sands and fossil coral limestones (Horkel et al., 1984).

2.2.3 Local geology

Caswell and Baker, (1953) shows that Shimoni area lies within Pleistocene Coral reef formation. Water bearing formation is expected within fractured or highly fissured coral rocks.

2.3 Climate

2.3.1 Rainfall

Rainfall in Kwale County is bimodal, the long rains fall between March and July while the short rains fall between October and November. The rainfall amounts range from 1200 to 1,600 mm/yr (Sombroek et al., 1982). Information from Climate-Data.org, (2018) estimates Kwale's annual rainfall at 1118.0 mm while the Kenya Meteorological Department (KMD) estimates this value at 1,397mm (KMD 9439043, 1959-85 and 2000-15) at Shimba Hills and 1,357 mm (KMD 9439014, 1986-2005) at Msambweni (KMD, 2015). Shimoni is closer to Msambweni, therefore a value 1,397mm will be used for calculations elsewhere in this report.

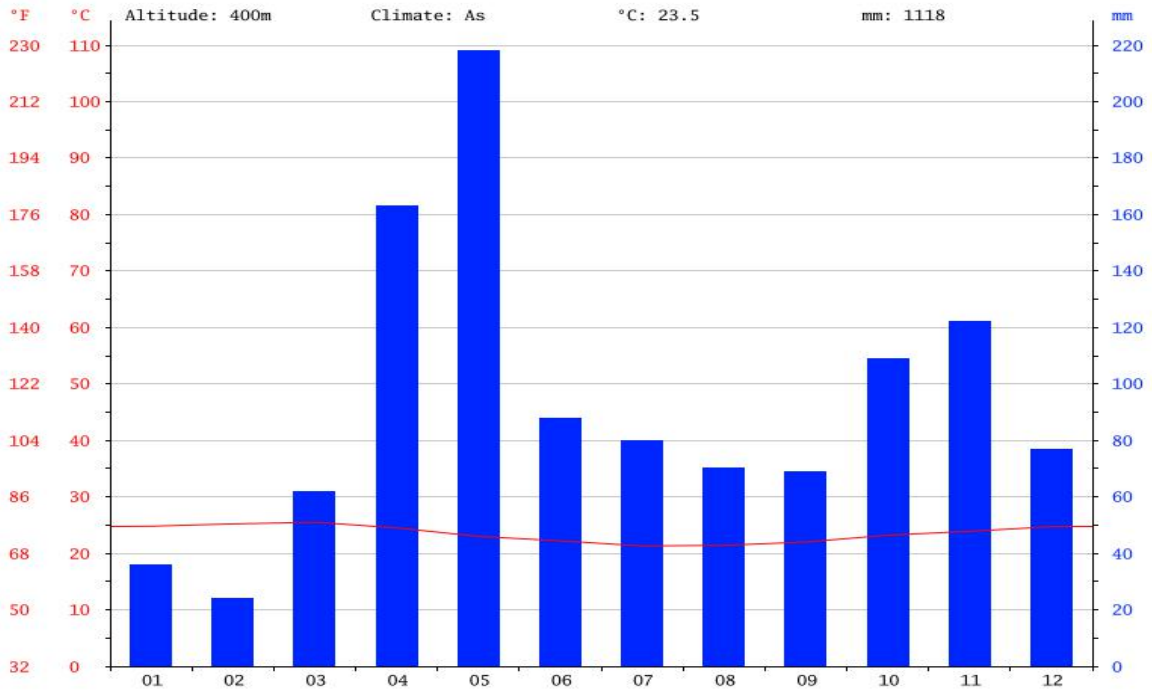

Figure 8: Rainfall information within Kwale County (Source: Climate-Data.org, 2018)

2.3.2 Temperature

Mean annual minimum and maximum temperatures in the study area are 22.8^{o} C and 30^{o} C respectively. The warmest months occur between November and April with mean temperatures ranging from 26^{o} to 28^{o} C, while the cooler months – May to October – record lower temperatures, between 24^{o} and 26^{o}C.

2.3.3 Evaporation

Woodhead, (1968) developed an empirical equation relating elevation and annual potential evaporation from

78 climate stations in Kenya, in the form: – E_o = 2422 – 0.358h (r2 = 0.66),
Where h is site elevation above the mean sea level (*amsl*)
E_o is potential evaporation in millimetres per year.

On this basis, evaporation at the site (which lies at approximately 124.0m *amsl*) is approximately 2377 mm/yr. This gives a rainfall/evaporation ratio of ≈ 0.5, which classifies the area as semi-humid (Sombroek et al., 1982).

2.3.4 Current water supply

Residents of Fikirini area depend on piped water supplied by Kwale Water Sewerage Company (KWAWASCo.). The area is supplied with water line managed by Coast Water Services Boards (CWSB), a 6-inch off-take service line managed by KWAWASCo; serves the area. They are very few boreholes and shallow wells within the area, the local geology constraints groundwater exploration due to low groundwater prospects and salinity close to the creek.

2.4 Land Use

The main land use systems in Kwale County include residential, agricultural, and industrial and tourist related comprised of hotels, restaurants and entertainment places. Land use patterns in the hinterland areas are greatly influenced by the existing topographical features and communities settled in a particular place. The coastal uplands which include Shimba hills, Tsimba, Mrima and Dzombo have abundant rainfall thus it is an area of medium to high agricultural potential. Also most of the terrestrial forests land is in the coastal uplands (Shimba hills) where the Shimba hills National Reserve is found and it's also reserved for wildlife. The Nyika plateau is underlain by basement rock system and the main activity is livestock rearing.

Fewer activities are experienced in the coastal plains where the project site lies and the foot plateau due to existence of Jurassic rocks and sand hills thus the establishment of hotels and cottages for tourists. Development in the area is greatly influenced by the tourists industry. This is evident in the rapid growth of Tiwi, Ukunda and Diani areas.

2.5 Waste Disposal

Most parts of Kwale County have no proper defined ways of solid and sewage waste management. The settlements along the beaches are served with refuse collection and disposal site at Mwabungo while for most of the inland population, these services are not provided. Within Gandini area, solid waste management is not organized. In other parts, residents usually have pits near their homestead where they burn their solid waste. On the other hand, there is no proper sanitary waste disposal in Kwale County. Reports show that among the waste disposal systems found in 43 centers, 81% had pit latrines only, 14% had pit latrines and septic tanks, 2% (one town) had septic tanks and only Lunga Lunga has a sewage treatment plant. Most of the hotels, cottages and private houses make use of septic tanks and effluent treatment plants. There is no designated asbestos disposal area in the entire county.

2.6 Environmental Resources

2.6.1 Fauna and Flora

The livestock population in the County is amongst the lowest in the country which constitutes 1% of the total rangeland livestock population and this is attributed to drought and diseases in most parts of the county. Most of the wildlife population is found in the western part of the county, which coincides with the Tsavo boundary. Kwale County is endowed with a national reserve and a number of marine parks. The Shimba hills national reserve is best known for its sable antelope population and also protects a variety of antelope

species, buffalo and elephant population (East 1997). The forest of Shimba hills are a remnant of higher rainfall period in the coastal Kenya and have an exceptional high biodiversity. Other wildlife species include eland, grants gazelles, kongoni, giraffe, Oryx, ostrich, warthog, waterbuck, crocodile, red duiker, and sable antelope among others.

There are wide ranges of resident bird species in any given forest, ranging in their habitant requirements from little disturbed close canopy forests to open glades. The coastal forests are particularly important for rare species (threatened + scarce) and they include, east coast akalat, Clarke's weaver, *amani* sunbird and spotted ground thrush (Wass, 1995). There are 26 rare species found in Kwale County of which 16 are forest dependent, while 10 comprise o trees and shrubs. The eight plant communities in Kwale County are mainly influenced by climate and soil type. The western part of the county is colonized by shrubbed or grassed woodland and open wooded scrubland dominated by Acacia- Euphorbia thorn bush land. Eastern part of the county is mainly occupied by *Afzelia-Albizia/Panicum* lowland moist savanna and the *Sterculia-Chlorophora/Memecylon* lowland rainforest community. Other specific plants include coconut palm (*Cocos nucifera*) *Borassus aethiopum, Casuarina equisetifolia, Stromboisiopsis spp, Diospyrossh mbaensis*, etc. Three Sisters Giant Caves complex which is about 15 kilometres from the Kenana-Shimoni junction, is situated about 1.6Km from the site.

The main physical features near the site includes the Three Sisters Giant Caves complex estimated to be about 1.5Km from the site. The complex is a sacred site or *kaya* in a fragment of East African coastal forest in south-east Kenya. Despite the tiny size of this non-gazetted forest reserve, it contains many of the threatened species of both flora (121 species) and fauna (46 species) representative of Kenya's coastal forest.

2.7 The Socio-Economic Environment

2.7.1 Cultural Heritage

Kayas from part of the cultural heritage and they are mainly found in the heart of dense forests in Kwale and Kilifi Counties. They are believed to shelter the fortified villages of the Mijikenda. There are a total number of 29 kayas and sacred groves found in Kwale County (Robert &Luke, 1993). Kaya Gandini is barely 3Km from the project boundary. Other national heritage sites in Kwale County are located along the coast with many of them located on private lands. They consist of mosque ruins, palaces, houses, walls with gates and tombs, which are located at Kombani, Tiwi , Kirima, Kongo, Diani and monumental arts. The Three Sisters Giant Caves complex is an important feuature in the area. Some have archeological research potential, architectural value or tourism potential. National museums are the entities that maintain various aspects of Kenyan history (NES, 1985).

2.7.2 Economy

Kwale County is very resourceful in crop production especially along the coast and in Shimba hills. Agricultural land accounts for a large part of the total county area and there are a variety of cash crops cultivated and they include oranges, mangoes, cashew nuts and coconuts. Also sea fishing and scale fish generates a lot of income for most communities along the coast, representing a major resource for the county. The tourism sector along the coast is a source of revenue for the government and provides employment opportunity for people thereby improving the community's living standards. Other economic activities include, livestock rearing, sale of handicraft products, mat making and sale of mangrove poles. The project area has limited potential for agriculture due to erratic rainfalls.

2.8 Infrastructure and Social Amenities

2.8.1 Health

There are a total of 50 health facilities involving only 5doctors and 217 paramedical staff in Kwale. Out of

the existing 27 health facilities, there are three hospitals at Msambweni, Kinango, and kwale, 5 health centres, 18 dispensaries and one public health centre at Ukunda. A self-help operated eye clinic is also available at Waa. Among the total health facilities, Msambweni division has 1 hospital, 2 health centres, 11 dispensaries and 6 other facilities (GOK, 1997). The urbanization of Diani and its environs has adequate health facilities.

2.8.2 Roads

Kwale County has a road network of about 1130km of which only 16% are of bitumen standard. Among the roads that have bitumen include the one that runs from Mombasa to Lunga Lunga serving along the coastal strip, the Mombasa – Nairobi road serving the Northern part of the county, access road from the coast to Kwale town, and some parts of Diani and Ukunda.

2.8.3 Transportation

The availability of transport depends on the location of a particular place and the road network. Public transportation is mainly provided by buses motor bikes and *Matatus* in accessible locations. Certain communities in the most interior parts of the county have to walk several kilometers to get public transport thus this has caused the hindrance of the community to proper health facilities, education and other socio-economic amenities.

2.8.4 Housing

There mainly exist two house types in the rural areas of the county. The traditional Mijikenda (Duruma) house and the Swahili house which is mostly found in the coastal strip and the 'up country' type houses in Shimba hills settlement schemes.

3.0 POLICY, INSTITUTIONAL AND LEGAL FRAMEWORK

3.1 Introduction

The relevant legislation which the project must comply with is intended to ensure project's sensitivity to environmental concerns. In response to environmental degradation, the Kenya parliament enacted the EMCA Cap. 387 No. 8 to comprehensively address the challenges of environmental management in Kenya. Later Legal Notice (LN) No. 101 was gazetted in 2003 as an attendant regulation to EMCA, Cap 387. Under this legal framework major changes in land use are required to undergo an EIA study which is later submitted to a statutory body i.e. NEMA for approval and granting of an EIA license. Similarly existing projects with a potential to impact on the environment, health and safety of the environment are required to undergo an initial environmental audit to determine compliance with environmental legislation and integrate environmental concerns into the operational stages of the project life cycle.

Environmental degradation is a major global challenge especially in terms of how to maintain sustainable development without degrading the natural environment on which people are dependent (UNEP & ACTS, 2002). It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound (Okidi and Mbote, 2001). Among the major environmental problems being experienced in Kenya today include land and habitat degradation, loss of biodiversity, environmental pollution and water management. The broad objectives of the national environmental policy include the following;

- Integrate environmental conservation and economic activities into the process of sustainable development,
- Optimal use of natural land and water resources in improving the quality of human environment,
- Undertake appropriate reviews and evaluations of developmental plans and operations to measure their progress and to ensure compliance with this policy.
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of the future generations,
- Encourage concern and respect for the environment, emphasize on every Kenyan's responsibility in environmental performance and ensure appropriate operating practices and training of generations,
- Communicate with the public on environmental matters to facilitate improvements in environmental performance, and,
- Meet national goals and international obligations by conserving biodiversity, arresting desertification, mitigating effects of disasters, protecting ozone layer and maintaining ecological balance on the earth.

Under Cap. 387, regulations have been established to facilitate the process of EIA and EA studies. These are contained in the Kenya Gazette Supplement No. 56 legislatives Supplement No. 31, LN No. 101 of 13th June 2003 and are known as the Environmental (Impact Assessment and Audit) Regulations 2003. Several other statutes and national policies to enhance environmental conservation and sustainable development are in place in Kenya. Several of these policies and legal provisions are briefly described in the following subsections.

3.2 Policies

3.2.1 National Policy on Water Resources Management and Development

While the National Policy on Water resources Management and Development (1999) enhances systematic development of facilities in all sectors for promotion of the country's socio-economic progress, it also

recognizes the by-products of this process as wastewater. It therefore calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. Industrial and business development activities therefore should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating from their activities. The same section requires that such projects should also undergo comprehensive Environmental Impact Assessment (EIA) that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighborhood and further downstream are not negatively impacted by their emissions.

As a follow-up to this, EMCA Cap 387 requires annual environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during EIA studies are implemented. In addition, the policy provides for charging levies on waste on the basis of quantity and quality. The "polluter-pays-principle" applies in which case parties contaminating water are required to meet the appropriate cost of treatment. The policy provides for establishment of standards to protect water bodies receiving waste water, a process that has been accomplished through the gazettment of LN No. 120 of 2006 (Water Quality Regulations).

3.2.2 Policy Paper on Environment and Development

The key objectives of the Policy on Environment and Development include:

- To comply with and make provisions for effluent treatment standards that will conform to acceptable NEMA guidelines.
- To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation; &,
- To ensure that from the onset, all development policies, programs and projects take environmental considerations into account.

3.3 Institutional Framework

To implement the legal framework outlined in the preceding sub topics, the government has established a number of institutions with varying mandates of implementation. These include;

- The National Environment Management Authority to implement the Environmental Management and Coordination Act and subsidiarry Regulations.
- The Directorate of Occupational Safety and Health Services to implement the Occupational Safety and Health Act alongside the subsidiary legislation.
- The Water Resources Authority to implement the Water Act.
- The County Government of Mombasa to implement the County Government Act, its by-laws and the Public Health Act.

3.4 Legal Framework

The key national laws that govern the management of environment resources in the country have been briefly discussed in the following paragraphs. Note that wherever any of the laws contradict each other, the Environmental Management and Coordination Act 1999 prevail.

3.4.1 The Constitution of Kenya (2010)

The Constitution of Kenya 2010 is the supreme law of the land. Any other law that is inconsistent with the Constitution is null and void to the extent of its inconsistency. Under Chapter IV, article 42 provides for the right to a clean and healthy environment for all. Further, Chapter V of the Constitution deals with Land and Environment. Specifically Part 2 elaborates on the following components regarding the protection of the environment:

- Enforcement of environmental rights;
- Obligations in respect of the environment;
- Agreements relating to natural resources; and,
- Legislation relating to the environment.

Under the Constitution the proponent is entitled to carry out the project within legal limits and a fair administrative decision making process from NEMA and other State organs. On the other hand, he is required to ensure:

- *That the project is carried out in an ecologically, economically and socially sustainable manner;*
- *That all the applicable provisions of the Constitution are observed at all times; &,*
- *That the right to a clean and healthy environment for all is upheld in all phases of the development.*

3.4.2 The Environmental Management and Co-ordination Act (EMCA, Cap. 387)

The purpose of this Act aims at improving the legal and administrative co-ordination of the diverse sectored initiatives in the field of environment so as to enhance the national capacity for its effective management. It has several Regulations that are discussed in the proceeding sections.

3.4.2.1 The Environmental Management and Co-ordination (EIA/EA) Regulations, 2003 (LN No. 101 of 2003)

The EIA/EA Regulations are meant to ensure the implementation of Sec. 58 of EMCA. It makes it illegal for anyone to undertake developments without an EIA license and stipulates the ways in which environmental experts should conduct the Environment Impact Assessment and Audits reports in conformity to the requirement stated. It is concise in its report content requirements, processes of public participation, licensing procedures, inspections and any possible offences and penalties under the Act.

Relevance to the proposed project

Acquisition of EIA license prior commencement of the project. The operations of the project are similarly licensed since the EIA report contains an Environmental Management Plan which forms the basis for approval of the project by NEMA and imposition of conditions to safeguard the environment. Due to its transparent nature, the EIA process builds neighborhood support and sustainability into the project.

3.4.2.2 Environmental Management and Co-ordination (Water Quality) Regulations (LN No. 120 of 2006)

Water quality regulations were gazetted as a legislative supplement to mainly address the challenges of pollution of water sources and conservation. It consists of VI parts and eleven schedules dealing with protection of water sources for domestic use to miscellaneous provision. Effluent discharge and water for industrial use are dealt with under part III which sets out the following:

- Standards for discharge into the environment;
- Standards for discharge monitoring; and,
- Application for Effluent Discharge License (EDL).

Generally the act addresses the challenges of pollution of water resources as well as their conservation. The regulation provides guides for water use and conservation as well as effluent standards for discharge.

Relevance to the proposed project

Important in protection of ground water sources. Since there is a potential of work force effluent to be

discharged into the environment, the proponent will ensure that such effluent is managed accordingly. EDL has to be sought prior operations.

3.4.2.3 The Environmental Management and Co-ordination (Waste Management) Regulations, 2006 (LN No. 121 of 2006)

In pursuit of the provisions of the Environmental Management and Coordination Act, Cap 387, the Minister for Environment in 2006 gazetted the waste management regulations focusing on management of solid wastes, industrial wastes, hazardous wastes, pesticides and toxic substances and radioactive substances. The regulations are aimed at addressing the following concerns;

- Licensing of waste disposal sites and transportation of wastes,
- Reduction of waste through adoption of cleaner methods of production,
- Responsibilities for waste generators and obligations for disposal,
- Proper transportation and disposal of wastes,
- Management of waste disposal sites,
- Waste treatment requirements,
- Application of existing regulations in relation to waste management,
- Licensing of waste handlers and disposal sites, and
- Licensing fees and procedures for waste handlers and pollution penalties

Relevance to the proposed project

The proponent should ensure there is proper contractual agreement with licensed solid waste handlers and that solid wastes are disposed on the manner prescribed. This could include PPE, packaging, plastic wrappings, etc. All solid wastes shall be disposed of by a contracted NEMA licensed solid waste handler. Onsite disposal of the hazardous material shall be done as per the guidelines issued by NEMA. To comply with Regulations 11, 24 & 25, the proponent shall seek license to Own/Operate a Waste Treatment Plant/Disposal Site.

3.4.2.4 The Environmental Management and Co-ordination (Excessive Noise and Vibrations Pollution Control) Regulations, 2009 (LN No. 61 of 2009)

These Regulations were gazetted to manage noise levels to levels that do not cause a disturbance to the public. The proposed activities will however have a potential for the production of noise above the acceptable limits.

Relevance to the proposed project

Ensure compliance with the set noise level limits for the site especially during construction. The contractor should ensure that employees are not exposed to noise levels above 85 dB (A) and in such cases provide suitable personnel protection equipment (ear protective devices).

3.4.2.5 The Environmental Management and Coordination (Air Quality) Regulations, 2014 (LN No. 34 of 2014)

These regulations were aimed at controlling, preventing and abating air pollution to ensure clean and healthy ambient air. The activities of the proposed project will have a potential to pollute the air from construction works and potential dust generation that could be asbestos fiber-laden. The proponent should implement recommended measures to minimize air pollution and undertake quarterly air quality monitoring.

3.4.3 The Water Act, 2016

The Water Act provides the legal framework for sustainable utilization and management of water resources through an elaborate governance framework. It has four key institutions charged with separate functions and decentralized decision making systems. These institutions are summarized in the table 3 below.

Table 2: Water Resources Management Institutions and their roles as established under the Water Act, 2016.

Institution	Role
Water Service Boards (WSBs)	Development and maintenance of regional water provision infrastructure
Water Service Providers(WSPs)	Provision of reticulated water supply
Water Resources Authority (WRA)	The Authority is responsible, among other things, for the issuance of permits for boreholes
Water Services Regulatory Board (WSRB)	License all providers of water and sewerage services who supply water services to more than twenty households

Relevance to the proposed project

The Water Act provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water, to provide for the regulation and management of water supply and sewerage services. The proponent will obtain water from the reticulated supply by Kwale Water Supply and Sanitation Company Limited supplemented by with water from bowsers.

3.4.4 The Occupational Safety and Health Act 2007, OSHA

The OSHA 2007 repealed the Factories Act, Cap 514 Laws of Kenya which had been originally adopted in 1962 and revised in 1972, underwent further and extensive amendments in 1990. The provisions of OSHA have far reaching implications on safety and health at the work place. The OSHA sets out to make provisions that aim to eradicate or minimize accidents at the work place. Throughout the world, work related accidents are a major concern for Governments and industry, the hospitality industry included. The ILO estimates that there are over 250 million work related accidents per year; 160 million work related ill health every year and that 3000 people are killed at work per day. Many of the accidents could be avoided if appropriate safety practices and information were used. Work related accidents affect not only the injured employee, but others as well – employers, family, co-workers, clients, suppliers, community etc.

The OSHA 2007 commenced on 26th October 2007. It is an Act to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces. Although the OSHA 2007 repealed the Factories and Other Places of Work Act, Cap 514 Laws of Kenya, it inherited all the subsidiary legislation issued under Cap 514. Examples of subsidiary legislation inherited include:

- Electric Power Special Rules L.N 340 of 1979
- First Aid Rules L.N 87 0f 1964
- Docks Rules L.N 306 of 1962
- Eyes Protection Rules L.N 44 of 1978
- Building Operations and Works of Engineering Construction Rules L.N 40 of 1984
- Cellulose Solutions Rule L.N 87 of 1964
- Health and Safety Committee Rules L.N 31 of 2004
- Medical Examination Rules L.N 24 of 2005
- Noise Prevention and Control Rules L.N 25 0f 2005

- Fire Risk Reduction Rules L.N 59 0f 2007
- Hazardous Substances Rules L.N 60 of 2007

Of particular importance to the project site is the requirement that all work places must be registered with the Department of Occupational Safety and Health Services. Further, there is a requirement that a Safety and Health Committee must be put in place and that employee and members of this committee must be inducted and trained on the provisions of the Act accordingly. The Act imposes various obligations on both employers and employees. These are all necessary for the health and safety of persons accessing and using the premises of the proposed site. Strict provisions are made for in respect of equipment containing self-acting machines, hoists and lifts and the requirement for supervision and training of inexperienced workers. There must be put in place an SHC and proper training to be done.

Relevance to the proposed project

The proponent should ensure that the site is registered with the DOSHS as a work place. Further an abstract of the facility's safety and health policy should be exhibited at a conspicuous location within the property.

3.4.5 The Public Health Act (Cap 242)

Part IX, section 115 of the Act states that no person\institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires local authorities to take all lawful, necessary and reasonable and practicable measures to maintain areas under their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable for injurious or dangerous to human health. Such nuisance or conditions are defined under section 188 as wastes, sewers, drains or refuse pits in such a state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health. Any noxious matter or waste flowing or discharged from any premises into a public street or into the gutter or side channel or watercourse, irrigation channel or bed not approved for discharge is also deemed as a nuisance. Other nuisances are accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbor rats or other vermin.

3.4.5 The Occupiers Liability Act Cap. 34

The Act regulates the duty that an occupier of premises owes to his visitors in respect of dangers due to the state of the premises or to things done or omitted to be done on them.

Relevance to the proposed project

The Act requires that the occupier warn the visitors of the likelihood of dangers within his premises to enable the visitor to be reasonably safe.

3.4.6 The County Government Act, 2012

The constitution of Kenya grants County Governments the powers to grant or to renew business licenses or to refuse the same. To ensure implementation of the provisions of the new constitution, the County Governments are empowered to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and well-being of the general public.

Relevance to the proposed project

The Act gives right to access private property at all times by the County Government officers and servants for inspection purposes.

3.4.7 The Penal Code (Cap. 63)

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

Relevance to the proposed project

This statute controls public nuisance including safety and security from construction activities.

3.4.8 HIV/AIDS Prevention and Control Act (Act No.14 of 2006)

Part 11, Section 7 requires HIV and AIDs education in the work place. The government is expected to ensure provision of basic information and instruction on HIV and AIDs prevention and control to; Employees of all Government ministries, Departments, authorities, and other agencies; and, Employees of private and informal sectors. The information on HIV/AIDs is expected to be treated with confidentiality at the work place and positive attitudes shown towards infected employees and workers.

Relevance to the proposed project

During the project implementation the contractor is expected to create awareness to the employees and the local communities on the issues related to HIV/AIDS.

3.4.9 Traffic Act (Cap. 403)

Section 42 Part 1 forbids any driver to drive a vehicle at a speed exceeding fifty kilometers per hour on any road within the boundaries of any trading centre, township, municipality or city: The highway authority is expected to erect and maintain traffic signs as prescribed so as plainly to indicate to drivers entering or leaving such roads or areas where the fifty kilometer per hour speed limit restriction begins
and ends.

Section 47 of the act states that any person who drives a motor vehicle on a road recklessly, or at a speed or in a manner which is dangerous to the public, shall be guilty of an offence and liable to a fine. Part VIII of cancelling any driving license or provisional driving license held by the offender and declaring the offender disqualified for holding or obtaining a driving license for such period as it thinks fit.

Section 52 Part 1, The driver of the vehicles are expected at all times to obey directions given by the police officer whether verbally or in signal, conform to the indications given by any traffic sign, and when any person in charge of any cattle raises his hand or in any manner signaling to stop, and keep it stationary for as long as it is reasonably necessary.

Section 52 A forbids any person who, being the driver of a vehicle from leaving the vehicle for a period in excess of the time, failing to comply with any traffic sign or leaving the vehicle in contravention of any traffic sign in any parking bay or parking area.

Under the Traffic sign rules part 13, temporary traffic sign signal unit may be used for purposes of controlling the movement of vehicles on the road where the road works are in progress or where the width of the carriageway is temporary restricted.

4.0 IMPACT IDENTIFICATION, ANALYSIS AND MITIGATION MEASURES

4.1 Introduction

This Chapter identifies both positive and negative environmental impacts likely to be occasioned by the project. Contained in this chapter is a detailed investigation of the proposed activity and site-specific potential impacts associated with the proposal. It discusses the nature of impacts, their magnitude, spatial and time extent and significance. Mitigation measures for negative impacts are also analysed.

4.2 Positive Impacts

The following positive impacts will be attributed to the project:

- Provision of a safe disposal site for asbestos waste;
- Income to the proponent;
- Inducement of additional investments within the locality;
- Job creation/employment opportunities will be realized due to the proposed investment;
- Stimulation of skills transfer: Due to the nature of their operations, the proponent will have to implement a training programme for operations staff; and,
- Stimulation of economic development.

4.3 Potential Negative Impacts and Mitigation

4.3.1 Potential negative impacts and mitigation during construction phase

4.3.1.1 Impact of raw materials at points of origin

- Raw materials for the construction of the development proposal will originate from quarries, wetlands and industries which will have an impact on the environment through;
- Destruction of the physical environment where mining is involved or wood materials are required,
- Disposal of pollutants into the environment from industries manufacturing raw materials
- Threat to water resources in the case of sand harvesting, and,
- Occupational hazards on the part of the people employed by industrial establishments that supply raw materials.

Mitigation measures

- The contractor will obtain raw materials from sources that are compliant with NEMA Regulations.
- The contractor will procure quantities that are sufficient for the intended works only.
- Recycling as far as practical to stem wastage is recommended.
- The contractor shall commit to extensive use of recycled raw materials as will be appropriate and in a manner that does not compromise the safety of the development.

4.3.1.2 Destruction of the Physical Environment

The construction phase of the project will cause some destruction to the physical environment. The impacts on soil will be localized and will be caused by:

Soil Compaction: Construction activities are normally accompanied by some form of compaction. Compaction seals the soil on the surface hence hindering the penetration of air or water beneath the surface. This limits the aerobic activities of the organisms underneath the soil, hence affecting soil productivity.

Compaction also hinders the infiltration of water into the surface hence increasing the surface run-off increasing the possibility of flooding downstream of the site. Surface run-offs eventually find their way to water sources thereby polluting them. The result is water borne diseases which affects the health adversely.

Excavation: Excavation creates loose soil that is easily carried away by water or wind. This causes soil erosion and disturbance in soil quality. Soil and wind erosion will lead to pollution of air and water sources. Air pollution results to breathing infections and thereby need for money for medication. Pollution of water sources can lead to water borne diseases therefore impacting negatively on the health of the workers and neighbours.

Loss of bio-diversity: The destruction to the physical environment will lead to loss of bio-diversity and thereby degrading the aesthetic value of the affected area.

Mitigation measures

- Landscaping disturbed areas.
- Plantg trees and suitable indigenous grasses in the premises shall be undertaken where possible and as soon as the construction is completed.
- Preserve mature trees.
- Control of earthworks to prevent compacting the loose soils.

4.3.1.3 Occupational Health and Safety Hazards

The movement of materials into the construction site by workers and during construction per se may cause accidents with potential to cause injury. This will affect the health of the workers and their potential to work thereby impacting negatively economically. Actual construction work is associated with high levels of interactions with unlimited social distancing a factor that could fuel the spread of COVID-19. The latter is a serious and rapidly evolving global pandemic with more than 134 million confirmed cases as of August, 2021.

Mitigation measures

- Provision of adequate and appropriate Personal Protective Equipment (PPE) including safety shoes, helmets, gloves and overalls.
- Employees to be given the correct tools and equipment for the jobs assigned.
- Employees to be trained in the use of all equipment that they will be required to operate.
- The contractor will conduct periodic safety inspection and risk assessment.
- First aid services and an emergency vehicle to be readily available at site.
- Moving parts of machines and sharp surfaces to be securely protected with guards to avoid unnecessary contacts and injuries during installation phase.
- The contractor will fully implement the provisions of the Occupational Safety and Health Act, No. 15 of 2007.
- The proponent and contractor shall adhere to the Ministry of Health guidelines on Management of COVID-19 in Kenya.

4.3.1.4 Workforce Sanitation

Sanitation provisions for the work force will be an issue of concern during construction. The proponent will install portable toilets to be emptied by a licensed handler as per the provisions of LN No. 121 of 2006.

4.3.1.5 Air Pollution

During construction phase dust will be expected from excavation of soil and movement of vehicles. The dust generated may be aggravated especially during the South East Monsoon months (March – August) when strong winds occur. If generated in large quantities dust may present a respiratory hazard and also cause visual intrusion hence presenting accident risks. Dust is also a mechanical irritant to the eye. Air emissions would also be expected from exhausts of vehicles delivering material. Stand-by generators that may be brought in to serve during power outages are likely to release some emissions to the atmosphere. The health impacts as a result of the air quality will reduce the production of workers at the site and also have financial impacts on their treatment and medication.

Mitigation measures

- Contractor to deploy fine dust screens at the site during construction.
- The contractor will implement sound project management strategies to ensure that installation works are completed in the shortest possible time taking advantage of low wind velocities.
- Sprinkle dust producing materials such as ballast with water on site.
- Retain vegetation as much as possible to reduce bare areas exposed to agents of soil erosion.
- Use low suplhur fuels to power delivery vehicles and site machinery.
- Truck drivers will maintain low speeds to avoid raising dust.
- Employees will be provided with dust masks and goggles.

4.3.1.6 Solid Waste Generation

Site preparation and construction activities are expected to generate significant quantities of solid waste such as overburden, rock rubbles, cuttings and rejected materials among others. Workers and visitors to the site will generate domestic wastes such as food left overs, plastics and wrappings among others. Poor disposal of solid waste is an eyesore, can harbor pests and disease causing pathogens as well as pollute the environment. Therefore, there is need for proper solid waste management and disposal.

Recommended mitigation measures

- Procure and strategically place adequate solid waste collection bins with a capacity for segregation within the construction site
- Procure a sizeable central solid waste collection bin with chambers to accommodate separated waste.
- Sensitize construction workers on the process of solid waste collection, segregation and proper disposal.
- Procure the services of a NEMA licensed waste handler to dispose of the solid waste
- Comply with the Environmental Management and Coordination (Waste Management) Regulations, 2006.

4.3.1.7 Noise and Excessive Vibrations

Noise is expected from movement of vehicles and equipment. It would also arise from construction activities at the site as such loading and offloading of material, lifting, etc. Vibrations are likely to occur during excavation to lay the foundation as well as from use of heavy equipment. Noise may lead to hearing impairments which will reduce the efficiency of the employees at work and also affect their finances due to treatment and medication. Vibrations, if in excess may lead to adverse effects to human health.

Mitigation measures

- Serviceable machines will be used for excavation to ensure vibrations are kept at below risk levels.
- Construction work and delivery of raw materials will be limited to daytime on weekdays only.
- Employees using equipment that produce peak sounds shall be provided with earmuffs.
- The contractor will deploy compact machinery and fit them with mufflers and vibration dampers.
- The contractor will deploy acoustic screens around noisy working areas to contain noises.
- The contractor will endeavor to comply with Noise Regulations, 2009.

4.3.1.8 Traffic Impact

This will occur as contractors' vehicles bring in deliveries at the site and as workers leave or come to the site. The vehicles use diesel or petrol which after combustion produces fumes. These are potential air polluters adversely affecting the health of workers and neighbors and increasing greenhouse gases that cause global warming.

Mitigation measures

- Heavy Commercial Vehicles (HCVs) delivering material shall observe designated speed limits for the area.
- Proper signage and warnings shall be placed at appropriate places to forewarn other motorists of HCVs turning.
- Delivery of material for the installation shall only be undertaken off-peak hours.
- All materials will be offloaded on the site and adequate space for that have been provided for.
- Flagmen / traffic marshals shall be deployed at the entrance to guide traffic.

4.3.1.9 Increased Water Demand

Construction projects utilize significant quantities of water for mixing and casting concrete. Water will also be required for human use including drinking and sanitary needs.

Mitigation measures

- The contractor will ensure water conservation and in all activities.
- Water will be recycled as far as is practice without compromising on quality and health.
- The contractor to ensure prudential use of water resources during construction by avoiding wastage such as running pipes and taps.
- The contractor will put in place sound water storage reservoirs that are leak proof.
- The contractor will instill water use discipline among employees.
- The contractor will seek alternative water source e.g. from bowsers, etc. apart from the reticulated supply.

4.3.1.10 Possible collapse of buildings/structures whilst under construction

A building may collapse while still under construction. This can be attributed to lack of geo-technical investigations and subsequent poor workmanship.

Mitigation measures

- Geotechnical investigations will be executed by geotechnical engineers prior onset of

construction works to acquire information regarding the physical characteristics of soil and rocks. The purpose of geotechnical investigations is to design earthworks and foundations for structures, and to execute earthwork repairs necessitated due to changes in the subsurface environment.

- All construction works will be done under constant supervision of engineers and architect.
- Construction works shall adhere to the KS Code (2009) - Building Code of the Republic of Kenya (2009 Edition).

4.3.1.11 Insecurity within the locality

Construction sites in Kenya attract all manner of people not directly engaged in the work. These will include people hoping to secure some form of casual work, outside caterers and idlers. This introduces an element of insecurity at the construction site.

Mitigation measures

- The contractor together with the proponent will undertake the following to mitigate insecurity:
- Engage workers with good conduct.
- Formulate and instil place of work conduct.
- Secure the site and have security personnel manning the site.
- The contractor to give out information of suspecting conduct within the site to the local administration.
- Vet all employees before engagement.
- Hire services of security firm to monitor personnel or visitor movement within and close to the site.

4.3.1.12 Visual Intrusion

The establishment of a construction site will not be in sync with current land use. The construction activity will therefore alter the normal scenery within the area.

Mitigation measures

The following should be undertaken to mitigate visual intrusion:

- The contractor should ensure tidiness throughout construction period. Construction materials and equipment should be kept in good order and all trash and debris contained;
- The contractor should install visual barriers to obstruct undesirable views of construction staging areas;
- Project landscaping will be implemented where landscaping is able to improve project aesthetics, provide visual screening, and restore vegetation affected by construction. Features such as landscape berms, combined with tree and shrub plantings will be used to help screen built features from existing viewpoints by allowing for additional height;
- Project proponent will consider design details to ensure that infrastructure and buildings structures are complementary of one another so that these facilities do not create further visual discordance in the landscape; and,
- Ancillary project features will be constructed with low sheen and non-reflective surface materials to reduce potential for glare.

4.3.1.13 Increased Energy Demand

Construction activities will use machinery that requires fossil fuel inputs such as diesel and generators

whose application will increase the demand for energy.

Mitigation measures

- Switch off engines when not in use.
- Use well serviced construction machinery that is efficient in fuel consumption.
- Maximize the use of natural lighting by limiting construction works to day time.
- Create awareness among workers on the importance of conservation of energy resources.
- Employ technologies that demand less energy consumption.
- Use energy saving lighting systems.

4.3.2 Potential Negative Impacts and Mitigation during Operation Phase

4.3.2.1 Increased Water Demand

The proposed premises will rely on significant volume of water to run. Water will be sourced from reticulated supply. Water will be used for ablution, sanitary and drinking purposes among others.

Mitigation measures

- The proponent will install sanitation facilities such as water closets that use minimal amounts of water and self-closing taps.
- Create awareness among employees and visitors on water conservation.

4.3.2.2 General Waste Generation

During operations, both solid wastes and effluent will be generated. Solid wastes will include mainly domestic waste from the workers and visitors to the site. Effluent will be generated from washrooms. Both the solid waste and effluent generated will need to be managed appropriately.

Recommended mitigation measures

- Provide litter bins with a capacity for waste segregation within the facility.
- Procure the services on a NEMA licensed waste contractor to dispose of wastes from the facility.
- Design and construct a septic tank – soak pit system for waste water management.
- Apply for and obtain an Effluent Discharge License (EDL) from NEMA.
- Monitor the quality of effluent discharged from the proposed soak pit to ascertain conformity to the Third Schedule of Environmental Management and Coordination (Water Quality) Regulations, 2006.
- Comply with the Environmental Management and Coordination (Waste Management) Regulations, 2006.
- Comply with the Environmental Management and Coordination (Water Quality) Regulations, 2006.

4.3.2.3 Hazardous waste generation and accumulation

Apart from the asbestos waste and asbestos contaminated soil, other waste may be generated by the asbestos clean-up activities including asbestos contaminated PPE that will be discarded will become hazardous waste, and if disposed incorrectly on the site or surrounding areas may pose health risk to people who come into contact with the waste.

- Ablution facilities must be provided for the asbestos disposal and clean-up for workers. These should be located in a designated area.
- Used PPE shall be disposed of together with asbestos waste.

- Should any spillage of the asbestos waste occur, it must be cleaned-up immediately and the affected areas appropriately remediated.
- Adhere to guidelines issued by NEMA (2013) on asbestos handling and disposal.

4.3.2.4 Potential Impact on Workers/Occupiers during Asbestos Disposal and Clean-Up

Asbestos containing dust is a complex mixture of fibrous structures. Not only do single fibres vary in dimensions but also such fibres may be found combined with other fibres in the form of bundles, clusters, or matrices. These are known as asbestos structures that can be inhaled. The relationship between soil and air levels of asbestos fibres is therefore considered complex. The potential for asbestos fibres to become airborne depends on the type of work activities as well as natural activities such as wind, i.e. the potential for mechanical disruption of the soil by human and/or natural activities. The removal/disposal of asbestos and asbestos containing materials, including soil, is anticipated to be high risk work. Suitable precautionary measures must be implemented during asbestos sheet handling in order to minimize the potential for the release of the fibres into the air.

The following negative human health effects may occur in the long term (note that it takes years before these effects could materialize and would be related to the level of exposure):

- Asbestosis (note that asbestosis is incurable).
- Lung cancer (can be treated but however can also result in death).
- Mesothelioma (can be treated but however can also result in death).
- Cancer of bronchus, Cancer of intestines (can be treated but however can also result in death).
- Warts or corns (Dermal) (can be treated).

A potential public health risk exists within 100 metres of the areas of the asbestos disposal and cleanup, unless the recommended mitigation measures are implemented.

Mitigation Measures

- All employees shall wear protective clothing during the exercise. Each asbestos' site worker will be provided and equipped with:
  - An approved unused disposable overall;
  - Clean gum boots; and,
  - Clean PVC gloves.
- Demarcate the areas of removal of contaminated soil. A respirator zone is an area where the concentration of regulated asbestos fibres in the air is, or is likely to be greater than the Operational Exposure Limit (OEL) for asbestos. No persons shall be allowed to enter the area without wearing respiratory protective equipment and protective clothing. Respirator zones shall be clearly demarcated and identified to prevent accidental and chance, albeit brief, entry. Even if a person passes through the area or there is little work being conducted in that area, a respirator must be worn. Ground markings are examples of demarcation where the area is not defined by walls. In addition, all access routes shall be demarcated and identified by symbolic warning signs that are clearly visible.
- Wire fencing will be used for high risk areas.
- No member of the public to be allowed near of the disposal zone.
- All personnel involved with the asbestos disposal process will be subjected to medical

surveillance.

- Asbestos contaminated areas shall be sprayed with water prior to commencement of cleaning activities in order to suppress the release of fibres.
- Clearing of asbestos at any site shall be completed entirely before moving onto a new working site.
- Temporary storage of waste: the area currently used for stockpiling of excavated material shall be lined with impermeable material.
- All machinery involved in an asbestos disposal process will be jet-washed prior to leaving site.
- Asbestos air sampling will be conducted on the sites for clean-up
- The employer must not allow anybody to work in or to enter an environment in which they may be exposed to asbestos that will exceed the exposure limit for asbestos.
- When there is a visible dust or winds in excess of 20 knots, any asbestos disposal and cleaning process will be stopped.
- Thorough, complete and up to date records should be kept for:
    - Medical surveillance of asbestos workers for a minimum period of 40 years;
    - Maintenance of control measures for a period of 3 years;
    - Asbestos inventory for minimum period of 40 years;
    - Training given to employee in terms of asbestos handling for as long as the employee remains employed at the workplace in which he or she is being exposed to asbestos dust; and,
    - Assessments and air monitoring at the sites that were cleaned.
- Safe transportation by ensuring that:
    - The waste transporting vessel is lined with a 500 gauge double wrapped plastic sheet with every seam sealed with a tape and covered**.**
    - The transportation vessel should be labeled **"Danger - Contains Asbestos Fibres. Cancers and Lung Disease Hazard"** and containing the identity of the hazardous waste and the name, physical address and telephone contact of the generator of waste.
    - The bags and stacks shall be gently loaded into transportation vessel.
    - The goosenecks shall not be used as handles for carrying the bags, because that might unseal the ends or tear the bags. Tossing the bags into a waste transporting vessel must be avoided because of the risk of rupture

4.3.2.5 Possible contamination of soil, surface and ground water

The asbestos may contaminate soil, ground and surface water. This may occur due to the following:

- Excessive excavation of the pit into the water table;
- Poor pit lining or if the pit lining is compromised; and,
- Poor covering of the pits or exposure due to soil erosion.

Mitigation measures

- Construction of water proof pits lined with 130mm thick concrete lining/wall and a base of similar thickness.
- Secure the area and install warning signs '**Asbestos Hazard' or '*Hatari'*** to discourage trespass and possible exploration of underground water, e.g. digging wells, sinking bore

holes, etc.

- Ensure that the siting is sheltered from waterways when it rains.
- Appropriate drainage channels should be put in place to divert as much rain water from the site.
- Limit excavation depth to 9m below the ground level.
- Adhere to the provisions set out in part IV of Legal Notice No. 121 as well as in the national guidelines on safe management and disposal of asbestos.
- Backfill areas which have undergone a substantial amount of excavation with stones or soil.

4.3.2.6 Increased Energy Demand

Operation activities will use machinery including HCVs that requires fossil fuel inputs such as diesel and generators whose application will increase the demand for energy.

Mitigation measures

- Switch off engines when not in use.
- Use well serviced operation machinery that is efficient in fuel consumption.
- Maximize the use of natural lighting by limiting construction works to day time.
- Create awareness among workers on the importance of conservation of energy resources.
- Employ technologies that demand less energy consumption.
- Use energy saving lighting systems.

4.3.2.7 Increased Water Demand

The proposed premises will rely on significant volume of water to run. Water will be sourced from reticulated supply. Water will be used for sanitary and drinking purposes among others.

Mitigation measures

- The proponent will put in place structural provisions for rain water harvesting to supplement huge demand by the facility.
- Install sanitation facilities such as water closets that use minimal amounts of water and self-closing taps.
- Create awareness among employees and visitors on water conservation.

4.3.2.8 Traffic Impact

This will occur as clients vehicles bring in disposal waste to the site and as workers leave or come to the site. The vehicles use diesel or petrol which after combustion produces fumes. These are potential air polluters adversely affecting the health of workers and neighbors and increasing greenhouse gases that cause global warming.

Mitigation measures

- HCVs delivering material shall observe designated speed limits for the area.
- Proper signage and warnings shall be placed at appropriate places to forewarn other motorists of HCVs turning.
- Delivery of material for the installation shall only be undertaken off-peak hours.
- All materials will be offloaded on the site and adequate space for that have been provided for.
- Flagmen / traffic marshals shall be deployed at the entrance to guide traffic.

4.3.3 Decommissioning Phase Negative Impacts and Mitigation Measures

A decommissioning phase is possible in the event of end of project life, closure by government agencies due to non-compliance with environmental and health regulations, an order by a court of law due to non-compliance with existing regulations, potential natural calamities and change of user of land. Decommissioning of the project will be accompanied by negative economic, social and environmental impacts. At the decommissioning stage, the proponent will prepare a due diligence decommissioning audit report in line with LN No. 101 of 2003 and submit it to NEMA for approval at least three months in advance. The decommissioning process may involve the safe handling and disposal of hazardous asbestos, material and waste and the cleanup of a site that has been contaminated by previous disposal operations.

For the purposes of prediction and information, the environmental and social concerns which may arise during decommissioning include;

- Loss of the disposal site,
- Economic decline,
- Safety and health risks,
- Waste generation,
- Insecurity.

4.3.3.1 Loss of the Disposal Site

The proposed development will serve an already growing demand for safe disposal of asbestos. Although such demand cannot be exponential over a life time an attribute to zero tolerance on asbestos material use globally; untimely closure may have far reaching impacts. The site will be a source of income to the proponent and employees as well as generate revenue to the government. Therefore, a decommissioning phase will lead to the loss of these benefits.

Recommended mitigation measures

- Obtain demolition and decommissioning permits from the County Government of Kwale (CGK) and NEMA.
- Adequate notices on the impending decommissioning should be given to interested and affected parties to enable them make alternative arrangements.
- Undertake a decommissioning environmental audit.

4.3.3.2 Economic Decline

The establishment and operation of the proposed project will bring about a lot of positive changes to the lives of the people around it and also to the surrounding economy. In the event of decommissioning of the proposed development, the proponent will incur huge financial loses and the employees will also lose their livelihoods. In addition, the government will lose revenue earned from the operations of the facility leading to economic decline.

Recommended mitigation measures

- Train employees on alternative livelihoods prior to decommissioning.
- Prepare and issue recommendation letters to employees to seek alternative employment opportunities.
- Review potential job opportunities in other ongoing contracts by the proponent and recommend the employees who qualify.
- Comply with labor laws by paying the employees their terminal dues.

4.3.3.3 Safety and Health Risks

Safety and health risks during demolition and dismantling activities are likely to emanate from accidental falls and cuts, injuries from demolition and dismantling tools and machinery use. Noise and air pollution from demolition and dismantling works could pose safety and health risks to workers, neighbors and visitors to the site.

Recommended mitigation measures

- Contract a licensed construction company to carry out demolitions.
- Install signage to forewarn people on ongoing demolition activities.
- Provide adequate and enforce the use of PPE throughout the demolition works.
- Avail first aid kits on site throughout the entire period.
- Ensure workers are given the correct hand tools and equipment for the jobs assigned.
- Comply with the Environmental Management and Coordination (Air Quality) Regulations, 2014.
- Comply with the Environmental Management and Coordination (Waste Management) Regulations, 2006.
- Comply with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.
- Comply with the provisions of the Occupational Safety and Health Act, 2007.
- Adhere to asbestos disposal guidelines issued by NEMA, 2013.

4.3.3.4 Waste generation

Demolition activities will result in generation of both effluent and solid waste. The waste generated will include wood cuttings, roofing waste and building rubbles among others. If not properly managed, these generated wastes will pose safety and health risks and environmental pollution.

Recommended mitigation measures

- Recover re-usable materials for sale or use in other project sites.
- Contract a NEMA licensed waste handler to handle and dispose both solid waste and effluent generated from the demolition activities.
- Comply with the Environmental Management and Coordination (Waste Management) Regulations, 2006.
- Comply with the Environmental Management and Coordination (Water Quality) Regulations, 2006.

4.3.3.5 Insecurity

Insecurity will result from the site when it's abandoned after decommissioning. Unoccupied structures within the site will act as criminal dens and the security boost that had been provided by the depot to the local community would be lost.

Recommended mitigation measure

The proponent should extend the tenure of contracted security firm during the decommissioning phase of the facility.

4.4 Environmental Impacts Analysis

In this sub-section, the significance of each potential environmental impact is evaluated. The anticipated impacts of the proposed project on the environmental elements are both positive and negative. The magnitude of each impact is described in terms of being significant, low significant or highly significant, short-term or long term, specific (localized) or widespread, reversible or irreversible. On the basis of information gathered during both the desktop and field study, the potential environmental impacts of the proposed project are as tabulated below.

Table 3: Impact significance matrix

	IMPACTS	ST	LT	R	IR	L	W	S
Construction Phase.	Inducement of additional investments in the area	□		□		□		+
	Job opportunities	□		□		□		+
	Stimulation of skills transfer	□		□		□		+
	Stimulation of economic development	□		□		□		+
	Impact of raw materials at points of origin	□		□		□		XX
	Destruction of the physical environment	□		□		□		XX
	Occupational health and safety hazards	□			□	□		XX
	Workforce sanitation	□			□	□		XX
	Air pollution	□			□	□		XX
	Solid waste generation	□		□		□		XX
	Noise and excessive vibrations	□			□	□		XX
	Traffic impact	□		□		□		XX
	Increased water demand	□		□		□		XX
	Possible collapse of structures	□		□		□		XX
	Insecurity within the locality	□		□		□		XX
	Visual Intrusion	□		□		□		XX
	Increased energy demand	□			□	□		XX
Operational Phase.	Provision of a safe disposal site for asbestos waste		□	□			□	+
	Income to the proponent		□	□		□		+
	Job creation		□	□			□	+
	Inducement of additional investments in the area		□	□		□		+
	Stimulation of skills transfer		□	□			□	+
	Stimulation of economic development		□	□			□	+
	Increased pressure on water and energy		□	□		□		X
	General waste generation		□	□		□		X
	Hazardous waste generation and accumulation		□	□		□		XXX
	Increased effluent waste generation		□	□		□		X
	Asbestos exposure to workers/occupiers/neighbours		□		□		□	XXX
	Traffic impact	□		□		□		XX
	Soil and water contamination		□		□	□		XXX
Decommissioning phase	Creation of employment opportunities	□		□		□		+
	Recovery of recyclable materials	□		□		□		+
	Rehabilitation of site	□		□		□		+
	Economic decline	□			□	□		XX
	Health & safety risks due to asbestos exposure	□			□	□		XXX
	Loss of the disposal site	□			□	□		XX

	IMPACTS	ST	LT	R	IR	L	W	S
	Noise and excessive vibrations pollution	☐		☐		☐		X
	Insecurity	☐		☐		☐		X

Weightings of significance in the table above range from 0-3 (denoted by number of X) whereby "0" represents no significance; "X" represents low significance; "XX" means there will be significant effect and "XXX" represent high environmental significance.

Key:

X – Not significant **XX** – Low significance **XXX** – Significant **XXXX** – Highly significant

ST – Short term **LT –** long term

R – Reversible **IR –** Irreversible

L – Local **W –** Wide spread

+ – Positive

S – Significance

It should be noted that with the adequate implementation of the proposed mitigation measures the proposed undertaking can be of low significance.

4.5 Risk Assessment

4.5.1 Occupational Health and Safety (OHS)

All appropriate precautions should be taken to ensure that all workplaces are safe and without risk of injury to the safety and health of workers, to protect persons present at or in the vicinity of a construction site from all risks which may arise from such site.

4.5.1.1 Site Access

There should be safe access onto and around the site for people and vehicles. Plan how vehicles will be kept clear of pedestrians, especially at site entrances where it may be necessary to provide doors or gates to achieve this segregation. Doors that open onto traffic routes may need viewing panels or windows.

4.5.1.2 Housekeeping

A suitable housekeeping programme should be established and continuously implemented on each construction site which should include provisions for:

- The proper storage of materials and equipment; and,
- The removal of scrap, waste and debris at appropriate intervals.

4.5.1.3 Precautions against fall of Materials and Persons, and Collapse of Structures

Adequate precautions should be taken such as the provision of fencing, look-out men or barriers to protect any person who might be injured by the fall of materials, or tools or equipment being raised or lowered. Adequate safety nets or safety sheets should be erected and maintained

4.5.1.4 Prevention of Unauthorized Entry

Construction site should be fenced to prevent the entry of unauthorized persons. This will also protect people from site dangers and the site from vandalism and theft. Visitors should not be allowed access to construction sites unless accompanied by or authorized and provided with the appropriate PPE.

4.5.2 Workers Welfare

Drinking water

Adequate supply of wholesome drinking water shall be provided at suitable points conveniently accessible to all workers.

Sanitary facilities

Sufficient and suitable sanitary conveniences for the workers shall be provided, maintained and kept clean. The number of toilets required will depend on the number of workers on site. Adequate washing facilities should be provided as near as practicable to toilet facilities.

Washing facilities

The contractor shall provide and maintain adequate and suitable facilities for washing, which shall be conveniently accessible and shall be kept in a clean and orderly condition.

Accommodation for clothing

The contractor / proponent shall provide and maintain adequate and suitable accommodation for clothing not worn during working hours.

4.5.3 Emergency Response Plan

At most sites, the most obvious emergency is fire. The general principles for dealing with fire risks can be applied to planning for other emergencies. Plan emergency procedures before work begins and put general precautions in place from the start of work. Some emergencies may require evacuation of the site or part of the site, while others might involve the rescue of an injured person. For example, it may be necessary to plan how someone injured in a fall can be attended to by first aiders and the emergency services before being taken to a place of safety.

4.5.3.1 Fire Prevention and Firefighting

All appropriate measures should be taken by the contractor to avoid the risk of fire, control quickly and efficiently any outbreak of fire and bring about a quick and safe evacuation of persons.

- Secure storage areas should be provided for flammable liquids, solids and gases such as paints and other such materials in order to deter trespassers.
- There should be no naked flames or similar means of ignition.
- Adequate ventilation should be provided.
- Provide suitable and sufficient fire-extinguishing equipment, which should be easily visible and accessible;
- Fire-extinguishing equipment should be properly maintained and inspected at suitable intervals by a competent person. Access to fire-extinguishing equipment such as hydrants, portable extinguishers and connections for hoses should be kept clear at all times.
- Sufficient number of workers should be trained in the use of fire- extinguishing equipment, so that adequate trained personnel are readily available during all working periods.
- Workers should be suitably trained in the action to be taken in the event of fire, including the use of means of escape.
- Where appropriate, suitable visual signs should be provided to indicate clearly the direction of

escape in case of fire.

- Means of escape should be kept clear at all times.
- Sufficient and suitable means to give warning in case of fire should be provided where this is necessary to prevent danger. Such warning should be clearly audible in all parts of the site where persons are liable to work.
- There should be an effective evacuation plan so that all persons are evacuated speedily without panic and accounted for.
- Notices should be posted at conspicuous places indicating the nearest fire alarm and the telephone number and address of the nearest emergency services.

4.5.3.2 Other Causes of Accidents

Other causes of accidents in construction sites include the following:

Accidental falls: People fall because access to and from the workplace is not adequate, or the workplace itself is not safe.

Construction equipment: Construction equipment can cause accidents if not properly handled. A hammer can cause significant damage to an unfortunate person standing under tool. Heavier and larger tools can do even more damage, and cause accidents to workers on the work site.

Falling material and collapses: People are struck by material falling from loads being lifted and material that rolls or is kicked off work platforms; others are struck or buried by falling materials when, buildings or structures collapse. Structural collapses can range from walls, to buildings.

Electrical accidents: Workers can suffer electric shock when they use unsafe equipment.

4.5.4 Personal Protective Equipment

The contractor shall provide suitable PPEs to protect workers against the risk of accidents or injury to health. The contractor shall require and ensure proper use of the PPEs. Workers should be instructed in the use of personal protective equipment.

Types

Workers should be provided with and wear the following personal protective equipment:

- **Head Protection**

Safety helmets or hard hats to protect the head from injury due to falling or flying objects, or due to striking against objects or structures.

- **Eye Protection**

Goggles when likely to be exposed to eye or face injury from airborne dust or flying particles, dangerous substances, harmful heat, light or other radiation, and in particular during welding, flame cutting, concrete mixing or other hazardous work.

- **Hand Protection**

Protective gloves and suitable protective clothing to protect hands or the whole body as required when exposed to heat radiation or while handling hot, hazardous or other substances which might cause injury to the skin.

- **Hearing Protection**

Use appropriate earmuffs or ear plugs if you work with or near a noisy machine and make sure they fit

properly and are comfortable.

- **Foot Protection**

Workers should wear work shoes or boots with slip-resistant and puncture-resistant soles for protection from foot injuries.

4.5.5 First Aid

Factories (First-Aid) Order section 50(1) of the Act requires the occupier to provide The first-aid boxes or cupboards at a work place which are adequate and appropriate equipment, facilities and personnel to enable first aid to be given to your employees if they are injured or become ill at work. The minimum provision for all sites is:

- A first aid box with enough equipment to cope with the number of workers on site as per the order;
- An appointed person to take charge of first-aid arrangements;
- Information telling workers the name of the appointed person or first aider and where to find them. A notice in the site hut is a good way of doing this;
- The first-aid arrangements should cover shift working, night and weekend working where this is carried out. This may mean appointing or training several people to ensure adequate cover.

5. 0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

5.1 Introduction

The preceding section has analyzed and identified the potential environmental and social impacts of the proposed private commercial asbestos disposal site as well as the mitigation measures to address the impacts. Under this section, three Environmental and Social Management Plans (ESMPs) are proposed to guide the proponent in implementing the mitigation measures. These are ESMPs for the construction, operational and possible decommissioning phases. Each of the ESMP is organized into five sections comprising of the environmental concerns, recommended mitigation measures, implementing party, timeframe and a budget. The strategies for mitigation include preventing the impact from occurring in the first place, minimizing the impact, taking corrective action where impact occurs among others. The overall focus is to ensure that the project complies with the substantive EIA Principle of ensuring the right to a clean and healthy environment during the entire project cycle. The objectives of the ESMPs are:

- To guide the project implementer to prioritize environmental matters in project planning;
- To guide the project implementer on the likely environmental impacts of the project and when they are likely to occur;
- To assess the capacity requirements for the implementation of the ESMPs;
- To guide the project implementer in allocating adequate resources needed to implement all the mitigation measures.

5.2 Plan Period

The ESMPs provided here is to cover the first year of the project's operations. It is then expected that an Environmental Audit (EA) will be undertaken at the end of the year to evaluate conformity to the ESMP as well as identify any gaps and recommend corrective adjustments to the plan. This will then be addressed through a loop mechanism from construction phase to operational phase to identify the success of the project versus the failures. This should be analyzed through the environmental management criteria of impact and mitigation.

5.3 Environmental and Social Management Plan for the construction phase

At the construction phase, the focus on the ESMP is on addressing impact of raw materials at points of origin, destruction of the physical environment, occupational health & safety hazards, workforce effluent, air pollution, solid waste generation, noise and excessive vibrations, traffic impact, increased water demand, possible collapse of structures, insecurity within the locality, visual intrusion and increased energy demand.

5.4 Environmental and Social Management Plan for the operational phase

The main environmental concerns at this phase include occupational safety and health risks, and emergency preparedness, air and noise pollution, use of environmental resources, pollution of environmental media, community concerns and storm water management..

5.5 Environmental and Social Management Plan for the decommissioning phase

The decommissioning ESMP is important in the event of end of project cycle, natural calamities and non-compliance with environmental and health regulations among others. The key issues of concern at this stage will be the economic decline, waste generation, safety and health risks and insecurity.

5.6 EMSP for Project Construction

Table 4: Construction Phase ESMP.

Anticipated Negative Impacts	**Recommended Mitigation Measures**	**Responsible Party**	**Time Frame**	**Cost (Ksh.)**
Impact of sourcing of raw materials from environment	– Obtain raw materials from sources that are compliant with NEMA Regulations. – Procure quantities that are sufficient for the intended works only. – Recycle as far as practical to stem wastage. – Commit to extensive use of recycled raw materials as will be appropriate and in a manner that does not compromise the safety of the development	Project Contractor	Throughout construction period	No Cost
Destruction of the physical environment	– Landscape disturbed areas. – Planting trees and suitable indigenous grasses as soon as the construction is completed. – Preserve mature trees. – Controlling of earthworks to prevent compacting the loose soils.	Project Contractor & Proponent	Throughout construction period	412,000. 00
Occupational health & safety of employees at the workplace	– Provide adequate and appropriate PPEs. – Train employees in the use of all equipment that they will be required to operate. – Observe rest times and breaks as necessary. – Give employees the correct tools and equipment for the jobs assigned. – Hire the right number of workers to avoid over working them. – First aid services and an emergency vehicle should be readily available on site. – Securely protect moving parts of machines and sharp surfaces with guards to avoid unnecessary contacts and injuries during construction phase. – Ensure adequate provision for artificial or natural lighting in all parts in the working areas. – Ensure that all chemicals used in construction are appropriately labeled or marked. – The contractor should implement the provisions of the OSHA No. 15 of 2007.	Project Contractor	Throughout construction period	180,000.00 for acquisition of PPE for workers

	− The construction site should be registered as a workplace with Directorate of Occupational Safety and Health (DOSH). − Obtain insurance cover for the workers at the site − Ensure proper storage and management of flammable materials within the project site			
Workforce effluent	− Procure at least two portable toilets to the workforce. − Provide adequate running water. − Comply with the provisions of LN No. 120 of 2006. − Comply with the provisions of LN No. 121 of 2006	Project Contractor	Entire construction period	No cost
Air pollution (dust and fumes)	− Secure the site using appropriate dust screens where applicable. − Ensure strict enforcement of on-site speed limit regulations. − Avoid excavation works in extremely dry weather periods. − Ensure all construction equipment is serviced regularly to avoid excessive fumes. − Insist on use of low sulphur diesel & other environmentally friendly fuels. − Provide dust masks to all employees and ensure their proper utilization. − Sprinkle building materials that are likely to produce dust such as ballast with water before use to suppress dust. − Access road and dust surfaces at the construction site should be sprinkled with water twice a day. − Employees will be provided with appropriate dust masks − Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3. Reuse 4. Disposal. − Through estimation of the sizes and quantities of materials required, order materials in the sizes and quantities they will be needed, rather than cutting them to size, or having large quantities of residual materials. − Dispose of waste at the designated dump sites. − Comply with the provisions of LN 121 of 2006.	Project Contractor	Entire construction period	286, 000.00

Solid waste generation	– Transportation of wastes from the site to be done by a NEMA registered solid waste handler who will use appropriate vehicles for conveyance of wastes from site to designated sites.	Project Contractor	Entire construction period	114, 000.00
Noise	– Restrict construction activities to day time only. – Ensure that noisy construction equipment is fitted with silencers where possible. – Provide workers with PPE for noise impact reduction. – Locate machinery that is likely to produce noise as far as practical from neighbouring properties. – Service machinery and equipment regularly to ensure that they are in good condition to minimize excessive noise. – Comply with the Noise and Excessive Vibration (Pollution Control) Regulations, 2009. – Sensitize truck drivers to avoid unnecessary hooting and running of vehicle engines.	Project Contractor	Throughout construction period	40,000.00
Traffic management	– Prepare and implement a traffic management plan. – Provide sufficient parking for HCVs and machinery at the site. – Vehicles delivering raw materials shall observe designated speed limits for the area. – Personnel shall be deployed at site entry and exit to direct traffic in and out of the site. – Proper signage to be placed on the access route to forewarn other motorists on the use of the road by HCVs. – Offload construction materials on the site but not on the road reserves to ensure smooth flow of traffic. – All the drivers must me competent and licensed to operate respective vehicles. – Comply with the Traffic Act, 2016.	Project Contractor & Proponent	Throughout construction period	10,000.00
Increased water demand	– Install self-regulating water taps for sinks and basins. – Seek water extraction permit from WARMA if a borehole is to be sunk onsite.	Project Contractor	Throughout construction period	10,000.00

	– Create awareness among employees on the importance of conservation of water resources. – Re-use recycled water where possible.			
Structural collapse	– Undertake geotechnical investigations prior structural installations. – Engage competent and skilled labourers. – All constructions to be supervised by competent engineer and architect.	Project Contractor, Geotechnical Engineer & Proponent	Throughout construction period	310,000.00
Insecurity	– Engage workers with good conduct. – Formulate and instil place of work conduct. – Secure the site with a stone boundary wall. – The contractor to give out information of suspecting conduct within the site to the local administration. – Vet all employees before engagement. – Hire services of security firm to monitor personnel or visitor movement within and close to the site.	Project Contractor	Throughout construction period	50,000.00
Visual intrusion	– Ensure tidiness throughout construction period. – Construction materials and equipment should be kept in good order and all trash and debris contained. – Install visual barriers to obstruct undesirable views of construction staging areas. – Undertake project landscaping. – Consider design details to ensure that infrastructure and buildings structures are complementary of one another so that these facilities do not create further visual discordance in the landscape. – Construct ancillary project features with low sheen and non-reflective surface materials to reduce potential for glare.	Project Contractor	Throughout construction period	150,000.00
Increased energy demand	– Create awareness among workers on the importance of conservation of energy resources. – Employ technologies that demand less energy consumption. – Use energy saving lighting systems.	Project Contractor	Throughout construction period	100,000.00

	− Use well serviced construction machinery that is efficient in fuel consumption. − Maximize the use of natural lighting by limiting construction works to day time.			
Stakeholders grievances	Develop and implement a grievances redress mechanism	Proponent/ community	Throughout construction	Nil

5.7 ESMP for Project Operational Phase

Table 5: Operation Phase ESMP.

Anticipated Negative Impacts	**Recommended Mitigation Measures**	**Responsible Party**	**Time Frame**	**Cost (Ksh.)**
Increased water demand	− Install self-regulating water taps for sinks and basins. − Create awareness among occupiers on the importance of conservation of water resources. − Undertake rain and storm water harvesting. − Re-use water from the waste water treatment plant.	Operations manager	Throughout operational phase	80,000.00 pa
Solid waste generation	− Use of an integrated solid waste management system i.e. through a hierarchy of options: Reduce Reuse, Recycling and Dispose. − Dispose of waste at the designated dumpsites. − Transportation of wastes from the site to be done by a NEMA registered solid waste handler who will use appropriate vehicles for conveyance of wastes from site to designated sites. − Comply with the provisions of LN No. 121 of 2006.	Operations manager	Throughout operation phase.	200,000.00 pa
Hazardous waste generation and accumulation	− Provide ablution facilities on site. − Used PPE shall be disposed of together with asbestos waste. − Should any spillage of the asbestos waste occur, it must be cleaned-up immediately and the affected areas appropriately remediated. − Adhere to NEMA guidelines on safe disposal asbestos, 2013.	Operations manager	Throughout operation phase.	1500,000.00 pa

Traffic management	– Vehicles delivering raw materials and dispatching products to observe designated speed limits for the area. – Deploy personnel at site entry and exit to direct traffic in and out of the site. – Place proper signage and warnings on the access roads to forewarn other motorists on the use of the road by heavy commercial vehicles.	Operations manager	Throughout operational phase	50,000.00 pa
Workforce effluent	– Design and construct a septic tank – soak pit system for waste water management.	Project Contractor	During construction	190,000.00
	– Monitor the quality of effluent discharged from the proposed septic tank – soak pit system.	Proponent	Quarterly on operation	12,000.00 per sample
	– Apply for and obtain an EDL from NEMA.	Proponent	Annually	35,000.00 pa
	– Procure the services on a NEMA licensed waste contractor to dispose of wastes from the facility	Proponent	Throughout operational	8,000.00 pm
	– Provide adequate running water.	Proponent	Throughout operational	200,000.00 pa
	– Comply with the provisions of LN No. 120 of 2006. – Comply with the provisions of LN No. 121 of 2006	Proponent	Throughout operational	Nil
Asbestos exposure to workers/occupiers/neighbours	– Ensure safe transportation and handling of the asbestos waste as per NEMA guidelines on safe disposal asbestos 2013. – Provide appropriate PPE to workforce/occupiers/visitors and enforce their use. – Use wire fencing for the entire site. – Engage security personnel to restrict access. – Install warning notices stating **"Asbestos hazard area, keep out". The** signs, with lettering of minimum 150mm in height, shall be placed so that they are clearly visible. – 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.	Proponent	Throughout operational phase	Variable depending on volume to be disposed
Soil & water contamination	– Construct water proof pits with 130mm thick concrete lining/wall and a base of similar thickness.	Proponent	Throughout operational phase	Variable depending on

	– Wrap asbestos waste with a 500 gauge double wrapped plastic sheet with every seam sealed with a tape and covered before disposal. – Burry asbestos waste at least **one meter** below the ground level or the asbestos waste is exhausted. – Dig disposal pit at least **one meter** above the water table. – Completely fence off the site 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(s). – Ensure that the siting is sheltered from waterways when it rains. – Appropriate drainage channels should be put in place to divert as much rain water from the site – Adhere to the provisions set out in part IV of Legal Notice No. 121 as well as in the national guidelines on safe management and disposal of asbestos. – Backfill areas which have undergone a substantial amount of excavation with stones or soil. – Limit excavation depth to 9m below the ground level.			volume to be disposed
Medical emergencies	– Have well trained first aid personnel at the premises site at all times. – Ensure first aid facilities are adequate and staffs have been trained. – Have contact numbers of reliable health facilities and professional health practitioners. – Ensure that there is always a standby ambulance for transportation in case of emergencies.	Proponent	Throughout operational phase	To be determined on a need by need basis
Accidents and incidents	Implement a health and safety program to address and minimize internal accidents and safety incidents.	Proponent	Throughout operational phase	Contingency fund to be established

5.8 ESMP for Decommissioning Phase

Table 6: Decommissioning Phase ESMP

Anticipated Negative Impacts	**Recommended Mitigation Measures**	**Responsible Party**	**Time Frame**	**Cost (Ksh.)**
Economic decline	Train employees on alternative livelihoods	Proponent	Prior to decommissioning	50,000. 00
	Prepare and issue recommendation letters to employees to seek alternative employment opportunities	Proponent	Prior to decommissioning	Nil
	Review potential job opportunities in other ongoing contracts by the proponent and recommend the employees who qualify	Proponent	Prior to decommissioning	Nil
	Comply with labor laws by paying the employees their terminal dues	Proponent/ workers	Prior to decommissioning	Nil
Health & safety risks	– Contract a licensed construction company to carry out demolitions. – Install signage to forewarn people on ongoing demolition activities. – Provide adequate and enforce the use of PPE throughout the demolition works. – Avail first aid kits on site throughout the entire period. – Ensure workers are given the correct hand tools and equipment for the jobs assigned. – Comply with the Environmental Management and Coordination (Air Quality) Regulations, 2014. – Comply with the Environmental Management and Coordination (Waste Management) Regulations, 2006. – Comply with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. – Comply with the provisions of the Occupational Safety and Health Act, 2007. – Adhere to asbestos disposal guidelines issued by NEMA, 2013.			To be calculated at the time

Decommissioning waste generation	– Use of an integrated solid waste management system i.e. through a hierarchy of options: Source reduction; Recycling; Composting and reuse; Combustion; and, Sanitary Land filling. – Transportation of wastes from the site to be done by a NEMA registered solid waste handler who will use appropriate vehicles for conveyance of wastes from site to designated sites. – Ensure compliance with the provisions of Waste Management Regulations, 2006. – Comply with the Water Quality Regulations, 2006.	Proponent & contractor	Throughout decommissioning phase	To be calculated at the time
Traffic management	– Vehicles carrying waste to observe designated speed limits for the area. – Deploy personnel at site entry and exit to direct traffic in and out of the site. – Place proper signage and warnings on the access roads to forewarn other motorists on the use of the road by heavy commercial vehicles.	Contractor	Throughout decommissioning phase	To be calculated at the time
Noise	– Restrict construction activities to day time only. – Ensure that noisy equipment is fitted with silencers where possible. – Provide workers with PPE for noise impact reduction.	Contractor	Throughout decommissioning phase	To be calculated at the time
Insecurity on site	Extend the tenure of contracted security firm during the decommissioning phase of the facility	Proponent/ contractor	Throughout the decommissioning	Tender

6.0 ENVIRONMENTAL MONITORING PROGRAMME

6.1 Overview of Monitoring Programme

A monitoring plan is essential to assess the impact of the development on the environmental setting of the area where it is located. The principles underlying an environmental monitoring plan as it relates to any given development is to document, track and report any changes in environmental parameters over time that would be associated with the project. These changes would in principle vary over time in both magnitude and direction. In the case of the latter it is important to bear in mind that changes in environmental parameters may be positive or negative. Thus in principle a monitoring program for the project would not necessarily focus only on the perceived or anticipated negative changes precipitated by a given development activity, but also on the positive or beneficial changes. The parameter chosen are those that have been identified in the analytical process as being affected in the most significant way by the proposed development.

6.2 Specific monitoring issues

The proposed monitoring plan for the project will entail those parameters and ecosystem components that have been identified through the mitigation matrix and other mitigation components. A number of these issues have also been highlighted in the mitigation plans and matrices associated with the previous section. These issues include:

- Occupational safety and health monitoring plan;
- Air quality monitoring plan;
- Noise monitoring plan;
- Wastewater quality monitoring plan; and,
- Solid waste monitoring plan.

The proposed monitoring program has been developed not only in relation to satisfying the statutory requirements of the EIA process, but also as a proactive tool for the proper implementation of the proposed development, within the context of its relationship to the integrity of the environment as well as the stakeholders in the area.

6.2.1 Occupational safety and health monitoring plan

6.2.1.1 Introduction

Potential safety and health risks during construction and subsequent operational phases will emanate from accidents from the use of machinery, noise and air pollution, health related problems due to inhalation of dust among others. All these have a potential to cause injures, permanent disability or even death to workers, neighbours and visitors to the site. The purpose of health and safety monitoring plan is to assess existing controls alongside potential health and safety risks in order to develop an effective plan of action and to ensure compliance with Occupational Safety and Health Act, 2007.

6.2.1.2 Monitoring strategy

The proponent should be committed to ensuring, as far as is reasonably practicable, the health and safety of the workers, visitors to the site and neighbours are not put at risk during the construction phase and from the operations of the disposal site. This will be achieved by:

- Conducting occupational safety and health reviews and reports;
- Hazard identification by analyzing activities that can be an immediate threat or cause harm over a period of time;

- Ensuring that all accidents and incidents occurring at the site are promptly reported and investigated;
- Keeping statistics of accidents, incidents and dangerous occurrences and ensuring that reportable cases are filed with the health, safety and environment officer;
- Administration of safety awareness and motivation scheme;
- Routine inspections of the facility and equipment;
- Visual inspection as well as interviewing key personnel to identify areas of improvement;
- Undertaking and reviewing of fire, energy and risk assessment reports;
- Review of safety awareness, fire drills and fire safety training requirements;
- Evaluation of the effectiveness of health and safety training to the workforce;
- Action plans related to significant findings of the risk assessment;
- Having emergency evacuation plans and emergency routes and safety signage among others; and,
- Assessment of risks involving hazardous substances i.e. receipt, storage & handling.

The responsibility for implementing this monitoring plan will be vested in the Department of Occupational Safety and Health Services and overall the management.

6.2.1.3 Indicator of success

The ideal indicators of success will include zero accidents and fatalities and reduction in the number of incidents and accidents at the site.

6.2.2 Air quality monitoring plan

6.2.2.1 Introduction

There are potential sources of air pollution during the construction phase and operation phases. Air pollution above acceptable limits are toxic to ecological systems and to human health. The purpose of the air quality monitoring plan is to ensure the concentrations air emissions from the construction and subsequent operations of the facility are within the stipulated standards set under the First Schedule of the Environmental Management and coordination (Air Quality) Regulations, 2014. In addition, the results will be used to evaluate if the adopted air pollution controls and management are effective.

6.2.2.2 Monitoring parameters

Construction sites are listed as sources of fugitive emissions under the Fifth Schedule of the Environmental Management and coordination (Air Quality) Regulations, 2014. Additionally, operations especially during dry weather could be sources of fugitive emissions. Therefore, the proponent should monitor fugitive emissions as per the First Schedule of the Environmental Management and coordination (Air Quality) Regulations, 2014.

Table 7: Ambient air quality tolerance limits for fugitive emissions.

Pollutant	Time weighted average	Industrial area
Sulphur oxides (SOx)	Annual Average*	80 µg/m3
	24 hours**	125 µg/m3
Oxides of Nitrogen (NOx)	Annual Average*	80 µg/m3
	24 hours	150 µg/m3
Nitrogen Dioxide	Annual Average	150 µg/m3

	24 hours	100 µg/m3
Suspended Particulate Matter (SPM)	Annual Average	360 µg/m3
	24 hours	500 µg/m3
Respirable particulate matter (< 10µm) (RPM)	Annual Average*	70 µg/m3
	24 Hours**	150 µg/Nm3
PM2.5	Annual Average	35 µg/m3
	24 Hours	75 µg/m3
Lead (Pb)	Annual Average*	1.0 µg/Nm3
	24 hours**	1.5 µg/m3
Carbon monoxide/ Carbon dioxide	8 hours	5.0 mg/m3
	One hour	10 mg/m3
Hydrogen Sulphide	24 hours**	150 µg/m3
Non methane hydrocarbons	Instant Peak	700ppb
Total VOC	24 Hours**	600 µg/m3
Ozone	One hour	200 µg/m3
	8 hour (Instant Peak)	120 µg/m3

Source: First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

6.2.2.3 Monitoring location

Air quality monitoring should be carried out within the project site.

6.2.2.4 Monitoring frequency

Air quality monitoring should be done on a quarterly basis during the construction and subsequent operational phases in collaboration with a NEMA designated laboratory.

6.2.3 Noise monitoring plan

6.2.3.1 Introduction

Potential sources of noise pollution will emanate mainly during construction activities, machinery use and from vehicle movement in and out of the facility. Noise may lead to hearing impairments which will reduce the workmanship of the employees. The purpose of noise monitoring plan is to therefore ascertain the extent of the impact due to the construction and subsequent operation of the disposal site in compliance with the Environmental Management and Coordination (Noise and Excessive Vibrations Pollution Control) Regulations, 2009.

6.2.3.2 Monitoring location

Noise monitoring should be carried out within the project site.

6.2.3.3 Monitoring frequency

Noise monitoring should be done on a quarterly basis in collaboration with a NEMA designated laboratory. Noise levels will be measured in dB (A).

Table 8: Maximum permissible levels for construction sites.

Zone		Maximum Noise Level Permitted (Leq) in db(A)	
		Day	Night
(i)	Health facilities, educational institutions, homes for disabled etc.	60	35
(ii)	Residential	60	35
(iii)	Areas other than those prescribed in (i) and (ii)	75	65

Source: Second Schedule of Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009.

Table 9: The Maximum permissible intrusive noise levels.

Zone		Sound Level Limits dB (A) Leq, 14 h		Noise Rating Level (NR) Leq, 14 h	
		Day	Night	Day	Night
A	Silent Zone	40	35	30	25
B	Place 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

Day: 6.01 a.m. – 8.00 p.m. (Leq, 14 h) Night: 8.01 p.m. – 6.00 a.m. (Leq, 10h)

Source: First Schedule of Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009.

6.2.4 Wastewater quality monitoring plan

6.2.4.1 Introduction

Sources of effluent from the development will be from sanitary facilities. The proponent should put in place a consistent wastewater quality monitoring plan targeting the quality of effluent discharging from the proposed septic tank – soak pit system. The objective of the monitoring plan is to provide data and information to improve water quality and management of the effluent in order to comply with the standards prescribed under the Third Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006.

6.2.4.2 Monitoring parameters

Effluent from the septic tank – soak pit system should be monitored pursuant to the Third Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006.

Table 10: Water quality monitoring parameters and the standards.

Parameter	EMC (Water Quality) Regulations, 2006 Standards
PH Value	6.5-8.5
BOD; mg/L	30max
COD; mg/L	50 max
Total Suspended Solids; mg/L	30 max
Ammonia-NH+; mg/L	100 Max
Total Dissolved Solids; mg/L	1200 Max
E. Coli Colonies; count/100ml	Nil
Total coliform; count/100ml	1000/100ml

Source: Third Schedule of Environmental Management and Coordination (Water Quality) Regulations, 2006.

6.2.4.3 Monitoring location

Effluent sampling should target the discharge point of the proposed septic tank – soak pit system.

6.2.4.4 Monitoring frequency

The frequency of wastewater monitoring should be quarterly in collaboration with a NEMA designated laboratory.

6.2.4.5 Indicator of success

Apart from implementing measures to meet the legal standards, obtaining an EDL from NEMA will also form part of the indicators of success of the water quality monitoring plan.

6.2.5 Solid waste monitoring plan

6.2.5.1 Introduction

Site preparation and construction activities are expected to generate significant quantities of solid waste such as overburden, rock rubbles, cuttings and rejected materials among others. Additionally, workers and visitors to the site will generate domestic wastes such as food left overs, plastics and wrappings among others. Poor disposal of the waste will cause odour problems, environmental pollution and therefore a health risk to the workers, visitors to the facility and neighbours. The purpose of the monitoring plan is to therefore ensure solid waste is managed in such a way that it protects both the public health and the environment.

6.2.5.2 Monitoring frequency

The frequency of solid waste monitoring will differ from the collection to the disposal stage in order to ensure reduced odours and accumulated heaps of waste. Table 12 describes the outline for which the activity will be monitored but can be adjusted depending on the amount generated

Table 11: Sample outline for solid waste monitoring plan.

Activity	Frequency	Critical levels (Tons)	Target	Responsibility
Collection	Daily			
Storage	Daily			
Management	Daily			
Disposal	Weekly			

6.2.5.3 Monitoring strategy

The solid waste monitoring plan will document the collection, storage and disposal of solid waste from the proposed development. There is need to code each of the collection points, note the capacity and critical levels, frequency of disposal and the personnel and contractor responsible. In addition, it will be important to characterize the waste streams at the collection points to inform investments in segregation infrastructure.

6.2.5.4 Indicator of success

Indicators of success will include timely collection and disposal of waste by the contractors, waste disposal tracking documents and certificates issued at the disposal sites.

7.0 PUBLIC AND STAKEHOLDER CONSULTATIONS

7.1 Introduction

Public and stakeholders participation in the ESIA process is a legislative requirement under Part 2, Section 69 (1d) of the Kenya Constitution 2010 and Regulation 17 of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. The aim of public and stakeholders consultations was to obtain and document comments, views and concerns that the neighbours and stakeholders have regarding the proposed project

An extensive public consultation process was engaged in gauging the sentiments of a variety of stakeholders in the development of this project. Besides the fact that this is a regulatory requirement under the Environmental Management and Coordination (EIA/EA) Regulations (2003), it was an excellent opportunity to offer the public an opportunity to ventilate their fears and concerns.

7.2 Methodology

Public participation for the proposed project was undertaken using two strategies:

- Administration of questionnaire to the neighbours and stakeholders. Questionnaires have been appended to this ESIA study report; and,
- Public consultative meeting held on May 25th, 2022 at the site. Minutes for the proceedings have been appended to this ESIA study report.

The respondents were purposively sampled targeting the immediate neighbour and the local administration including the area Chief, Village Elder and *Nyumba Kumi* chair persons.

Figure 9: Some participants during consultative meeting onsite.

Figure 10: Area Chief (l), EIA expert (centre) and the proponent (R) during consultative.

Figure 11: Some participants in during the consultative meeting onsite.

7.3 General Comments

The table below shows details and comments from respondents who were consulted.

Table 12: Public consultation comments.

Nos.	Name	ID No	Tel. No.	Respondents' Comments
1.	Munga Ndegwa (Area Ass. Chief)	23988522	0705811862	– The project has potential to pollute soil and water. – NEMA regulations should be adhered to. – Affected persons, animals and water to be given reparation. – Residents to be educated more on the nature of the project. – Local residents to be given employment

				opportunities. - Resident's grievances should be addressed amicably. - No anticipated negative impact for the proposal. - No objection to the proposal.
2.	Jenjewa Kaginya	4635334	0790675919	- No anticipated negative impact from the proposal. - No objection to the proposal.
3.	Chiwaya Sawa	10955888	0711733191	- No anticipated negative impact from the proposal. - No objection to the proposal. - Access roads to their property and Kaya Gandini should be maintained.
4.	Yawa Mrina	>	0113251229	- No anticipated negative impact from the proposal. - No objection to the proposal.
5.	Jumaa Jenjewa	3266082	0702810034	- Environmental pollution is possible due to disposal of hazardous waste on the land. - Disposal could lead to ill health and contamination of soil & water. - Caution must be taken during transportation and actual disposal. - NEMA must supervise all the operations.
6.	Chalsi Kaginya	2206178	0729253486	- No anticipated negative impact from the proposal. - No objection to the proposal.
7.	Kambi Sawa	21086042	0721591218	- Negative impacts cannot be foreseen not unless project starts. - Project should not cause harm to the land and health. - Neighbours should be granted priority in job opportunities.
8.	Kambaza Mrina	29532422	0716138856	- No anticipated negative impact from the proposal. - No objection to the proposal.
9.	Ndoro Nyamawi	3187061	0740037562	- Dust and noise during construction and actual operation will be an issue of concern. - The entire area should be enclosed. - Water should be sprinkled on the access roads. - Project is welcome. - Job opportunities should be given to

				neighbours first.
10.	Ngoa Ndoro	2213222	0757587599	– There is potential contamination of ground water. – Injuries during operations are potential occurrences. – All operations must be undertaken within the law.
11.	Nyae Nyamawi	11354831	0799841801	– Dust will be a major cause of worry as witnessed in the nearby quarry. – Access roads should be sprinkled with water. – Work should be undertaken during day time.
12.	Nyondo Nyamawi	21812659	0794350418	– No anticipated negative impact from the proposal. – No objection to the proposal. – All operations must be undertaken within the law.
13.	Kombo Mrina	28921323	0714409116	– Access roads will be rendered dusty. – Asbestos may be harmful to the environment. – There are potential injuries for workers during operations. – Water should be sprinkled to keep down dust. – Provide insurance cover to workers. – Seek approval from NEMA and County
14.	Mwahui Sawa	21102039	0714164650	– No anticipated negative impact from the proposal because of vast distance. – No objection to the proposal.

7.4 Summary on findings

From a general observation the following was noted:

- The overwhelming majority of the respondents could see enormous benefits accruing to them by the coming into being of the project.
- There was no objection to the proposal.
- In the case that there will be job opportunities, the local residents should be given priority.
- No major negative impact that could not be mitigated was foreseen.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusion

The proposed project is considered important as it will offer safe a disposal site for asbestos waste that is considered hazardous. The proposal is in line with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006 and has adopted the National Guidelines on Safe Management and Disposal of Asbestos by NEMA (2013). On the basis of the evaluation of the development proposal, this EIA study presents significant impacts that need to be adequately mitigated. However with appropriate impact mitigation as proposed herein, the project will not occasion environmentally significant negative impact that could lead to environmental degradation on an appreciable scale.

8.2 Recommendations

The proponent should be favored with EIA license subject to the conditions that NEMA may impose during the decision making process. The proponent should however use the EMP as monitoring and evaluation tool to submit an Environmental Audit (EA) report to NEMA annually or as may be directed by the Authority without fail and seek license to Own/Operate a Waste Treatment Plant/Disposal Site to comply with Regulations 11, 24 & 25 of the Environmental Management and Coordination (Waste Management) Regulations, 2006.

9.0 REFERENCES

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10.0 LIST OF APPENDICES

i. EIA/EA experts' practising licenses.
ii. TOR approval.
iii. Certificate of business registration.
iv. PIN certificate.
v. Land ownership documents.
vi. Hydrogeological study report.
vii. Architectural drawing.
viii. Minutes of public consultation meeting.
ix. Public consultation questionnaires.