ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTS FOR THE PROPOSED ASBESTOS DISPOSAL SITE, PLOT NO. 3404/KALUMANI MNYENZENI ADJUDICATION SECTION, KILIFI COUNTY

GPS Cordinates: 3°47'02.2"S 39°29'17.4"E

PROPONENT
QUALITY INSPECTION SERVICES LIMITED
P.O. Box 87222-80100
MOMBASA

OCTOBER 2021

CERTIFICATION

Certification by Experts

We hereby certify that this Environmental and Social Impact Assessments Report (ESIA) has been done under our supervision and that the content reporting conforms to the requirements of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya.

Expert Name:	Registration no.	Signature	Date
MUNYUA A. MWENGA	0340		12/10/2021
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NANCY NZOKA	SOCIAL EXPERT		12/10/21
ALEX MUTUKU	GEOLOGIST GOK		12/10/2021
OTIENO WYCLIFF OGALLO	ENGINEER		12/10/21

Certification by Proponent

We, **QUALITY INSPECTION SERVICES LIMITED,** hereby confirm that this Environmental and Social Impact Assessments Report (ESIA) has been prepared and submitted to NEMA with our authority as the proponent.

Signed for and on behalf of: **QUALITY INSPECTION SERVICES LIMITED**

Name: ABBAS HATIM ALI

Signature: _____ Date: 05/10/2021

Proponent contact details

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Official Rubberstamp or Seal

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ACKNOWLEDGEMENTS

The successful preparation and eventual submission of this Environmental and Social Impact Assessments Report (ESIA) was made possible by contributions from the proponent, the consultants and project stakeholders.

We acknowledge the proponent, **QUALITY INSPECTION SERVICES LIMITED**, for the provision of pertinent project documents and resources required by the consultants. In this regard, we are thankful to all participants for providing us with the necessary information required for the ESIA processes and overall coordination. The team acknowledges the neighbors for their participation in the public consultative exercise, which is an integral part of the ESIA process.

EXECUTIVE SUMMARY

The client has commissioned for the assessment of environmental and social impacts for the proposed Asbestos disposal site project. This is in adherence to legislative requirements in place to ensure that the development activities consider environmental protection during its cycle.

The primary objective of this consultancy is to prepare an ESIA application for EIA license. These materials are collectively expected to present the environment and social management procedures of the project during its development cycle. These inputs of development confer it sustainability. The proposed site is approximately 10 acres and has a 2kms buffer from human settlement. As at the time of this report, the proponent had acquired the parcel from the owners who inherited it from their fathers. A copy of the title deed has been attached to this report. The facility to be set up shall occupy approximately 10 acres of land, where a pit, depending on the quantity of the asbestos to be disposed, shall be dug at a maximum depth of nine decimal five meters (9.5m) below the ground. A concrete lining/wall of 130mm shall be constructed all round before the asbestos materials are placed in the pit, covered by 130mm concrete cover, then pour the topsoil. The pit shall be considered full when the material reaches a mark of 1.5m below the ground level. The pits shall be dug when the materials are received on the site and the volume of excavation shall depend on the mount of the asbestos materials to be disposed. Other amenities to be provided at the site include jet wash area, sanitary facilities, car park, fence, and a lockable gate.

The project specific objectives of the ESIA Study:

1. To identify and evaluate the potential environmental and social effects generated by the proposed development.
2. To examine the potential environmental and social effects of alternative development proposals to the project area.
3. To identify and describe safeguards that will anticipate and mitigate the potential adverse impacts of the proposed project.
4. To appraise beneficial impacts of the proposed activities.
5. To integrate interested and affected party perceptions of the proposed development for enhanced compliance to existing safeguards policies and regulations.
6. Develop an environmental and social management plan.

The proposed project is anticipated to generate negative environmental impacts. The key impacts have been scoped, analysed and possible mitigation measures collated in the EMP are summarized in the table below: -

Environmental concern	Potential impact	Proposed Mitigation measures
Occupational health & safety	Health risk to site workers	1. All employees will wear protective clothing during the exercise. 2. All personnel involved with the asbestos disposal process will be subjected to medical surveillance 3. Asbestos air sampling will be conducted on the sites for clean- up 4. Ensure all asbestos is collected and loaded into a transportation vehicle licensed by NEMA 5. Fence off the site to avoid unauthorized access 6. Inform all the relevant stakeholder and government officials prior to commencement of any work. 7. Provision of respirators to all persons entering the asbestos site 8. The transporting vessel shall be labelled **"hazardous waste"** 9. Thorough, complete and up to date records should be kept of at the site 10. Warning & Safety signage will be placed at the strategic areas within the disposal site 11. When there is a visible dust or winds in excess of 20 knots, any asbestos disposal and cleaning process will be stopped
Ground Water Quality	Contamination of surface & ground water	12. Develop disposal cells which will be lined with a 1,000-gauge HDP liner and impervious cement to ensure that the cells are leak proof.
Screening of asbestos wastes	Contamination of the environment due to the unregulated asbestos waste handling	13. Removal and handling of asbestos sheets should be undertaken by a NEMA licensed contractor
Flora & fauna	Degradation /modification of animal habitats on the proposed project site & loss of flora	14. Comply with the Environmental Management and Coordination (Waste Management) Regulations, 2006 and the National Guidelines on the Safe Management and Disposal of Asbestos

The proposed project has elicited mixed feeling from the neighbours but all of these concerns have been mitigated in the ESIA report.

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LIST OF ACRONYMS & ABBREVIATIONS

CGK-	County Government of Kilifi
DOSH-	Directorate of occupational Health and Safety
EA-	Environmental Audit
EHS-	Environmental Health and safety
EIA-	Environmental Impact Assessment
EMCA-	Environmental Management and Coordination Act
EMP-	Environmental Management Plan
GHGs-	Green House Gases
KIMAWASCO-	Kilifi Mariakani Water and Sewerage Company
LN-	Legal Notice.
NEC-	National Environmental Council
NEMA-	National Environment Management Authority
NGOs-	Non–Governmental Organization
OSH-	Occupational Safety and Health
OSHA-	Occupational Safety and Health Act
PM-	Particulate Matter
WRA-	Water Resource Authority

1 DESCRIPTION OF THE PROJECT

1.1 Introduction

Asbestos is a naturally occurring mineral fibres found in various rock formations. It is a collective name for a fairly diverse group of different fibres based on hydrated silicates. Different ratios of oxygen, hydrogen, sodium, iron, magnesium, and calcium elements account for several different types of asbestos, the most common ones being Amosite, Chrysotile, Crocidolite, Anthophyllite, Actinolite, and Tremolite. Asbestos can be divided into two groups, Serpentine that contains only Chrysotile and is composed of only curly fibres that often form into bundles. It comprises 90% of the world production of asbestos and is considered by many to be the least hazardous. The other group is called Amphiboles that contains Amosite, Crocidolite, Anthophyllite, Actinolite and Tremolite. It is usually considered a greater hazard than Chrysotile due to its straight and sharp fibres formation. Amosite and Crocidolite have been used in relatively significant quantities, and in non-fibrous forms are referred to as grunerite and riebeckite respectively.

Asbestos was a popular fire-proofing material once used in thousands of commercial and consumer products. It wasn't until the late 1970"s that the use of asbestos was banned after it was classified as a carcinogen. By that time, asbestos had been widely used in a large number of construction products and was already a potential source of great harm to those who came in contact with it. Buildings that were built or refurbished at a time when the use of Asbestos Containing Materials (ACMs) was prolific are likely to have ACMs. These materials included ACMs cemented water pipes and ACMs cemented roofing sheets amongst others. ACMs were used in the construction industry until late 1970s and early 1980s after which it was discovered that they posed serious health risks. These ACMs especially the roofing asbestos cement roofing sheets were projected to have a life expectancy of between 30 to 50 years. These asbestos cemented roofing sheets still exist in roof structures many years after their life expectancy. Nonetheless, the presence of ACMs in itself does not constitute danger. Potential risk to health is only present if such material is disturbed and damaged. It is also important to note that an isolated accidental exposure to asbestos fibres for a short duration is unlikely to result in the development of asbestos related diseases. Activities such as dismantling, breaking, sawing, cutting, drilling etc. are the most likely to present risks and therefore must be managed accordingly.

Every person is entitled to a clean and healthy environment. The proposed project proposes to provide a facility that will offer solutions on safe disposal of asbestos from various entities that intend to dispose-off the asbestos roofing's within republic of Kenya.

The proponent **QUALITY INPECTION SERVICES LIMITED**, is a limited Liability company incorporated in Kenya with a registered office in Mombasa, Kenya and of P.O. Box 87222-80100.

1.2 Location of the project site

The proposed project site is situated along Mariakani-Bamba Road on PLOT L.R. NO. **3404/KALUMANI MNYENZENI ADJUDICATION SECTION, Kilifi County** at Latitude **3°47'02.2"S** and Longitude **39°29'17.4"E** (-3.7839567, 39.4881672). The site falls within a sparsely populated residential area with huge tracts of land characterized by scanty vegetation, and associated developments including a road network, electricity supply and other infrastructure.

Figure 1: The location of the proposed Asbestos disposal site (Source: Google earth, 2021).

Figure 2: Mariakani- Bamba road connecting to the proposed project

1.3 Infrastructure

The development will have a comprehensive and robust infrastructure including access roads, parking areas, water storage, electricity distribution and waste disposal mechanism.

1.3.1 Electrical system

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

1.3.2 Water Reticulation system

Water in Kilifi is supplied by the Kilifi Mariakani Water and Sewerage Company (KIMAWASCO). Several boreholes supplement this supply within the county for uses other than drinking. Hydrogeological survey was conducted during the ESIA study and the report has been appended.

1.3.3 Effluent Management

Kilifi county has no existing sewerage infrastructure. The most common effluent disposal mechanisms in the county include discharge into pit latrines, septic tanks and soak away pit systems. These have to regularly be exhausted to ensure proper functioning.

1.3.4 Solid Waste

The main sources of solid waste in Kilifi County comes from domestic waste, commercial and industrial ventures, hotels, markets, and other institutions such as health centres. All types of waste are transported to designated transfer stations awaiting disposal in the main designated dumpsites.

1.3.5 Security

There will be the main entrance for easy security operations around the compound a boundary wall connected with security alarms, entry control, and quick response systems will be used within the project area.

1.3.6 Fire safety

The development will provide for firefighting facilities such as fire extinguishers in the form of hydrants and carbon dioxide gas extinguishers.

1.3.7 Buildings Construction

The technology used in the design and construction of the disposal site as presented in the architectural drawings in the appendix, will be based on international standards, which have been customized by existing asbestos disposal sites in Kenya.

The project will consist of the following;

- Disposal cells which will be lined with a 1,000-gauge HDPE liner and impervious cement to ensure that the cells are leak proof.
- Once each cell is filled up, seal it with an impervious cement slab.
- The site will be fenced all round and labelled appropriately to warn off third parties.
- The site entry/exit will be locked and manned at all times as guided by the National guidance on management and disposal of asbestos

- Disposed Material will be one metre below ground level.
- The site is to be demarcated into three sections so as to avoid cross-contamination. the sections are; the clean zone, intermediate zone and the dirty zone.

1.4 Description of the Project's Construction Activities

1.4.1 Pre-construction Investigations

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

1.4.2 Sourcing and Transportation of Building Materials

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

1.4.3 Clearance of Vegetation.

The site has some vegetation cover including grass growing in it and few mature trees.

The proponent shall ensure as many indigenous trees as possible are used for revegetation as well as conserving the mature trees

1.4.4 Storage of Materials

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

1.5 Description of the Project's Operational Activities

1.5.1 Asbestos removal

Aactivities to be undertaken at removal and handling will include; Preparation of the work area by ensuring safe access through a mobile platform/ scaffolding, restricting access by minimizing the number of people who can access the site and Placement of warning signage on the removal of hazardous material at the site.

Process of removal will include the following activities;

1. Since the asbestos sheets at the site are fasted using bolts, the method of removal will first and foremost seek to avoid breakage or minimize that possibility.
2. To do this, the contractor will cut the bolts holding the asbestos sheets on the top side to release each individual sheet
3. The unbolted sheets will then be lowered to the ground for packaging using high density polyethylene (HDP) and sealed with a duct tape to await transportation to the disposal site
4. Each sealed package of asbestos sheets will be labeled as hazardous
5. Any debris arising from accidental breakages will be collected and held in sealed plastic waste containers awaiting loading into transport truck
6. When removed, the asbestos sheets bundles will be placed on firm level supports on pieces 2 inches by 4 inches spaced into 12 inches to 18 inches and laid at right angles to the corrugations. Sheets will be stacked to less that or 4 feet high while awaiting transportation to the disposal site.

1.5.2 Packaging

1. Packages will be small enough to be handled easily by personnel
2. The contractor will place a 500 gauge double wrapped of polythene sheeting in the cargo carrying compartment of the truck to overflow the entire bottom and sides with the liner
3. The sheets will then be laid on the polythene liner to the capacity of the trucks to be used and the overflow polythene used to cover the upper part of the truck and closed
4. Loose pieces, breakages and waste pipes i.e. both existing for collection or from active removal of the asbestos during the current works, will be wrapped using polythene sheets 500 gauge double wrapped thick and sealed with adhesive tapes prior to loading on transport trucks and labeled with asbestos warning signage

1.5.3 Temporary storage

If the asbestos must be stored before disposal and or transportation for disposal, they must be stored in such a way that its containers are secure from accidental or deliberate damage, access by staff and the public. Temporary storage refers to the time between removal and final disposal of asbestos waste. The duration for temporary storage of asbestos waste should not exceed thirty (30) days from the time of removal. The temporary site should be within the premises where the asbestos is being removed. The storage area must have restricted entrance and locked or secured on a 24-hour basis. Warning label ("Asbestos hazard area, keep out") and danger signs should be affixed to each wrapped stack or storage area using English, Swahili and Local language

1.5.4 Transportation

The proponent is expected to observe the following precautions during the packaging and transportation of the asbestos wastes:

1. The waste transporting vessel must be lined with a 500 gauge double wrapped plastic sheet with every seam sealed with a tape and covered.
2. The transportation vessel should be labelled "Danger - Contains Asbestos Fibres. Cancers and Lung Disease Hazard"
3. The bags and stacks should be gently loaded into transportation vessel. The goosenecks should 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. The asbestos waste should be transported to a prepared disposal site that is authorized by NEMA.
5. The vehicle transporting the asbestos waste should be licensed as per the EMCA (Waste Management) Regulations 2006 and must be accompanied by a tracking document. The waste shall be transported to the disposal site in an enclosed vehicle or container, capable of being washed without lodgment of debris and fibres, and secure from escape of fibres to the atmosphere
6. The proponent should ensure that all persons involved in handling and disposal of asbestos are trained in emergency operating procedures. These procedures shall include how the waste is to be handled, services to be contacted during such an exposure, and additional personal protective equipment.

1.5.5 Disposal operations

The proponent shall ensure that the following precautions are observed when disposing asbestos wastes:

1. The proponent shall notify the Authority on commencement of disposal activities.
2. Asbestos materials must not be reused or offered for sale.
3. All asbestos sheets and the debris should be wrapped in 1000mm gauge sheets before it is hauled to the disposal site or transfer station in a covered vehicle.
4. Asbestos waste must be disposed of only at approved disposal site for which this report is prepared.
5. The depth of the disposal pit shall be as deep as practically possible to accommodate more asbestos waste but at least one 1 metre above water table.

6. The asbestos should be lowered gently into the disposal site and should not be dropped from any height to avoid breakage.
7. When all available asbestos has been lowered into the pit, cover with polythene paper followed by 6-inch layer of soil. Continue doing this until the pit is full or the waste is finished.
8. The pit shall be considered full when the asbestos waste is at least one meter below the ground level, or the asbestos waste is exhausted.
9. After the pit is full, cover with 1000 gauges double wrapped polythene sheet and fill the pit with layer of soil up to the ground level.
10. Disposal site should be completely fenced off with at least chain link and a lockable gate which shall be locked at all times. The fence should be at least one 1 metre from the edge of the pit.
11. Warning notices stating "Asbestos hazard area, keep out" shall be placed at the disposal site. These signs, with lettering of minimum 150mm in height, are to be placed so that they are clearly visible

1.5.6 Post Disposal

Upon completion of the disposal operations, the proponent is expected to observe the following post-disposal guidelines:

1. 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.
2. The disposal site should be maintained including the warning signs, the fence, the gate among others to prevent vandalism and interference.
3. Human activities which might interfere with the buried asbestos waste such as construction and pitting should not be allowed at the disposal site.
4. The proponent shall notify the Authority in writing on completion of disposal of asbestos waste.

1.6 Public participation

Public participation basically involves engaging members of the public to express their views about a certain project. Public participation tries to ensure that due consideration will be given to public values, concerns and preferences when decisions are made. Public participation in this project was facilitated through interviews with the project proponent and neighbors of the facility. A sample of the neighbor's comments, occupation, contacts and signatures has been appended in this report.

Public involvement is a fundamental principle of the EIA process. Timely, well planned and appropriately implemented public involvement programmes will contribute to EIA studies and to the successful design, implementation, operation and management of proposals. Specifically, public involvement is a valuable source of information on key impacts, potential mitigation measures and

the identification and selection of alternatives. It also ensures the EIA process is open, transparent and robust, characterized by defensible analysis. Nearly all EIA systems make provision for some type of public involvement. This term includes public consultation (or dialogue) and public participation, which is a more interactive and intensive process of stakeholder engagement. Most EIA processes are undertaken through consultation rather than participation. At a minimum, public involvement must provide an opportunity for those directly affected by a proposal to express their views regarding the proposal and its environmental and social impacts. Due to Covid-19 pandemic, gatherings were banned and public participation was restricted to and followed Ministry of Health regulations on public gatherings. Attached with the report is the minutes and questionnaires administered to the community and key institutions.

The purpose of public involvement is to:

- Inform the stakeholders about the proposal and its likely effects;
- Canvass their inputs, views and concerns; and
- Take account of the information and views of the public in the EIA and decision making.

The key objectives of public involvement are to:

1. To obtain local knowledge that may be useful for decision-making;
2. To facilitate consideration of alternatives, mitigation measures and tradeoffs;
3. To ensure that important impacts are not overlooked and benefits are maximized;
4. To reduce conflict through the early identification of contentious issues;
5. To provide an opportunity for the public to influence project design in a positive manner (thereby creating a sense of ownership of the proposal);
6. To improve transparency and accountability of decision-making; and
7. To increase public confidence in the EIA process.

Figure 3: stakeholders in a meeting on 29th September, 2021 (source; Field survey, September 2021)

1.7 Scope of the project

The scope of the study includes carrying out of environmental investigations in line with current provisions on environmental legislations. This has been done in line with the requirements of Environmental Management and Coordination Act (EMCA) 1999 and Environmental (Impact Assessment) and Audit regulations 2003. The report is aimed at analyzing the physical extent of the project site and its immediate environs, implementation works of the proposed project and installation of key utilities and other facilities required for the project to function optimally.

1.8 Terms of Reference (TOR)

The TORs for this Project Report is the production of an ESIA report to address the effects and impacts (Positive and Negative) of the proposed Asbestos disposal site. The EIA firm of experts is under instructions from the project proponent to do a thorough environmental assessment with the aim getting approval from the National Environment Management Authority before commencement of the project. This report addresses the following key specific objectives:

- To review existing legal and institutional framework related to the proposed project.
- To collect and collate baseline information relevant to the proposed housing development
- To collect primary data through the community participatory process.
- To identify and assess positive and negative impacts of the proposed project
- To identify and analyze alternative options for the proposed project
- To develop mitigation measures and cost estimates for the negative impacts of project.

- To design an Environmental Management Plan and a monitoring framework for the environmental impact of the project.

1.9 Methodology

1.9.1 Environmental Screening.

Environmental screening was carried out to determine whether an EIA study is necessary for this project and at what level of evaluation. This took into consideration the requirements of the Environmental Management and Coordination Act (EMCA), 1999, and specifically the second schedule of the same act. From the screening process, it was understood that this project will cause significant impacts on the environment.

1.9.2 Environmental scoping

In scoping, focus was on environmental impacts of great concern. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects. Impacts were also classified as immediate and long-term impacts. This will include assessment of the proposed project in respect of but not limited to:

- Project Background: this will give the brief history of the proposed project site, the parties involved and justification of the project in terms of demand or lack of the same, the project area, relevant policy and legislation, identification of any associated project, or any planned projects including products within the region which may compete for the same resources; the project including products, by-products, processes both at implementation and operational level, resources required for successful implementation and operation of the project and the different options considered.
- The proposed project objectives; both in the short and long run; and how they are linked to the overall objectives.
- Present environmental conditions; description of the project site, ecological zoning as well as the state of the environment and its surroundings. Attempts will state if it is already suffering from degradation, causes of the original degradation if any established.
- Identification of Environmental Impacts; the report will distinguish between significant positive and negative impacts, direct and indirect impacts and immediate and long term impacts which are unavoidable and / or irreversible,
- Community/ Stakeholder Consultations: these will be undertaken to determine how the project will affect the local people / various stakeholders.

- Cost- Benefit Analysis; to evaluate the economics of the project and establish its viability in terms of the expected environmental concerns and measures.
- Development of an Environmental Management Plan (EMP); to mitigate negative impacts, recommending feasible and cost effective measures to prevent or reduce significant negative impacts to acceptable levels,
- Development of a Monitoring Plan; this will be used in monitoring the implementation of the mitigation measures and the impacts of the project during construction and operational phases, including an estimate of capital and operational costs, and Make necessary recommendations pertaining to the proposed development.

1.9.3 Desktop study

This involved review of project documents, architectural drawings, past EIA, relevant policy, legal and institutional frameworks. Documents containing climatic, demographic and hydrological data for Kilifi County were also relied upon.

1.9.4 Reporting and documentation

In the entire exercise, the proponent and EIA experts contacted each other on the progress of the study and signing of various documents. The proponent will have to submit 10 copies of this report alongside a soft copy summarized version of the ESMP in word form and one electronic copy of the report to the National Environment Management Authority for review and issuance of an EIA license. All the materials and workmanship used in the execution of the work shall be of the best quality and description. Any material condemned by the architect shall be removed from the site at the contractor's cost. Environmental concerns need to be part of the planning and development process and not an afterthought. It is therefore advisable to avoid land use conflicts with the surrounding area through the implementation of the Environmental Management Plan (EMP).

2 POLICY, LEGAL AND LEGISLATIVE FRAMEWORK

Environmental Impact Assessment is an instrument for environmental management and development control. It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound. It is a condition of the Kenya Government for developers to conduct Environmental Impact Assessment (EIA) on the development Projects. According to Sections 58 and 138 of the Environmental Management and Coordination Act (EMCA) No. 8 of 1999 and Section 3 of the Environmental (Impact Assessment and Audit) Regulations, 2003 (Legal Notice No.101), construction of buildings require an Environmental Impact Assessment project report prepared and submitted to the National Environment Management Authority (NEMA) for review and eventual licensing before the development commences. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.

2.1 Policy Framework.

Environmental policies cut across all sectors and government departments. As such policy formulation, should be consultative steered by interdisciplinary committees. Recent policies which the government is working on include; Draft Wildlife Policy; Draft National Land Policy; and Wetlands Management and Conservation Policy among others.

2.1.1 National Environmental Action Plan (NEAP).

National Environmental Action Plan was a deliberate policy effort to integrate environmental concerns into the country's development initiatives/plans. This assumed a consultative and multi-sectoral approach. Such an approach ensured that environmental management and the conservation becomes integral in various decision-making platforms.

As a result of its adoption and implementation, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP process, Environmental Impact Assessments were introduced targeting the industrialists, business community and local authorities.

2.1.2 National Shelter Strategy to the Year 2000.

Kenya adopted this strategy following the International Year of Shelter for the Homeless in 1987.This advocate for the involvement of various actors to come in and assist the government in providing housing. This took cognizance of the governments' inability to provide sufficient shelter for all its citizens. The government was to simply facilitate other actors such as developers to invest in shelter.

2.1.3 The National Poverty Eradication Plan (NPEP).

The objective NPEP is to alleviate poverty in rural and urban areas by 50 percent by the year 2015; as well as the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow

gender and geographical disparities and a healthy, better educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for the Sustainable Development (WSSD) of 1995. Since poor housing is among the indicators of poor societies, pursuits to address it build individuals capacity to relieve poverty.

2.1.4 National Policy on Water Resources Management and Development

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water 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. This implies that Industrial and business development activities should be accompanied by corresponding waste management systems to handle the waste water and other waste emanating there from. The same policy also requires that such projects undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighbourhood and further downstream are not negatively impacted by the emissions. As a follow-up to this, EMCA, 1999 requires annual environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during EIAs are implemented. In addition, the policy provides for charging levies on waste water 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 remediation. Consequently, to ensure water quality, the policy provides for establishment of standards to protect water bodies receiving wastewater, a process that is ongoing. The standards and measures to prevent pollution to water resources are provided for in the Environmental Management and Coordination (Water Quality) Regulations, 2006 which is a supplementary legislation to EMCA, 1999.

2.1.5 Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999):

The key objectives of the Policy include: -

(i) To ensure that from the onset, all development policies, programmes and projects take environmental considerations into account,

(ii) To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation,

(iii) To come up with effluent treatment standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that require a "sustainable development" approach. These issues relate to waste management and human

settlement. The policy recommends the need for enhanced re-use/recycling of residues including wastewater, use of low or non-waste technologies, increased public awareness raising and appreciation of a clean environment. It also encourages participation of stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others.

2.2 Legal and Legislative Framework

2.2.1 Environmental Management and Coordination Act, 1999 section 91 (1-7)

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. To administer the Act, two major institutions have been established. They include the National Environmental Council (NEC) and the National Environmental Management Authority (NEMA). It has several Regulations that are discussed in the proceeding sections. The EMCA, 1999 requires the Authority to categorize hazardous wastes on the recommendation of Standards Enforcement and Review Committee (SERC) and to issue guidelines and regulations for the management of each category of hazardous wastes. The categorization has been done under the EMC (Waste Management) Regulations, 2006, while these guidelines provide for safe management of asbestos and its wastes.

2.2.2 The Environmental Management and Co-ordination (Waste Management Regulations 2006)

Legal Notice No. 121: Section 4-6

Part II of the Environmental Management and Co-ordination (Waste Management) Regulations, 2006 states that: -

- No person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.
- Any person whose activities generate waste shall collect, segregate and dispose or cause to be disposed off such waste in the manner provided for under these Regulations.
- Without prejudice to the foregoing, any person whose activities generates waste has an obligation to ensure that such waste is transferred to a person who is licensed to transport and dispose off such waste in a designated waste disposal facility.
- A waste generator shall segregate waste by separating hazardous wastes from non-hazardous waste and shall dispose of such wastes in such facility as shall be provided by the relevant local authority.

In addition, the Regulations state that a waste generator shall minimize the waste generated by adopting the following cleaner production methods;

(i) Improvement of production process through Conserving raw materials and energy, Eliminating the use of toxic raw materials and reducing toxic emissions and wastes.

(ii) monitoring the production cycle from beginning to end by Identifying and eliminating potential negative impacts of the product, Enabling the recovery and re-use of the product where possible, Reclamation and recycling

(iii)Incorporating environmental concerns in the design and disposal of a product.

(23) No person shall engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by Authority under the provisions of the Act.

The proponent has complied with the regulation and is in the process of seeking approval to dispose the waste.

2.2.3 Waste Water Management;

Legal Notice No. 120; Part II – Protection of Sources of Water for Domestic Use.

Every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of these Regulations

No person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution

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

The asbestos to be disposed off in underground concrete confinement as per the NEMA guidelines on disposal of asbestos waste. In addition, Hydro geophysical survey was conducted on 2nd October, 2021 to determine appropriate depth of burial of asbestos that would not contaminate ground water.

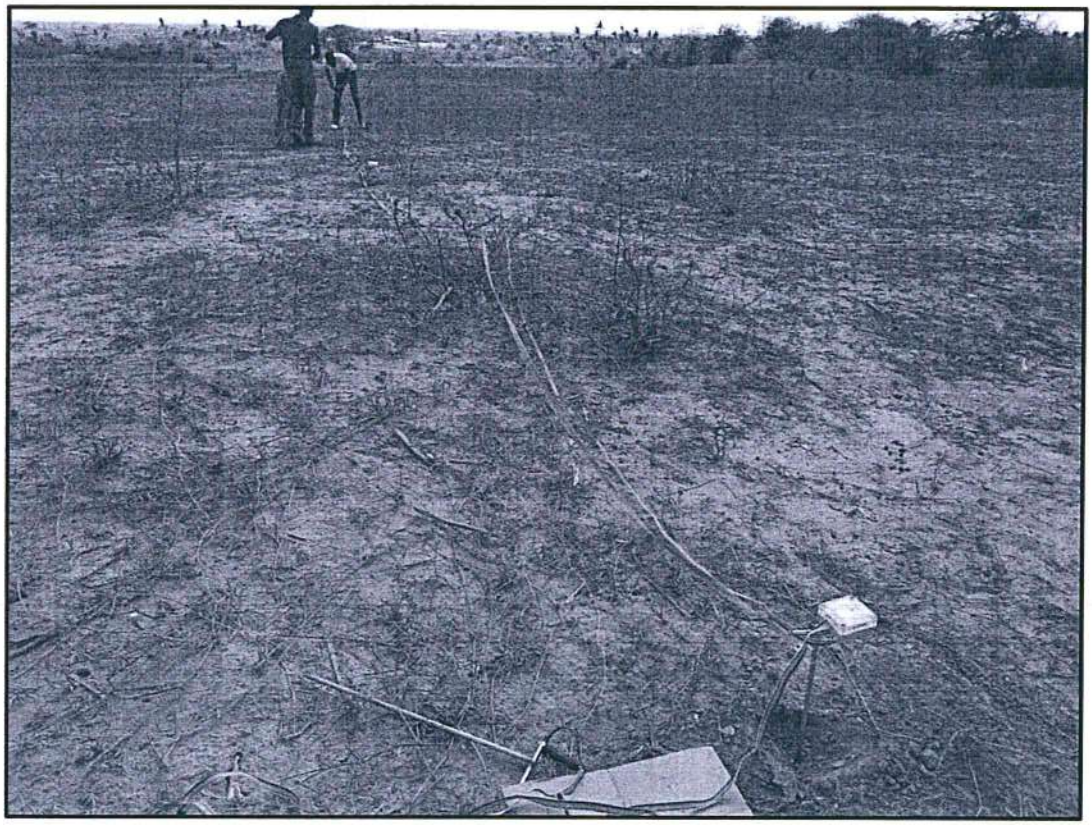

Figure 4: Hydrogeological Experts undertaking Hydrogeological assessment of ground water conditions (source; Field survey, October 2021)

2.2.4 Public Health Act Cap 242 Sections 11-13 –

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

The Public Health Act Cap 247, Section 3 gives provisions for use of poisonous substances. It refers to regulations for protection of persons against risk of poisoning, imposing restrictions or conditions on the importation, sale, disposal, storage, transportation or use of poisonous substances. This Act also requires persons concerned with importation, sale, disposal storage, transportation or use of poisonous substances to be registered and licensed and provides measures for detecting and investigating cases in which poisoning has occurred. The Public Health Act Sec 126 A, empowers municipal councils, urban and area councils to make by laws for all or any of the following matters with regards to buildings for – Controlling the construction of buildings and the materials to be used in the construction of buildings; Preventing the occupation of a new or altered building until a

certificate of the fitness thereof for occupation or habitation has been issued by such local authority. To compel owners to repair order to demolish unsafe, dangerous or dilapidated buildings. The Act further gives the municipal Urban or area councils power to require removal or alteration of work in certain cases the local authority may by notice to the owner either require him to pull down or remove the work, or if he so elects to comply with any other requirements.

The proponent has complied with the act and has planned to assist by elimination of asbestos waste by offering the disposal site

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

The The purpose of the Occupational Safety and Health Act (OSHA) is to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces and to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. Though not explicitly provided, the act and the rules made there under have various sections on hazardous materials that apply to Asbestos. The OSHA stipulates that an employer shall not require or permit his employee to engage in the manual handling or transportation of a load which by reason of its nature is likely to cause the employee to suffer bodily injury. It also states that any person supplying, distributing, conveying or holding in chemicals or other toxic substances shall ensure that they are packaged, conveyed, handled and distributed in a safe manner so as not to cause any ill effect to any person or the immediate environment.

The proponent is expected to observe safety and healthy procedures during demolition, transportation and disposal of asbestos wastes.

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

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

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

The Factories (Building, Operations and Work of Engineering Construction) Rules, Legal Notice No 40 of 1984, rules 20 and 21 prohibit any inhalation of dust and fumes. In any building operation or work of engineering construction where dust or fumes likely to be injurious to the health of persons employed are given off, all reasonably practicable measures shall be taken to prevent the inhalation of dust or fumes by the person employed by ensuring adequate ventilation or providing suitable respirators at the place where the operation or work is carried on.

2.2.8 Water Act 2016

The water act No. 8 of 2016 provides for the management, conservation, use and control of water resources and for acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services. Section 18 of this Act provides for national monitoring and information systems on water resources. Following on this, sub-Section 3 mandates the Water Resources Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a site operator and the information thereof furnished to the authority. Section 73 of the Act provides that a person who is licensed to supply water has a responsibility of safeguarding the water sources against degradation. According to section 75 (1) such a person is required to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction.

On the other hand, section 76 makes it an offence for any person to discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee which should be sought by making an application indicating the nature and composition of the effluent, maximum quantity anticipated, flow rate of the effluent and any other information deemed necessary. The consent shall be issued on conditions including payment of rates for the discharge as provided under Section 77 of the same Act.

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

The Proponent will dispose the asbestos in underground confinement as per NEMA guidelines in disposal of asbestos.

2.2.9 County Government Act (2012).

The County Government act was formed after promulgation of the new constitution of Kenya (2010). The constitution calls for devolution of duties in the counties for effective results. These county governments may manage and let land besides regulating and licensing trade activities including construction in their areas of jurisdiction besides provision and maintenance of roads, footways, street lighting, sewerage and solid waste in their areas. Section 160 of the act empowers counties to establish and maintain sanitary services for the removal and destruction of, or otherwise deal with

all kinds of refuse and effluent and where such service is established, compel its use by persons to whom the service is available.

Similarly, section 163 (e) empowers the local Authorities to prohibit businesses which by reason of smoke, fumes, chemicals, gases, dust, smell, noise, vibration or other cause, may be or become a source of danger, discomfort or annoyance to the neighbourhood, and to prescribe conditions subject to which such business shall be carried on. It is in this vain that section 165 mandates the council to grant or to renew business licenses or to refuse the same.

In order to discharge its duties effectively, section 170 of the act allows the right of access to private property at all times by local authorities, its officers and servants for purposes of inspection, maintenance and alteration or repairs of sewers. According to section 173, any person who, without prior consent in writing from the council, erects a building on; excavate or opens-up; or injures or destroys a sewer, drains or pipes shall be guilty of an offence. Any demolitions and repairs thereof shall be carried out at the expense of the offender.

2.2.10 Noise Regulations (Legal Notice No. 61 of 2009)

These Regulations were gazetted to manage noise pollution to levels that do not cause nuisance to the public. The proposed construction activities will however have a potential for the production of noise above the acceptable limits. Generally, construction sites generate noise that is above 85 dB (A).

The proponent should ensure that employees are not exposed to noise levels above 85 dB (A) and in such cases provide suitable personnel protection equipment

2.2.11 The Penal Code (Cap. 63)

Section 191 of the Penal Code makes it an offence for any person or institution that voluntarily corrupts, or foils water for public springs or reservoirs rendering it less fit for its ordinary use. Similarly, section 192 of the same act prohibits making or vitiating 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 a public way.

The proponent will be required to ensure strict adherence to the Environmental Management Plan throughout the project cycle in order to mitigate against any possible negative impact.

2.3 Other relevant Provisions

The following are the relevant environmental treaties to which Kenya is signatory in order of ratification:

- Montreal Protocol on Substances that Deplete the Ozone Layer (1987) ratified 9 November 1988
- United Nations Convention to Combat Desertification (1994), ratified 12 June 1994
- United Nations Framework Convention on Climate Change (1992), ratified 30 August 1994
- Convention on Biological Diversity (1992), ratified 11 September 1994
- Bamako Convention (1991), ratified 17 December 2003
- Kyoto Protocol (2004), ratified 25 February 2005

2.4 Institutional Framework

At present, there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environmental Management Authority (NEMA), the Forestry Department, Kenya Wildlife Services (KWS) and others. There are also local and international NGOs involved in environmental activities that impact on the environment in one way or the other in the country.

2.4.1 National Environmental Management Authority (NEMA).

The object and purpose for which NEMA is established is to exercise general supervision and coordination over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. A Director General appointed by the president heads NEMA. The Authority shall, among others:

Implementation of Legal Notice no. 121 on Environmental Management and Coordination (Waste Management) Regulations, 2006 which stipulates the disposal of Hazardous waste such as asbestos.

Co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects with a view to ensuring the proper management and rational utilization of the natural resources environment on a sustainable yield basis for the improvement of the quality of human life in Kenya.

Take stock of the natural resources in Kenya and their utilization and consultation, with the relevant lead agencies, and develop land use guidelines.

Examine land use patterns to determine their impact on the quality and quantity of the natural resources among others.

2.4.2 Ministry of Public Health and Sanitation (MoPHS)

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

prevention of communicable and non-communicable diseases, health promotions, and curative services at all levels. The department of environmental health and sanitation aims to reduce disease burden arising from environmental pollution, by preventing disease transmission from general environmental health pollutants.

2.4.3 National Environmental Tribunal.

This tribunal guides the handling of cases related to environmental offences in the Republic of Kenya. The Tribunal hears appeals against the decisions of the Authority. Any person who feels aggrieved may challenge the tribunal in the High Court.

2.4.4 The Occupational Safety and Health Act, 2007.

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

- General duties including duties of occupiers, self-employed persons and employees
- Enforcement of the act including powers of an occupational safety and health officer
- Registration of workplaces.
- Health General Provisions including cleanliness, ventilation, lighting and sanitary conveniences
- Machinery safety including safe handling of transmission machinery, hand held and portable power tools, self-acting machines, hoists and lifts, chains, ropes & lifting tackle, cranes and other lifting machines, steam boilers, air receivers, refrigeration plants and compressed air receiver
- Safety General Provisions including safe storage of dangerous liquids, fire safety, evacuation procedures, precautions with respect to explosives or inflammable dust or gas
- Chemical safety including the use of material safety data sheets, control of air pollution, noise and vibration, the handling, transportation and disposal of chemicals and other hazardous substances materials
- Welfare general provisions including supply of drinking water, washing facilities, and first aid
- Offences, penalties and legal proceedings.

Under section 6 of this act, every occupier is obliged to ensure safety, health and welfare of all persons working in his workplace. The occupier shall achieve this objective by preparing and as often as may be appropriate, revising a written statement of his general policy with respect to the safety and health

at work of his employees and the organization and arrangements for the time being in force for carrying out that policy (Section 7).

He is also required to establish a safety and health committee at the workplace in a situation where the number of employees exceeds twenty (section 9) and to cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a registered safety and health Advisor (Section 11). In addition, any accident, dangerous occurrence, or occupational poisoning which has occurred at the workplace needs to be reported to the occupational safety and health officer of the respective area by an employer or self-employed person (section 21). According to section 44, potential occupiers are required to obtain a registration certificate from the Director for all premises intended for use as workplaces. Such places shall be maintained in a clean state during the operation phase (section 47).

To ensure machinery safety, every hoist or lift – section 63 and/or all chains, ropes and lifting tackles – section 64 (1d), shall be thoroughly examined at least once in every period of six months by a person approved by the Director of Occupational Health and Safety Services. Similarly, every steam boiler - section 67 (8) and/or steam receiver - section 68 (4) and all their fittings and/or attachments shall be thoroughly examined by an approved person at least once in every period of twelve months whereas every air receiver shall be thoroughly cleaned and examined at least once in every period of twenty-four months or after any extensive repairs - section 69 (5). According to section 71 (3), every refrigeration plant capable of being entered by an employee also needs to be examined, tested and certified at least once in every period of twelve months by an approved person.

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

To promote health and safety of employees who are at risk of being exposed to chemical substances, section 84 (3) and 85 (4) requires every employer to maintain at the workplace material safety data sheets and chemical safety data sheets respectively for all chemicals and other hazardous substances in use and ensure that they are easily available to the employees.

The employers' positive contribution towards the welfare of the employees include provision and maintenance of adequate supply of wholesome drinking water - section 91 and a first aid box or cupboard of the prescribed standard – section 95 at suitable point (s) conveniently accessible to all employees.

Other precautionary measures include: issuance of a permit to work to any employee, likely to be exposed to hazardous work processes or hazardous working environment, including such work processes as the maintenance and repair of boilers, dock work, confined spaces, and the maintenance of machinery and equipment, electrical energy installations, indicating the necessary precautions to be taken – section 96 (1); provision and maintenance for the use of employees, adequate, effective and suitable protective clothing including suitable gloves, footwear, goggle and head coverings in any workplace where employees are likely to be exposed to wet, injurious or offensive substance – section 101 (1). The proponent will be required to ensure that the main contractor includes in the contract document, adequate measures to promote safety and health of workers.

2.4.5 Trade Licensing Act (Cap 497)

Section 5 of the Act makes it mandatory for all businesses to obtain trading licenses.

2.4.6 Environmental Vibration Pollution (Control) Regulations, 2009

These regulations were published as legal Notice No. 61 being a subsidiary legislation to the Environmental Management and Co-ordination Act, 1999. The regulations provide information on the following:

- Prohibition of excessive noise and vibration
- Provisions relating to noise from certain sources
- Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations and
- Noise and excessive vibrations mapping.

According to regulation 3 (1), no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose,

health or safety of others and the environment. Regulation 4 prohibits any person to (a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or (b) cause to be made excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 metres from any moving source.

Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property.

Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which- (a) produces any loud and unusual sound; and (b) exceeds 84 dB(A) when accelerating. According to sub regulation 2 of this regulation, no person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident.

Regulation 13 (1) provides that except for the purposes specified in sub-Regulation (2) there under, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations.

Regulation 16 (1) stipulates that where a sound source is planned, installed or intended to be installed or modified by any person in such a manner that such source shall create or is likely to emit noise or excessive vibrations, or otherwise fail to comply with the provisions of these Regulations, such person shall apply for a License to the Authority. According to regulation 18 (6) the license shall be valid for a period not exceeding seven (7) days. Regulation 19 (1) prohibits any person to carry out activities relating to fireworks, demolitions, firing ranges or specific heavy industry without a valid permit issued by the Authority. According to sub regulation 4, such permit shall be valid for a period not exceeding three months.

The project proponent will be required to comply with the above-mentioned regulations in order to promote a healthy and safe working environment.

Table 1 Summary of applicable legislation and regulations

Legislation & regulations	Institution	Relevance in project cycle	Status/Remark
1. EMCA 1999	NEMA	– Issuance of construction & operational license (EIA license) – Monitoring project compliance with approval conditions – Monitoring for compliance with all applicable legislations under EMCA Rev, 2015.	ESIA report submitted –
2. County Government Act 2012 3. Noise & Excessing vibration pollution control regulations 4. Public Health Act Cap 242 5. EMC (Waste Management) Regulations, 2006	CGK	– Issuance development approval – Infrastructure provision- utilities & social amenities – Provision of waste management & emergency service – Sanitation & health standards at the project site	– Development plans submitted
6. OSHA 2007	DOHSS	– Registration of the construction site as a work place – Enforcing compliance with Occupational Health and Safety Regulations at the construction site	– Pending approval of EIA

3 BASELINE INFORMATION OF THE PROJECT AREA

3.1 Introduction

The following baseline information details on environmental, ecological and bio-physical characteristics of the proposed project locality. It is expected that it will provide a benchmark for continued impact and compliance monitoring on the environmental services associated with the operations of the proposed project.

3.2 Administrative set up

The project site lies in Kilifi County. Kilifi County is a county of Kenya. It was formed in 2010 as a result of a merger of Kilifi District and Malindi District. Its capital is Kilifi and its largest town is Malindi. The county has a population of 1,453,787. It covers an area of 12,245.90 km^2. The county is located north and northeast of Mombasa.

3.3 Climate

The project location in Kilifi County falls within a coastal zone characterized by a tropical and monsoon climate typical of the Kenyan coastline. The temperatures are high throughout the year ranging between 24.5oC to 27oC. Lower temperatures (24.5oC) are generally experienced between May to October and during rainy periods. The higher temperatures (27oC) are typically recorded between November to April.

The region has a bimodal rainfall pattern and annual convectional rainfall. Rainfall in the coastal region averages 900mm – 1300mm annually. Long rains usually occur between November and December while the long rains are usually experienced between March and July.

3.4 Population

The Population of Kilifi has been steadily rising with the major increase being in the urban centres of the county. The major cause of the increase can be attributed to rural-urban migration which is the driver for urban growth in many parts of the country fuelled by the search of a better life. Other factors influencing the increased urban growth include tourism, an increase in development projects and the influx of foreigners. Nonetheless there is also a significant number of the rural population concentrated around high potential areas. The Coastal population is largely heterogenous with the largest indigenous group coming from the Mijikenda tribe. The Mijikenda comprise 9 subtribes including Giriama, Digo Rabai, Duruma, Kauma, Chonyi, Kambe, Ribe and Jibana.

3.5 Land use patterns and Economic activities

Land use in the wider county is mixed use characterised by housing, industries, and commercial facilities. The proposed site location is mainly bare covering an area of 10 acres.

3.6 Infrastructure and social amenities

3.6.1 Energy

The main source of energy supply in Kilifi County is electricity from the Kenya Power Company (KPC). However, this will be mostly supplemented with diesel powered generators in times of power blackouts.

3.6.2 Roads

Kilifi County is served by both classified and non-classified roads. Most rural areas in the county are served with a dilapidated and narrow road network. The project site is accessible via a bituminous road along Mariakani- Bamba road.

3.6.3 Information and communication technology

Kilifi County is mostly covered by cellular phone network provided by Safaricom, Airtel and Telkom. The project site area is served by all type of telecommunication facilities.

3.7 Environmental quality

3.7.1 Water supply

Water in Kilifi is supplied by the Kilifi Mariakani Water and Sewerage Company (KIMAWASCO). Several boreholes supplement this supply within the county for uses other than drinking.

3.7.2 Effluent management

The project site area has no sewerage infrastructure hence the common methods for disposal of effluent is through bio digesters, septic tank and soak away pit systems.

3.7.3 Solid waste management

The main sources of solid waste in Kilifi County are domestic, commercial ventures, hotels, markets, industries and institutions including health facilities. All types of waste are transported to designated transfer stations awaiting disposal in the main dumpsites.

4 IMPACT ASSESSMENT METHODOLOGY AND ANALYSIS OF ALTERNATIVES

4.1 Introduction

This chapter will describe the impact assessment methodology to be used for this project. The methodology has been developed by the consultant and aims to provide a relatively objective approach for the assessment of potential impacts.

4.2 Methodology

To ensure a direct comparison between various impacts, standard rating scales have been defined for assessing and quantifying the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. the following factors need to be considered when assessing the significance of impacts, namely:

1) Relationship of the impact to **temporal** scales – the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
2) Relationship of the impact to **spatial** scales – the spatial scale defines the physical extent of the impact.
3) The severity of the impact – the **severity/beneficial** scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party. The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' means not just 'compensation', but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.
4) The **likelihood** of the impact occurring – the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

4.3 Analysis of Alternatives

4.3.1 The No Action Alternative

The No Action Alternative in respect to the proposed project implies that the status quo is maintained i.e. no construction/development activity to take place. This option is most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. However, the need for such development is high and the anticipated insignificance environmental impacts resulting from construction have already been experienced. This option will however, involve several losses both to the project proponent/land owner and the Kenya society and Government. The property will remain under-utilized or neglected. The No Project Option is the least preferred from the socio-economic and partly environmental perspective since if the project is not done.

4.3.2 The relocation Alternative

Relocation option to a different site is an option available for the project implementation. At the moment, there are no alternative sites for the proposed development (i.e. the project proponent doesn't have an alternative site). This means that the proponent has to look for the land if relocation is proposed. Looking for the land to accommodate the scale and size of the project and completing official transaction on it may take a long period. In addition, it is not a guarantee that such land would be available. It's also worth noting that the said project is already underway in terms of seeking development approvals in various government departments.

The project proponent would spend another long period of time on design and approvals of the plans by the relevant government departments. The project design and planning before the stage of implementation would call for costs; already incurred in the proposed development i.e. whatever has been done and paid to date would be counted as a loss to the proponent. In consideration of the above concerns and assessment of the current proposed site, relocation is not a viable option. From the analysis above, it becomes apparent that the No Project Alternative is not the appropriate alternative to the local people, Kenyans, and the Government of Kenya.

4.3.3 Project Design

This ESIA Project Report is based on information and consultations with the project proponent, the Architect and details contained in the architectural plans and drawings of the project. (***Please see attached copies of Architectural Plans***).

5 POTENTIAL ENVIRONMENTAL IMPACTS

5.1 Introduction

This chapter outlines the potential negative and positive impacts that will be associated with the housing project. The impacts will be related to activities to be carried out during construction of the project. The operational phase impacts of the project will be associated with the activities carried out by the residents/tenants, which will mainly be domestic. In addition, closure and decommissioning phase impacts of the project are also highlighted.

The impacts of the housing project during its life cycle stages (construction and operation) can be categorized into: impacts on the biophysical environment; health and safety impacts; and socio-economic impacts. The proposed project is likely to present several environmental impacts. These can be either positive or negative.

5.2 IDENTIFICATION AND PREDICTION OF IMPACTS

Impacts that may result from the planning, design, construction, operational, decommissioning, and closure phases as well as proposed management of identified impacts and proposed mitigation measures.

5.3 Potential Impact on health of asbestos workers and Premises employees during the Removal, transportation, disposal and Clean-Up.

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 removal or even the disturbance of asbestos contaminated soil in order to minimize the potential for the release of the fibers into the air.

Mitigation measures.

1. All employees will wear protective clothing during the exercise.
2. Demarcate the areas of removal of contaminated soil.
3. Ground markings are examples of demarcation where the area is not defined by walls. In addition, all access routes should be demarcated and identified by symbolic warning signs that are clearly visible.
4. Wire fencing will be used for high-risk areas.
5. Warning & Safety signage will be placed at the areas within the premises for clean-up on the site.
6. All personnel involved with the asbestos disposal process will be subjected to medical surveillance.
7. Asbestos contaminated areas shall be sprayed with water prior to commencement of cleaning activities in order to suppress the release of fibers.

8. Temporary storage of waste: the area currently used for stockpiling of excavated material shall be lined with impermeable material.
9. All machinery involved in an asbestos disposal process will be jet-washed prior to leaving site.
10. Asbestos air sampling will be conducted on the sites for clean-up.
11. When there is a visible dust or winds in excess of 20 knots, any asbestos disposal and cleaning process will be stopped.

Mitigation Measures to be applied during transportation include the following;

1. Ensure all asbestos is collected and loaded into a transportation vehicle licensed by NEMA
2. The transporting vessel (truck will be lined with polythene).
3. The transporting vessel shall be labelled <HAZARDOUS WASTE>
4. The waste shall be transported to the disposal site in an enclosed vehicle.
5. The tenderer shall have a documented HSE policy and ensure that all persons involved in asbestos handling are appropriately inducted/trained in emergency procedures e.g. how to handle asbestos waste, services to be contacted during such spillages.

Safety risk to asbestos workers while working at the Sites

While working at the temporary and disposal sites, the asbestos workers will face daily safety risks. These include:

- Uneven walkways
- Dust
- The handling and transportation of dangerous substances

These hazards have the potential to cause injury or death to the workers/contractors who will be undertaking the asbestos-clean-up and disposal. In this regard, the proponent should have a Safety, Health and Environmental policy that will apply to the asbestos disposal and clean-up workers to avoid and minimize injuries or fatalities on their premises.

Mitigation Measures:

1. All employees will wear protective clothing during the disposal and clean-up of the area.
2. The asbestos project team who will access the area must be in possession of a valid premises access card.
3. If more than 20 employees are involved, the employer must have a Health and Safety representative (1per 50 employees).
4. There must be a health and safety plan that is kept onsite which must contain appropriate safety measures.

5. Employees must be trained on the contents of the health and safety plan.
6. The premises first aiders must be available to the asbestos workers. A first aid kit must be kept onsite.

Impact on soil during asbestos clean-up

During the clean-up activities, the contaminated soil will be removed and disposed of at the disposal site– this will result in a loss of soil, which will be replaced with either clean soil or stone at relevant areas where asbestos remediation is required. The loss of soil can be completely reversed by the addition of clean soil.

However, remediation of the contaminated soils may lead to open excavated areas. The extent of soil removal coupled with the already impacted nature of the area does not warrant the implementation of mitigation measures. To cover these areas with soil would entail removal of soil from some other (probably not impacted) area and may therefore constitute loss of valuable soil resources. Soil erosion is a minimum in the area owing to the nature of the soils and the extent of the area development. Areas that require a substantial amount of excavation, and pose a safety hazard as a result, can be backfilled with stones or soil.

Generation of waste (general and hazardous waste) during the clean-up

Apart from the asbestos waste and asbestos contaminated soil, other waste may be generated by the asbestos clean-up activities, including the following:

a. Hazardous waste:

- 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.
- Wastewater will be generated from the decontamination facility where asbestos workers will shower (on a daily basis, until the clean-up is complete). This water will not go into the municipal system and will be collected in receptacles - drums) and will be treated as hazardous waste, and disposed to a hazardous landfill.

b. General waste:

- food wrappers
- eating utensils
- paper
- plastic
- used equipment

General waste can be disposed to a general landfill by the asbestos workers to avoid cross contamination with general waste from the daily operations at the active landfills. If general waste is dumped in the surrounding area, it may impact the environment and people around there, by creating a breeding ground for pests and disease. If hazardous waste is incorrectly disposed of into the surrounding environment (onto uncontaminated soil, which then can result in the release of asbestos fibers into the air), this will create an exposure route for asbestos related disease and could pose health risks to people in the vicinity of the waste. With proper general and hazardous waste disposal, the impacts of the general and hazardous waste that is generated by the disposal and clean up can be avoided.

Creation of job opportunities during the disposal and clean-up process

The exercise will result in a number of short-term employment opportunities. The number of staff required will be informed by the scope of work. Therefore, short term job creation will be a minor positive socio-economic impact.

Long –term positive impact on environment due to the Disposal and clean up

The removal of asbestos waste visible on the surface of the premises will reduce the future health risk for any of premises employees, pupils or any other people who operate or reside near the premises. The completion of the disposal process will be seen as having a positive impact on the environment (air and soil) and social (premises employees and nearby residents) elements. This is mainly due to the risk of asbestos occurring in the air being reduced to low risk or eliminated altogether and as a result a low risk or elimination of risk of asbestos-related diseases.

Therefore, the long-term impact of removal of asbestos from the premises premise is viewed in a positive light (or as a positive action / impact) in terms of the premises' duty of care towards the environment and their social responsibility to remedy contamination due to the presence of asbestos and to prevent any further negative environmental (soil and air) or social impacts.

6 MITIGATION MEASURES

6.1 Introduction

This chapter highlights the necessary mitigation measures that will be adopted to prevent or minimize significant negative environmental, health and safety impacts associated with the activities of the project during its construction and operation phases. Allocation of responsibilities, time frame and estimated costs for implementation of these measures are presented in the environmental management programme (EMP).

Table 2: Summary of potential impacts and the proposed mitigation measures.

Environmental concern	Potential impact	Proposed Mitigation measures
Occupational health & safety	Health risk to site workers	1. All employees will wear protective clothing during the exercise. 2. All personnel involved with the asbestos disposal process will be subjected to medical surveillance 3. Asbestos air sampling will be conducted on the sites for clean- up 4. Ensure all asbestos is collected and loaded into a transportation vehicle licensed by NEMA 5. Fence off the site to avoid unauthorized access 6. Inform all the relevant stakeholder and government officials prior to commencement of any work. 7. Provision of respirators to all persons entering the asbestos site 8. The transporting vessel shall be labelled **"hazardous waste"** 9. Thorough, complete and up to date records should be kept of at the site 10. Warning & Safety signage will be placed at the strategic areas within the disposal site 11. When there is a visible dust or winds in excess of 20 knots, any asbestos disposal and cleaning process will be stopped
Ground Water Quality	Contamination of surface & ground water	12. Develop disposal cells which will be lined with a 1,000-gauge HDP liner and impervious cement to ensure that the cells are leak proof.
Screening of asbestos wastes	Contamination of the environment due to the unregulated asbestos waste	13. Removal and handling of asbestos sheets should be undertaken by a NEMA licensed contractor t
Flora & fauna	Degradation /modification of animal habitats on the proposed project site &	14. comply with the Environmental Management and Coordination (Waste Management) Regulations, 2006 and the National Guidelines on the Safe Management and Disposal of Asbestos

7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 Introduction

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

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

The EMP outlined in Table has addressed the identified potential negative impacts and mitigation measures for the proposed project.

7.2 Environmental Monitoring and Evaluation

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

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

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

Table 3: Environmental Management Plan

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
CONSTRUCTION PHASE				
Commissioning of the Construction Works	▪ Site hand-over and Ground breaking	Project team (Lead Consultant/Architect, contractor /proponent) Part of/Covered in the Project Cost		Presence of the project Team
Securing the Construction Site	▪ Construction of Perimeter Wall and Hoarding	Contractor	Part of/Covered in the Project Cost	Presence of Perimeter Fence
Housing for Construction / Site staff	▪ Construction of a Camp	Contractor	100,000	Presence of a Camp
Dust emission	▪ Appropriate scheduling of activities. Dust suppression through sprinkling of water	Contractor	10,000	Presence of Site store
Health and safety aspects	▪ Notify workers about the upcoming activity ▪ Train staff of safe working procedures ▪ Provide appropriate PPE complying with international good practise ▪ Post appropriate signages onsite to inform/warn employees and the public	Contractor/Proponent/project team	Part of/Covered in the Project Cost	Minimal incidents/ accidents

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
Traffic and Pedestrian safety	▪ Signposting, warning signs, barriers and traffic diversions: site should be clearly visible, and the workers warned of all potential hazards ▪ Provision of safe passages and crossings for pedestrians be made ▪ Active management by trained and visible staff at the site, if required for safe and convenient passage for the workers. ▪ Ensuring safe and continuous access to office facilities, shops and residences during disposal and	Contractor/project team	Part of/Covered in the Project Cost	Presence of appropriate signage
OPERATION PHASE				
Air pollution from dust and/or Asbestos dust, Exhaust fumes etc	▪ Adhere to the Asbestos disposal guidelines listed above ▪ Strict enforcement of on-site speed limit to reduce ▪ Provide Adequate PPE to staff ▪ Air monitoring should be done continuously in areas related to asbestos removal works. ▪ Management of asbestos-contaminated soil/dust by sweeping around the area where asbestos removal work is undertaken and packaging the asbestos contaminated soil in asbestos waste bags, labelled as asbestos waste and disposed of together with the asbestos waste in the licensed disposal pit	Contractor/Proponent Architect/Site engineer Landscape Architect	400,000	Zero cases related to health issues

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
Oil Spillages	▪ Proper maintenance of vehicles and machinery involved to avoid oil leaks during equipment and machinery use. ▪ Maintenance activities to be conducted in areas designated for the purpose i.e. maintenance workshop.	Contractor	10,000	Minimal oil spills
Noise Pollution and Vibration	• Ensure use of serviced and greased equipment • Switch off engines not in use • Construction work to be confined to between 8am to 5pm • Ensure use of earmuffs by machine operators	Proponent and Contractor	Part of Routine operation procedure	Lack of complaints
Air Quality	• Water sprinkling of driveways or the use of biodegradable hydrant	Proponent and Contractor	Part of Routine operation procedure	Lack of complaints
Risks of Accidents and Injuries to Workers	• Education and awareness to all construction workers • Ensure use of appropriate personal protective clothing • Provide First Aid Kits on site • Proper supervision	Proponent Contractor	Part of Routine operation procedure	Presence of well-equipped First Aid kit Presence of Security Guards on site Presence of a register on the site
Health and Safety	• Provide First Aid Kits on site • Proper signage and warning to public of heavy vehicle turning • Ensuring Building Strength and stability • Provide clean water and food to the workers	Proponent Contractor	Part of Routine operation procedure	Presence of well-equipped First Aid kit Presence of Security Guards on site Presence of a register on the site

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
	• The contractor to abide by all construction conditions			
Solid Waste Generation	• Ensure waste materials are disposed of on county and NEMA approved sites • Ensure re-use of materials that can be re-used • Use of the 3rs – Reduce, Re-use, Re-cycle	Proponent Contractor	-	Absence of Solid waste on the site
Energy Consumption	• Use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability • Use of Standby Generators	Proponent Contractor	-	Presence of KPLC power lines Presence of Generators
Excessive Water Use	• Excessive water use may negatively impact on the water source and its sustainability	Proponent Contractor	-	Presence of MOWASCO water lines Metering of water
Underground water contamination	▪ Construct a concrete lining in the asbestos disposal site Before disposing the asbestos. This will reduce possibility of underground water contamination	Architect Proponent Contractor	Part of/Covered in the Project Cost	Compatibility with the neighbourhood

8 ENVIRONMENTAL HEALTH AND SAFETY (EHS)

8.1 EHS Management and Administration

The EHS is a broader and holistic aspect of protecting the worker, the workplace, the tools/ equipment and the biotic environment. It is an essential tool in determining the EIA study. The objective of the EHS on the proposed project is to develop rules that will regulate environmentally instigated diseases and occupational safety measures during construction and the operation phases of the proposed project by:

- Avoidance of injuries
- Provision of safe and healthy working environment for workers' comfort so as to enhance maximum output.
- Control of losses and damages to plants, machines, equipment and other products.
- Enhance environmental sustainability through developing sound conservation measures.

8.2 Policy, Administrative and Legislative Framework

It is the primary responsibility of the contractor to promote a safe and healthy environment at the workplace and within the neighbourhood in which the proposed project will be constructed by implementing effective systems to prevent occupational diseases and ill-health, and to prevent damage to property. The EHS Management Plan when completed will be used as a tool and a checklist by the contracted engineers in planning and development of the construction of this project.

8.3 Organization and implementation of the EHS Management Plan

The contactor shall use the EHS plan at the proposed project site both during construction and operation. The engineer will use it during construction phase with the assistance of an EHS consultant who shall enforce its provision throughout the life of the project.

8.4 The Guiding Principles to be adopted by the contractor

The company will be guided by the following principle: -

- It will be a conscious organization committed to the promotion and maintenance of high standards of health and safety for its employees, the neighbouring population and the public at large.
- Ensuring that EHS activities are implemented to protect the environment and prevent pollution.
- Management shall demonstrate commitment and exercise constant vigilance in order to provide employees, neighbours of the project and the environment, with the greatest safeguards relating to EHS.

- Employees will be expected to take personal responsibility for their safety, safety of colleagues and of the general public as it relates to the EHS management plan.

8.5 EHS management strategy to be adopted by the contractor

The following strategies will be adopted to achieve the above objectives:

- Create an Environment Health and Safety Management committee and incorporate EHS as an effective structure at various levels and units to manage and oversee EHS programs in all construction and operation phases of the project
- Maintain an effective reporting procedure for all accidents.
- Provide appropriate tools and protective devices for the success of the project.
- Encourage, motivate, reward and support employees to take personal initiatives and commitment on EHS.

8.6 Safety Agenda for both the proponent and contractor

There will be a permanent EHS agenda during construction.

(a) Contractors

The EHS management plan code of practice shall be applicable to the contractors working in the premises, and shall be read and signed. It shall be incorporated into the contract to perform work. This should also remind the contractor of his/her;

- Legal requirements.
- Statutory obligations.
- Obligation to lay-down a system for reporting accidents
- Responsibility to ensure that his/her employees are supplied with personal protective equipment and where applicable as per the EHS management plan for the whole project.
- Responsibilities as it relates to contracting an EHS consultant in liaison with the proponent
- Obligation to ensure that he obtains detail of jobs and areas where permit-to-work must be issued

(b) All residents' and workers' responsibility

Know the location of all safety equipment, and learn to use them efficiently

8.7 Safety requirement at the project site during construction and operation Period

(a) The contractor

The contractor will ensure that:

- Safe means of entry and exit at the proposed project site.
- Ensure adequate briefing of job at hand on the safe system of work before commencement of work.

- The EHS coordinator must be in attendance at all times throughout the duration of the project.
- The EHS consultant must maintain constant assessment of the risk involved as the work progresses
- A safety harness must be worn before entry into all confined spaces
- An EHS consultant must be posted at the entrance at the project site to monitor progress and safety of the persons working at the construction site.

(b) The Traffic / Drivers

Within the construction premises, the following traffic rules will be observed:

- Observe speed limits and all other signs and obey traffic rules.
- Use the vehicle for the purpose to which it is intended only.

(c) Fire hazard at the construction site,

Workers at the site shall ensure that: -

- Oxy-acetylene cylinders are not contaminated with grease or oil.
- Oxy-acetylene cylinders are not subjected to direct sunlight or heat.
- Oxy-acetylene cylinders are not to be used or stored standing in a vertical position.
- When in use, ensure the inclination should never be over 30° from the vertical.

8.8 Welding at the construction site

It is the responsibility of the contractor during construction to: -

- Ensure that welding clamp is fixed such that no current passes through any moving parts of any machine.
- Ensure that all welding clamps are in good operating condition and conduct current without arcing at the point of contact.
- Ensure that welding clamps are free from any contact with explosive vapors i.e. Oil spillage, Fuel tanks, Coal dusts and miscellaneous combustible material (e.g. Cotton rags filter bags, rubber belting, and wood shavings).
- Ensure that any slag or molten metal arising from welding activities does not start up fires by:
    - Clearing combustible material to a distance of at least 3 meters away from the working area or covering area with metal or asbestos sheet.
    - Appropriate fire extinguisher is to be kept available for immediate use at all times

8.9 Emergency procedure during construction and operation

An emergency situation means:

- Unforeseen happening resulting in serious or fatal injury to employed persons or the neighbouring communities.
- Fire or explosion, Natural catastrophe.

In the event of such an emergency during construction, the workers shall:

- Alert other persons exposed to danger.
- Inform the EHS coordinator
- Do a quick assessment on the nature of emergency.
- Call for ambulance on standby
- When emergency is over the EHS coordinator shall notify the workers by putting a message: "ALL CLEAR"

9 DECOMMISSIONING

9.1 10.1 Introduction

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

- The site should be well landscaped by flattening the mounds of soil and planting indigenous trees and flowers
- All the equipment should be removed from the site
- Fence and signpost unsafe areas until natural stabilization occurs
- Backfill surface openings if practical

10 CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

From the foregoing analysis, the social and economic rating for this project is highly positive. Evaluation of alternatives has already shown that options are limited and costly. Already the proponent has sunk a substantial amount of money in the project up to design stage. Further delay of the project is denying all stakeholders the anticipated benefits of the investment. On the other hand, redesigning or relocation will lead to loss of time and money that is already tied in the preliminary costs of the project. The project does not pose any serious negative environmental impacts. Adequate mitigation measures have been proposed to address any of the negative impacts arising from the project. The project will create employment and improve income earnings. The project will seek to resolve health issues associated by asbestos by providing disposal site for asbestos.

10.2 Recommendations

This assessment recommends the project for licensing subject to the following proposals to inject environment sustainability:

1. All necessary approvals be obtained and conditions of such approval complied with.
2. The proponent will ensure implementation of the proposed EMP
3. Project to priorities employment of local labour and content in the project implementation & operational cycle

11 REFERENCES

1. Documents provided by **QUALITY INSPECTION SERVICES LTD**
2. Government of Kenya Policies
   - National Environment Policy, 2013
   - National Industrialization Policy, 2012
3. Government of Kenya Statutes
   - Constitution of Kenya, 2010
   - Environmental Management and Coordination Act, Cap 387 of the Laws of Kenya
   - Environmental Management and Coordination (Air Quality) Regulations, 2014
   - Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003
   - Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009
   - Environmental Management and Coordination (Waste Management) Regulations, 2006
   - Environmental Management and Coordination (Water Quality) Regulations, 2006
   - Occupational Safety and Health Act, 2007
   - Public Health Act, Cap. 242
   - The County Government Act, 2012
   - The Energy Act, 2016
   - The Water Act, 2016
   - Kenya gazette supplement Acts Physical Planning Act, 1999
   - Kenya National Housing Policy in 2004
   - Kenya gazette supplement Acts Building Code 2000 by government printer

12 APPENDICES

1. Questionnaires
2. Land ownership document.
3. Drawing plans
4. KRA PIN for QUALITY INSPECTION SERVICES LTD
5. Certificate of incorporation for QUALITY INSPECTION SERVICES LTD
6. Hydrological survey for the proposed site
7. Copies of practicing Licenses for EIA Experts and all experts involved in the ESIA process.

QUESTIONNAIRE FOR PUBLIC PARTICIPATION IN ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTS (ESIA) FOR PROPOSED ASBESTOS DISPOSAL SITE ON PLOT No. 3404/KALUMANI MNYENZENI ADJUDICATION SECTION, KILIFI COUNTY

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Name: Chenzo Baya **P.O. Box** ..... **Tel. No:** 0704915615

ID No. 13734304 **Signature** ..... **Date** 29/09/2024

1. Are you aware of the proposed site? Yes ☐ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☐ 100-500m ☑ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☑ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   None
   ii. Negative impacts
   None
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) None
7. Provide any additional comment regarding the proposed Project
   None

Thank you

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Name: Shariff Bango **P.O. Box** ..... **Tel. No:** 0745325474

ID No. 13734295 **Signature** ..... **Date** .....

1. Are you aware of the proposed site? Yes ☐ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☑ 100-500m ☐ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☑ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   - Better the livelihoods of the people working there due to employment opportunities arising
   ii. Negative impacts
   N/A
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) NA
7. Provide any additional comment regarding the proposed Project
   Employ locals to work at the place

Thank you

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Name: Kamba Baya ..... **P.O. Box** ..... **Tel. No:** 0726209311

ID No. 10690279 ..... **Signature** Baya. ..... **Date** .....

1. Are you aware of the proposed site? Yes ☐ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☐ 100-500m ☑ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☑ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   Jobs will come .....
   .....
   ii. Negative impacts
   N/A .....
   .....
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) N/A .....
   .....
7. Provide any additional comment regarding the proposed Project
   We do not object .....
   .....
   .....

Thank you

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Name: Nyundo Ngoka **P.O. Box** ..... **Tel. No:** 0759166061

ID No. 38807098 **Signature** ..... **Date** 20/9/2024

1. Are you aware of the proposed site? Yes [✓] No [ ]
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m [ ] 100-500m [✓] 500m-1km [ ] >1km [ ]
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes [✓] No [ ]
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   It will bring job opportunities to the surrounding communities
   ii. Negative impacts
   N/A
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) N/A
7. Provide any additional comment regarding the proposed Project
   No objection to the project

Thank you

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Name: Jeremiah Mutuku **P.O. Box** 9100 **Tel. No:** 0729521046

ID No. 30613118 **Signature** [signature] **Date** 20/9/2024

1. Are you aware of the proposed site? Yes [✓] No [ ]
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m [ ] 100-500m [ ] 500m-1km [✓] >1km [ ]
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick		✓		

4. Do you have any objections to the proposed Project? Yes [ ] No [✓]
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   It will bring job opportunities to the neighbouring community
   ii. Negative impacts
   No negative impact. But dust maybe during ground works
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) Apply water so that it reduces dust. Fence the area for security purposes
7. Provide any additional comment regarding the proposed Project
   Its a viable project.

Thank you ***FOR MORE SPACE, PLEASE TURN OVER PAPER***

QUESTIONNAIRE FOR PUBLIC PARTICIPATION IN ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTS (ESIA) FOR PROPOSED ASBESTOS DISPOSAL SITE ON PLOT No. 3404/KALUMANI MNYENZENI ADJUDICATION SECTION, KILIFI COUNTY

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Name: Khadija Chenge ..... **P.O. Box** ..... **Tel. No:** .....

ID No. 27331913 ..... **Signature**..... **Date**.....

1. Are you aware of the proposed site? Yes [✓] No [ ]
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m [✓] 100-500m [ ] 500m-1km [ ] >1km [ ]
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes [ ] No [✓]
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts

   - Creation of Jobs

   ii. Negative impacts

   —

6. In your opinion what measures need to be put in place to address the negative impacts (if any?)

   —

7. Provide any additional comment regarding the proposed Project

   - Ensure the proposed project will not contaminate water.

Thank you

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Name: Kaseche Baya P.O. Box ..... Tel. No: 0729857213

ID No. 13734297 Signature..... Date.....

1. Are you aware of the proposed site? Yes ☑ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☑ 100-500m ☐ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☑ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   Job creation
   ii. Negative impacts
   Dust during the start of the project
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) Mitigate dust impacts
7. Provide any additional comment regarding the proposed Project
   No objection

Thank you

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Name: Kadzo Harrison **P.O. Box** ..... **Tel. No:** 0737567069

ID No. ..... **Signature**..... **Date**.....

1. Are you aware of the proposed site? Yes ☐ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☑ 100-500m ☐ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☑ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   N/A
   ii. Negative impacts
   N/A
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) N/A
7. Provide any additional comment regarding the proposed Project
   No objection to the project

Thank you

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Name: Kadzo Kahindi **P.O. Box** ..... **Tel. No:** 07 00009795

ID No. 34558762 **Signature**..... **Date**.....

1. Are you aware of the proposed site? Yes ☑ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☑ 100-500m ☐ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☑ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   Creation of job opportunities
   ii. Negative impacts
   N/A
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) None
7. Provide any additional comment regarding the proposed Project
   N/A

Thank you

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Name: Kache baya ..... **P.O. Box** ..... **Tel. No:** .....

ID No. 2180635 ..... **Signature**..... **Date**.....

1. Are you aware of the proposed site? Yes [✓] No [ ]
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m [✓] 100-500m [ ] 500m-1km [ ] >1km [ ]
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes [✓] No [ ]
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   Provide a place to dispose asbestos which is very dangerous to the human
   ii. Negative impacts
   N/A
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) N/A
7. Provide any additional comment regarding the proposed Project
   No objection

Thank you

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Name: Kadzo Charo **P.O. Box** ..... **Tel. No:** 0700009795

ID No. 34556752 **Signature**..... **Date**.....

1. Are you aware of the proposed site? Yes ☐ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☐ 100-500m ☐ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				

4. Do you have any objections to the proposed Project? Yes ☐ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   N/A
   ii. Negative impacts
   N/A
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) N/A
7. Provide any additional comment regarding the proposed Project
   I do not object the project

Thank you

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Name: Ndoko Kitsao ..... **P.O. Box** ..... **Tel. No:** 0717174066 .....

ID No. 31121181 ..... **Signature**..... **Date**.....

1. Are you aware of the proposed site? Yes ☑ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☑ 100-500m ☐ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☑ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   N/A
   ii. Negative impacts
   N/A
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) N/A
7. Provide any additional comment regarding the proposed Project
   No objection

Thank you

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Name: Kahas - Chevitinye **P.O. Box** ..... **Tel. No:** 0797511421

ID No. ..... **Signature**..... **Date**.....

1. Are you aware of the proposed site? Yes ☑ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☐ 100-500m ☑ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☑ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   Create jobs
   .....
   ii. Negative impacts
   —
   .....
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) —
   .....
7. Provide any additional comment regarding the proposed Project
   N/A
   .....

Thank you

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Name: Amos Baya ..... **P.O. Box** ..... **Tel. No:** 0769607919

ID No. 36919127 ..... **Signature** ..... **Date** .....

1. Are you aware of the proposed site? Yes ☑ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☐ 100-500m ☐ 500m-1km ☑ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☐ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   ...
   ii. Negative impacts
   ...
   No
6. In your opinion what measures need to be put in place to address the negative impacts (if any?)...
7. Provide any additional comment regarding the proposed Project
   ...
   Safe for the Surrounding
   ...

Thank you

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Name: Chaw Sese ..... **P.O. Box** ..... **Tel. No:** 0792402731

ID No. 21909459 ..... **Signature** ..... **Date** .....

1. Are you aware of the proposed site? Yes [✓] No [ ]
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m [ ] 100-500m [ ] 500m-1km [✓] >1km [ ]
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes [✓] No [ ]
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   Provide job opportunities
   ii. Negative impacts
   N/A
6. In your opinion what measures need to be put in place to address the negative impacts (if any?) N/A
7. Provide any additional comment regarding the proposed Project
   No problem

Thank you

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Name: Bakari Baya **P.O. Box** ..... **Tel. No:** 0716168841

ID No. 37162258 **Signature** BB **Date** 26/9/2024

1. Are you aware of the proposed site? Yes ☑ No ☐
2. What is the distance from your interest (home, work etc.) to the proposed site
   <100m ☐ 100-500m ☑ 500m-1km ☐ >1km ☐
3. How long have you lived here?

Years	<1	1-5	5-10	>10
Tick				✓

4. Do you have any objections to the proposed Project? Yes ☑ No ☐
5. Give your comments on how the project will affect you and the surrounding community
   i. Positive impacts
   Employment opportunities will arise.....
   .....
   ii. Negative impacts
   N/A
   .....
6. In your opinion what measures need to be put in place to address the negative impacts (if any?). safety measures since asbestos is a high risk project.....
   .....
7. Provide any additional comment regarding the proposed Project
   N/A
   .....
   .....

Thank you

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED ASBESTOS DISPOSAL SITE, PLOT NO. 3404/KALUMANI MNYENZENI ADJUDICATION SECTION, KILIFI COUNTY

The client, **QUALITY INSPECTION SERVICES LIMITED** has commissioned for the assessment of environmental and social impacts for the proposed Asbestos disposal site project. This is in adherence to legislative requirements in place to ensure that the development activities consider environmental protection during its cycle

Through the consulting services of NEMA Registred environmental experts, the Client intends to carry out an Environmental and Social Impact Assessment process on the above project and would like your views as an interested and/ or affected party. Kindly give answers to the questionnaire provided. Your responses will help protect the environment.

Kama mmoja wa washika dau katika eneo ambamo mradi uliotajwa ulioko, jibu maswali yafuatayo. Majibu yako yatafaidi katika kuboresha mazingira.

1. Are you aware of the proposed project?
   Je, unafahamu kuweko kwa mradi unaotarajiwa?
   Yes / Ndio ☐ **No /** La ☑

2. Do you think it will benefit you as a person?
   Je, unafikiri mradi utakunufaisha wewe kibinafsi?
   Yes / Ndio ☐ **No /** La ☑

   If **No**, state reason:
   Kama huoni manufaa yoyote kwako, eleza sababu
   .....

3. Do you think it will benefit the community?
   Je, unadhania mradi huu utakuwa na manufaa kwa jamii?
   Yes / Ndio ☐ **No /** La ☑

   If **No**, state reason:
   Kama huoni manufaa yoyote kwa jamii, eleza sababu
   .....

4. Do you think the project could damage (or negatively affect) any of the following items?
   Je, unafikiri mradi huu waweza ukawa na madhara yoyote kwa miswada ifuatayo?

	Items/ **Miswada**	Yes/ **Ndio**	No/ **La**
1	Local Residents / **Wenyeji**	✓	
2	Human environment / **Mazingira ya binadamu**	✓	
3	Recreational and Leisure facilities / **Maeneo ya starehe**		✓
4	Road transport / **Usafiri wa barabara**	✓	✓
5	Water security resources quality and quantity / **Maji**		✓
6	Natural ecology of the area / **Mazingira ya eneo hili**	✓	
7	Soils / **Mchanga**	✓	
8	Public health and safety / **Usalama na afya kwa jamii**	✓	

If your answer to any of the above is **YES** state reason;
Kama jibu lako ni NDIO kwa mswada wowote hapo juu, eleza zaidi;
.....
.....

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St. John Ambulance		6/10/2021	—

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED ASBESTOS DISPOSAL SITE, PLOT NO. 3404/KALUMANI MNYENZENI ADJUDICATION SECTION, KILIFI COUNTY

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1. Are you aware of the proposed project?
   Je, unafahamu kuweko kwa mradi unaotarajiwa?
   Yes / Ndio ☐ **No /** La ☑

2. Do you think it will benefit you as a person?
   Je, unafikiri mradi utakunufaisha wewe kibinafsi?
   Yes / Ndio ☑ **No /** La ☐

   If **No**, state reason:
   Kama huoni manufaa yoyote kwako, eleza sababu
   .....

3. Do you think it will benefit the community?
   Je, unadhania mradi huu utakuwa na manufaa kwa jamii?
   Yes / Ndio ☑ **No /** La ☐

   If **No**, state reason:
   Kama huoni manufaa yoyote kwa jamii, eleza sababu
   .....

4. Do you think the project could damage (or negatively affect) any of the following items?
   Je, unafikiri mradi huu waweza ukawa na madhara yoyote kwa miswada ifuatayo?

	Items/ **Miswada**	Yes/ **Ndio**	No/ **La**
1	Local Residents / **Wenyeji**		✓
2	Human environment / **Mazingira ya binadamu**	✓	
3	Recreational and Leisure facilities / **Maeneo ya starehe**		✓
4	Road transport / **Usafiri wa barabara**	✓	
5	Water security resources quality and quantity / **Maji**	✓	
6	Natural ecology of the area / **Mazingira ya eneo hili**	✓	
7	Soils / **Mchanga**	✓	
8	Public health and safety / **Usalama na afya kwa jamii**	✓	

If your answer to any of the above is **YES** state reason;
Kama jibu lako ni NDIO kwa mswada wowote hapo juu, eleza zaidi;
1 Asbestos causes Lung cancer and mesothelioma. Care should be taken to disposed it. Construction of the facility to take care of

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WRA		4/10/2021	

for Subregional manager

1. Pleural effects of asbestos
2. Laryngeal effects of the asbestos
3. Immune System effect of the asbestos

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED ASBESTOS DISPOSAL SITE, PLOT NO. 3404/KALUMANI MNYENZENI ADJUDICATION SECTION, KILIFI COUNTY

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Kama mmoja wa washika dau katika eneo ambamo mradi uliotajwa ulioko, jibu maswali yafuatayo. Majibu yako yatafaidi katika kuboresha mazingira.

1. Are you aware of the proposed project?
   Je, unafahamu kuweko kwa mradi unaotarajiwa?
   Yes / Ndio [✓] **No /** La [ ]

2. Do you think it will benefit you as a person?
   Je, unafikiri mradi utakunufaisha wewe kibinafsi?
   Yes / Ndio [ ] **No /** La [ ]

   If **No**, state reason:
   Kama huoni manufaa yoyote kwako, eleza sababu
   .....

3. Do you think it will benefit the community?
   Je, unadhania mradi huu utakuwa na manufaa kwa jamii?
   Yes / Ndio [✓] **No /** La [ ]

   If **No**, state reason:
   Kama huoni manufaa yoyote kwa jamii, eleza sababu
   ..... N/A .....

4. Do you think the project could damage (or negatively affect) any of the following items?
   Je, unafikiri mradi huu waweza ukawa na madhara yoyote kwa miswada ifuatayo?

	Items/ **Miswada**	Yes/ **Ndio**	No/ **La**
1	Local Residents / **Wenyeji**		✓
2	Human environment / **Mazingira ya binadamu**	✓	
3	Recreational and Leisure facilities / **Maeneo ya starehe**		✓
4	Road transport / **Usafiri wa barabara**		✓
5	Water security resources quality and quantity / **Maji**		✓
6	Natural ecology of the area / **Mazingira ya eneo hili**		✓
7	Soils / **Mchanga**		✓
8	Public health and safety / **Usalama na afya kwa jamii**		✓

If your answer to any of the above is **YES** state reason;
Kama jibu lako ni NDIO kwa mswada wowote hapo juu, eleza zaidi;
If not well handled it can pollute the environment.
Handle it well for Safety to the environment.

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KFS		7/11/2017	KENYA FOREST SERVICE HEAD COAST CONSERVANCY

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTS REPORT FOR THE PROPOSED ASBESTOS DISPOSAL SITE ON PLOT NO. 3404/KALUMANI MNYENZENI ADJUDICATION SECTION, KILIFI COUNTY.

ATTENDANCE LIST

DATE:

SNO.	NAME	CONTACT/ EMAIL ADDRESS	SIGNATURE
1.	Kasecha Mbaya	0729857213	
2.	Kadzo Katanana	0700009795	
3.	Kenga Charo Tinga	07	
4.	Ndoko Kitsao	0717749066	
5.	Kache Mbaya		
6.	Khadija Chengo	.	
7.	Kadzo Harison	07	
8.	Kanga Baya	0726209311	Baya.
9.	Shavish Bango Baya	0745325474	
10.	Chengo Baya	0704915615	
11.	Charo Sese	0792402751	
12	Nyundo Ngoka	38807098	
13	Jeremiah Mutaka	0729549046	
14	Benard Onku	0711367263	
15	Amos Baya	0769807919	
16	Bakari Baya	0716168541	
17			
18			
19			
20			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED ASBESTOS DISPOSAL SITE ON PLOT NO. 3404/KALUMANI MNYENZENI ADJUDICATION SECTION, KILIFI COUNTY

MINUTES OF THE MEETING HELD WITH MNYENZENI AREA RESIDENTS

DATE: **24TH SEPTEMBER, 2021**

VENUE: **MNYENZENI.**

STARTING TIME: 12:00 Hrs.

	Present:	**contacts**	**Distance from proposed project (Approximate metres)**
No.	**NAME**		
1.	Kaseche Mbaya	0729857213	2000
2.	Kadzo Katanondo	0700009795	1000
3.	Kuaso Charo Tinya	-	1500
4.	Ndoko Kitsao	0717174066	800
5.	Kache Mbaya	-	2000
6.	Khadija Chengo	-	1000
7.	Kadzo Harrison	-	2000
8.	Kanza Baya	0726209311	1500
9.	Shariff Bango Baya	0745325474	2000
10.	Chengo Baya	0704915615	1000
11.	Charo Sese	0792402751	500
12.	Nyundo Ngoka	38807098	1000
13.	Jeremiah Mutuku	0729521046	1500
14.	Amos Baya	0769807919	2000
15.	Bakari Baya	0716168841	1500
16.	Benard Oriku	0711367263	Environmental expert
	Absent with Apology		
1.	Andrew Mwenga	0733785894	Environmental expert

Item	Details of discussions	Action by
	Agenda	
1.1	Preliminaries	
1.2	Community concerns emanating from the project	
1.3	adjournment	
1.1	**Preliminaries** The meeting was called to order at 10:00 am by the Environmentalist who welcomed all members to the meeting and called upon one member to say a word of prayer to officially start the meeting. Members absent with apologies were mentioned. The environmentalist indicated that From the ongoing analysis, the social and economic rating for this project is highly positive. The environmentalist informed the Mnyenzeni community that; 1. Adequate mitigation measures have been proposed to address any of the negative impacts arising from the project. 2. The project will create employment and improve income earnings. 3. The project will allow for safe disposal of asbestos, which the government is trying to do away with due to its long-term health effects. 4. The positive impacts are highly rated and will benefit all stakeholders and the Mombasa residents at large.	Environmentalist
1.2	**Community concerns emanating from the project** The community members of Kizingo area raised the following issues that needed attention during construction and operational phase of the project: • **Noise Pollution and Vibration** as a result of equipment and vehicular movement. The proponent was tasked to ensure noisy equipment will be fitted with noise mufflers to reduce the impact of noise.	Proponent/ Contractor/ Environmentalist

	• **Air pollution from fugitive dust** as a result of excavation and vehicular movement. The contractor was tasked to put up dust screens to trap dust. • **Risk of accidents as a result of increased traffic.** It was agreed that speed bumps to be erected and use of flagmen to slow down the speed of vehicles • **Increased social conflicts** the proponent promised to employ the local people during the construction and operation phase. The community members were advised to form a committee that will look into the social wellbeing of their residents. • The members requested every activity to be guided by the constitution of Kenya 2010. The proponent assured the members that all protocols have been observed.	
1.4	**Adjournment** There being no other business, the meeting was adjourned at 11:20 am	Environmentalist

Minutes Prepared by:

Environmentalist: Benard Oriku **Sign:** ..... **Date** 2/10/2021

Minutes Seconded by:

Community representative: Sharif Baya **Sign:**.....**Date**2/10/2021

Temporary plot Certific

Kalumoni Mnyenzeni Adj Sec

Plot No 3404

Quality Inspection Services Limited.

Issued by the

Demarcation Office I/C

I.m. Bembeya

THE DEMARCATION OFFICER I/C
ADJ SECTION
P. O. BOX 242 - KILIFI

K.mnyenzi

15/7/021

KENYA REVENUE AUTHORITY

PIN Certificate

For General Tax Questions
Contact KRA Call Centre
Tel: +254 (020) 4999 999
Cell: +254(0711)099 999
Email: callcentre@kra.go.ke

www.kra.go.ke

Certificate Date : 05/03/2018

Personal Identification Number
P051340078Y

This is to certify that taxpayer shown herein has been registered with Kenya Revenue Authority

Taxpayer Information

Taxpayer Name	QUALITY INSPECTION SERVICES LIMITED
Email Address	QUALITYINSPECTIONLTD@GMAIL.COM

Registered Address

L.R. Number :	**Building :** CANNON
Street/Road : MWAKILINGO OFF MOI AVE.	**City/Town :** MOMBASA CITY (SOUTH)
County : Mombasa	**District :** Mombasa North District
Tax Area : Mombasa	**Station :** Mombasa South*
P. O. Box : 87222	**Postal Code :** 80100

Tax Obligation(s) Registration Details

Sr. No.	Tax Obligation(s)	Effective From Date	Effective Till Date	Status
1	Income Tax - PAYE	14/02/2018	N.A.	Active
2	Income Tax - Company	30/04/2010	N.A.	Active
3	Value Added Tax (VAT)	30/06/2012	N.A.	Active

The above PIN must appear on all your tax invoices and correspondences with Kenya Revenue Authority. Your accounting end month is December unless a change has been approved by the Commissioner-Domestic Taxes Department. The status of Tax Obligation(s) with 'Dormant' status will automatically change to 'Active' on date mentioned in "Effective Till Date" or any transaction done during the period. This certificate shall remain in force till further updated.

* The station is subject to change based on the verification done by Commissoner.

Disclaimer : This is a system generated certificate and does not require signature.

No. CPR/2010/18941

CERTIFICATE OF INCORPORATION

I hereby CERTIFY, *that -*

QUALITY INSPECTION SERVICES LIMITED

is this day Incorporated under the Companies Act (Cap. 486) and that the Company is **LIMITED**.

GIVEN under my hand at Nairobi this **30 th** day of **April** Two Thousand and **Ten**

Registrar Of Companies

HYDROGEOLOGICAL ASSESSMENT STUDY REPORT GROUNDWATER CONDITIONS ON PLOT No. 3404/KALUMANI MNYEZENI ADJUDCATION SECTION, KILIFI COUNTY

Project: Proposed safe disposal of Asbestos waste material

Prepared for:

Quality Inspection Services Limited
P.O Box 87222 - 80100
Mombasa, Kenya

Prepared by:

Geosol Consulting Limited
P.O Box 97097 - 80112
Makupa, Kenya
+254 710 676 903
info@geosolconsulting.com

GEOSOL
CONSULTING LTD

Report No. HSR/023/02/10/2021

Our Services:

Water Resources | Water Infrastructure | Mapping with GIS

Compiled by:

Alexander Mutuku -
Reg. Geologist (GSK & GRB)

HYDROGEOLOGICAL ASSESSMENT STUDY REPORT GROUNDWATER CONDITIONS ON PLOT No. 3404/KALUMANI MNYEZENI ADJUDCATION SECTION, KILIFI COUNTY

For

Proponent:
Quality Inspection Services (QIS) Limited

Project:
Proposed Asbestos Disposal Site

Investigating Geologists:

Alexander M. Nzomo
P.O Box 97097 – 80112
Makupa, Mombasa
0710 676 903
Reg. Geologist
MGSK & MGRB

Signed: .....

Date: .....

Julius O. Ogut.
P.O Box 21815 - 00400
Nairobi, Kenya
Reg. Hydrogeologist
MGSK & MGRB
WD/WRP/250

Signed: .....

Date: .....

HYDROGEOLOGICAL ASSESSMENT STUDY REPORT GROUNDWATER CONDITIONS ON PLOT No. 3404/KALUMANI MNYEZENI ADJUDCATION SECTION, KILIFI COUNTY

For

Proponent:
Quality Inspection Services (QIS) Limited

Project:
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Alexander M. Nzomo
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Makupa, Mombasa
0710 676 903
Reg. Geologist
MGSK & MGRB

Signed: .....
Date: 7/10/2021

GEOSOL CONSULTING Tel: 0710 676 903 07 OCT 2021 P.O. Box 82735-80100, MOMBASA

Julius O. Ogut.
P.O Box 21815 - 00400
Nairobi, Kenya
Reg. Hydrogeologist
MGSK & MGRB
WD/WRP/250

Signed: .....
Date: 07/10/2021

Julius O. Ogut (MSc, MGRB) WD/WRP/250 07 OCT 2021 Tel: 0723 130 540 0786 498 474 P.O. Box 21815 - 00400, NAIROBI

EXECUTIVE SUMMARY

Introduction

This report presents the outcome of a hydrogeological and geophysical assessment for the proposed safe disposal of asbestos waste materials on Plot No. 3404/Kalumani Mnyezeni Adjudication section, Kilifi County at grid reference 37M UTM 554193 E 9581727S (*WGS 84)*. The report has attempted to faithfully adhere to the *Water Act No.43 of 2016* and *Water Resources Management Rules, 2007, Legal Notice No. 171, 28 September 2007.*

It is as part of adherence to the *National Guidelines on Safe Management and Disposal of Asbestos of 2013* as required by National Environmental Management Authority (NEMA). Findings of the report would inform a separate Environmental Impact Assessment (EIA) study carried out for the project as required by Environmental Management and Coordination Act (EMCA), No. 8 of 1999, Legal Notice No. 101 of June 2003 (Environmental Impact Assessment and Audit Regulations), EMCA - Amendments 2015, EMCA Legal Notice 31 of 2019 and National Guidelines on Safe Management and Disposal of Asbestos of 2013.

Geology of the site

Mnyenzeni site lies on Triassic Mariakani sandstones of the Duruma sandstone series. Water bearing formation is expected within fractured and weathered section of the sandstones.

Geophysical Investigations

Geophysical investigations comprised of referenced Two sets of roll along 2-Dimensional ERT (each approximately 95 long and with effective depth of up to 20m below groung level). Interpreted geophysical model indicated presence of shallow sands with patches of mud/clays/silts and deep shallow dry and compact sandstones. ERT section picked faults and minute fractures as labels on the section, the structure are dry and do not host any aquifer neither do they recharge deep aquifer.

Hydrogeology of the area

Data obtained from existing neighbouring boreholes, borehole completion records from Water Resources Authority (WRA) for the area, shows that area hosts a confined aquifer which quiet deep, average Water Struck Levels (WSL) from neighbouring boreholes is recorded at approximately 70 .0 m bgl with boreholes depths at > 100.0 m bgl.

The aquifer recharged directly because it quite deep and confined, the recharge is through lateral flow through faults and fractured section of the deep aquifer exposed on topographic highs or catchment.

Hypothetical description of the sandstone aquifer show that it has a Specific Capacity (S_c) 3.4274 m^2/day, Transmissivity (T) value of 4.1814 m^2/day, Hydraulic conductivity (K) 0.1387 m/day and storage coefficient (S) = $\mathbf{9.042\times 10^{-5}}$

Conclusion and Recommendations

Mnyenzeni area lies on Triassic Mariakani Sandstone rocks, water bearing rock within such formation is expected on faults and fractures. ERT profiles conducted at the site did NOT detect any shallow aquifers within the site. The site hosts dry compact to slightly weathered sandstone rocks.

Data from the neighboring boreholes within 8 Km radius shows presence of a confined aquifer at Water Struck Level (WSL) of at **approximately 70 m below ground level.** The aquifer is confined aquifer, i.e; capped by a compact sandstone at the top as detected by ERT profiles; there any activity or development will have minimal effect on the deep aquifer.

NEMA approval should sort before commencing any work; if approved, the proponent should adhere to all NEMA license conditions; more importantly the National Guidelines on Safe Management and Disposal of Asbestos of 2013.

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LIST OF ACRONYMS AND ABBREVIATIONS

EC	Electrical Conductivity (in microSeimens/centimetre)
Km	Kilometres
M	metres
amsl	metres above mean sea level
bgl	metres below ground level
ppm	parts per million, equivalent to mg/l
SWL	static water level (in m bgl) (the piezometric level or water table.)
TDS	Total Dissolved Solids (ppm)
uPVC	unplasticized polyvynlchloride (pvc)
WSL	water struck level (in m bgl)
HEP	Horizontal Electrical Profile
VES	Vertical Electrical Profile
SP	Self Potential
IP	Induced Polarisation

Aquifer	A geological formation or structure which transmits water and which may supply water to wells, boreholes or springs.
Altitudes	height above sea level
Catchment area	the area of land catching or collecting water draining into a river
Casing	A protective case or covering
Contamination	Addition of harmful substances; Pollution
Deforestation	Cutting down of trees and other vegetation
Evapotranspiration:	the combine loses of moisture from the ground (evaporation) and the loss from green plants (transpiration)
Faults	a fracture in the earth crust with displacement in either side.
Fracture	breaking of something like rocks or bones.
Gravel Pack	well-sorted sand mostly made of silica
Humidity	The measure of moisture in the air.
Metamorphic	A rock, which has changed its form under high pressure and temperature
Infiltrated	to pass through by filtering gradually
Percolate	to pass or ooze through very small holes. It is also the gradual spreading.
Porosity	the percentage of open space in a rock formation
Recharge	The general term indicating the process of transport of water from surface sources (ie, from rivers or rainfall) to groundwater storage.
Saturation	when it has had enough and cannot take any more of that substance
Screen	a filter to clean water from the earth into the well.
Springs	a water flow from underground to the surface without any pumping
Tectonic movement	movement of the earth crust over molten magma
Topography	description of the surface of an area like its hills, rivers, valleys (landscape)
Transmissivity	the rate at which water travels underground
Unconformity	The representation in physical geology (i.e., in the rock record) of a break in the ordered succession of rocks
Well	a hole or shaft bored into the ground to tap water or gas or oil
Weathering	a process of a rock breaking down into smaller particles naturally

CHAPTER ONE

1 INTRODUCTION

1.1 Background

Quality Inspection Services (QIS) intends obtain approvals for safe disposal asbestos material at section of their premise located on Plot No. 3404/Kalumani Mnyezeni Adjudication section, Kilifi County at grid reference 37M UTM 554193 E 9581727S (*WGS 84).*

This report presents the outcome of a hydrogeological and geophysical assessment for the proposed work as required by *National Guidelines on Safe Management and Disposal of Asbestos* (NEMA, 2013). The study will also attempt to faithfully adhere to the relevant provisions of the *Water Act No.43 of 2016* (Government of Kenya (GoK), 2016) and *Water Resources Management(WRM) Rules 2007, Legal Notice No. 171, 28 September 2007* (GoK, 2007) as required for hydrogeological reports.

Findings of this report would inform a separate Environmental Impact Assessment (EIA) project report for the undertaking. The EIA project report would be submitted to National Environmental Management Authority (NEMA) for approval before commencing any work.

Hydrogeological assessment reports are required to consider the *"impact of proposed activity on aquifer, water quality, other abstractors, including likelihood of coalescing cones of depression and implications for other groundwater users in any potentially impacted areas"* (Second Schedule, WRM Rules 2007, (GoK, 2007)). It is good to note that this assessment does not comprises an EIA in the sense of *Environmental Management and Coordination Act (EMCA), No. 8 of 1999* (GoK, 1999), *Legal Notice No. 101 of June 2003 (Environmental Impact Assessment and Audit Regulations)* (GoK, 1999), *EMCA - Amendments 2015* (GoK, 2015) or *EMCA Legal Notice 31 of 2019* (GoK, 2019).

1.2 Reporting and Legal Requirements

This report has attempted to faithfully adhere to the *Water Resources Management Rules, 2007, Legal Notice No. 171, 28 September 2007* (GoK, 2007).The rules on Second Schedule – formats for Technical Reports which stipulates the following format: -

1. Name and details of applicant.
2. Location and description of proposed activity.
3. Details of climate
4. Details of geology and hydrogeology.
5. Details of neighbouring boreholes, including location, distance from proposed borehole or boreholes, number and construction details, age, status and use, current abstraction and use.
6. Description and details (including raw and processed data) of prospecting methods adopted. g remote sensing, geophysics, geological and/ or hydrogeological cross sections, hydrogeological characteristics and analysis, to include but not necessarily be limited to the following:
    a) Aquifer Transmissivity
    b) Borehole specific capacities.
    c) Storage coefficient and/ specific yield.
    d) Hydraulic conductivity.
    e) Groundwater flux.

f) Estimated mean annual recharge, and sensitivity to external factors.

7. Assessment of water quality and infringement of National Standards.
8. Assessment of availability of groundwater.
9. Analysis of the reserve.
10. Impact of proposed activity on aquifer, water quality, other abstractors, including likelihood of coalescing cone of depression and implications for other groundwater users in any potentially affected areas.
11. Recommendations for borehole development, to include but not limited to the following:
    a. Locations of recommended borehole (s) expressed as coordinate(s) and indicated on a sketch map.
    b. Recommendations regarding borehole or well good density and minimum spacing in the project area.
    c. Recommended depth and maximum diameter.
    d. Recommended construction characteristics, e.g., wire-wound screen, grouting depth.
    e. Anticipated yield.
12. Any other relevant information (e.g., need to monitor neighbouring boreholes during tests).

1.3 Location

Kilifi County lies within 3° 16' South and 4° South, and 39° 15' East and 40° East, Plot No. 3404/Kalumani Mnyezeni Adjudication section, Kilifi County is located at grid reference 37M UTM 554193 E 9581727S (*WGS 84)*. The site is 7 Km from Mariakani off Mariakani -Bamba road.

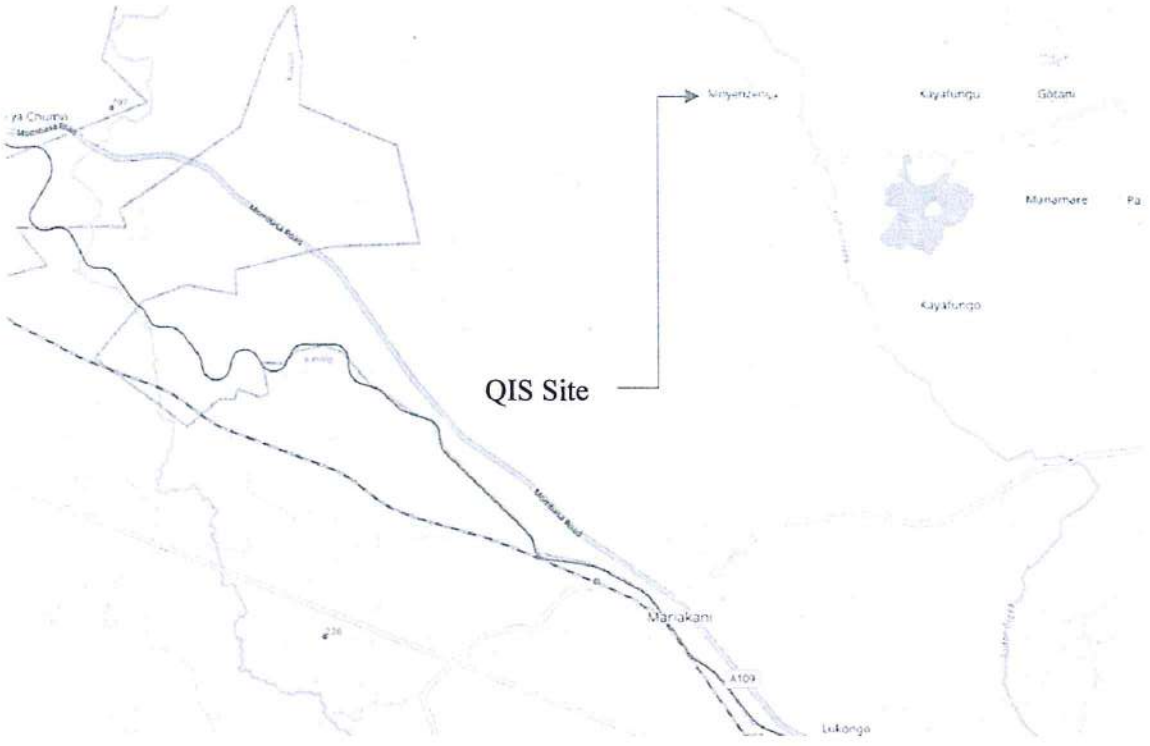


Figure 1-1: Location of the proposed site

CHAPTER TWO:

2 ENVIRONMENTAL CONDITIONS

2.1 Introduction

This chapter highlights the main environmental conditions that influences presence of groundwater in the study area. This is vital information that would be used elsewhere in this report.

2.2 Climate

Kilifi County lies within a semi-humid zone of Kenya (Sombroek et al., 1982), characterized by hot and dry climatic conditions. The pattern of rainfall in Kilifi County is bimodal, with the long rains falling from April to June with peak in May, the short rains fall from October to December.

2.2.1 Rainfall

The average annual rainfall ranges from 400 mm in the hinterland to 1,200 mm at the coastal belt. The coastal belt receives an average annual rainfall of between 900 to 1,100 mm with marked decrease in intensity to the North and to the Hinterland. For the purposes of calculations elsewhere in this report, we shall assume average value of 1200 mm as study area's rainfall (closer to the coastal belt) mean annual rainfall.

2.2.2 Temperature

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

2.2.3 Evaporation

Woodhead, (1968) developed an empirical equation relating elevation and annual potential evaporation from 78 climate stations in Kenya, in the form: $-E_o = 2422 - 0.358h$ ($r^2 = 0.66$),

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 average altitude of 180 m amsl) is approximately 2358 mm/yr. This gives a rainfall/evaporation ratio of ≈ 0.5, which classifies the area as semi-humid (Sombroek et al., 1982).

2.2.4 Water supply situation

Kilifi County is supplied with water from the Kilifi water supply system, the system is made of Kilifi water supply system and Mtwapa water supply system. *Kilifi water supply system* covers the coastal strip from Takaungu to Roka (about 50 km long by 8 km wide) which includes Kilifi Town and rural areas located along connections from the Sabaki pipeline is mainly supplied by the Baricho wells (Sabaki river). *Mtwapa water supply system* covers a 20 km long by about 5 km wide strip along the Malindi road from Mtwapa Bridge to Vipingo is mainly supplied by the Baricho wells (Sabaki river). North Mainland network supplies Mtwapa network by an interconnection across the Mtwapa Bridge. However, residents of Mnyezeni village and environs depend on surface water sources from seasonal streams and water pans. There are few boreholes have been drilled in the area, majority of which are quite deep (upto 250 m bgl) and very saline.

2.3 Geology

2.3.1 Introduction

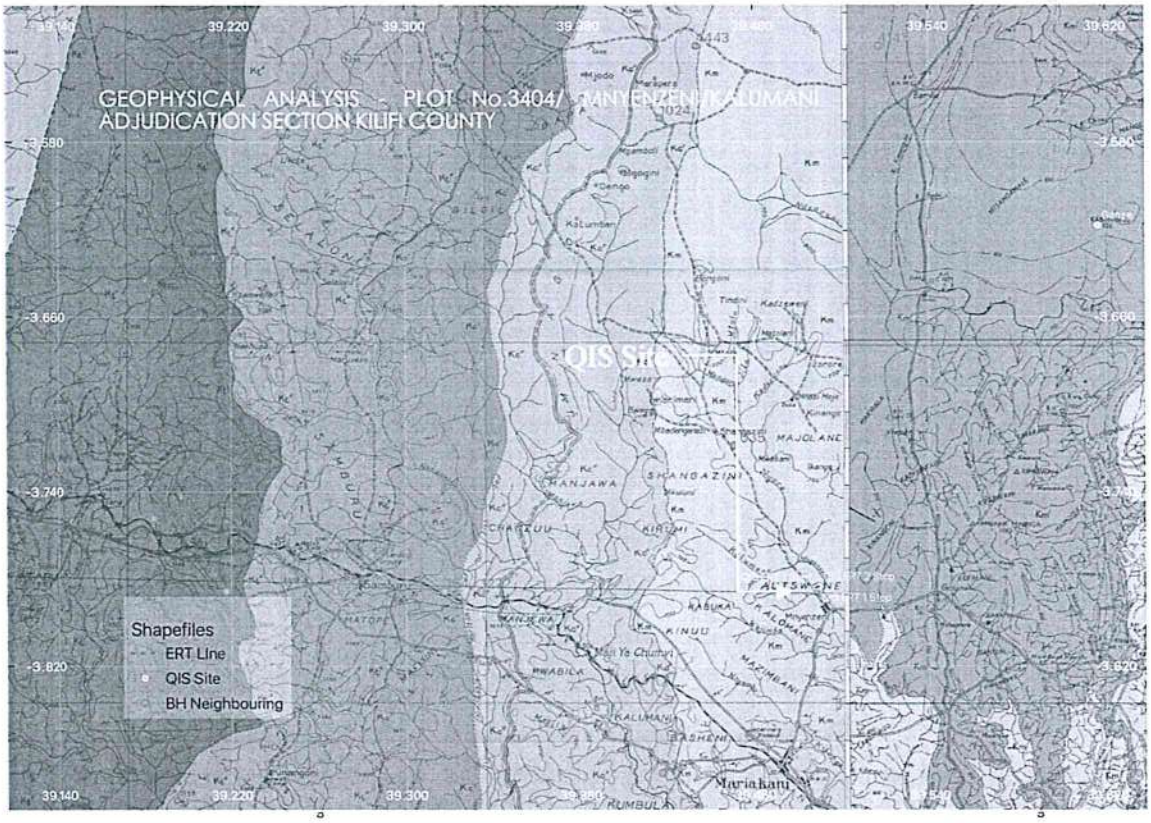
The hydrogeology of any area is intimately related to the geology: the occurrence of groundwater being a function of recharge, porosity, permeability and gradient. This Section examines the geology in the study area in some detail, and is based on studies conducted by Horkel et al., (1984) and Thompson, (1955).

2.3.2 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).

2.3.3 Local geology

Locally, Caswell, (1956) shows that the site lies on Triassic Mariakani sandstones of the Duruma sandstone series. Water bearing formation is expected within fractured and weathered section of the sandstones. An excerpt from (Caswell, 1956) geological map is shown on Figure 2-1.



Source: (Caswell, 1956)

Figure 2-1: An excerpt of geological map of the area.

CHAPTER THREE:

3 HYDROGEOLOGY

3.1 Introduction

This Chapter discusses the hydrogeology of the area. The client had attempted to successfully do drilling for the purpose of brine abstraction but eventually abandoned the boreholes. The presence of these borehole is a good indication that fair subsurface brine prospects in the area.

3.1.1 Information with regards to Neighboring Boreholes

Table 3-1: The closest registered boreholes neighbouring site

Geology	ID	OWNER	LOCALITY	TD (m)	WSL (m)	WRL (m)	YIELD (m3/h)	DIST/ DIR. (Km)
	967	M.O.W.D	MAZERAS	69.00	24.00	13.00	3.00	
	797	M.O.W.D.	MAJI YA CHUMVI	38.00	31.00	11.00	11.00	
	1035	M.O.W.D. KILIFI No9	TSANGATSINI	153.00	116.00	13.00	11.00	
Sandstones	1272	SHEREA &OMAR	MALINDI	52.00	40.00	34.00	4.00	> 8 Km
	236	MINIST.OF DEFENCE	MARIAKANI	152.00	145.00	46.00	3.00	
	190	MINIST.OF DEFENCE	KWALE	153.00	98.00	38.00	14.00	
	764	M.O.W.D.	SABURU	80.00	32.00	10.00	11.00	
AVERAGE				**99.57**	**69.43**	**23.57**	**8.14**	

Source: WRMA, (2007)

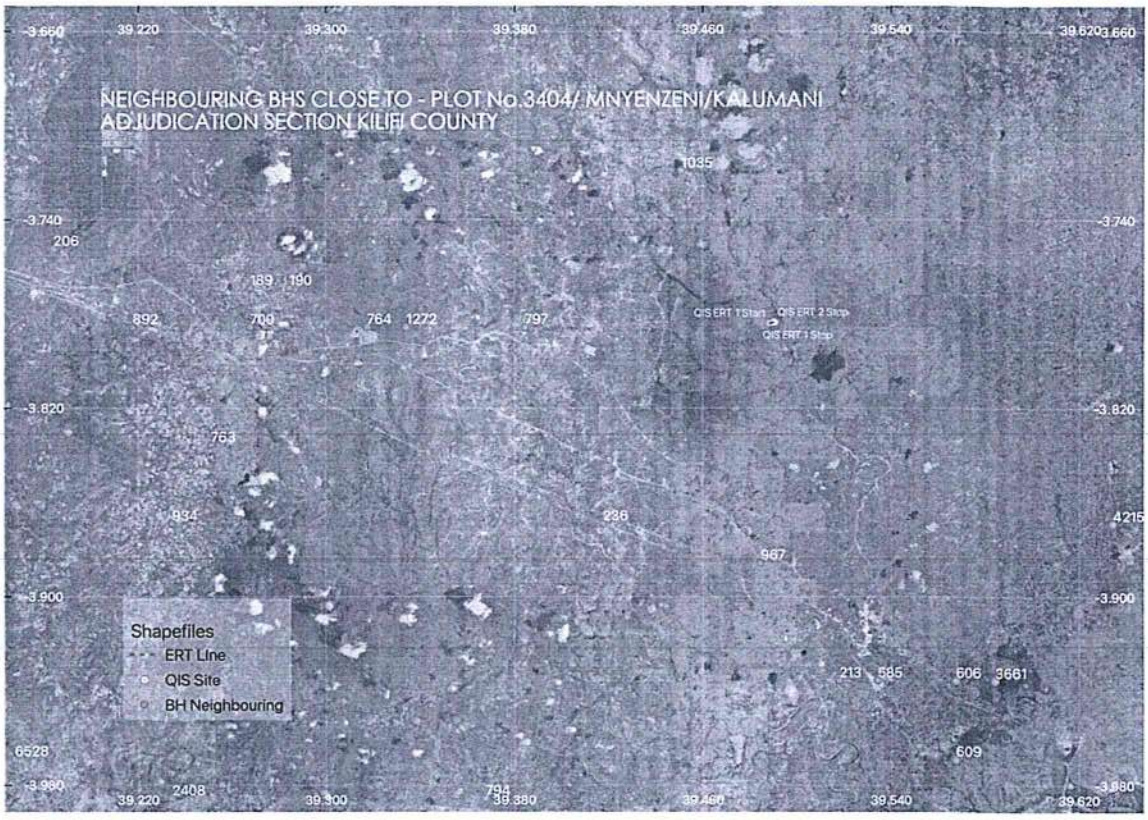


Figure 3-1: A plot of the neighbouring BHs close to QIS site

3.1.2 Specific Capacity

Specific yield is the volume of water that drains from a saturated rock or sediment by gravity relative to the total volume of the rock. The best estimate of ground water potential is through calculation of specific capacity of aquifer. If the yield (discharge is divided by draw down in a pumping well, the specific capacity is obtained:

(s_y/dd)

s= drawdown

dd= discharge

There are no discrete details of the boreholes but hypothetically specific capacity can be estimated based on the information on the neighbouring boreholes, the water column in the nearby boreholes in the table above is averagely 76.0 m. If therefore, a pump was to be given a 25% pump intake allowance, then

s=75/100 x 76.0 = 57.0 m

Therefore, since, Q= Ts where, s= drawdown. Then if Q is averagely 13.5 m^3/h as illustrated above,

Specific capacity =Q/s= 8.14/ 57.0 = 0.142 m^2/h

Specific capacity = **3.4274 m^2/day**

3.1.3 Transmissivity

Transmissivity (T) is the rate at which water of prevailing kinematic viscosity is transmitted through a unit width of aquifer under a unit hydraulic gradient.

T=Kb= (m/day) (m) =m^2/day where,

b=saturated thickness of the aquifer.

However, Transmissivity can be calculated hypothetically from Logan's, (1964) formulae where T=Q/s * 1.22. Where Q/s= specific capacity calculated as **3.4274 m^2/day**

Therefore, T= 3.4274 * 1.22

T= **4.1814 m^2/day**

3.1.4 Hydraulic Conductivity

A medium is deemed to have a unit hydraulic conductivity (permeability) if it transmits in unit time, a unit volume of groundwater at a prevailing kinematic viscosity through a cross section of unit area measured at right angles to the direction of flow, under a unit hydraulic gradient. Its units are, K=m/day

Since T= Kb this can be rearrange to reflect Hydraulic Conductivity K =T/b where T=Transmissivity (**4.1814 m^2/day**) and b = aquifer thickness (assumed hypothetically to be avg. Total depth - Avg. WSL = **30.14 m**

K= 4.1814 /30.14

K= **0.1387 m/day**

3.1.5 Permeability

The permeability of a rock defines its ability to transmit a fluid. It can be expressed as $k=K\mu/\rho g$,

Where: K=hydraulic conductivity

μ= dynamic viscosity ρ=fluid density

g=acceleration of gravity

3.1.6 Storage Coefficient

This is the volume of water discharged from an aquifer releases from its storage per unit surface area per unit change in the component of head normal to the surface (S).

One method to estimate S is a rule-of-thumb technique described by Todd and Mays, (2005) in which since specific storage S is directly proportional to aquifer thickness b,

$$S = 3 \times 10^{-6} \text{ x } b \text{ (where b is aquifer thickness).}$$

For this particular case the storage coefficient $S = 3 \times 10^{-6} \text{ x } 30.14$

$$\mathbf{S = 9.042 \times 10^{-5}}$$

Table 3-2: Hydraulic Conductivity for the study area

Material	Hydraulic Conductivity (m/d)	Remarks
Fetter, (1994)		
Clay	$8.6^{-7} - 8.6^{-4}$	
Silt, sandy silts, clayey sands or till	$8.6^{-4} - 0.09$	
Silty sands, fine sands	$8.6^{-3} - 0.86$	
Well-sorted sands, glacial outwash	0.86 – 86	
Well-sorted gravel	8.6 – 860	
Domenico and Schwartz, (1998)		
Shale	$8.6^{-11} - 1.7^{-6}$	
Anhydrite	$3.5^{-10} - 1.7^{-5}$	
Salt	$8.6^{-10} - 8.6^{-8}$	
Siltstone	$8.6^{-9} - 1.2^{-5}$	
Sandstone	$2.6^{-7} - 5.2^{-3}$	Value for Mnyenzeni - area
Limestone and dolomite	$8.6^{-7} - 5.2^{-3}$	
Karts and reef limestone	$8.6^{-4} - 17$	

Source: Fetter, (1994) and Domenico and Schwartz, (1998)

CHAPTER FOUR

4 Aquifer Recharge

4.1 Introduction

The *Water Resources Management Rules, 2007* (GoK, 2007), require that Hydrogeological assessment reports describe and estimated mean annual recharge, and sensitivity to external factors. This Chapter does so within the context of the rules.

4.2 Background to groundwater recharge

An understanding of groundwater recharge and discharge (both natural and artificial) are critical in assessing whether additional groundwater abstraction is sustainable. Recharge – the process by which waters (be they precipitation, surface flow or adjacent groundwater) percolate into an aquifer – is a fundamental hydrological process, and probably the most important single element of any groundwater investigation. Recharge calculations: –

- Allow the volume of groundwater that can be sustainably exploited to be estimated;
- Assist in the proper management of an aquifer;
- Allow the development of simulations of physical and chemical processes in an aquifer;
- Assist in the study of contaminant transport in an aquifer.

4.3 Types of recharges

There are essentially three modes of recharge in groundwater engineering as documented by Kinzelbach et al., (2002): –

- Direct or autogenic recharge. This is recharge directly from infiltrating rain into an aquifer unit and is the dominant case for the unconfined aquifer within the study area.
- Indirect or allogenic recharge is recharge from rivers/Intrusion from sea water flowing from adjacent geologies over and into an aquifer unit.
- Lateral recharge from one geological unit to another at depth, and allogenic by definition; this is not a significant recharge regime within area.

The recharge is one of the most difficult processes to measure empirically and invariably requires extensive and protracted field measurements. For this particular study, both *Indirect or allogenic* and *Direct or autogenic recharge* method is used.

4.4 Area recharge

4.4.1 Direct or autogenic recharge from recharge ratios

We can use recharge ratios to estimate recharge to the unconfined aquifer at Mnyenzeni using estimated mean annual rainfall for Kilifi County – (900 mm/yr: *S. 2.2.1* above), and the recharge ratio calculated for the
Kilifi North 13%: Walters (1986)

Thus:

Recharge = recharge ratio (13%) x rainfall (900 mm) = 117 mm/yr.
This is equivalent to 117,000 $m^3/km^2/yr$.

CHAPTER FIVE

5 Geophysical Analysis

5.1 Introduction

Geophysics is the technique used by scientist to investigate the underlying conditions without necessarily excavating into the ground. There are many methods of geophysics and the choice of one depends on the kind of investigation one is carrying. In this case, Resistivity method was used to investigate the underlying conditions.

5.2 Resistivity Methods

Also, referred to as DC resistivity technique, this method measures the earth's resistivity by driving a direct current (DC) signal into the ground and measuring the resulting potentials (voltages) created in the earth. From that data, the electrical properties of the earth (the geoelectric section) can be derived and thereby the geologic properties inferred. The diagram below illustrates the basic electrical array for that measurement. The figure above is a schematic diagram showing the basic principle of DC resistivity measurements.

Two short metallic stakes/current electrodes (AB) are driven about 1 foot into the earth to apply the current to the ground. Two additional potential electrodes (MN) are used to measure the earth voltage (or electrical potential) generated by the current. Depth of investigation is a function of the distance of current electrodes. In the resistivity method, the spatial variation of resistivity (or conductivity the inverse) in the field is determined using four-electrode measurements AB and MN. Two (transmitter/current) electrodes (AB) are deployed to create an electrical circuit. Measurement of the potential difference (voltage) between the two other (potential) electrodes permits determination of an apparent resistivity (i.e., the resistivity a homogenous half space should have to give the actual measurement). Inverse methods may be applied to such measurements to determine an image of the subsurface structure Electrodes may be placed on the ground surface and/or in boreholes.

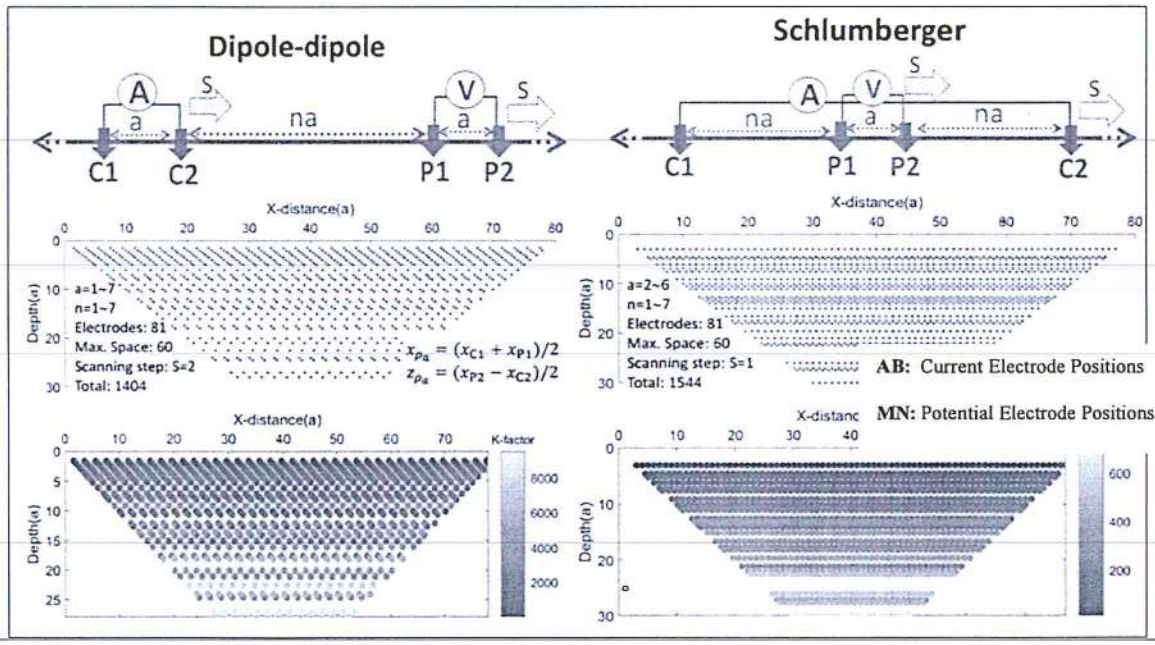


Figure 5-1: Schematic diagram of electrode array arrangement basic

The electrical properties of rocks in the upper part of the earth's crust are dependent upon the lithology, porosity, and the degree of pore space saturation and the salinity of the pore water. Saturated rocks have lower resistivity than unsaturated and dry rocks. The higher the porosity of the saturated rock is, the lower its resistivity, and the higher the salinity of the saturating fluids, the lower is the resistivity. The presence of clays and conductive minerals also reduces the resistivity of the rock. The resistivity of earth materials can be studied by measuring the electrical potential distribution produced at the earth's surface by an electric current that is passed through the earth. The resistance R of a certain material is directly proportional to its length L and cross-sectional area A, expressed as:

$$R = Rs * L/A \text{ (Ohm)} \quad \text{.....(i)}$$

Where; Rs is known as the specific resistivity that is a characteristic of the material and independent of its shape or size. With Ohm's Law,

$$R = dV/I \text{ (Ohm)} \quad \text{.....(ii)}$$

Where dV is the potential difference across the resistor and I is the electric current through the resistor, the specific resistivity may be determined by:

$$Rs = (A/L) * (dV/I) \text{ (Ohm.m)} \quad \text{..... (iii)}$$

5.2.1 Methodology

(a) Horizontal Electrical Profile

In horizontal resistivity profiling, lateral changes in resistivity are measured at a given depth depending on the values of AB and MN where AB is the distance between the current electrodes and MN is the distance between the potential electrodes. The variations in resistivity reflects the variation in the Lithology of the area. The direction in which a profile is taken is always across the fault and fractures. The profile would therefore detect these regions where VES probes would conduct.

(b) Vertical Electrical Sounding (VES)

Vertical Electrical Soundings (VES) were conducted using non-polarized potential electrodes placed at fixed distances and current electrodes increase in Logarithmic order. Electric current is passed through the current electrodes to the ground and the potential difference measured across the potential electrodes. In VES survey the current electrode are expanded symmetrically about the centre of spread. Schlumberger array configuration was used to carry out the study.

(c) Geophysical Equipment

The geophysical equipment used for the entire exercise was 4point light 10W Earth Resistivity meter manufactured Erich Lippmann, (2014) – Geophysical instruments Schaufling Germany. Its technical specification is annexed.

5.3 Data analysis

5.3.1 ERT 1 & 2 at QIS site

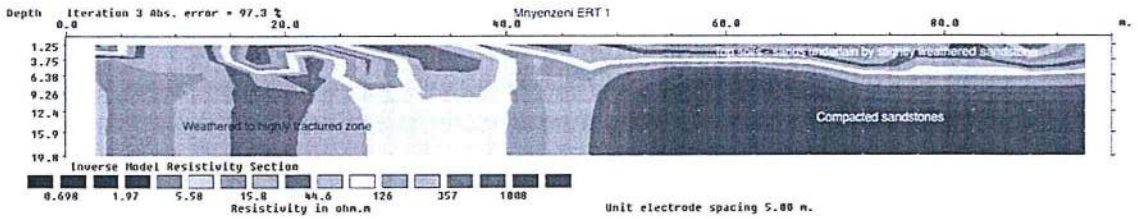


Figure 5-2: ERT 1

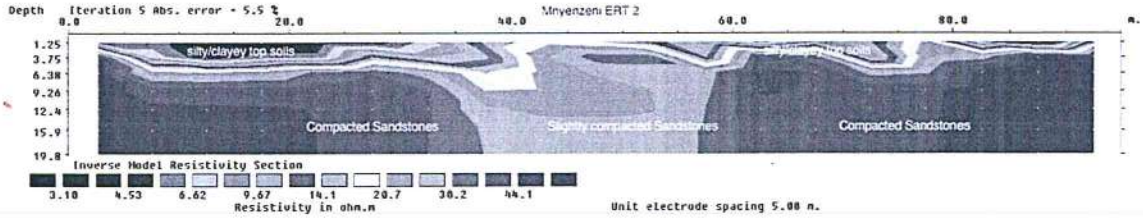


Figure 5-3: ERT 2

INTERPRETATION:

The ERT profile were on conducted as roll along. i.e.; the two overlaps at the End and Start of the lines at 5m. The geology of is composed of Triassic sandstones, the ERT penetrated to a depth of 20 m below ground level aimed at detecting any shallow aquifers of in the area. The section shows no presence of any shallow or perched aquifer, actually dry compacted to slightly weathered sandstone commences 6.0 – 8.0 m below ground level.

Table 5-1: ERT location Summary

No.	Name/Direction		Latitude (WGS 84)	Longitude	Locality
1	ERT 1 – SW-NE	START:	03.78405	39.48807	QIS at Mnyenzeni
		STOP:	03.78386	39.48887	
2	ERT 1 – SW-NE	START:	03.78386	39.48883	
		STOP:	03.78367	39.48967	

6 Conclusion and Recommendations

Mnyenzeni area lies on Triassic Mariakani Sandstone rocks, water bearing rock within such formation is expected on faults and fractures. ERT profiles conducted at the site did NOT detect any shallow aquifers within the site. The site hosts dry compact to slightly weathered sandstone rocks.

Data from the neighboring boreholes within 8 Km radius shows presence of a confined aquifer at Water Struck Level (WSL) of at **approximately 70 m below ground level.** The aquifer is confined aquifer, i.e; capped by a compact sandstone at the top as detected by ERT profiles; there any activity or development will have minimal effect on the deep aquifer.

NEMA approval should sort before commencing any work; if approved, the proponent should adhere to all NEMA license conditions; more importantly the National Guidelines on Safe Management and Disposal of Asbestos of 2013.

7 REFERENCES

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Appendix 1: Technical specification data of the geophysical equipment

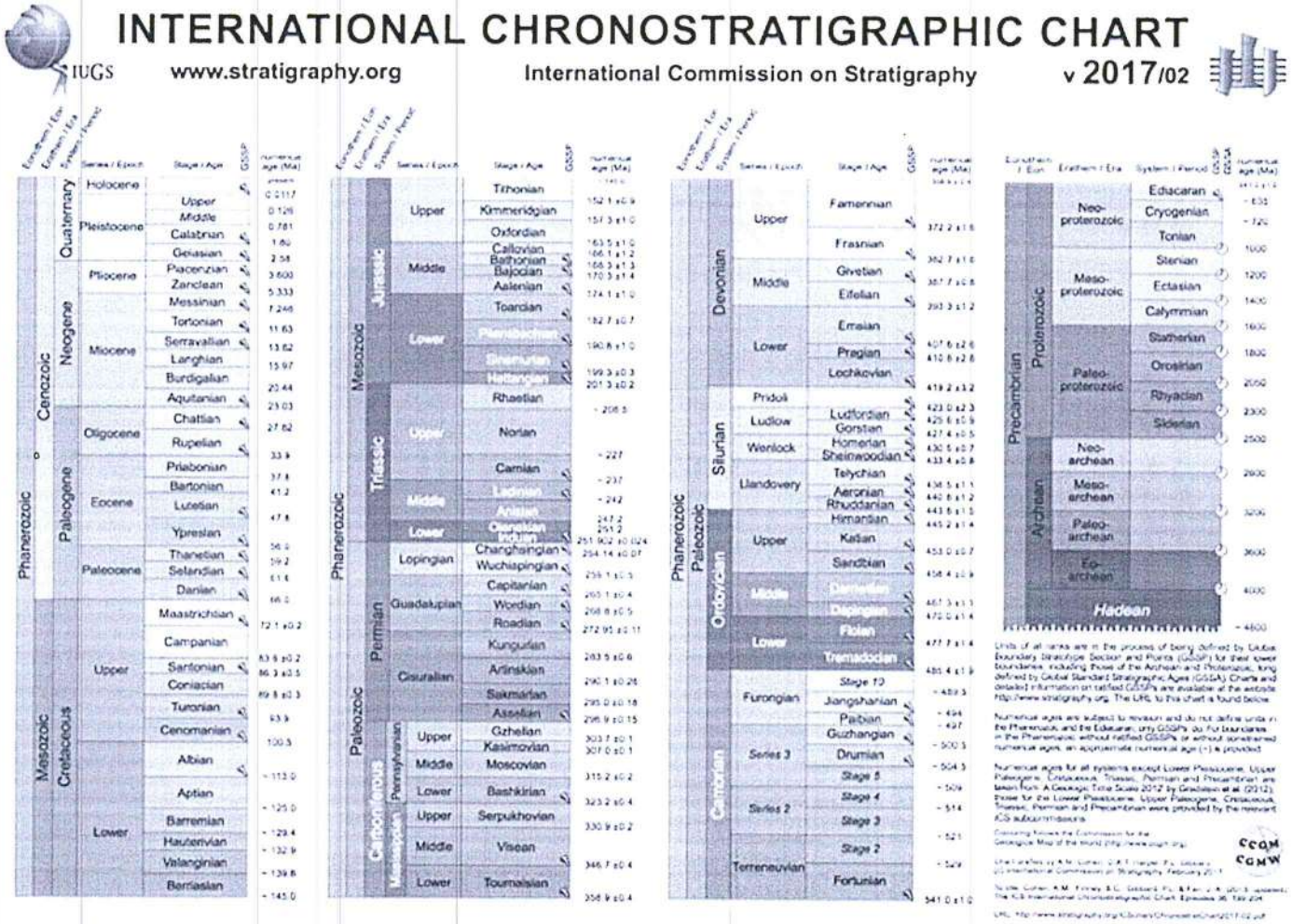
Housing	
Size	25 x 12 x 5 cm
Weight	742 g
Display	4 x 20 characters
Interfaces	Serial interface RS232, isolated with full remote control for all functions

Transmitter	
Output frequency	0.26 Hz ... 30 Hz
Output voltage	max. 380 V p-p
Constant output current	
Stability	> 0,5 %
Short circuit proof	exists

Receiver	
Input impedance	20 MΩ
Max. input voltage	±500 mV
Max. noise voltage	+ DC ±0,6 V
Resolution	100 nV
Accuracy	> 0,5 %
Max. overvoltage	200 V
Measurement speed	
AD-converter	24 Bit
Amplifier	Lock-in-amplifier with in-phase/out-of-phase detection
Transmitter cable	Crosstalk reduction
Very high suppression	at 16,66 Hz, 50 Hz, 60 Hz

Source: Lippmann, (2014)

Appendix 2: Geological Time Scale



Source: Cohen et al., (2013)

FORM 7 (r.15(2))

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

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

License No : NEMA/EIA/ERPL/15991

Application Reference No: NEMA/EIA/EL/20805

M/S **BENARD MATUNDURA ORIKU**
(individual or firm) of address

P.O. Box 632-30202, Moi's Bridge

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Associate Expert**
registration number **11073**

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

Issued Date: **8/24/2021** Expiry Date: **12/31/2021**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

FORM 7 (r.15(2))

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

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

License No : NEMA/EIA/ERPL/13919

Application Reference No: NEMA/EIA/EL/18321

DATE : 12TH OCTOBER 2021

M/S **Andrew Munyua Mwenga**
(individual or firm) of address

P.O. Box 34075-80118 Mombasa

PROJECT : ESIA PROPOSED ASBESTOS DISPOSAL SITE is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **340**

in accordance with the provisions of the Environmental Management and Co-ordination Act Cap 387.

LOCATION : PLOT NO. 3404/KALUMANI MNYENZENI ADJUDICATION SECTION, KILIFI COUNTY

GPS Co-ordinates $4^{0}01'58.45''$ S, $39^{0}38'40.12''$ E Expiry Date: 12/31/2021

Signature.....

PROPONENT: QUALITY INSPECTION SERVICES LIMITED

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001: 2008 Certified