ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY.

GPRS CORDINATES: -4.042100, 39.646377

PROPONENT

ECO CHOICE LIMITED,

P.O.BOX 1805-80100

MOMBASA, KENYA.

SEPTEMBER 2022

CERTIFICATION

Certification by Experts

We hereby certify that this Environmental Impact Assessment Report (EIA) has been done under our supervision and that the content reporting conforms to the requirements of the Environmental

KUSO HUSSEIN	EIA/EA Lead Expert	NEMA Reg. 8904
Benard. M Oriku	EIA/EA Associate Expert	NEMA Reg. 11073

Report Checked by Client/ Client's Representative

Signed for and on behalf of: ECO CHOICE LIMITED

Name: MAURO ZACCARIA.

Signature: _____ Date: 04 JAN 2023

ECO CHOICE LTD P.P.V.T-GYUJ69K

Official Rubberstamp or Seal

Proponent contact details

ECO CHOICE LIMITED,

P.O.BOX 1805-80100

MOMBASA, KENYA.

ACKNOWLEDGEMENTS

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

We acknowledge the proponent, **ECO CHOICE LIMITED**, for the provision of pertinent project documents and resources required by the consultants.

The team acknowledges the neighbors for their participation in the public consultative exercise, which is an integral part of the EIA process.

EXECUTIVE SUMMARY

The proponent, **ECO CHOICE LIMITED** contracted environmental consultants in September 2022 to prepare an EIA Report for the project. The purpose of the EIA is to enable the proponent to comply with Sec. 68 of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya and Regulation 31 of the Environmental Management (Impact Assessment and Audit) Regulations, 2003. In addition, the findings and recommendations will serve as a tool for continuous improvement of environmental performance through a concerted implementation of the Environmental Management Plan (EMP).

ECO CHOICE LIMITED. Limited, is a limited Liability company incorporated in Kenya with a registered office in Mombasa, Kenya and of P.O. Box 1805-80100.

In carrying out the EIA, the consultants used a number of methods which are prescribed by the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. These included, site visit undertaken on the month of September 2022 and photography, observations, interviews with the neighbors and public consultations. The results of the EIA documented both the positive and negative impacts of the proposed project on the environment.

Overview of the Project

The primary objective of the proposed project is to install and operate a hazardous waste treatment facility. The main design components of the project include installation of the THERMAL DESORPTION UNIT(TDU).

ECO CHOICE LTD has developed a closed-loop called Enviloop to treat and dispose hazardous material (medical waste, waste oil/oil filters, sludge) and provides a novel circular economy approach for HAZMAT. Enviloop is a thermal treatment whereby heat increases the volatility of contaminants such that they can be separated and recovered or destroyed. Thermal treatment is the most effective way to get rid of waste by using little resources in the process. The process uses its own by-product (syn-gas or oil) as fuel and is able to treat any carbon-based hazardous material. By separating the contaminants, the Enviloop process removes the hazard and creates useful by-product that have high commercial value on commodity markets such as; syn oil, carbon black, iron, syn gas and aggregate. The proposed TDU will operate on the principle of circular economy where waste is seen as a source of income and focus on zero emission. The technology would reduce the non-recyclable output to zero.

Environmental Impacts and Mitigation Measures

The potential negative environmental impacts of the proposed project and possible mitigation measures are summarized below: -

Potential Negative Environmental Impacts	Mitigation Measures
1. Trapped pressure- spillage overflow due to insufficient containment	• Inspect seals • Ensure sufficient containment measures • Emergency containment under connections should suffice spillage
2. Risk associated with working around high pressure vessels	• All gauges to be tested • Check for trapped pressure at all times • Pressure vessel SOP
3. Pollution and health Hazards • Dust and other construction waste • Noise generation from construction activities.	• Damping down of site e.g. sprinkling water to dusty areas on construction site. • Containment of noisy operation, including locating noise operations away from sensitive neighbours. • Construction work limited to day time only and take shortest time possible.
4. Spillage due to the following: • Vessel failure • Gauge failure	• Visual inspection of vessel integrity • ISO Calibration procedure & preventive maintenance • Preventive maintenance programme (PMP)
5. Worker accidents and health infection. • Fire during welding, grinding, cutting of metals • Electrocution during wiring repairs • Trapped by moving parts during repairs • Foreign object in eyes when grinding, cutting and sanding • Dispersion of contaminants during sand blasting • Asphyxia during tanks maintenance and cleaning	• Work permit mandate lockout tagout procedure, training, and signage • Adequate PPE and isolation screens • Eye washing screens • Work permit mandates a second worker stationed outside vessel • Training & refresher, +ve pressure respirators

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LIST OF ACRONYMS

CGM-County Government of Mombasa

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

HAZMAT- Hazardous Material

LN-Legal Notice.

MOWASCO-Mombasa Water and Sewerage Company

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

SOP-Standard Operating Procedure

TDU- Thermal Desorption Unit

WRA- Water Resource Authority

1 DESCRIPTION OF THE PROJECT

1.1 Introduction

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1.2 Location of the project site

The Proposed project site is situated on plot No. **MOMBASA/BLOCK I/588, SHIMANZI**, Mombasa County at GPRS Coordinates -4.042100, 39.646377. The site is currently unoccupied.

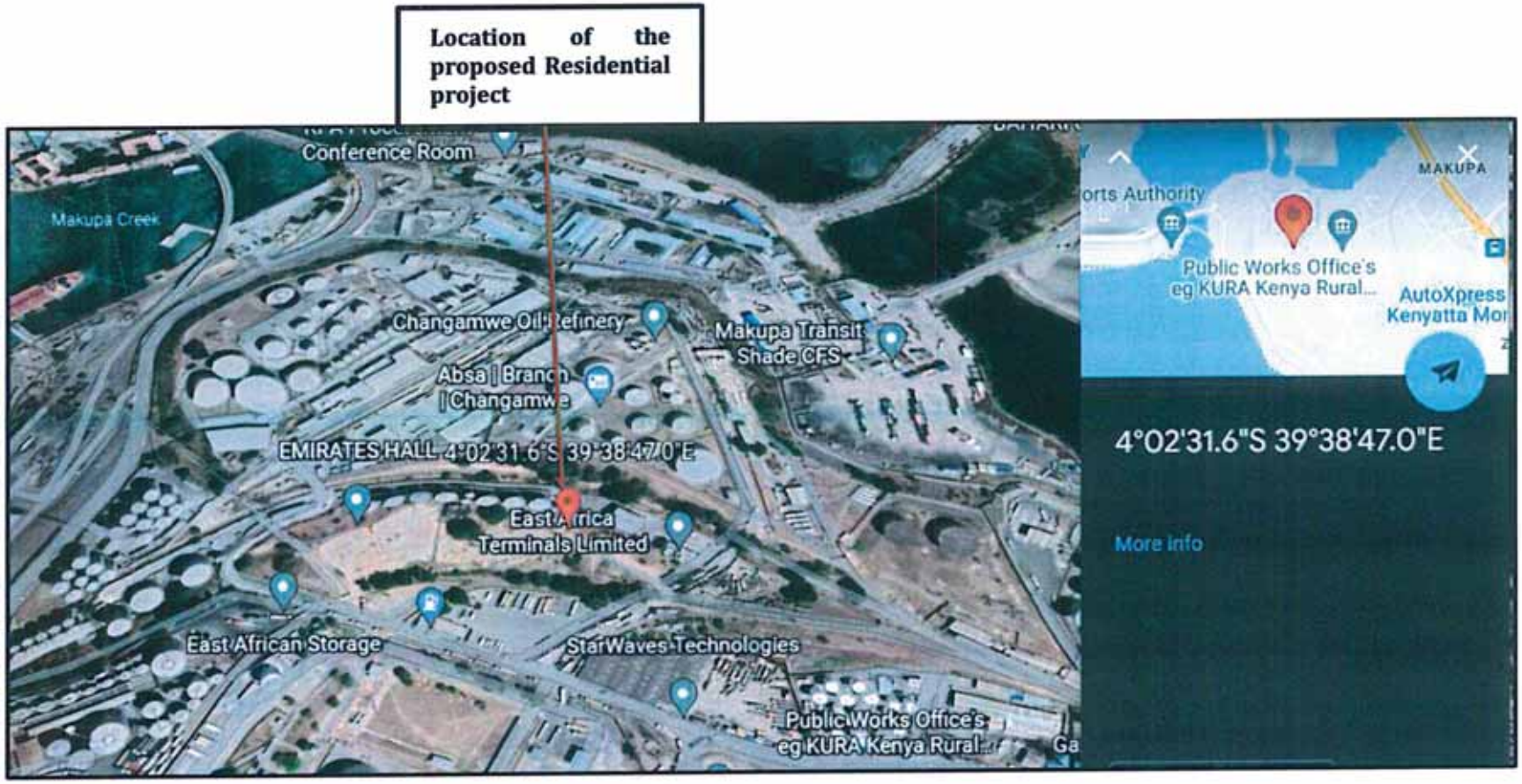

Figure 1: Aerial view of the proposed project (Source: Google Earth, 2022).

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 (TDU).

1.4 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.

1.5 Water Reticulation system

Water from MOWASCO will be used during construction and operation phases.

1.6 Sewerage system

The proponent proposes to install and operate a hazardous waste treatment facility.

1.7 Solid Waste

Once the proponent has been given an approval by NEMA, Solid waste will be managed through the proposed Thermal Desorption Unit whereby the contaminants will be separated and recovered depending on the waste management strategy to be adopted in line with the Environmental Management and Co-ordination (Waste Management) Regulations, 2006.

1.8 Security

Currently the site has control access with one entry point managed by security personnel. The Enviloop process is self-contained and controls are in place to ensure zero emissions. The process is controlled from the control screen located within a control room. The operator is provided with dual screen workstation to monitor and regulate the whole process.

1.9 Fire safety

The development provides for firefighting facilities such as fire extinguishers in the form of hydrants and carbon dioxide gas extinguishers. Fire breaks have also been provided for. In addition, a remote monitoring unit will be installed in such a location designated by the chief officer for the department of environment, waste and energy to enable real-time monitoring of performance and emissions.

1.10 Parking area

The drive way and parking area bill be provided for as there will be an increase in traffic.

1.11 Landscaping

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

1.12 The project designs

The technology used in the design will be based on international standards as illustrated in the attached designs and drawings. The proposed project adopts/ fully integrates continuous feeding thermal desorption system called Enviloop.

Figure 2: Layout of the Thermal Desorption System. (Source: Eco Choice ltd)

The Enviloop uses its own by-product (syn- gas or oil) as fuel and is able to treat any carbon-based hazardous material such as:

Table 1 Carbon based material treated by the proposed TDU

Product	Source
Exhausted oil and sludge	Ships, motor shops, oil pipelines
Tank bottoms	Oil deposits and pipelines
Plastic	Solid municipal waste, medical waste
Drilling cuttings	Oil & gas industry
Soil	Oil pipeline and oil deposits spill
Medical waste	Health care facilities
Ballast fluid	Ships
Oily rags	General industry and motor garages
Tires & industrial rubber	General motor-vehicle and industrial machinery

By separating the contaminants, the process removes the hazard and creates a useful by-product that have high commercial value on the commodity markets.

Table 2: useful products obtained from the hazardous material

Product	Use
Syn oil	• Direct use as fuel for burners • Further processed into diesel • Re used in the Enviloop process
Caerbon black	• Direct sale to commodity market • Make carbon brick as substitute for charcoal • Further processed into high grade carbon
iron	• Direct sale to commodity market
Syn gas	• Re-used in the Enviloop process • Bottled as a household cooking gas
aggregate	• Sandy material used in asphalt or construction

The proposed plant will operate on the principle of circular economy where waste is seen as a source of income and focus on zero emission. The technology will reduce the non-recyclable output to zero.

1.12.1 Three phase development of the proposed project

To accelerate the availability of the facility, the proponent will roll out the activity in three phases that is: phase one, the plant will receive rubber and oily materials, in phase two it will also receive medical waste and in phase three double the capacity for oily materials.

Phase I	Phase II	Phase III
3 x 16t/day Enviloop™ multi-process[1] units, 100% fuel from syndiesel and syngas produced by the unit itself. Uses water from the sewage plant.	*1 x 12t/day high temperature bio-hazards incinerator fueled by the syngas produced with the ETDUs.*	*3 x 16t/day Enviloop™ multi-process[1] units, 100% fuel from syndiesel and syngas produced by the unit itself. Uses water from the sewage plant.* *Power is generated from the incinerator steam and will provide for 50% of the electricity consumption.*
[1] can accept any sort of material: oil sludge, plastic, tires, MSW, medical waste, etc.		

Figure 3: Description of the Enviloop phases (source; Eco Choice)

1.12.2 HAZMAT Tracking

For Efficient waste management, tracking of waste is crucial in the whole process. For this reason, tracking starts on collection through proprietary mobile application that enable all stakeholders to

monitor the material on route to the facility. In case of incident during transport, any bystander could initiate an emergency call that will activate immediate HAZWOP response. Once on site the system automatically adds the material to the facility register for further monitoring. The register includes Safety Data Sheet (SDS) and is linked to SOP

1.12.3 HAZMAT Storage continuous assessment

In case of an increase in the hazardous materials storage capacity, an assessment of the implications to the site of hazardous materials storage volumes in relation to hazardous materials licensing shall be undertaken. Where the project will trigger an exceedance of dangerous goods manifest quantities, direction shall be sought from the hazardous materials compliance officer to determine if a hazardous materials consultant shall be engaged for the project. If the project identifies manifest quantities, the hazardous materials compliance officer must be contacted to determine if the overall risk is acceptable

1.12.4 Secure access arrangements

Imposing access restriction to laboratory and hazardous materials storage spaces will be the primary method of mitigating risk for staff and contractors whose qualifications, induction level and operational requirements preclude them from unrestricted access to the space

1.13 Description of the Project's Decommissioning

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.

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

1.13.1 Dismantling of Equipment and Fixtures

All equipment including electrical installations, furniture partitions, pipe-work and sinks among others will be dismantled and removed from the site on decommissioning of the project. Priority will

be given to reuse of this equipment in other projects. This will be achieved through resale of the equipment to other building owners or contractors or donation of this equipment to schools, churches and charitable institutions.

1.13.2 Site Restoration

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

1.14 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.

1.15 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 development (ground preparations, foundation, walling, roofing, fixtures and fitting among other activities) and installation of key utilities and other facilities required for the project to function optimally.

1.16 Terms of Reference (TOR)

The TORs for this Project Report is the production of an EIA report to address the effects and impacts (Positive and Negative) of the proposed project. The EIA experts are under instructions from the project proponents 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 residential apartments project development.
- To collect and collate baseline information relevant to the proposed project
- 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 (including cost estimates) and a monitoring framework for the environmental impact of the project.

1.17 Methodology

1.17.1 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.

1.17.2 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.

1.17.3 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 Mombasa County were also relied upon.

1.17.4 Site Visits

Field visits were meant for physical inspections of the project site in order to gather information on the state of environment. Several photos of the project site were taken for inclusion in this report.

1.17.5 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 7 copies of this report alongside a CD 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/engineer 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.

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 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. The proposed project will employ the local people hence help in poverty reduction.

2.1.3 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.

2.1.4 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. The proposed project will install a Thermal Desorption Unit (TDU) to manage hazardous waste.

2.2 Legal and Legislative Framework

2.2.1 Environmental Management and Coordination Act No.8 of 1999

This project report has been undertaken in accordance with the Environment (Impact Assessment and Audit) Regulations, 2003, which operationalizes the Environmental Management and Coordination Act, 1999. The report is prepared in conformity with the requirements stipulated in the Environmental Management and Coordination Act No. 8 of 1999 (EMCA) and the Environmental Impact Assessment and audit Regulations 2003, Regulation 7 (1) and the Second Schedule.

Part II of the said act states that every person is entitled to a clean and healthy environment and has the duty to safeguard the same. In order to achieve the goal of a clean environment for all, new projects listed under the second schedule of Section 58 of EMCA No. 8 of 1999 shall undergo an Environmental Impact Assessment. This includes development activities such as this proposed project. In addition to the legal compliance above, the following legal aspects have also been taken into consideration or will be taken into consideration before commencement of construction:

The Environment Management and Coordination Act (EMCA), 1999 provides for the establishment of an umbrella legal and institutional framework under which the environment in general is to be managed. EMCA is implemented by the guiding principle that every person has a right to a clean and healthy environment and can seek redress through the High court if this right has been, is likely to be or is being contravened.

Pursuant to section 25 (4) of EMCA, National Environmental Management Authority (NEMA) is required to restore degraded environmental sites using the National Environmental Restoration Fund. Currently, the restoration fund consists of ***0.1 %*** levied from industries and other project proponents through the EIA process. Section 58 of the Act makes it mandatory for an Environmental Impact Assessment study to be carried out by proponents intending to implement projects specified in the second schedule of the Act which are likely to have a significant impact on the environment. Similarly, section 68 of the same Act requires operators of existing projects or undertakings to carry out environmental audits in order to determine the level of conformance with statements made during the EIA study. The proponent is required to submit the EIA and environmental audit reports to NEMA for review and necessary action.

Section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. According to section 73 of the act, operators of projects which discharge effluent or other pollutants into the aquatic environment are required to submit to NEMA accurate information on the quantity and quality of the effluent. Section 76 provides that all effluent generated from point sources are to be discharged only into the existing sewerage system upon issuance of prescribed permit from the local authorities.

Section 87 (1) makes it an offence for any person to discharge or dispose of any wastes, whether generated within or outside Kenya, in such a manner as to cause pollution to the environment or ill health to any person.

The proponent will have to ensure that environmental protection facilities or measures to prevent pollution and ecological deterioration such as sewerage connections, solid waste management plans, and landscaping and aesthetic improvement programme are implemented and maintained throughout the project cycle. As well the; proponent will have to ensure that appropriate measures to prevent pollution of underground and surface water are implemented throughout the project cycle.

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 engaged environmental experts to conduct an EIA for the proposed project with the aim of obtaining an EIA license.

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 proponent and project Architect as well as engineer are urged to ensure that no pollution to land and water body..

2.2.4 Public Health Act Cap 242

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 Proponent will ensure the project will be sustainable. In addition, the project will be subject to annual Environmental audits and a copy to be submitted to NEMA for review and improvement orders.

2.2.5 Physical planning act, 1999

The said Act section 29 empowers the local Authorities to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section allows for prohibition or control of the use and development of an area. Section 30 state that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local Authority.

The proposed project site is marked as a waste handling and management facility

2.2.6 Land planning act cap 303

Section 9 of the subsidiary legislation (the development and use of land Regulations 1961) under which it requires that before the local authority to submit any plans to then minister for approval, steps should be taken as may be necessary to acquire the owners of any land affected by such plans. Particulars of comments and objections made by the landowners should be submitted, which intends to reduce conflict of interest with other socio-economic activities.

2.2.7 Building code 2000

A person who erects a building or develops land or changes the use of a building or land, or who owns or occupies a building or land shall comply with the requirements of these by- laws. For the purpose of this by- laws and the following operations shall be deemed to be the erection of a building: -

a) The alteration or extension of a building.

b) The changing of the use or uses to which land or building is put.

c) The formation or lying out of an access to a plot.

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local authority for permit to connect to the sewer line and all the wastewater must be discharged in to sewers. The code also prohibits construction of structures or building on sewer lines.

The proponent will utilise the available space in the event of setting up any auxiliary services.

2.2.8 Water Act

The water act No. 8 of 2002 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 Management 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 be required to implement necessary measures to ensure water conservation and also to prevent potential for water contamination during the project life cycle.

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 and sewerage 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. The Act, by virtue of section 176 also empowers the local authority to regulate sewerage and drainage, fix charges for use of sewers and drains and ensure that connecting premises meets the related costs.

The proposed project will operate on the principle of circular economy where waste is seen as a source of income and focus is on zero emission.

2.2.10 The Electricity Power Act, 1997

Section 55 (1) in the execution of works in connection with the construction, modification, maintenance or operation of an electric supply line or apparatus or conductor connected thereto, every licensee shall:

In no way damage the works, conveniences or property belonging to any such other such authority, company or person, nor obstruct or interfere with public traffic, except with the previous consent of the board. Take adequate precautions to protect from danger any person engaged upon such works by the provision and maintenance in safe and efficient conditions of the necessary safety appliances for the use of such persons and by ensuring their proper use, or by other means approved by the board.

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 the atmosphere in any place 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:

- ✓ 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. Moreover, NEMA mandate is designated to the following committees:

2.4.2 Public Complaints Committee.

The Committee is charged with the following functions:

- ✓ Investigating allegations/ complaints against any person or against the Authority (NEMA) in relation to the condition of the environment and its management,
- ✓ Prepare and submit to the Council periodic reports of its activities which shall form part of the annual report on the state of the environment, and to
- ✓ perform such other functions and excise such powers as may be assigned to it by the Council.

2.4.3 National Environment Action Plan Committee.

This Committee is responsible for the development of a 5-year Environment Action plan among other things. The National Environment Action Plan shall contain:

Analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time, and Analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity among other duties as the EMCA specifies.

2.4.4 Standards and Enforcement Review Committee.

This is a technical Committee responsible for environmental standards formulation methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures. Standards and Enforcement Review Committee consists of the members set out in the third schedule to the Environmental Management and Co-ordination Act.

2.4.5 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.

2.4.6 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.

The figure below illustrates the risk identification and mitigation measures as developed by the proponent;

REC-07 Hazard Identification Record

Select a work process, work area or specific activity and identify hazards. Review documentation such as inspection reports, illness/injury reports, Health and Safety Committee minutes, policies and procedures, inventory reports, safe operating procedures, checklists, job descriptions and routines, etc. Walk through the work area and observe the practice and talk to the workers who do the job in the area.

List the potential hazards or incidents that could happen while doing this process or job. A hazard is something with the potential to cause harm or injury. All hazards rated as 'Moderate' and 'Major' scores are considered significant and are prioritized for risk assessment in order to determine appropriate controls.

Likelihood of Occurrence	Severity of Impact				
	Negligible	Minor	Serious	Major	Catastrophic
Remote	1	2	3	4	5
Unlikely	2	4	6	8	10
Likely	3	6	9	12	15
Highly likely	4	8	12	16	20
Almost certain	5	10	15	20	25

Ref	Task/ Work Area	Parties Affected	Potential Hazard Description	Current Controls	Severity	Likelihood	Initial Risk Rating	Proposed Additional Controls	Severity	Likelihood	Final Risk
1	Office Work	Staff & Visitors	Slips, trips, falls	Signage, good illumination, housekeeping	Serious	Likely	Moderate	Training and STOP card policy	Serious	Unlikely	Minor
2	Office Work	Staff	Electric shock	Electrical equipment is tested at least once a year, Training	Serious	Remote	Minor				
3	Office Work	Staff & Visitors	Fire & smoke intoxicatoin	Signage, Fire fighting equipment	Major	Unlikely	Moderate	Fire drills, Muster point, access control	Serious	Remote	Minor
4	Office Work	Staff	Lone working	None	Serious	Likely	Moderate	Lone working Policy, Access control	Serious	Unlikely	Minor
5	Office Work	Staff	Stress	None	Serious	Likely	Moderate	Employee Code of Conduct	Serious	Unlikely	Minor
6	Office Work	Staff & Visitors	Contagious illness spread by sick workers	None	Major	Highly Likely	Major	Access control, hygiene & sanitation policy, Training	Serious	Unlikely	Minor
7	Office Work	Staff	Ergonomic / prolongued bad posture	None	Major	Likely	Moderate	Training, frequent breaks	Minor	Unlikely	Minor
8	Office Work	Staff	Extreme temperature	Proper ventilation	Major	Remote	Moderate	Training, Stop Work Authority	Serious	Remote	Minor
9	Office Work	Staff	Chemical hazards	None	Serious	Likely	Moderate	Move laser printers to ventilated printing room, chemical storage	Negligible	Remote	Minor
10	Office Work	Staff	Manual handling	None	Serious	Likely	Moderate	Training	Minor	Unlikely	Minor
11	Office Work	Staff	Falling office equipment	None	Serious	Likely	Moderate	Secure file cabinets and shelves	Serious	Remote	Minor
12	Office Work	Staff	Poor lighting and eye strain	None	Serious	Likely	Moderate	Adeguate lighting, computer usage training	Minor	Remote	Minor
13	Office Work	Staff & Visitors	Workplace violence	None	Serious	Likely	Moderate	Training on Employee Code of Conduct, Security Staff	Minor	Unlikely	Minor
14	Office Work	Staff	Poor san tation	Ordinary cleaning and fumigation	Serious	Likely	Moderate	Cleaning by trained and certified Staff	Serious	Remote	Minor
15	Communication Collection	Staff	Additional driving time to correct miscomunication	Manual call records trickled down to driver	Serious	Likely	Moderate	IMS including Universal Manifest	Negligible	Remote	Minor
16	Communication Collection	Environment	Unexpected material in case of leakage	Reaction by staff	Serious	Likely	Moderate	IMS including Universal Manifest	Minor	Remote	Minor

Figure 4: Hazard identification and mitigation register (source: Eco Choice ltd)

Ref	Task/ Work Area	Parties Affected	Potential Hazard Description	Current Controls	Severity	Likelihood	Initial Risk Rating	Proposed Additional Controls	Severity	Likelihood	Final Risk
18	Communication: Storage	Environment	Unexpected material in case of leakage, insufficient space	Reaction by staff	Serious	Likely	Moderate	IMS including Universal Manifest	Minor	Unlikely	Minor
19	Communication: Storage	Staff	Undesired material, unavailable process/procedure	Emergency response	Major	Likely	Moderate	IMS including Universal Manifest	Minor	Unlikely	Minor
20	Travel to/from sites	Staff	Entering /exiting vehicle: slip, trip and fall	Do not carry anything when entering or exiting vehicle.	Serious	Likely	Moderate	Maintain three-point contact training	Serious	Unlikely	Minor
21	Travel to/from sites	Staff	Opening / closing doors and tailgate - crush/pinch	Staff awareness	Serious	Highly Likely	Moderate	Hand safety campaign	Minor	Unlikely	Minor
22	Travel to/from sites	Staff	Distracted Driving	Voice-only GPS	Serious	Likely	Moderate	No phone when driving policy. Training	Serious	Unlikely	Minor
23	Travel to/from sites	Staff	Accident / Injury	Wear safety belt, monern built vehicles	Major	Likely	Moderate	Defensive driving training	Serious	Unlikely	Minor
24	Travel to/from sites	Staff	Other Drivers	Driver experience	Major	Likely	Moderate	Defensive driving training	Serious	Remote	Minor
25	Travel to/from sites	Staff	Fatigued driver	Journey management monitoring drivers' previous work hours	Serious	Unlikely	Minor				
26	Travel to/from sites	Staff	Getting lost	Journey management reviews itinerary and alternative routes. GPS assitsed	Negligible	Likely	Minor				
27	Travel to/from sites	Staff	Bad weather	Journey management	Minor	Likely	Minor				
28	Travel to/from sites	Staff & Environment	Fuelling vehicle	Training: no mobile phone. Monitor fuelling for spillage	Minor	Likely	Minor				
29	Travel to/from sites	Others' properties and passerby	Property damage / vehicle accident	Moving vehicle SOP.	Serious	Likely	Moderate	Buddy system for manouvering large vehicles	Serious	Unlikely	Minor
30	Travel to/from sites	Staff	Getting Stuck	Journey management to plan for correct vehicle and road conditions	Minor	Likely	Minor				
31	Travel to/from sites	Passerby	Pedestrians	implement and observer pedestrian crossing and pathways.	Major	Unlikely	Moderate	Buddy system for manouvering large vehicles	Serious	Unlikely	Minor
32	Travel to/from sites	Environment	HAZMAT Spillage	Emergency response based on Universal Manifest data	Serious	Likely	Moderate	ISO Tanks and mud skips	Minor	Unlikely	Minor
33	HAZMAT Collection/Response	Third party Staff and property	Ste traffic	Driver experience	Major	Highly Likely	Major	Predetermine site trucking rules. GOAL procedures and spotter	Serious	Unlikely	Minor
34	HAZMAT Collection/Response	Staff	Exertion	Staff experience, work schedule schedule, hot environment policy	Serious	Likely	Moderate	Work permit and Stop work authority	Minor	Unlikely	Minor
35	HAZMAT Collection/Response	Staff	Insects and animal bites	Staff medical profile, insect infested work procedure	Serious	Unlikely	Minor				
36	HAZMAT Collection/Response	Staff	Loading / unloading: Overhead loads	Pull/Push extensions, qualified spotter and Material handling SOP	Serious	Unlikely	Minor				
37	HAZMAT Collection/Response	Staff	Noise	Hearing protection. Training	Minor	Unlikely	Minor				
38	HAZMAT Collection/Response	Staff	Slip/Trip/Fall	Site preparation, adequate footware, housekeeping, training	Serious	Likely	Moderate	STOP Card, Work Permit, Stop Work Authority	Serious	Unlikely	Minor
39	HAZMAT Collection/Response	Staff	Weather (Heat/Sunburn/Dehydration)	PLenty of water, UV protection, headgear,plan work hours	Serious	Unlikely	Minor				

Figure 5: Continuation of Hazard identification and mitigation register (source: Eco Choice ltd)

Ref	Task/ Work Area	Parties Affected	Potential Hazard Description	Current Controls	Severity	Likelihood	Initial Risk Rating	Proposed Additional Controls	Severity after control	Likelihood after control	Final Risk
40	HAZMAT Collection/Response	Staff	Weather (Thunderstorm/lightining)	Stop operation iflightening/thunder are less than 20 seconds apart	Major	Unlikely	Moderate	STOP Card, Work Permit, Stop Work Authority	Serious	Unlikely	Minor
41	HAZMAT Collection/Response	Staff	Wildlife	Maintain distance	Serious	Unlikely	Minor				
42	HAZMAT Collection/Response	Staff	Work around heavy equipment	Reflective vest, eye contact, only necessary personnel	Major	Unlikely	Moderate	Training, Work Permit	Serious	Unlikely	Minor
43	HAZMAT Collection/Response	Staff	Work near water	Maintain minimum 1.5m distance, erect barricades. Float plan	Major	Unlikely	Moderate	Work permit and Stop work authority	Serious	Unlikely	Minor
44	HAZMAT Collection/Response	Staff & Environment	Connect/disconnect - Trapped pressure - spillage	Never force a connection, inspect seals, ensure sufficient containement	Major	Highly Likely	Major	Pressure Vessel SOP	Serious	Unlikely	Minor
45	HAZMAT Collection/Response	Staff & Environment	Work around high pressure vessels - Ovepressure	All gauges are tested. Check for trapped pressure at all times	Catastrophic	Likely	Major	Pressure Vessel SOP	Serious	Unlikely	Minor
46	HAZMAT Storage	Staff & Environment	Sudden release of pressure during d sconnection	All gauges are tested. Check for trapped pressure.	Major	Likely	Moderate	Pressure Vessel SOP	Serious	Unlikely	Minor
47	HAZMAT Storage	Environment	Spillage overflow due to insufficient containement	Emergency containement under connections should suffice spillage	Serious	Unlikely	Minor				
48	HAZMAT Storage	Environment	Spillage due to Vessel failure	Visual inspection of vessel integrity	Major	Likely	Moderate	Preventive Maintainance Program (PMP)	Serious	Unlikely	Minor
49	HAZMAT Storage	Environment	Spillage due to Gauge failure	ISO calibration procedure and preventive maintenance	Serious	Unlikely	Minor				
50	Maintainance and Repair	Staff	Asfixia during tanks maitainance and cleaning	Work permit mandates a second worker stationed outside vessel	Major	Remote	Moderate	Training and refresher, +ve pressure respirators (Planning for ROV)	Minor	Unlikely	Minor
51	Maintainance and Repair	Staff	Fire during welding, grinding, cutting of metals	Work permit with mandate fire spotter. Adeguate PPE, Signage	Serious	Unlikely	Minor				
52	Maintainance and Repair	Staff	Electricution during wiring repairs	Work Permit mandates lockout tagout procedure. Training, Signage	Serious	Unlikely	Minor				
53	Maintainance and Repair	Staff	Trapped by moving parts during repairs	Work Permit mandates lockout tagout procedure. Training, Signage	Serious	Unlikely	Minor				
54	Maintainance and Repair	Staff	Foreign object in eyes when grinding, cutting, sanding	Work permit mandates adeguate PPE	Serious	Likely	Moderate	Eye washing stations	Minor	Likely	Minor
55	Maintainance and Repair	Staff & Environment	Dispersion of cntaminants during sand blasting	Work permit mandates adeguate PPE and isolation screens	Minor	Unlikely	Minor				
56											
57											

Figure 6: Continuation of Hazard identification and mitigation register (source: Eco Choice ltd)

2.4.7 Trade Licensing Act (Cap 497)

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

2.4.8 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.

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 Shimanzi, Mombasa County. The County is situated in the south eastern part of the former Coast Province. It borders Kilifi County to the north, Kwale County to the south west and the Indian Ocean to the east. Administratively, the county is divided into seven divisions, eighteen locations and thirty sub-locations. It is the smallest county in Kenya, covering an area of 229.7 km² excluding 65 km² of water mass

3.3 Climate

The project site is located in Shimanzi area which lies in a coastal zone characterized by a tropical and monsoon climate that characterizes the Kenyan coastline with temperatures high throughout the year. The warmest temperatures are generally recorded during the months of November to April (mean daily temperature of 27°C) while slightly cooler temperatures are experienced from May to October (mean daily temperature of 24.5°C). The rainfall pattern is bimodal with rainfall averaging at between 900-1300mm annually. The long rains fall between March and July while the short rains are experienced between November and December.

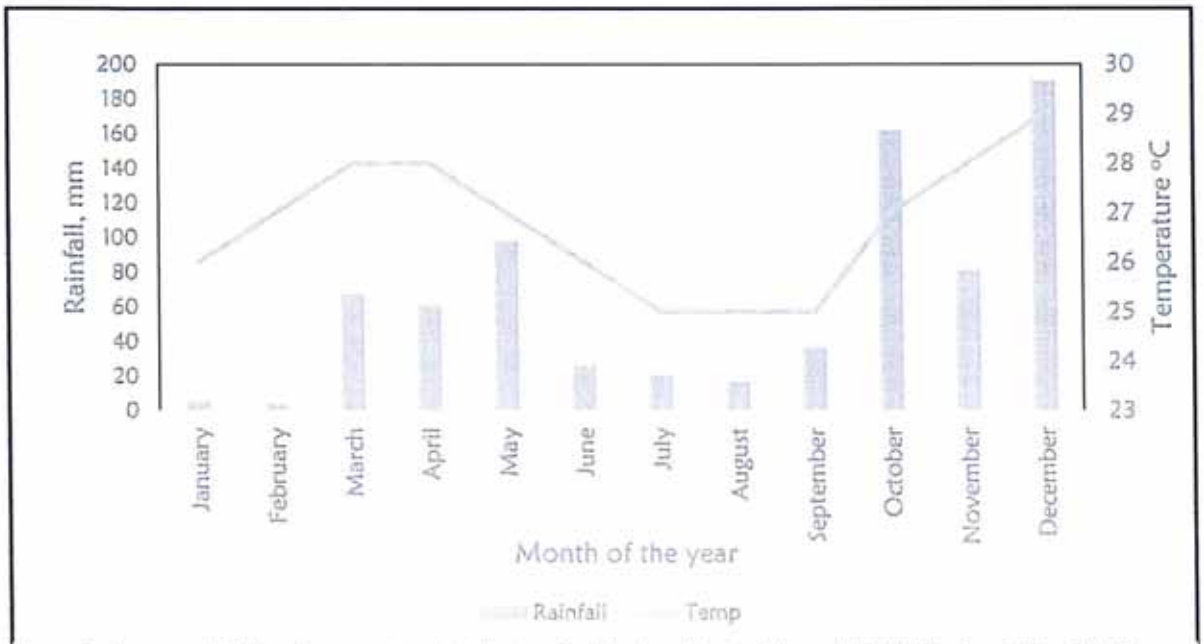

Figure 7: Average rainfall and temperature distribution for Mombasa County (Source: World Weather Online, 2022).

3.4 Population

The population of Mombasa especially in its urban centers has been on the rising mainly due to rural urban migration, tourism and the influx of foreigners. The Coastal population in Kenya is culturally heterogeneous. The largest indigenous ethnic group being the Mijikenda which is comprised of nine sub-tribes namely: Giriama, Digo, Rabai, Duruma, Kauma, Chonyi, Kambe, Ribe, and Jibana.

3.5 Land use patterns and Economic activities

Land use patterns mainly features commercial and industrial developments. Other socio- economic activities include small scale vending activities.

3.6 Infrastructure and social amenities

3.6.1 Energy

The main source of energy supply in Shimanzi is electricity from the Kenya Power Company (KPC). However, the proposed project will use its own by-product (syn-gas or oil) as fuel.

3.6.2 Roads

Mombasa 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 shimanzi road.

3.6.3 Information and communication technology

Mombasa 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

Reticulated water supply in Mombasa is supplied by the Mombasa Water Supply and Sanitation Company Limited (MOWASCO). Drinking water for the employees will be purchased from various local water vendors.

3.7.2 Effluent management

The proposed project seeks to treat hazardous waste.

3.7.3 Solid waste management

The main sources of solid waste in Mombasa 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. The proposed project seeks to treat any carbon-based hazardous material.

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 and ***the proponent has received an award letter from Mombasa County Government (Tender No. CGM/PRO/T/008/2021-2022) to proceed with the proposal.***

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.

5 POTENTIAL ENVIRONMENTAL IMPACTS

5.1 Introduction

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

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

5.2 Anticipated Environmental Impacts

During the field survey and preparation of this EIA report, key impacts both positive and negative relating to the proposed project was identified. They were obtained by making physical observations at the project site as well as existing land use in the neighbourhood and literature review of similar projects.

5.3 Positive Environmental Impacts of Construction Activities

5.3.1 Treatment of Hazardous waste

The proposed project will be able to treat any carbon-based hazardous material such as; exhausted oil and sludge, plastic, drilling cuttings, soil, medical waste, ballast fluid, oily rags, tire and industrial rubber.

5.3.2 Creation of Employment Opportunities

Several employment opportunities will be created for construction workers during the construction phase of the project. This will be a significant impact since unemployment is currently quite high in the country at large.

5.3.3 Provision of Market for Supply of Building Materials

The project will require supply of large quantities of building materials most, of which will be sourced locally. This provides ready market for building material suppliers such as hardware shops and individuals with such materials.

5.3.4 Increased Business Opportunities

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

removes the hazard and creates useful by product that have high commercial value on the commodity markets. Some of the products to be obtained are; syn oil, syn gas, carbon black, iron and aggregate.

5.3.5 Individual Investment

Economically, the project will be an investment to the proponent. The proposed project once complete can also be used as a collateral asset.

5.3.6 Improved sanitation

The proposed project will treat hazardous waste.

5.3.7 Revenue to Government.

Value Added Tax (VAT) on construction materials/ tools to be purchased/ imported and NEMA fees among others will be sources of revenue for the government and its institutions.

5.3.8 Enhanced Security.

During the operation of the project, security will be enhanced through distribution of suitable security lights and presence of a security guard. This will lead to improvement in the general security in the surrounding area. In addition, there will be an access control around the TDU system as employees with different rank levels will be allowed to access specific parts of the system.

5.3.9 Improved Infrastructure.

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

5.4 Negative Environmental Impacts of Construction Activities

5.4.1 Incidents and accidents during the installation of the TDU system

Accidents are likely to occur during the installation of the TDU, hence strict adherence to the health and safety measures as outlined in this report and risk assessment register.

5.4.2 Dust Emissions

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

5.4.3 Exhaust Emissions.

The trucks used to transport various building materials from their sources to the project site contribute to increases in emissions of CO2, NO2 and fine particulate along the way as a result of diesel combustion. Such emissions can lead to several environmental impacts including global warming and health impacts. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent gunning of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

5.4.4 Traffic flow during construction

There is a likelihood of increase in traffic on road adjacent to the site during construction. Frequent vehicle turning and slow vehicle movement in the loading and offloading areas such trucks may slow down traffic flow.

5.4.5 Noise and Vibration

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

Elevated noise levels within the site can affect project workers and the residents, passers-by and other persons in within the vicinity of the project site.

5.4.6 Risks of Accidents and Injuries to Workers

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

5.4.6 Solid Waste Generation

Solid waste will be generated at the site during construction of the project and related infrastructure. Such waste will consist of metal cuttings, rejected materials, surplus materials, surplus oil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. Such solid waste materials can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on human and animal health. This may be emphasized by the fact that some of the waste materials contain hazardous substances such as paints, cement, adhesives and cleaning solvents, while some of the

waste materials including metal cuttings and plastic containers are not biodegradable and can have long-term and cumulative effects on the environment.

5.4.7 Energy Consumption

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

5.4.8 Water Use

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

5.5 Positive Environmental Impacts of Operational Activities

5.5.1 Provision of hazardous waste treatment facility

The project will provide a system that will treat and dispose hazardous material will is less harmful to the environment as it provides a circular economy approach for HAZMAT.

5.5.2 Employment Opportunities

Some people will be employed by the project as professional staff, management agents, cleaners, security personnel and technicians.

5.5.3 Revenue to National and Local Governments

Through payment of relevant taxes, rates and fees to the government and the local authority, the proposed project will contribute towards the national and local revenue earnings.

5.5.4 Improved Security

Security will be ensured around the project site through distribution of suitable security lights and presence of 24-hour security guards. This will lead to improvement in the general security in the surrounding area.

5.6 Negative Environmental Impacts of Operational Activities

5.6.1 Incidents and accidents

Incidents and accidents are highly expected to occur during the operation of the project. These may include; slips, trips, falls, fire, falling objects, chemical hazards, extreme temperature, poor lighting eye straining, leakage, property damage, HAZMAT spillage, insects and animal bites among others.

5.7 Negative Environmental Impacts of Decommissioning Activities

5.7.1 Solid Waste

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

5.7.2 Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas.

5.8 Positive Environmental Impacts of Decommissioning Activities

5.8.1 Rehabilitation

Upon decommissioning the project, rehabilitation of the project site will be carried out to restore the site to acceptable status. This will include replacement of topsoil and re-vegetation that will lead to improved visual quality of the area.

5.8.2 Employment Opportunities

Several employment opportunities will be created for demolition and construction staff.

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, operation and decommissioning phases. Allocation of responsibilities, time frame and estimated costs for implementation of these measures are presented in the environmental management programme (EMP).

6.2 Mitigation of Construction Phase Impacts

6.2.1 Efficient sourcing and Use of Raw Materials

To reduce the negative impacts on availability and sustainability of the materials, the proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss (through run-off, wind, etc.) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction or purchase materials.

In addition to the above measures, the proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

6.2.2 Minimization of Run-off

The proponent will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site. These measures will include terracing and levelling the project site to reduce run-off velocity and increase infiltration of rainwater into the soil. In addition, construction vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off.

6.2.3 Minimization of Construction Waste

It is recommended that demolition and construction waste be recycled or reused to ensure that materials that would otherwise be disposed of as waste are diverted for productive uses. In this regard, the proponent is committed to ensuring that construction materials left over at the end of construction will be used in other projects rather than being disposed of. In addition, damaged or wasted construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects. Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, local

community groups, institutions and individual residents or homeowners. The proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal. It is further recommended that the proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste. Additional recommendations for minimization of solid waste during construction of the project include: -

- ✓ Use of durable, long- lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time
- ✓ Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements
- ✓ Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials
- ✓ Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste
- ✓ Use of construction materials containing recycled content when possible and in accordance with accepted standards.

6.2.4 Reduction of Dust Generation and Emission

Dust emission during construction will be minimized through strict enforcement of onsite speed controls as well as limiting unnecessary traffic within the project site. In addition, it is recommended that excavation works be carried out in wet weather; and traffic routes on site be sprinkled with water regularly to reduce amount of dust generated by the construction trucks.

6.2.5 Minimization of impacts on traffic flow

The proponent will put in place measures to address such concerns by ensuring that construction vehicles preferably deliver materials during off-peak hours when traffic volume is low. There will also be provision for caution signs on the access road to alert users on construction activities in progress in order to prevent occurrence of accidents. This will be achieved through proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road. In addition, truck drivers will be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines at these points.

6.2.6 Minimization of Noise and Vibration

Noise and vibration will be minimized in the project site and surrounding areas through sensitization of construction truck drivers to switch off vehicle engines while offloading materials. In addition, they will be instructed to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, schools and hospitals. In addition, construction machinery shall be kept in good condition to reduce noise generation. It is recommended that all generators and heavy-duty equipment be insulated or placed in enclosures to minimize ambient noise levels.

6.2.7 Health and safety of Workers on site

The proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act (Cap 514). In this regard, the proponent is committed to provision of appropriate personal protective equipment such as gloves; helmets, overall as well as ensuring a safe and healthy environment for construction workers by providing sanitary facilities (toilets) and portable water while food will be bought by workers from the nearby hotels.

6.2.8 Reduction of Energy Consumption

The proponent shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used.

In addition, proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during construction and set targets for reduction of energy use.

6.2.9 Minimization of Water Use

The proponent shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water usage.

6.3 Mitigation of Operation Phase Impacts

6.3.1 Ensuring Efficient Solid Waste Management

The proponent will be responsible for efficient management of solid waste generated by the project during its operation. In this regard, the proponent will provide waste handling facilities such as waste bins for temporarily holding domestic waste generated at the site. In addition, the proponent will ensure that such disposed of regularly and appropriately.

6.3.2 Ensure Efficient Energy Consumption

The proponent plans to install an energy-efficient lighting system for the project. This will contribute immensely to energy saving during the operational phase of the project. In addition, employees will be sensitized to ensure energy efficiency in their operations. To complement these measures, it will be important to monitor energy use and set targets for efficient energy use.

6.3.3 Ensure Efficient Water Use

The proponent will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. In addition, the occupants of the apartments will be sensitized to use water efficiently.

7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 Introduction

Integrating environmental issues in business management, such as those related to the proposed project is that it increases efficiency while enhancing the project proponent financial and environmental management. These issues, which are normally of financial concern, are: costs, product quality, investments, level of productivity and planning.

Environmental planning and management as a concept seek to improve and protect environmental quality for both the project site and the neighbourhood through segregation of activities that are environmentally incompatible. Environmental planning and management integrate land use structure, social systems, regulatory law, environmental awareness and ethics.

Environmental management plan (EMP) for development projects such as the proposed project 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 residential development.

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 Implementation Phase

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
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	▪ Hoarding	Contractor	Part of/Covered in the Project Cost	Presence of Perimeter Fence
Housing for Construction / Site staff	▪ Construction of a Camp	Contractor	200,000	Presence of a Camp
Security for Construction Material	▪ Construction of Site Stores ▪ Construction materials to be delivered in small quantities to minimize storage problems	Contractor	100,000	Presence of Site store
Extraction and Use of Building Materials	▪ Availability and sustainability of the extraction sites as they are non-renewable in the short term ▪ Landscape changes e.g. displacement of animals and vegetation, poor visual quality and opening of depressions on the surface	Contractor/Proponent/project team	Part of/Covered in the Project Cost	Material site rehabilitation

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
Collapse of Building during Construction	▪ Ensuring Building Strength and stability ▪ Use of appropriate construction materials and reinforcements as per specifications ▪ Ensuring building components are as per designs ▪ Proper supervision ▪ Ensure proper timelines are followed e.g. curing time	Contractor/project team	Covered in the project coast-BoQ	Presence of the project Team
Disturbance of Traffic flow during construction	▪ Proper signage ▪ Awareness creation ▪ Education to truck drivers	Contractor/Project team and general public	100,000	Presence of site Noticeboard /Hoarding. Presence of Security guards to control traffic Presence of warning signs and education materials

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
CONSTRUCTION PHASE				
Soil Erosion	• Create and Maintain soil traps and embankments. • Landscaping after completion of construction	Contractor/Proponent Architect/Site engineer Landscape Architect	400,000	Lack/Absence of Soil Erosion
Soil Excavation leading to site disturbance	• Excavate only areas to be affected by buildings • Dumping of excess excavated materials to sites designated by NEMA • Restoration of sites Excavated	Contractor	200,000	Landscaping after completion of construction
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 e.g.	Proponent and Contractor	Part of Routine operation procedure	Lack of complaints

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
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 • Ensuring SOP during the installation of the TDU • 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 SOP during installation of the TDU • 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
Solid Waste Generation	• Ensure waste materials are disposed of NEMA approved sites • Use of the 3rs – Reduce, Re-use, Re-cycle	Proponent Contractor	200,000 annually	Absence of Solid waste on the site

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
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	250,000 annually	Presence of MOWASCO water lines Metering of water
OPERATIONAL PHASE				
Solid Waste Generation and Management	Regular inspection and maintenance of the waste disposal systems during operation phase Establish a collective waste disposal and management system Provide waste disposal bins to each house well protected from adverse weather and animals. Treatment of the waste generated through the TDU	Proponent	Covered in the project coast-BoQ	Presence of waste handling bins Absence of wastes

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
Liquid Waste Generation and Management	• Regular inspection and maintenance of the waste disposal systems during the operation phase	Proponent	Covered in the project coast-BoQ	Conventional sewer line and or septic tank Presence of waste handling bins Absence of wastes
Traffic	Provide adequate parking facilities within the project site	Contractor/Proponent	Routine operation procedure	Presence of amble parking in the premises
Increased social conflict	• Increased economic activities • Employment generation, income earnings	Contractor Proponent		

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
Storm Water impacts	• Provide roof gutters to collect and direct roof water to drains • Construct drains to standard specifications • Develop a storm water drainage system and linkage to natural drains	Proponent Contractor	300,000	Absence of Flooding and dampness in the building
Disruption of existing natural environment and modification of micro-climate	• Development restricted to follow zoning policy/approved density – building line, plot coverage and plot ratio. • Careful layout and orientation of buildings to respect wind and sun direction. • Adequate provision of green and open space planted with grass, shrub and tree cover. • Minimum use of reflective building material and finishes for roof, wall and pavement.	Project team (Contractor Proponent, Architect/Lead Consultant	500,000	Proper orientation Planted trees/Landscaping
Insecurity	• Ensure secure perimeter wall where applicable • Have a single entry point that is manned 24 hours	Contractor, Proponent	200,000	Presence of perimeter wall

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
DECOMMISIONING PHASE				
Building Safety	• Assess the condition of buildings to ascertain usefulness	Engineer/Proponent	600,000	Engineer and Tests on the building
Land and Building use	• Ascertain the Planning development policy	Local Authority Physical Planner	650,000	Consultants present
Accidents/Injuries	• Securing the Site by fencing off	Contractor/Proponent	500,000	Presence of perimeter fence
Un-disconnected Services e.g. TDUs, Power, Water, telephone, sewer etc	• Ensure disconnection of all services • Remove all surface and underground cables and wiring	Contractor	800,000	Absence of cabling
Solid Waste Generation (demolition waste)	• Ensure waste materials are disposed of on Council 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	200,000	Absence of Debris

ENVIRONMENTAL IMPACT	MITIGATION MEASURES	RESPONSIBILITY	COST (KES)	INDICATORS OF SUCCESS
Noise and Vibration	• Ensure use of serviced equipment • Switch off engines not in use • Demolition work to be confined to between 8am to 5pm • Ensure use of earmuffs by workers	Proponent/Contractor	80,000	Lack of complaints from the neighbours

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 proposed 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.

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 vapours 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

8.8 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 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;

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

The table below shows the proposed decommissioning plan:

Table 4: Decommissioning plan

Expected Negative Impacts	Recommended Measures	Responsible Party	Time Frame	Cost (KShs)
1. Construction Machinery/Structure & Wastes				
Scraps material and other debris	Use of an integrated solid waste management system i.e. through a hierarchy of options. Wastes generated as a result of facility decommissioning activities will be characterized in compliance with standard waste management procedures. The contractor will select disposal locations and the local council based on the properties of the particular waste generated.	Project Manager & Contractor	During decommissioning	3,000,000
	All buildings, machinery, equipment, structures and partitions that will not be used for other purposes should be removed and reused or rather sold/given to scrap material dealers.	Project Manager & Contractor	During decommissioning	-
	Where recycling/reuse of the machinery, equipment, structures and other waste materials is not possible the materials should be taken to approved dumpsites.	Project Manager & Contractor	During decommissioning	-
Rehabilitation of project site				
Vegetation disturbance Land deformation: soil erosion, drainage problems	-Implement an appropriate re-vegetation programme to restore the site to its original status. -During the vegetation period, appropriate surface water runoff controls will be taken to prevent surface erosion; -Monitoring and inspection of the area for indications of erosion will be conducted and appropriate measures taken to correct any occurrences; -Fencing and signs restricting access will be posted to minimize disturbance to newly vegetated areas;	Project Manager & Contractor	During decommissioning	2,000,000

Social- Economic impacts				
Loss of income	The safety of the workers should surpass all other objectives in the decommissioning project. -Adapt a project – completion policy; identifying key issues to be considered. -Compensate and suitably recommend the workers to help in seeking opportunities elsewhere.	Project Manager & Contractor	During decommissioning	3,000,000

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 and 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.

During the preparation of this report for the proposed project it is observed and established that most of the negative impacts on the environment are rated low and short term with no significant effect. The positive impacts are highly rated and will benefit all stakeholders and the Mombasa residents at large. The project proponents have proposed to adhere to prudent implementation of the environmental management plan. They are obtaining all necessary permits and licenses from the relevant authorities and have qualified and adequate personnel to do the project as proposed. They have proposed adequate safety and health mitigation measures as part of the relevant statutory requirements

10.2 Recommendations

This study is recommendable and should be approved by NEMA for issuance of an EIA license subject to annual environmental audits after it has been completed and running. This will be in compliance with the Environmental Management and Coordination Act of 1999 and the Environmental Impact Assessment and Audit regulations, 2003. Above all the proponent should carry out Environmental Audit 12 months after the project is completed.

The proponent should therefore be licensed to implement this project subject to adherence to the environmental management plan proposed in this report and the statutory requirements.

11 REFERENCES

1. Documents provided by ECO CHOICE LIMITED
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. Letter from the office of the director public health approving ECO CHOICE LTD to manage health care waste.
3. ECO CHOICE LTD ISO certification for provision of hazardous material treatment and disposal services to both private and government customers.
4. Single business permit
5. Certificate of workplace registration- HAZMART Management & treatment
6. KRA PIN for ECO CHOICE LTD
7. Land ownership document.
8. Drawing plans
9. certificate of incorporation for ECO CHOICE ltd
10. Copies of practicing Licenses for EIA Experts

nema

Payment Receipt

Invoice Number
Invoice Status

Applicant Details:
PIN
Name
Phone
Email

Service	Description		Amount (KES)
Project Submission report	Payment for Project Submission report		110,000
Convenience Fee	Eclizen Convenience Fee		50.00
		Total Amount Paid	110,050
		Balance	0

eCitizen

Payment Mode

QUESTIONNAIRE FOR PUBLIC PARTICIPATION IN ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIA) FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU) ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY.

The Proponent, ECO CHOICE LIMITED of P.O.BOX 1805-80100 MOMBASA, KENYA intends to install & operate a Thermal Desorption Unit (TDU)- hazardous waste treatment facility within your neighbourhood and has commissioned an Environmental Impact Assessment (EIA) for the proposed Project.

This questionnaire survey is part of public consultation requirement of EMCA Act of 1999 (and amendment act of 2015) & Environmental (Impact Assessment and Audit) regulations of 2003(Revised 2016). As stakeholders we are seeking your views, comments and concerns that you would like addressed in the EIA process for sustainable development.

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Name: Faith Karungu **P.O. Box** ………… **Tel. No:** 0717499210

ID No. 39442117 **Signature** Faith **Date** 25/010/022

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/worked 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
   Proper waste disposal will be put in place.
   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 ……
   No objection on the project

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

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Name: Jamesn Nonso **P.O. Box** .... **Tel. No:** 0795526411

ID No. 32152426 **Signature**............ **Date** 25/12/2022

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/worked 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 for the locals

   ii. Negative impacts
   Dust

6. In your opinion what measures need to be put in place to address the negative impacts (if any?) Use dust nets and fence the project
7. Provide any additional comment regarding the proposed Project
   Proceed

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

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Name: Maria Taby **P.O. Box** .... **Tel. No:** 0790102791

ID No. 29774229 **Signature** (signed) **Date** 25/5/2022

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/worked 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 to the engineers around the area

   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 ....

   Should draw Man Power from the neighbours and not import labour!

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

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Name: PETER PJIWA P.O. Box ..... Tel. No: 0751319090

ID No. 9629117 Signature ..... Date 25/10/2022

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/worked 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

   Waste will be recycled and risk minimised

   ii. Negative impacts

   .....

   .....

6. In your opinion what measures need to be put in place to address the negative impacts (if any?)..... Owe the land is ready we need the neighbours around to be given preference in term of contracts & employment.
7. Provide any additional comment regarding the proposed Project .....

Thank you

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Name: Phileron Reuben P.O. Box ..... Tel. No: 0700536530

ID No. 37574499 Signature ..... Date 25/10/20

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/worked 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
   Wastes will be easily handled and cycle through the project.
   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 It is a good project since hazardous waste is easily managed and controlled

Thank you

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

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/worked 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

   .....

   .....

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 .....

   .....

Thank you

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Name: KIPTOO IAN **P.O. Box** 5677 **Tel. No:** 0757564449

ID No. 36050843 **Signature** [signature] **Date** 25/10/22

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/worked 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 more jobs for those in the field of work
   ii. Negative impacts
   None
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 Viable Project.

Thank you

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Name: Jeremy Mutenfu **P.O. Box** .... **Tel. No:** 0729521046

ID No. 30612197 **Signature** [signature] **Date** 25/10/2022

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/worked 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
   Proper hazardous waste disposal

   ii. Negative impacts
   Dust During construction

6. In your opinion what measures need to be put in place to address the negative impacts (if any?) Minimise dust by use of dust water
7. Provide any additional comment regarding the proposed Project Its a good Project and should be allowed to Proceed.

Thank you

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Name: Lilian Nungwi P.O. Box ..... Tel. No: 0719714921

ID No. 27254176 Signature ..... Date 21/8/2022

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/worked 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
   Good project will see proper waste disposed
   ii. Negative impacts
   None
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
   No objection

Thank you

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MINUTES OF THE MEETING HELD WITH SHIMANZI AREA RESIDENTS/ BUSINESS COMMUNITY AT SHIMANZI ON 23RD FEBRUARY 2023 AS FROM 10:00 A.M

ATTACHED WITH ATTENDANCE SHEET

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 Chief who welcomed all members to the meeting including the area DCC, Member of County assembly and other government stakeholders present. The meeting officially started by a word of prayer. the chief welcomed the environmentalist to educate the public concerning the proposed project. the environmentalist indicated that from the ongoing analysis, the social and economic rating for this project is highly positive. The environmentalist informed the 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 boost the efforts by the county government of Mombasa in hazardous waste treatment. 4. The positive impacts are highly rated and will benefit all stakeholders and the Mombasa residents at large.	Chief, DCC, Environmentalist
1.2	**Community concerns emanating from the project** The community 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. • **Air pollution from fugitive dust** as a result of excavation and vehicular movement. The proponent was tasked to ensure	Proponent/ Contractor/ Environmentalist

ATTACHED WITH ATTENDANCE SHEET

	suppression of dust and that air quality conforms the required specifications. • **Risk of accidents as a result of increased traffic**. It was agreed that, use of a flagman to assist in traffic and slow down the vehicles • **Increased social conflicts** the proponent was advised by the area MCA and DCC to consider the local community wen hiring people. The DCC added that community members should form a committee that will look into the social wellbeing of their residents. • **Insecurity/ access control**. The proponent was tasked to ensure installation of Security light and CCTV Cameras as well as employ security guards as a security measure • 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 2:45 pm	Environmentalist

Minutes Prepared by:

Environmentalist: Benard Oriku **Sign:** ..... **Date** 03/03/2023

Minutes confirmed by:

SHIMANZI AREA CHIEF: **Sign:** ..... **Date** .....

ATTACHED WITH ATTENDANCE SHEET

eco choice

To:
The Regional Manager Coasts KeNHA
P. O. Box 84254 - 80100
Msa.

Subject: INVITATION TO PUBLIC PARTICIPATION

Dear Sir/Madam,

We are pleased to invite you for a public participation meeting to be held at Shimanzi next to East African Terminals, Mombasa County on 23rd February, 2023 as from 10.00 am. The agenda of the meeting is to discuss the proposed installation of Thermal desorption unit and treatment of hazardous waste (medical waste, waste oil/oil filters, sludge).

Several other stakeholders such as Kenya Maritime Authority, NEMA, KFS, Mombasa County Department of Environment, Kenya Ports Authority, Water Resource Authority, KWS and Public health, are expected to grace the event.

For your convenience, the site coordinates are:

Long. -4.043444046432162
Lat. 39.645802433587576

Your presence will be highly appreciated, however do not hesitate to call me should you need any clarification.

Yours Sincerely,

ECO CHOICE LTD PVT-GYUJ69K

Mauro Zaccaria, CEO
+254 728 687168

REGIONAL DIRECTOR-COAST REGION
RECEIVED
22 FEB 2023
REG NO:
KENYA NATIONAL HIGHWAYS AUTHORITY
P.O. Box 84254-80100 MOMBASA

eco choice

To:

Acc.
Coast Division

Subject: INVITATION TO PUBLIC PARTICIPATION

Dear Sir/Madam,

We are pleased to invite you for a public participation meeting to be held at Shimanzi next to East African Terminals, Mombasa County on 23rd February, 2023 as from 10.00 am. The agenda of the meeting is to discuss the proposed installation of Thermal desorption unit and treatment of hazardous waste (medical waste, waste oil/oil filters, sludge).

Several other stakeholders such as Kenya Maritime Authority, NEMA, KFS, Mombasa County Department of Environment, Kenya Ports Authority, Water Resource Authority, KWS and Public health, are expected to grace the event.

For your convenience, the site coordinates are:

Long. -4.043444046432162
Lat. 39.645802433587576

Your presence will be highly appreciated, however do not hesitate to call me should you need any clarification.

Yours Sincerely,

ECO CHOICE LTD
PVT-GYUJ69K

Mauro Zaccaria, CEO
+254 728 687168

Received
22/02/2023

ECO CHOICE LTD
P.O. Box 1805-80100, Mombasa Kenya | compliance@ecochoice.ltd
Company number PVT-GYUJ69K
KRA PIN P051727754V

eco choice

To:

Mr. Affaroq Wesonga
Sub-Chief — Shimanzi

Subject: INVITATION TO PUBLIC PARTICIPATION

Dear Sir/Madam,

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Yours Sincerely,

ECO CHOICE LTD PVT-GYUJ69K 2023

Mauro Zaccaria, CEO
+254 728 687168

Received 20/2/23

eco choice

To: ASSISTANT CHIEF KILINDINI,
P.O BOX 90430 - 80100,
MOMBASA.
0729718422.

Subject: INVITATION TO PUBLIC PARTICIPATION

Dear Sir/Madam,

We are pleased to invite you for a public participation meeting to be held at Shimanzi next to East African Terminals, Mombasa County on 23rd February, 2023 as from 10.00 am. The agenda of the meeting is to discuss the proposed installation of Thermal desorption unit and treatment of hazardous waste (medical waste, waste oil/oil filters, sludge).

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ECO CHOICE LTD
PVT-GYUJ69K

Mauro Zaccaria, CEO
+254 728 687168

Received
ASSISTANT CHIEF
KILINDINI SUB - LOCATION
Date: 22/02/23 Sign

eco choice

To:
Principal Environment Officer
Kenya ports Authority
P. O Box 95009 - 80104
MSA, Kenya.

Subject: INVITATION TO PUBLIC PARTICIPATION

Dear Sir/Madam,

We are pleased to invite you for a public participation meeting to be held at Shimanzi next to East African Terminals, Mombasa County on 23rd February, 2023 as from 10.00 am. The agenda of the meeting is to discuss the proposed installation of Thermal desorption unit and treatment of hazardous waste (medical waste, waste oil/oil filters, sludge).

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Yours Sincerely,

ECO CHOICE LTD
PVT-GYUJ69K

Mauro Zaccaria, CEO
+254 728 687168

PRINCIPAL ENVIRONMENT OFFICER
RECEIVED
22 FEB 2023
P.O. Box 95009 - 80104
MOMBASA
KENYA PORTS AUTHORITY

PRINCIPAL ENVIRONMENT OFFICER
P.O. Box 95009 - 80104
22 FEB 2023
MOMBASA
KENYA PORTS AUTHORITY

eco choice

To:
National Construction Authority - Coast Regional Office,
P. O. Box 80343-80100
Msa.

Subject: INVITATION TO PUBLIC PARTICIPATION

Dear Sir/Madam,

We are pleased to invite you for a public participation meeting to be held at Shimanzi next to East African Terminals, Mombasa County on 23rd February, 2023 as from 10.00 am. The agenda of the meeting is to discuss the proposed installation of Thermal desorption unit and treatment of hazardous waste (medical waste, waste oil/oil filters, sludge).

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ECO CHOICE LTD PVT-GYUJ69K

Mauro Zaccaria, CEO
+254 728 687168

NATIONAL CONSTRUCTION AUTHORITY
COAST REGIONAL OFFICE
P. O. Box [illegible] MOMBASA
2 FEB 2023
RECEIVED

16th February 2023

CHIEF OFFICER
Mombasa County Department of Environment,
BIMA Towers,
P.O. Box 81599-80100,
Mombasa, Kenya

Subject : INVITATION TO PUBLIC PARTICIPATION

Dear Sir/madam.

We are pleased to invite you for a public participation meeting to be held at Shimanzi next to East African Terminals. Mombasa County on 23rd February. 2023 as from 10.00 am. The agenda of the meeting is to discuss the proposed installation of Thermal desorption unit and treatment of hazardous waste (***medical waste, waste oil/oil filters, sludge)***.

Several other stakeholders such as Kenya Ports Authority. NEMA. KFS. KMA. Water Resource Authority. Kenya Wildlife Service. Public health and Kenya Railways. are expected to grace the event.

Your presence will be highly appreciated.

Benard Oriku
ENVIRONMENTALIST- ECO CHOICE LTD

ECO COICE LIMITED
Phone: +254711367263 | E-mail: benardorik@gmail.com | P.O BOX 1805-80100

16th February 2023

The director,
Kenya Maritime Authority,
P.O. Box 95076-80104,
Mombasa, Kenya

Subject : INVITATION TO PUBLIC PARTICIPATION

Dear Sir/madam,

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Benard Oriku
ENVIRONMENTALIST- ECO CHOICE LTD

ECO COICE LIMITED
Phone: +254711367263 | E-mail: benardorik@gmail.com | P.O.BOX 1805-80100

16th February 2023

20/2/2023
466

The County forest Conservator-Mombasa,
Mvita house,
P.O. Box 80078-80100,
Mombasa, Kenya

Subject : INVITATION TO PUBLIC PARTICIPATION

Dear Sir/madam,

We are pleased to invite you for a public participation meeting to be held at Shimanzi next to East African Terminals, Mombasa County on 23rd February, 2023 as from 10.00 am. The agenda of the meeting is to discuss the proposed installation of Thermal desorption unit and treatment of hazardous waste (***medical waste, waste oil/oil filters, sludge)***.

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ENVIRONMENTALIST- ECO CHOICE LTD

ECO COICE LIMITED
Phone: +254711 167263 | E-mail: benardoriku@gmail.com P.O BOX 1805-80100

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY.

ATTENDANCE LIST

DATE: 23rd/02/2023

SNO.	NAME	CONTACT/ EMAIL ADDRESS	ORGANIZATION REPRESENTED	SIGNATURE
1.	IRENE NDAMBUKI	irenehnl@gmail.com	INTERIOR	
2.	Felix Waomgs	0721725833	Interior	
3.	MAINGA BRIGID	0718651400	KENHA	
4.	Benson Ntaka	0724541213	INTERIOR	
5.	JOSEPHINE KININDA	0729718422	INTERIOR	
6.	RONO ARON	0740354085	NCA	
7.	WILSON OMONDI	0701012592	KENYA SCOUTS ASS.	
8.	SHIRIVNA VINCENT	0745801186	K S A	
9.	AINGS WAMBUA	0725141353	NGMA	
10.	HON Priscilla Mumbo	0722991379	M.C.A	
11.	MILICENT ATIENO	0791903297	M.C.A BDG	
12				
13				
14				

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY.

ATTENDANCE LIST

DATE: 23rd/02/2023

SNO.	NAME	CONTACT/ EMAIL ADDRESS	ORGANIZATION REPRESENTED	SIGNATURE
1.	James Murumbi	0721450211		
2.	Duncan Mwithi	0726335936		
3.	Stephen Orute	0706675844		
4.	Eston Murimi	0716376688		
5.	Stellah Gwaro	0724823947		
6.	Mohamed Mohamed	0727319778		
7.	Hakima Sarah	0705281136		
8.	James Mutiku	0712067607		
9.	Denis Musoti	Musoti 0703570495@		
10.	George Akoimu	0757249109		
11.	Julius Kanga	0112506169		
12	Stephen Ojiambo	0723988772		
13	Elijah Engesa	0722887203		
14	Elizabeth Njeri	0468320848		

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY.

ATTENDANCE LIST

DATE: 23rd/02/2023

SNO.	NAME	CONTACT/ EMAIL ADDRESS	ORGANIZATION REPRESENTED	SIGNATURE
1.	Benjamin Ngala	0707980567	4 SIKI	
2.	Samuel Kileta	0716081154		
3.	SARAH MASESG	0720094777		
4.	FARIDA SALIM	0 718645144		
5.	ALBERCINA MAKAU	0704469593		
6.	NJERI BETH	0722843594		
7.	MARY WANGARI	0727039642		
8.	MERCY CATHONI	0724 70 53 90.		
9.	FRANCISCA MUENI	0723 422803.		
10.	Christine Mulekye	0706550542		christine
11.	MWANDA	0798012784		
12	Samson Kamata	0740824842		
13	ALEX OKERO	0748801381		
14	IGNATIUS MUTHOKO	0770023658		

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY.

ATTENDANCE LIST

DATE: 23rd/02/2023

SNO.	NAME	CONTACT/ EMAIL ADDRESS	ORGANIZATION REPRESENTED	SIGNATURE
1.	SAMUEL K KIMANI	0746678641		
2.	CHARLES K MUIGA	0799 041630		
3.	PAUL MARARA	0798780949		
4.	Granda Imoiti	0719395310		
5.	PURITY WAGIRA	0716849904		
6.	RAHIM NJETE	0727751393		
7.	JULIA KAVENGHA	0703141255		
8.	BETH MBURU (STIKU)	0715 678 392		
9.	CHARLES MARUA	0722376872		
10.	MUASA WAMBUA	0724370234		
11.	NAOMI MUSYOKI	0700 186 857		
12	RACHAEL MWEIU	0727176548		
13	JOSHUA M MUIA	0723-404397		
14	ALI SAID	07A6821202		

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

ECO CHOICE LIMITED has commissioned for the assessment of environmental and social impacts for the proposed Hazardous Waste Treatment Facility (medical waste, waste oil/oil filters, sludge). 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 Registered environmental experts, the proponent 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
   To help in Solid waste Management.

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;
To help in Job creation and environmental Conservation.
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
KENYA SCOUTS ASSOCIATION		23/2/2023	

0701012592

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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3	Recreational and Leisure facilities / **Maeneo ya starehe**		NO
4	Road transport / **Usafiri wa barabara**		NO
5	Water security resources quality and quantity / **Maji**		NO
6	Natural ecology of the area / **Mazingira ya eneo hili**		NO
7	Soils / **Mchanga**		NO
8	Public health and safety / **Usalama na afya kwa jamii**		NO

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

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
KSA - Kenya Surf Association		23/02/2023	

0745 50 11 86

santiagomoslen25@gmail.com

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
NCA		23rd Feb 2023	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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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;
....
....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
SAMUEL K KIMANI	[signature]	23/--/23	

0710544164/ 0746623641

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
CHARLES NYAKOA		23/02/23	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

ECO CHOICE LIMITED has commissioned for the assessment of environmental and social impacts for the proposed Hazardous Waste Treatment Facility (medical waste, waste oil/oil filters, sludge). 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 Registered environmental experts, the proponent 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 uliko, 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;
....
....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Stephen Odhiambo	[signature]		

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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Through the consulting services of NEMA Registered environmental experts, the proponent 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 [X] **No** / La [ ]

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

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

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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
IGNATIUS MUTHOKA		23/02/23	2

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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, eieza 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;
Tungeomba nafasi ziwe kwa watu wote kwa ujumla sio kwa wanajamii wengine.

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
PAUL MARARA	0798780242		

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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
   .....

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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
JOSHUA M MUH		23/03/2023	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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
   If it will be as it has been state

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
   If it will be as stated

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;
Employment is the first key role if it is the priority.

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Julius Kenga.			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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
   .....

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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
George Awiao		23/2/2023	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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
   .....K.....

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
   .....C.....

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;
Because it will improve the living standard of the Local people who will benefit directly or indirectly

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Peris Mosel.		23/02/2023	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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
   .....

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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
ESTON MURIMI		23/02/2023	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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
   ..... Wa .....

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
   ..... Wa .....

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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
James Mukka			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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
   .....

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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
[illegible]	[signature]	27/02/2023	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

ECO CHOICE LIMITED has commissioned for the assessment of environmental and social impacts for the proposed Hazardous Waste Treatment Facility (medical waste, waste oil/oil filters, sludge). 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 Registered environmental experts, the proponent 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.

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   Je, unafahamu kuweko kwa mradi unaotarajiwa?
   Yes / Ndio [✓] **No** / La [ ]

2. Do you think it will benefit you as a person?
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   If **No**, state reason:
   Kama huoni manufaa yoyote kwako, eleza sababu
   .....

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   Kama huoni manufaa yoyote kwa jamii, eleza sababu
   .....

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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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Stephen Orucho	[signature]	23/07/2023	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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2. Do you think it will benefit you as a person?
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   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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
M Duncan Muiti			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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
   ..... Hana Manufaa .....

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
   ..... Hana faida Kwangu .....

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**		
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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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.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
James Mumbi			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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   If **No**, state reason:
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   .....

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   Kama huoni manufaa yoyote kwa jamii, eleza sababu
   .....

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

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Ignatius Muhoro			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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4	Road transport / **Usafiri wa barabara**	✓	
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7	Soils / **Mchanga**	✓	
8	Public health and safety / **Usalama na afya kwa jamii**	✓	

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Kama jibu lako ni NDIO kwa mswada wowote hapo juu, eleza zaidi;
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NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Alex Odero			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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Kama jibu lako ni NDIO kwa mswada wowote hapo juu, eleza zaidi;
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NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Samson Kimoto			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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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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NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Mueni Kavoi Jan			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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   Yes / Ndio [—] **No** / La [ ]

2. Do you think it will benefit you as a person?
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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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Mercy Gathua			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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   Je, unafahamu kuweko kwa mradi unaotarajiwa?
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2. Do you think it will benefit you as a person?
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   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:
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   .....

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	Items/ **Miswada**	Yes/ **Ndio**	No/ **La**
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3	Recreational and Leisure facilities / **Maeneo ya starehe**		
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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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Mary Wanyoro			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

ECO CHOICE LIMITED has commissioned for the assessment of environmental and social impacts for the proposed Hazardous Waste Treatment Facility (medical waste, waste oil/oil filters, sludge). 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 Registered environmental experts, the proponent 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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Njeri Bell			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Albakre Mohamed			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA 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 [X]

2. Do you think it will benefit you as a person?
   Je, unafikiri mradi utakunufaisha wewe kibinafsi?
   Yes / Ndio [X] **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 [X] **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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Farida Salim			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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   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
   Because Im not fed Convinced Properly.

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
   Viangozi wetu hawajatushawishi

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?

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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;

.....

.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Samuel Kilela			

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED INSTALLATION & OPERATION OF THERMAL DESORPTION UNIT (TDU)- HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO. MOMBASA/BLOCK I/588, SHIMANZI, MOMBASA COUNTY

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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;
.....
.....

NAME OF INSTITUTION	SIGNATURE	DATE	OFFICIAL RUBBER STAMP
Benjamin Ngolo		23/2/2023	

KENYA REVENUE AUTHORITY

www.kra.go.ke

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

Certificate Date : 13/09/2018

Personal Identification Number

P051727754V

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

Taxpayer Information

Taxpayer Name	ECO CHOICE LTD
Email Address	COMPLIANCE@ECOCHOICE.LTD

Registered Address

L.R. Number :	**Building** PARKVIEW SUITES
Street/Road NYERERE ROAD	**City/Town :** NAIROBI
County : Nairobi	**District** Starehe District
Tax Area CBD	**Station** North of Nairobi
P. O. Box 15501	**Postal Code** 00509

Tax Obligation(s) Registration

Sr. No.	Tax Obligation(s)	Effective From Date	Effective Till	Status
1	Value Added Tax (VAT)	13/09/2018	N.A.	Active
2	Income Tax - Company	13/09/2018	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 REPUBLIC OF KENYA

BUSINESS REGISTRATION SERVICE
P. O. BOX 30031
NAIROBI
30 MAR 2022

To
ECO CHOICE LTD
P.O. Box 15501
00509 - LANGATA

THE COMPANIES ACT, 2015

Records relating to the below company held by the Companies Registry as at 30 Mar 2022

COMPANY	ECO CHOICE LTD
COMPANY NUMBER	PVT-GYUJ69K
NOMINAL SHARE CAPITAL	100.00
NUMBER AND TYPE OF SHARES (VALUE PER SHARE)	ORDINARY: 100 (KES 1.00 EACH)
DATE OF REGISTRATION	16TH NOV, 2017
REGISTERED OFFICE	P.O BOX 15501 LANGATA TELEPHONE: +254702466221, EMAIL: CONTACTS@EAGLEES.COM COUNTY: NAIROBI, DISTRICT: LANGATA DISTRICT , LOCALITY: KAREN STREET: MARULA LANE, BUILDING: MARULA MANOR
POSTAL ADDRESS	P.O BOX 15501 LANGATA
ENCUMBRANCES	

Name of Directors and Shareholders of the above company with their particular are as follows

NAME	DESCRIPTION	ADDRESS	NATIONALITY	SHARES
ABDULHAMID YUSUF MWAURA GITHUKU	DIRECTOR/SHAREHOLDER	P.O BOX 1805 MOMBASA G.P.O	KENYA	ORDINARY: 90
MAURO ZACCARIA	DIRECTOR/SHAREHOLDER	P.O BOX SUITE 204 PARKVIEW SUITES NYERERE ROAD	ITALY	ORDINARY: 10
			TOTAL	100

Yours Faithfully,
REGISTRAR OF COMPANIES

REF NO: OS-JGFGJXYX

DISCLAIMER: THIS IS A SYSTEM GENERATED CERTIFICATE AND DOES NOT REQUIRE A SIGNATURE

No. PVT-GYUJ69K

CERTIFICATE OF INCORPORATION

I hereby **CERTIFY** that,

ECO CHOICE LTD

is on this date 16 Nov 2017 Incorporated under the Companies Act, 2015 and that the Company is a **PRIVATE LIMITED COMPANY.**

I certify that this is a true copy of the original
29/03/18
TOM WACHAKANA
Commissioner For Oaths
P. O. Box 9161 - 00300, Nairobi

Registrar Of Companies

This is a system generated certificate. To validate this document send the word BRS to 21546

COUNTY GOVERNMENT OF MOMBASA

PROVISIONAL SINGLE BUSINESS PERMIT

Provisional Single Permit ARN-AAA12I:

For the period ending 19 June 2022

ombasa County Grants this Business Permit to			Business ID
Applicant Business Commercial Name CO CHOICE LIMITED			ARN-AAA12IH9
ID Number 27757710	Phone Number 0722984495, 0722984495	Plot Number 3	

To Engage in the Activity / Business / Profession or Occupation of
C95 Other Professional and Technical Services

Business Activity Description
WASTE MANAGEMENT

having paid a Business Permit Fee	KSH. 12550
clusive of Fire Fees for	
id Dimensional Sign Fees of for	

Business under this Permit shall exclusively be conducted at the address as indicated below:

P.O.Box 0 Plot No. 3

Business Physical Address NYALI

Date of Issue: 20 May 2022

PROVISIONAL

PROVISIONAL

PROVISIONAL

Notice: Granting this Permit DOES NOT EXEMPT the business identified above from complying with [illegible]
as established by the Government of Kenya and the COUNTY GOVERNMENT OF MOMBASA

REPUBLIC OF KENYA

THE LAND REGISTRATION ACT
(No. 3 of 2012, Section 108)
THE REGISTERED LAND ACT
(Chapter 300, Repealed)

Certificate of Lease

TITLE NO.	APPROXIMATE AREA
MOMBASA/BLOCK I/588	1.100 HA

LESSOR KENYA PORTS AUTHORITY

RENT KSH. 1,138,050/= P.A.

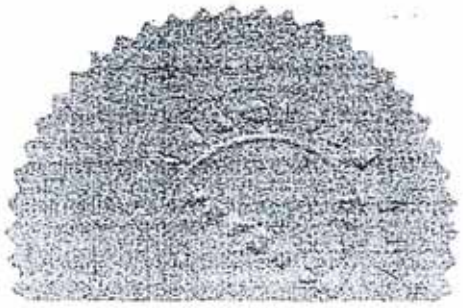
TERM 33 YEARS FROM 1.1.2015

This is to certify that M-TECH BUILDING WORKS LIMITED, P. O. BOX 41876 - 80100, MOMBASA.

" " "

" " "

is (are) now registered as the proprietor(s) of the leasehold interest above referred to, subject to the agreements and other matters contained in the registered lease, to the entries in the register relating to the lease and to such of the overriding interests set out in section 30 of the Registered Land Act as may for the time being subsist and affect the land comprised in the lease.



GIVEN under my hand and the seal of the

MOMBASA District Land Registry

this 9TH day of JUNE, 20 16

(To be completed only when the applicant has paid Sh. 125)

At the date stated on the front hereof, the following entries appeared in the register relating to the land:—

EDITION 1

OPENED: 9.6.2016

PART A—PROPERTY SECTION

REGISTRATION SECTION	PARTICULARS OF LEASE	NATURE OF TITLE
MOMBASA/BLOCK I	LESSOR: KENYA PORTS AUTHORITY	LEASEHOLD
PARCEL NUMBER 588	LESSEE: M-TECH BUILDING WORKS LTD	
APPROXIMATE AREA 1.100 HECTARES	RENT: TERM: 33 YRS FROM:1.1.2015 KSH. 1,138,050/= P.A.	
REGISTRY MAP SHEET No. MSA/BLOCK I	FOR APPURTENANCES SEE THE REGISTERED LEASE. N.B. WHERE THE LEASE IS OF A PART OF A PARCEL THE PARCEL NUMBER REFERS TO THE NUMBER SHOWN ON THE FILED PLAN	

PART B—PROPRIETORSHIP SECTION

ENTRY NO.	DATE	NAME OF REGISTERED PROPRIETOR	ADDRESS AND DESCRIPTION OF REGISTERED PROPRIETOR	CONSIDERATIONS AND REMARKS	SIGNATURE OF REGISTRAR
		RESTRICTION: NO DISPOSITION BY THE PROPRIETOR SHALL BE REGISTERED WITHOUT THE WRITTEN CONSENT OF THE LESSOR (S. 48)			
1	9.6.2016	M-TECH BUILDING WORKS LIMITED.	P. O. BOX 41876 - 80100 MOMBASA.		
2	9.6.2016	CERTIFICATE OF LEASE ISSUED.			

PART C – ENCUMBRANCES SECTION

ENTRY NO.	DATE	NATURE OF ENCUMBRANCE	FURTHER PARTICULARS	SIGNATURE OF REGISTRAR

Land Registrar

REPUBLIC OF KENYA

THE REGISTERED LAND ACT
(Chapter 300, Repealed)

Certificate of Lease

FORM 5

(r.14(4))

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

CERTIFICATE OF REGISTRATION AS AN ENVIRONMENTAL IMPACT ASSESSMENT / AUDIT EXPERT

Certificate No: NEMA/EIA/RC/4580

Application Reference No: NEMA/EIA/ER/9[illegible]

This is to certify M/s **BENARD MATUNDURA ORIKU** of

P.O. Box 634-30202, Moi's Bridge (Address) has been registered as an Environmental Impact Assessment Expert in accordance with the provisions of the Environmental Management and Coordination Act Cap 387 and is authorized to practice in the capacity of a Lead Expert/Associate Expert/Firm of Experts (Type) **Associate Expert**

Expert Registration No: **11073**

Issued Date : **8/29/2019**

Signature

(Seal)

Director-General
The National Environmental Management Authority

P.T.O.

ISO 9001: 2008 Certified

INVOICE

Bill To:

KUSO HUSSEIN KUSO,
P.O. Box 21-80201 GARSEN

Customer No : ERC_14725,
Invoice No: EPL_24012,
Posting Date: 12/21/2022 9:25:37 PM
E-citizen Tracking ID:EPL_24012

National Environment Management Authority(NEMA),
P.O BOX 67839 -0100,
Popo Road off Mombasa Road, Nairobi,
Phone: +(254)-020-6005522/6/7
Email: dgnema@nema.go.ke
Homepage: www.nema.go.ke
VAT Reg. No: P051149406X

No	Description	Unit Amount	Quantity	Amount (KES)
1	Expert License application	5,000	1	5,000

Payment Mode

Note: Use the following link to make payment through E - Citizen Platform
https://portal.nema.go.ke/_layouts/epi/payment.aspx?tracking_id=EPL_24012

Tel: +254 20 6005522/3/7, 6001945
Wireless: +254 20 210370
Mobile: 0724 253 398, 0733 600 035
Email: dgnema@nema.go.ke

Popo Road, Off Mombasa Road
P.O Box 67839-00200
Nairobi, Kenya
Website: www.nema.go.ke

NEMA/EIA/EL/24012

2022-12-21

KUSO HUSSEIN KUSO

P.O. BOX 21-80201 GARSEN.

RE: ACKNOWLEDGEMENT OF EXPERTS LICENSE APPLICATION.

The National Environment Management Authority (NEMA) acknowledge receipt of your application for license as **Lead Expert** Environmental (Impact Assessment/ Audit) expert.

The application reference is **NEMA/EIA/EL/24012**. The Authority will review and communicate the record of decision in due course through the email address provided in the online system.

Annastacia Vyalu

HEAD OF EXPERT SECTION

FORM 7 (r.15(2))

nema
mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

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

License No : NEMA/EIA/ERPL/18170

Application Reference No: NEMA/EIA/EL/23723

M/S **KUSO HUSSEIN KUSO**
(individual or firm) of address
P.O. Box 21-80201 GARSEN

is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**

General

registration number **8904**

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

Issued Date: **11/7/2022** Expiry Date: **12/31/2022**

Signature.....

1

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001: 2015 Certified

ONLY FOR THE PROPOSED WASTE TREATMENT FACILITY ON PLOT L.R NO. MOMBASA/BLOCK 1/538, MOMBASA COUNTY FOR ECO CHOICE LIMITED.

PRACTISING CERTIFICATE FOR QUANTITY SURVEYORS

Pursuant to the Architects & Quantity Surveyors Act Cap 525

QS. ANDERSON KINOTI GITONGA (Q1131)

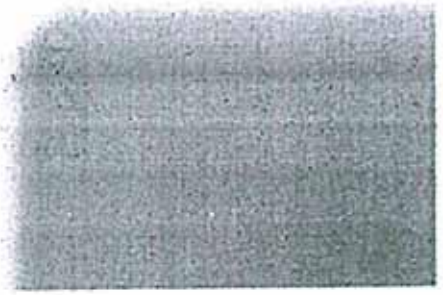
is duly qualified as a Quantity Surveyor and is entitled to practise as such Quantity Surveyor

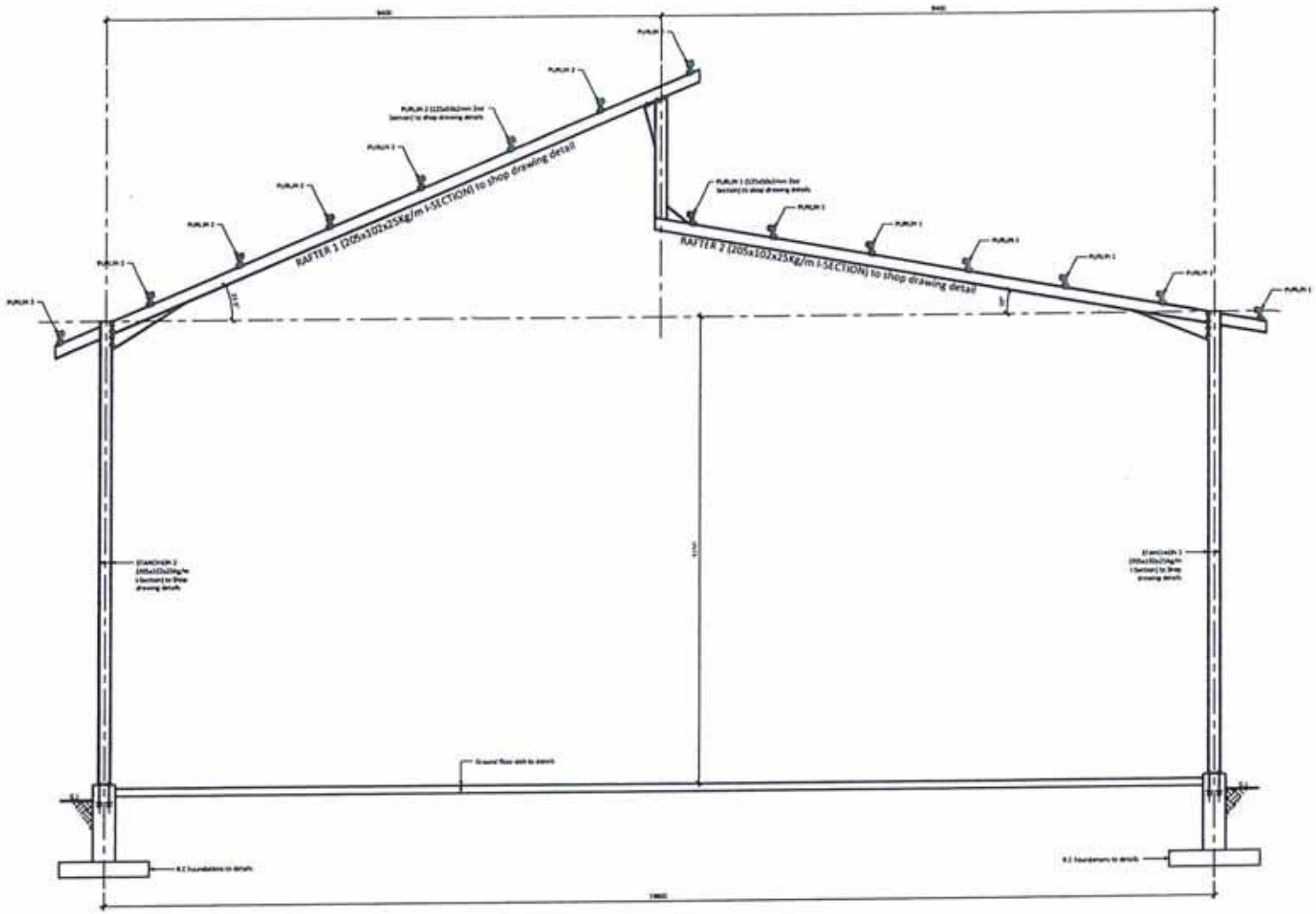
From **1st July 2022** *to* **30th June 2023**

Registrar *Date* **7th July 2022**

LICENSED QUANTITY SURVEYOR
ANDERSON * GITONGA
20 OCT 2022
REG No. Q1131
Email: kinotianderson@gmail.com

serial no. PCQS/1188/22-23





MAIN STEEL STRUCTURE PORTAL FRAME 'PF1' GENERAL ELEVATION DETAILS

NOTES

PROJECT
PROPOSED HAZARDOUS WASTE TREATMENT FACILITY
ON-LR No. MOMBASA/BLOCK I/588, MOMBASA COUNTY

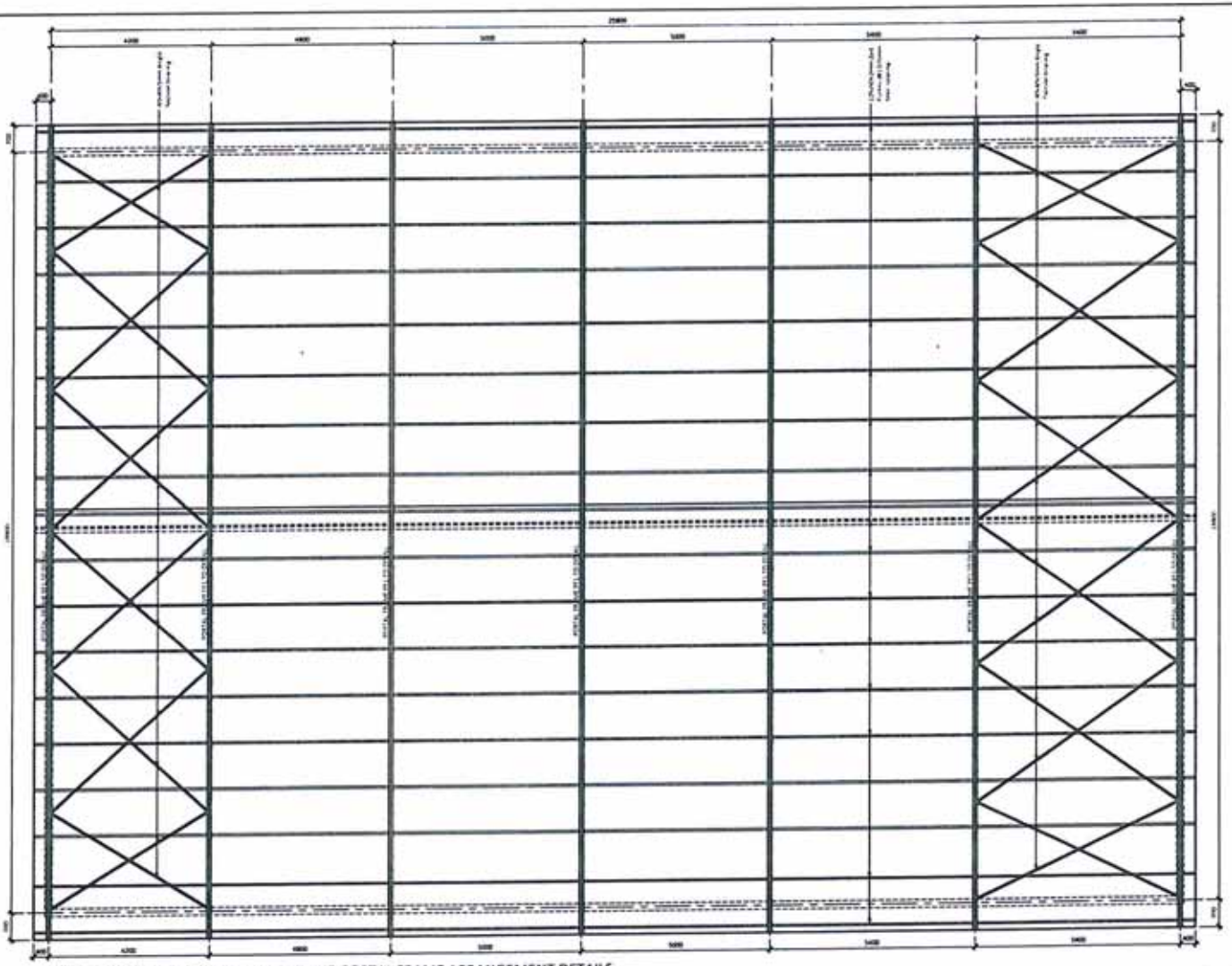
CLIENT
ECO CHOICE LTD

CONSULTANTS DESIGN
Stradic Engineering Ltd

DRG. TITLE
MAIN STEEL PORTAL ELEVATION & DETAILS

	NAME	DATE
DESIGNED		Aug 2022
DRAWN		Aug 2022
CHECKED		Aug 2022
SCALE(S)	1:50, 1:25 (A1)	

DRG. No.
SEL/HWTP/22/STR03



ROOF STRUCTURE GENERAL LAYOUT AND PORTAL FRAME ARRANGEMENT DETAILS

NOTES

PROJECT: PROPOSED HAZARDROUS WASTE TREATMENT FACILITY ON LR No. MOMBASA/BLOCK I/588, MOMBASA COUNTY

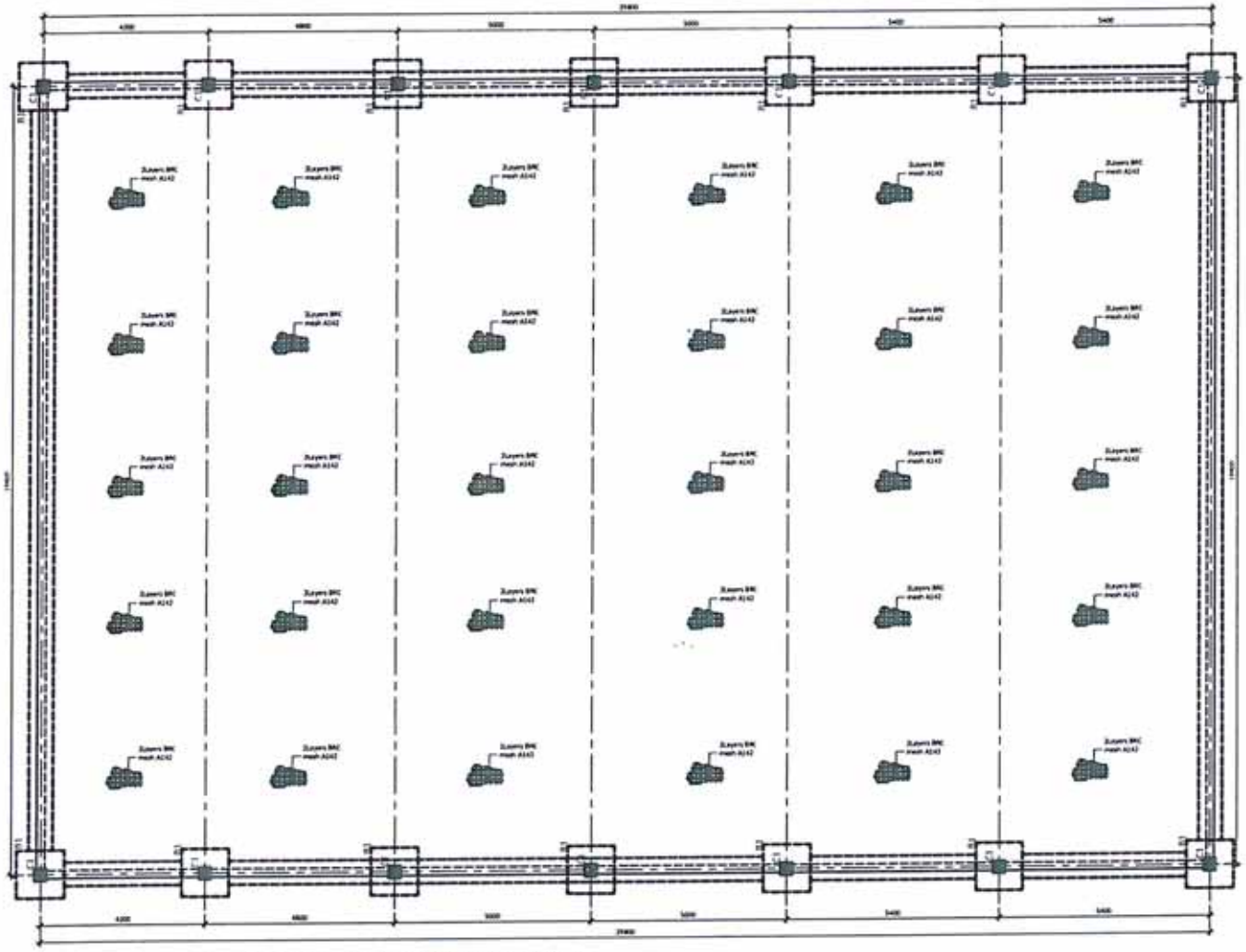
CLIENT: ECO CHOICE LTD

CIVIL/STRUCTURAL DESIGN: Stradic Engineering Ltd

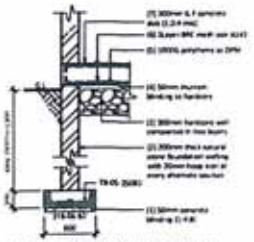
DWG TITLE: PLANT SHED ROOF GENERAL ARRANGEMENT DETAILS

	NAME	DATE
DESIGNED	DOSHIS A.A	Aug 2022
DRAWN	DOSHIS A.A	Aug 2022
CHECKED	Eng. J.M.M	Aug 2022
SCALE(S)	1:50, 1:25 (A1)	

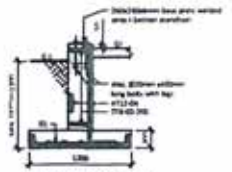
DWG. No.: SEL/HWTP/22/STR02



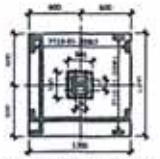
FOUNDATION AND GROUND FLOOR SLAB GENERAL ARRANGEMENT DETAILS



TYPICAL STRIP FOOTING R.C DETAILS



COLUMN C1 R.C DETAILS



COLUMN BASE B1 R.C DETAILS
1200x1200x200mm

NOTES

PROJECT
PROPOSED HAZARDROUS WASTE TREATMENT FACILITY
ON LR No. MOMBASA/BLOCK I/588, MOMBASA COUNTY

CLIENT
ECO CHOICE LTD

CIVIL/STRUCTURAL DESIGN
Stradic Engineering Ltd

DWG. TITLE
PLANT SHED FOUNDATIONS
G.A & R.C DETAILS

	NAME	DATE
DESIGNED	[illegible]	Aug 2022
DRAWN	[illegible]	Aug 2022
CHECKED	[illegible]	Aug 2022
SCALES	[illegible]	

DWG. No
SEL/HWTP/22/STR01

PROPOSED HAZARDROUS WASTE TREATMENT FACILITY ON
LR. No. MOMBASA/BLOCK I/588, MOMBASA COUNTY

MAIN SUMMARY

S.No	SECTION DESCRIPTION	AMOUNT
1	STRUCTURE ONLY WITH ROOF AND WALLING	[illegible]
2	CONTIGENCIES @5%	[illegible]
3	PRELIMINARIES (SITE STORES, INSURANCE, EQUIPIMENT, POWER, HEALTH & SAFETY PROVISIONS)	[illegible]
	TOTAL AMOUNT	...00

LICENSED QUANTITY SURVEYOR
20 OCT 2022
REG No
Email: kinorianderson@gmail.com

The above Tender Sum of Kshs 14,580,364.00 In Words (Fourteen Million, Five Hundred Eighty thousand, Three Hundred SixtyFour Only) Shall be considered as the Contract Amount between the Two Undersigned Parties;

The Contractor, M/s.. of P.O.Box......................................., thus solely undertakes to carry out the afforementioned works in this Bills of Quatities as described and to details as per the contract drawings issued to the satisfaction of the Employer, M/s.. of P.O.Box... The Terms and Conditions of Contract Shall be as stipulated in the Contract document

Signed For On Behalf Of:

Name..
(Contractor)

Designation...

Sign..

Date..

Name..
(Employer)

Designation...

Sign..

Date..

Quantity Surveyor:

Name. ANDERSON K GITONGA...

Sign.....[signature]....................................

Date...20/10/2022.......................

MINISTRY OF HEALTH
OFFICE OF THE DIRECTOR PUBLIC HEALTH

Telephone Nairobi 2717077
Email: directorphke@gmail.com
When replying please quote

AFYA HOUSE
CATHEDRAL ROAD
P O Box 30016 -00100
NAIROBI

Ref. No MOH/EHS/Waste/Vol. IV (114)

3rd May 2018

TO WHOM IT MAY CONCERN

RE: PARTNERSHIP WITH EAST AFRICA GROWTH LOCAL ENERGY LIMITED (EAGLE) AND ECO CHOICE LIMITED ON MANAGEMENT OF HEALTH CARE WASTE AND OTHER WASTES IN KENYA

Reference is made to the above subject matter.

Ministry of Health recognizes the importance to strengthen health care waste management and related programs in the country and is committed to provide coordination, support, and engagement necessary for strengthening health care waste management systems in the country. The request for partnership by East Africa Growth Local Energy Limited (EAGLE Ltd) and Eco Choice Ltd will ensure the technical expertise and project design and implementation advance our institutional capacity and strengthen our national programs and engagement with the Counties and other service points. Additionally, the partnership will go a long way in supporting the implementation of the recently developed Health Care Waste Management Public Private Partnership Framework.

The Ministry therefore supports establishing and continuing collaboration with EAGLE Ltd through its partner Eco Choice Ltd in promoting best available technologies and best environment practices in waste to energy and other waste management options including production of sanitized water which meets all our legal and regulatory parameters.

We therefore write to recommend EAGLE Ltd and its partner Eco Choice interest in supporting Kenya implement and manage projects requiring public private partnership especially in health care waste and other wastes in Kenya

Sincerely,

Dr. James Mwitari, PhD
DEPUTY DIRECTOR PUBLIC HEALTH

HYDROGEOLOGICAL ASSESSMENT STUDY REPORT GROUNDWATER CONDITIONS ON PLOT No. MN/VI/254 LOCATED WITHIN SHIMANZI AREA, MOMBASA COUNTY

Prepared for:

Eco Choice Limited
P.O Box 1805-80100
Mombasa, Kenya

Prepared by:

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

GEOSOL
CONSULTING

Report No. SN02012023

Water Resources & Development Specialists
Registered Office: Mombasa, Kenya
Asha Trust Ground Floor Building Suite No. 4
Located along, Meru Road.

HYDROGEOLOGICAL ASSESSMENT STUDY REPORT GROUNDWATER CONDITIONS ON PLOT No. MN/VI/254 LOCATED WITHIN SHIMANZI AREA, MOMBASA COUNTY

Client:

Eco Choice
P.O Box 1805-80100
Mombasa, Kenya

Investigating Hydrogeologist(s):

Alexander Mutuku Nzomo
P.O Box 97097 – 80112
Makupa, Mombasa
+254 710 676 903
Reg. Hydrogeologist
License No.: WP/WRP/311
Member: GSK & MGRB

Signed: .....

Date: 28:02:2023

GEOSOL CONSULTING LTD.
P.O. Box 97097 - 80112
MAKUPA
Date: 28/02/2023

ALEXANDER MUTUKU
REG. HYDROGEOLOGIST
WD/WRP/311
TEL: 0710 676 903

EXECUTIVE SUMMARY

Introduction

Eco Choice Limited intends to develop Plot No. MN/VI/254 located within Shimanzi area of Mombasa County. This report presents an outcome of geophysical and hydrogeological assessment for the proposed development. The study seeks to establish groundwater conditions; within the area and locate a suitable point for drilling 1 No. of production borehole.

This report is also compiled in support of an application that would be lodged to obtain authorization required for commencement of drilling and construction from Water Resources Authority (WRA). This is in adherence to part IV of the Water Resources Management Rules section 72 (1) and 72 (4) for groundwater development in Kenya.

Geology of the site

The site lies on Pliocene Kilindini sands with minor coral reef formations; the water bearing formation is a coastal aquifer with saturated sands. Typical of any coastal aquifer the fresh water is separated from the saline zone by an interface.

Geophysical Investigations

Geophysical investigations comprised of 1 Electrical Resistivity and three 1-Dimensional Vertical Electrical Sounding (VES) at a suitably selected point along the ERT profile. The points have herein been referred to as VES 1, VES 2 and VES 3 all marked with GPS coordinates.

Findings: geophysics and hydrogeology of the section

Data obtained from existing neighbouring boreholes and Borehole Completion Records (BCR) from Water Resources Authority (WRA) for the area, shows that area hosts a shallow coastal aquifer. The boreholes have an average Depth of 23.57; Water Struck Levels (WSL) 20.71 m, Water Rest Level (WRL) 16.86 m and Yield at 6.86 m^3/h.

Hypothetical description of the shallow unconfined aquifer shows that it has approximate Specific Capacity (S_c) 4.0760 m^2/day, Transmissivity (T) value of 4.9728 m^2/day, Hydraulic conductivity (K) 0.4144 m/day and storage coefficient (S) = 1.56×10^{-5}.

Geophysical models show presence of saturated sands (inferred water struck level WSL) from approximately **16 to 18 m below ground level (bgl).** The saline fresh water interface is inferred from the 1-D VES data to be a approximately **22 m bgl.**

Recommendations for BH drilling

A borehole at VES 3 should be drilled to 25 m at a diameter of 10" (254 mm), and completed with 6" (154 mm) uPVC casing and screen, and gravel pack. Close monitoring of salinity levels with progressive drilling is highly recommended, an Electrical Conductivity (EC) meter should be used for this purpose. Should increase saline conditions be noticed, drilling should be terminated without necessarily reaching the final depth.

The drilling method adopted should be one able to maintain a stable wellbore in unconsolidated sands – conventional direct rotary fluid flush (or *Mud drilling*) method is recommended.

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Other Recommendations

Drilling works may not commence until the Water Resources Authority (WRA) has assessed permit application (*Form WRMA 001; 001D*), in light of this report and issue an authorization to commence work (*Form WRMA 004*). Once all work is complete Borehole Completion Certificate/report (*WRMA 008 & 009A*) should be filled and submitted to WRA. Then authority will analyse information submitted and may inspect the borehole. If all is acceptable, a Water Permit will be issued after payment of the appropriate water permit fee. Water permit conditions will include the installation of a flowmeter on the discharge line: and the payment of water use charge will apply

A Test pumping exercise should be carried for the borehole once all drilling and construction work is complete. It is an exercise aimed at establishing safe abstraction rates and selection of the right pump size for the borehole. Upon completion of the exercise, the water should be sampled (2 litres) and taken to competent laboratory for chemical and bacteriological analysis, the results should be checked against Kenya Bureau of Standards (KEBS) thresholds for safe drinking or domestic water use.

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

EC	Electrical Conductivity (in micro Seimens/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	unplasticised polyvynlchloride (pvc)
WSL	water struck level (in m bgl)
HEP	Horizontal Electrical Profile
VES	Vertical Electrical Profile
SP	Self Potential
KNBS	Kenva National Bureauof Statistics
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

Eco Choice Limited intends to develop Plot No. MN/VI/254 located within Shimanzi area of Mombasa County. This report presents an outcome of geophysical and hydrogeological assessment for the proposed development. The study seeks to establish groundwater conditions; within the area and locate a suitable point for drilling 1 No. of production borehole.

This report presents an outcome a geophysical assessment and hydrogeological assessment study whose aim is to establish groundwater conditions within the area and pinpoint a suitable point for drilling the proposed borehole. the assessment was conducted Tuesday, 21st February, 2023.

This report is also compiled in support for application that would be lodged to obtain the required authorization before commencing any drilling works from Water Resources Authority (WRA). This is in line with the *Water Act No. 43 of 2016* (GoK, 2016) and *Water Resources regulations Legal Notice 170 of 2021*(GoK),2021) where approval is required from WRA for groundwater development in Kenya.

1.2 Reporting and Legal Requirements

This report has attempted to faithfully adhere to the *Water Resources Regulations Legal Notice 170 of 2021*(GoK),2021) or as otherwise revised by the Authority. The rules on Second Schedule – formats for Technical Reports 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

Plot No. MN/VI/254 property is located off Shimanzi Road close to Shell and bordered by East African Terminal LTD at grid reference 37 M UTM 571663 E 9553060 S (WGS 84).

Figure 1: A satellite image showing location property

CHAPTER TWO:

2 BASELINE INFORMATION

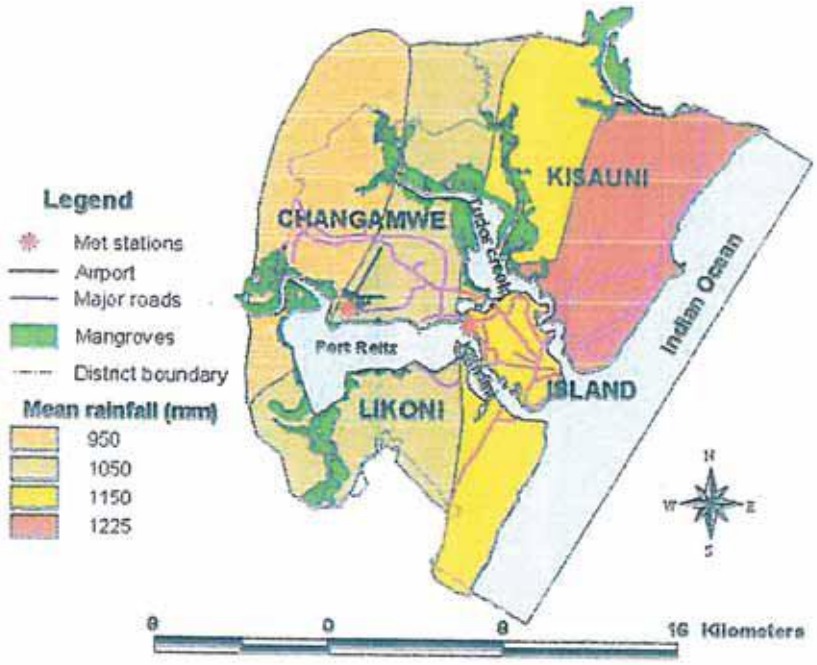
2.1 Introduction

This chapter highlights the main environmental conditions that influence presence of groundwater in the study area. This is important information that would also be useful in the subsequent chapters of this report.

2.2 Climate

2.2.1 Rainfall

Rainfall in Mombasa County is bimodal with the long rains falling between March and May, and the short rains between October and November. Rainfall ranges from 800 to 1,400 mm/yr (Climate-Data.org, 2018; Sombroek et al., 1982). For purposes of calculations elsewhere in this report, we shall assume take a maximum value of 1225 mm as estimated by Munga et al., (2013).



Source: Munga et al., (2013)

Figure 2: Rainfall distribution within Mombasa County

2.2.2 Temperature

Mean annual minimum and maximum temperatures in the study area are 22.8° C and 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° and 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. $E_o = 2422 - 0.358h\,(r2 = 0.66)$,

Where h is site elevation above the mean sea level (*amsl*)
E_o is potential evaporation in millimetres per year.

On this basis, evaporation at the site (which lies at approximately 22.0 m *amsl*) is approximately 2413 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

Mombasa County is supplied with piped water by Mombasa Water and Sewerage Company Limited (MoWaSCo), a contracted company by Coast Water Works Development Agency (CWWDA) formerly Coast Water Services Board (CWSB). The agency gets its water supplies from Baricho well fields from the North, Mzima Springs from the North East and Marere Water works from the south (MWI, 2012).

Groundwater sources from private boreholes and shallow wells meets over 35% of the water needs of the residents of Mombasa (Munga et al., 2006). Locally, majority of the residents of Shimanzi area supplied with piped water by MoWaSCo from Mzima Springs. the supply is intermittent and very unreliable in the area. The piped supply is supplemented by groundwater inform of shallow well and drilled boreholes.

2.3 Geology

2.3.1 Introduction

This section examines the regional and local, geology in brief and is based on field observation coupled with studies Caswell and Baker, (1953).

2.3.2 Regional Geology

a) The Coastal Plain, composed of the Pleistocene deposits,
b) The Foot Plateau, which very nearly coincides with the Jurassic deposits, and
c) The Nyika, which is underlain by the Duruma Sandstones.

2.3.3 Local geology

Caswell and Baker, (1953) shows that the site lies on Pleistocene Kilindini sands underlain by Coral reef formation. The water bearing formation is expected saturated Kilindini sands. An excerpt from Caswell and Baker, (1953) geological map is shown on Figure 3.

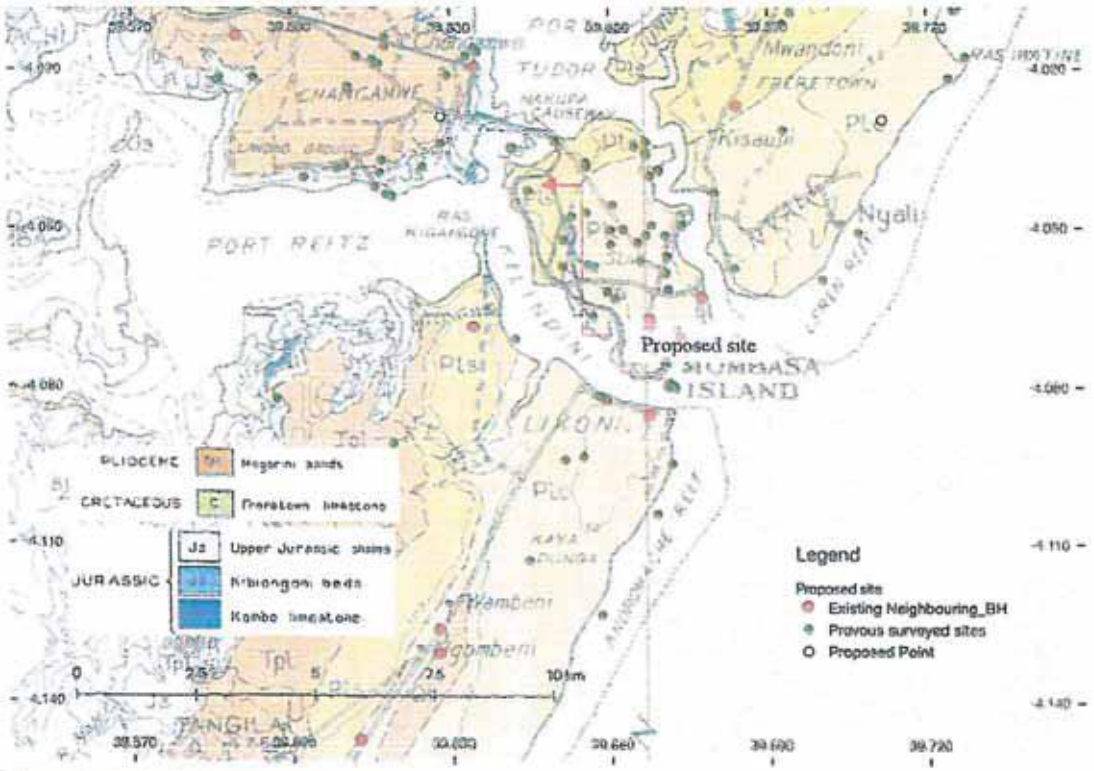


Figure 3: Geological of map of the proposed site;

Source: Caswell and Baker, (1953)

CHAPTER THREE

3 Hydrogeology

3.1 Introduction

This Chapter discusses the hydrogeology of the area. There are numerous operational wells and a borehole within Mombasa Island an indication that ground water prospects in the is fairly good.

3.1.1 Information with regards to Neighboring Boreholes

Table 3-1: A list of registered boreholes within the area

ID	OWNER	LOCATION	LOCALITY	TDEPTH (m)	WSL (m)	WRL (m)	YIELD (m^3/H)	Dist. Direct
			Telegraph					
C 181	D.W.D	Msa Island	Port Mbar	24	23	21	16	
C 182	D.W.D	Msa Island		21	20	18	2	
C 183	D.W.D	Msa Island	Golf Course Sch	21	13	13	18	
C 3083	Msa. Sports Club	Msa Island	Msa Sports Club	17	17	15	6	
C 9392	G.Ngugi Kanimali	Msa Island	Nyali	33	31	14	2	
C 9961	Padya Mem. Hospital	Msa Island	Kizingo	24	20	17	2	
C 10501	Magistrate Courts	Msa Island	Kizingo	25	21	20	2	---
	AVERAGE			**23.57**	**20.71**	**16.86**	**6.86**	

3.1.2 Hypothetical estimation of groundwater potential

Mombasa island hosts many productive boreholes mostly used for domestic purposes, a small hydrocensus conducted shows that the information is very scanty. It therefore, very difficult to estimate hypothetically the aquifer properties of the area. However, a borehole at Shimanzi area approximately 1.4 Km NE on a straight line, has all the necessary drilling and pump testing information.

Table 3-2: Recorded geologic logs during drilling at Shimanzi off along Swalch Nguru Road -

From	To	Description of the penetrated formation
0	6.0	Top yellowish-brown sands
6.0	9.0	Sands intercalated with clays -
9.0	18.0	Clavey sands mixed with Coral limestone particles (Water Struck Range)
18.0	30.0	A mix of sands and coral reef formation.

3.1.3 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 33.55 m. If therefore, a pump was to be given a 25% pump intake allowance, then:

$$s=75/100 \times 15.28 = 14.72 \text{ m}$$

Therefore, since, Q= Ts where, s= drawdown. Then if Q is averagely 2.5 m^3/h as illustrated above,

Specific capacity =Q/s=2.5/14.72= 0.1698 m^2/h

Specific capacity = **4.0760 m^2/day**

3.1.4 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 (De Ridder and Kruseman, 1990)

T=Kb= (m/day) (m) =m^2/day where,
b=saturated thickness of the aquifer.

However, Transmissivity can be calculated hypothetically from (Logan, 1964) formulae Where, T=Q/s * 1.22, where, Q/s= specific capacity calculated as 4.454 m^2/day

Therefore, T= **4.07060** * 1.22

T= **4.9728 m^2/day**

3.1.5 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 be rearrange to reflect Hydraulic Conductivity K =T/b where T=transmissivity (**4.9728 m^2/day**) and b = aquifer thickness (assumed hypothetically to be avg. T. depth - Avg. WSL = **12.00 m**)

K=4.9728/12.00

K=**0.4144 m/day**

3.1.6 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

3.1.7 Storage Coefficient

This is the volume of water that the aquifer releases from or takes into storage per unit surface area of aquifer 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,

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

For this particular case, the storage coefficient S = $3 \times 10^{-6} \times 12.00$

$$S = 1.56 \times 10^{-5}$$

Table 3-3: 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	$8.6^{-3} - 0.86$	
[illegible]	[illegible]	[illegible]
Well-sorted gravel	8.6 – 860	
Domenico and Schwartz, (1998)		
Shale	$8.6^{-11} - 1.7^{-6}$	
Anhydrite	$3.5^{-12} - 1.7^{-9}$	
Salt	$8.6^{-10} - 8.6^{-4}$	
Siltstone	$8.6^{-9} - 1.2^{-5}$	
Sandstone	$2.6^{-7} - 5.2^{-3}$	
Limestone and dolomite	$8.6^{-7} - 5.2^{-3}$	
Karts and reef limestone	$8.6^{-4} - 17$	

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

3.2 Groundwater Flux

The groundwater flux can be inferred with respect to Darcy's law. This is a velocity measure and gives the ideal velocity of groundwater from the Darcy's law it follows that the rate of groundwater movement is governed by hydraulic conductivity of an aquifer and the hydraulic gradient. Groundwater can typically be conceived of as a massive body of water. The velocity of groundwater is based on hydraulic conductivity (K), as well as the hydraulic head (I). Therefore, the equation determined by Darcy to describe the basic relationship between subsurface materials and the movement of water through them is

Q = K*i*A where Q is the volumetric flow rate (or discharge) and A is the area that the groundwater is flowing through. Since from Darcy Q=K*i*A (b x W), It follows that Q= T x *i* x W ..... Substituting K with T/b (T=Kb) Where T = transmissivity calculated from the neighbouring borehole at Table 1 as **4.9728 m²/day** and Hydraulic gradient as *I;*

The study assumes groundwater flow is from the site northwards towards the Indian Ocean gravity; ground elevations fall from approximately 22 m amsl (above mean sea level) to 0 m at amsl (above mean sea level) at shoreline. this translates to a horizontal distance of approximately 1.4 km (1400.0 m) (from topo map 201/1 below).

It therefore follows that i is approximately 0.01643 ... 23/1400) w= the study assumes a width of 1000 m (per kilometre) It follows that Qdarcy is

Q = T.*i*.W = 4.9728 x 0.01643 x 1.000 = **81.70 m³/d for each Kilometre**

Figure 4: Topo map 201/1– Mombasa respectively used for Qdacy calculations

3.3 Impact of water abstraction in the area of survey

Cases of subsidence of land have been witnessed in limestone and dolomite formations where dissolution of the formation occurs causing caving in of the land, which can be catastrophic. Drilling experience in the area show there is minimal chances of this occurring, as there is no evidence that this might occur in the study area. However, abstraction of water from a well or borehole will generally cause some changes in the fresh - salt-water equilibrium. Since by virtue of density contrast, fresh water normally overlies the salty water hence creating a salty-fresh water interface. It is evident that abstraction will shift the saline component. Due to the lowering of the fresh water head, the saline interface will tend to move upward, and seek a new equilibrium with the pumped water level.

Thus, in a continuous aquifer zone, any lowering of the water table will ultimately result in an upward movement of the saline interface and the brackish transition zone. If pumping is excessive, the interface will eventually reach the base of the borehole and result to saline water intrusion. This parameter should be monitored during drilling using an electrical conductivity (EC) meter.

CHAPTER FOUR

4 Aquifer Recharge

4.1 Introduction

The *Water Resources Regulations Legal Notice 170 of 2021*(GoK,2021) require that Hydrogeological assessment reports describe groundwater flux 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 Type of recharge

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 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, *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 within Mombasa Island using estimated mean annual rainfall for Shimanzi area (1,225 mm/yr: *S. 2.1*), and the recharge ratio calculated for the Mombasa North aquifer (13%: Walters, 1988), thus:

Recharge = recharge ratio (0.13) x rainfall (1,225) = 159.25 mm/yr.
This is equivalent to 159,250 $m^3/km^2/yr$ (0.15925 x 1,000,000 m^2 or 436 $m^3/Km^2/d$.

CHAPTER FIVE

5 Geophysical Analysis

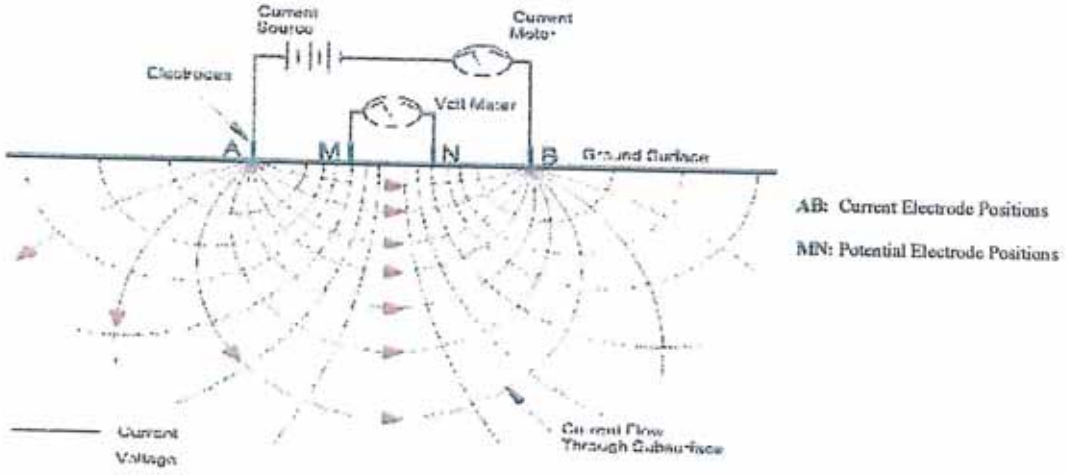
5.1 Introduction

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.



Source: Northwest Geophysical Associates, Inc.,(n.d.)

Figure 5: Schematic diagram of electrode array arrangement Basic Principals

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 reflect 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 and there VES would be conducted at the appropriate areas along the profile zones.

(b) Vertical Electrical Sounding (VES)

Vertical Electrical Soundings (VES) were conducted at the site non-polarized potential electrodes are placed at fixed distances and current electrodes increase in Logarithmic order. Electric current is passed through the current electrodes and the potential difference measured 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. It's technical specification herein been annexed.

5.3 Data analysis

5.3.1 ERT Interpretation

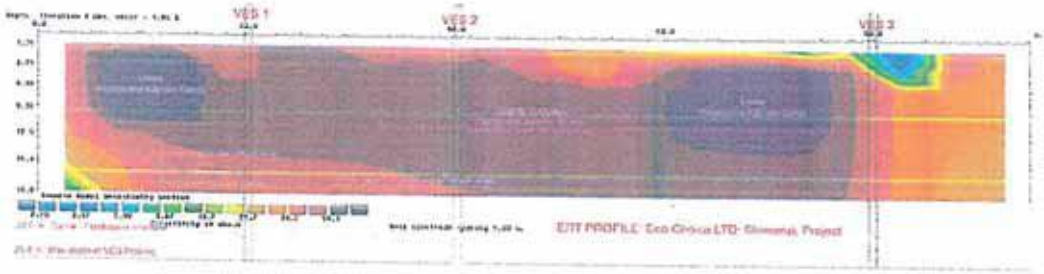


Figure 6:: ERT Section and interpretation

NOTE:

From ERT section patches of dry loose and compact Pleistocene Kallidini sands are visible to a variable depth of between 16 to 18 m below ground level (bgl) . Below this depth we find saturated sands with a fresh saline interface at approximately 22.0 m *bgl.*

Table 5-1: ERT location

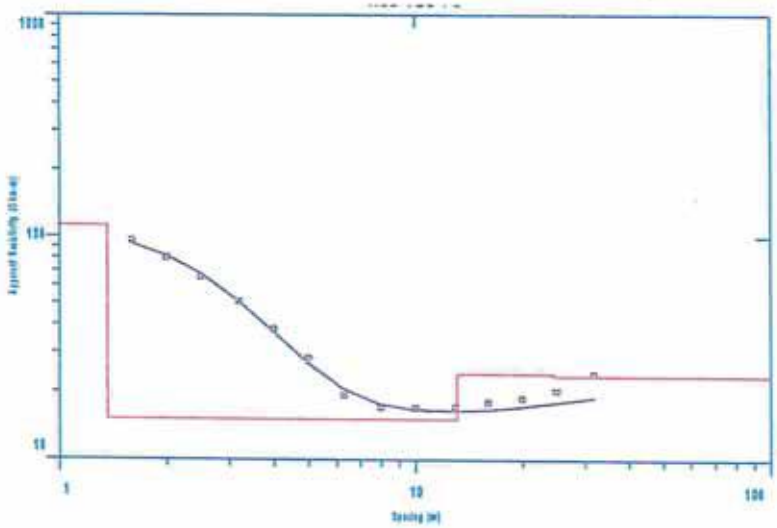
Shimanzi (Datum: WGS 84)				Comments (Direction & Length)
ERT 1	ERT 1-Start	-4.04346	39.64564	Profile 1
	ERT 2-End	-4.04262	39.64548	Along the East Boundary (N-E Direction)

Table 5-2: VES location

No	VES Pt.	Station/ Point	Lat.	Long. (WGS 84)	Lat. Long. (Arc,1960 37S UTM: 21037)
1	VES 1	Station 4	-4.04328	39.6456	
2	VES 2	Station 8	-4.04311	39.64557	
3	VES 3	Station 16	-4.0428	39.64552	
4	VES 4	BH Point	-4 04298	39.64593	

5.3.2 VES Interpretation

ECL VES 1
Schlumberger Array
37 M UTM 571663 E 9553060 S *Elevation*: 23 M (amsl)



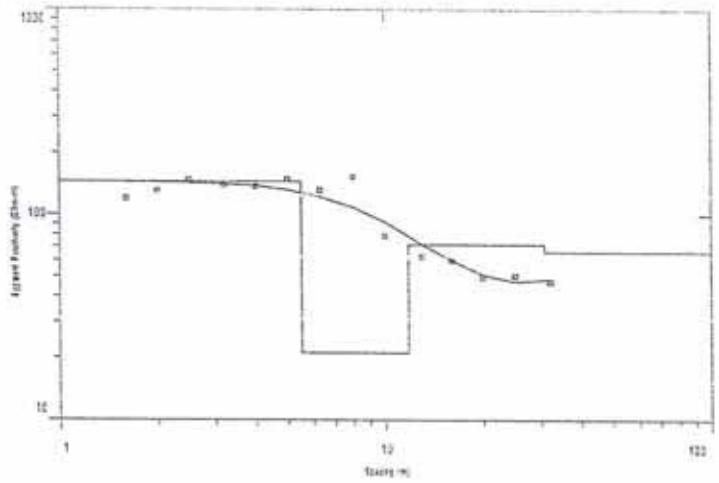
VES 1 AB/2 (m)	MN/2 (m)	ρ (Ohm -m)
1.6	0.5	95.900
2	0.5	79.870
2.5	0.5	65.290
3.2	0.5	50.700
4	0.5	38.120
5	0.5	28.260
6.3	0.5	19.370
8	0.5	17.070
10	0.5	17.020
13	0.5	17.190
16	0.5	18.070
16	0.5	19.510
20	0.5	20.250
25	0.5	21.960
32	5	26.100
32	5	21.690
40		

Figure 7: VES 1 Graph

Table 5-3: VES Point Layered model interpretation

Layer No	Resistivity (Ohm-m)	Thickness (m)	Depth (m)	Lithology	Water prospects
1	111.1	1.37	1.37	Top loose sands with corals	Poor
2	15.13	11.82	13.19	Clayey Kilindini sands	Poor
3	24.11	11.51	24.71	Wet Sands	Fair to Good
4	23.63	═══	>24.71	Wet sands	Fair to Good

ECL VES 2
Schlumberger Array
37M UTM 571659 E 9553079 S *Elevation*: 23 m (amsl)



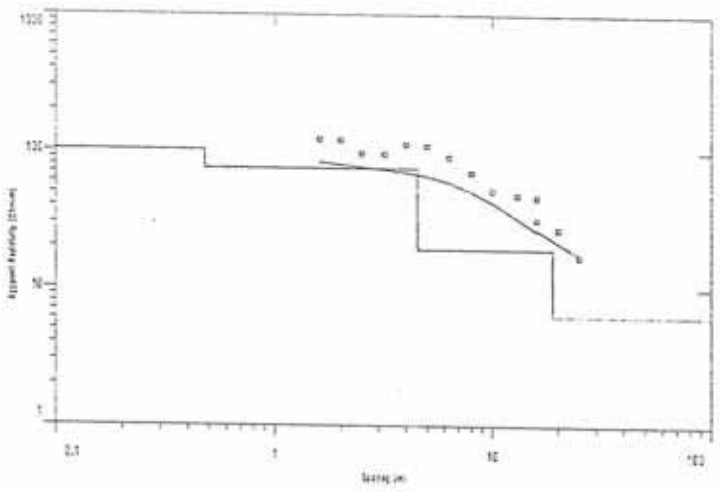
VES 2		
AB/2	MN/2	ρ
(m)	(m)	(Ohm -m)
1.6	0.5	119.2
2	0.5	130.4
2.5	0.5	147.7
3.2	0.5	139.2
4	0.5	137.2
5	0.5	148.4
6.3	0.5	131.7
8	0.5	152.3
10	0.5	78.75
13	0.5	62.56
16	0.5	60.00
16	0.5	62.12
20	0.5	51.35
25	0.5	52.13
32	5	48.76
32	5	
40		

Figure 8: VES 2 Graph

Table 5-4: VES 2 Layered model interpretation

Layer no.	Resistivity (Ohm-m)	Thickness (m)	Depth (m)	Lithology	Water prospects
1	[illegible]	[illegible]	[illegible]	Top reddish-brown soils	Poor
2	21.22	6.24	11.76	Dry Kilindini sands	Fair
3	15.12	18.97	30.74	Wet Kilindini sands	Fair to Good
4	10.13	----	>30.74	Wet Kilindini Sands – Saline?	Fair to Good

ECL VES 3
Schlumberger Array
37 M UTM 571654 E 9553113 S *Elevation*: 22 m (amsl)



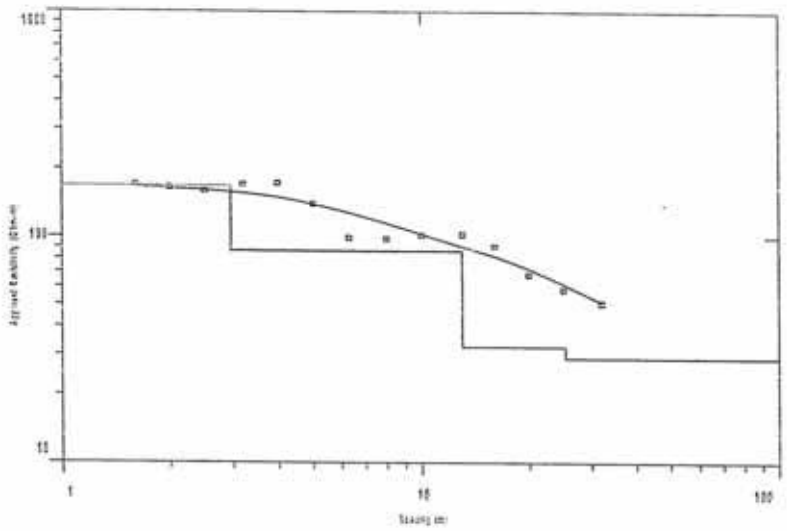
VES 3 AB/2 (m)	MN/2 (m)	ρ (Ohm -m)
1.6	0.5	170.19
2	0.5	165.23
2.5	0.5	160.23
3.2	0.5	170.15
4	0.5	173.13
5	0.5	140.13
6.3	0.5	99.01
8	0.5	98.12
10	0.5	101.94
13	0.5	102.7
16	0.5	90.74
16	0.5	92.12
20	0.5	68.98
25	0.5	59.13
32	5	51.74
32	5	
40		

Figure 9: VES 3 Graph

Table 5-5: VES 3 Layered model interpretation

Layer no.	Resistivity (Ohm-m)	Thickness (m)	Depth (m)	Lithology	Water prospects
1	101.4	0.478	0.478	Top reddish-brown soils	Poor
2	74.90	4.01	4.49	Sands	Poor
3	19.37	14.38	18.87	Wet sands	Fair to Good
4	6.34	=====	>18.87	Wet clayey sands	Fair

ECL VES 4
Schlumberger Array
37 M UTM 571699 E 9553093S *Elevation*: 22 m (amsl)



VES 4 AB/2 (m)	MN/2 (m)	ρ (Ohm -m)
1.6	0.5	121.9
2	0.5	120.1
2.5	0.5	96.71
3.2	0.5	95.13
4	0.5	111.9
5	0.5	109.12
6.3	0.5	91.33
8	0.5	70.14
10	0.5	51.74
13	0.5	48.13
16	0.5	46.66
16	0.5	31.79
20	0.5	27.11
25	0.5	17.13
32	5	
32	5	
40		

Figure 10: VES 4 Graph

Table 5-6: VES 4 Layered model interpretation

Layer no.	Resistivity (Ohm-m)	Thickness (m)	Depth (m)	Lithology	Water prospects
1	167.5	2.95	2.95	Top reddish-brown soils	Poor
2	86.26	10.02	12.98	Dry loose sands	Fair
3	32.59	12.31	25.29	Wet sands	Fair to Good
4	19.03	====	>25.29	Wet Kilindini sands	Good

CHAPTER SIX

Other Recommendations

Drilling works may not commence until the Water Resources Authority (WRA) has assessed permit application (*Form WRMA 001; 001D*), in light of this report and issue an authorization to commence work (*Form WRMA 004*). Once all work is complete Borehole Completion Certificate/report (*WRMA 008 & 009A*) should be filled and submitted to WRA. Then authority will analyse information submitted and may inspect the borehole. If all is acceptable, a Water Permit will be issued after payment of the appropriate water permit fee. Water permit conditions will include the installation of a flowmeter on the discharge line; and the payment of water use charge will apply.

A Test pumping exercise should be carried for the borehole once all drilling and construction work is complete. It is an exercise aimed at establishing safe abstraction rates and selection of the right pump size for the borehole. Upon completion of the exercise, the water should be sampled (2 litres) and taken to competent laboratory for chemical and bacteriological analysis, the results should be checked against Kenya Bureau of Standards (KEBS) thresholds for safe drinking or domestic water use.

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Appendix 1: Geophysical Equipment technical specification data

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 1: Drilling Technique

Drilling Technique

Drilling is an integral part of the extraction of underground resources, when it comes to groundwater drilling the techniques vary considerable depending on several factors, the most striking factor is the host geology. The dominant lithology is of the study area is that of sands and clay formations with interbedded siltstone, sandstone of Pleistocene age. As such drilling technique adopted should be one that is able to stabilize the wellbore with progressive drilling; rotary fluid flush or mud drilling is recommended.

Drilling Rig

The drilling rig should consist of a power pack, drilling assembly, mud pump and draw-works, with at least two diesel engines are used for a typical drilling machine. These engines should be reliable, readily available, durable and generally easy to service and maintain. For ease of mobility drilling rig should be mounted on a lorry for ease of mobility.

The drilling assembly contains a *rotating table* - whose function is to transfer rotary motion through to the kelly to the drill pipe, and eventually to the drill bit, *kelly bar* – works to transfer motion to the drill pipe, and transfer mud down to the drill pipes and to the bit, *drill pipe* - serves as a medium for the transmission of rotary motion to the bit and also acts as a passage for the mud, *drill collars* - are used to provide weight on bit and to keep drill pipe in tension in the drilling line, *stabiliser* – is used to prevent buckling or bending of drill collars and to control drill-string direction and finally *bit* - constitutes the heart of the drill string and is used to cut the rock for the purpose of making boles.

Mud rotary drilling

Mud drilling technique is recommended for the project, besides cooling and lubrication of drilling bits, the addition of special muds or other additives to circulating water provides the following significant advantages when drilling in unstable formations:

- By using fluids of a density higher than that of water itself, significant hydrostatic pressure is applied to the walls of the borehole, preventing the formation from caving in
- The liquid forms a supportive 'mud cake' on the wall of the borehole, discouraging the collapse of the formation
- The liquid holds cuttings in suspension when drilling is halted for the addition of drill pipes
- The liquid removes cuttings from the drill bit, carries them to the surface, and deposits them in mud pits.

Drilling mud/Fluid

Drilling mud used is a partially colloidal suspension of ultra-fine particles in water – fulfils these functions by virtue of its properties of velocity, density, viscosity, and thixotropy (ability to gel or freeze when not circulated) Water by itself exerts hydrostatic pressure at depth in a borehole, but at shallow depths this may not be sufficient. Among additives for increasing the density of water, suitable polymer is most convenient if used in the right quantities; but one of the most widely used is a natural clay mineral known as bentonite (*calcium montmorillonite*), which swells enormously in water. Slurry consisting of water and bentonite combined in the proper proportions has a higher viscosity (to achieve high viscosity the mud needs to be mixed and left for some 12 hours before use to allow the viscosity to build up) than water and forms a mud cake

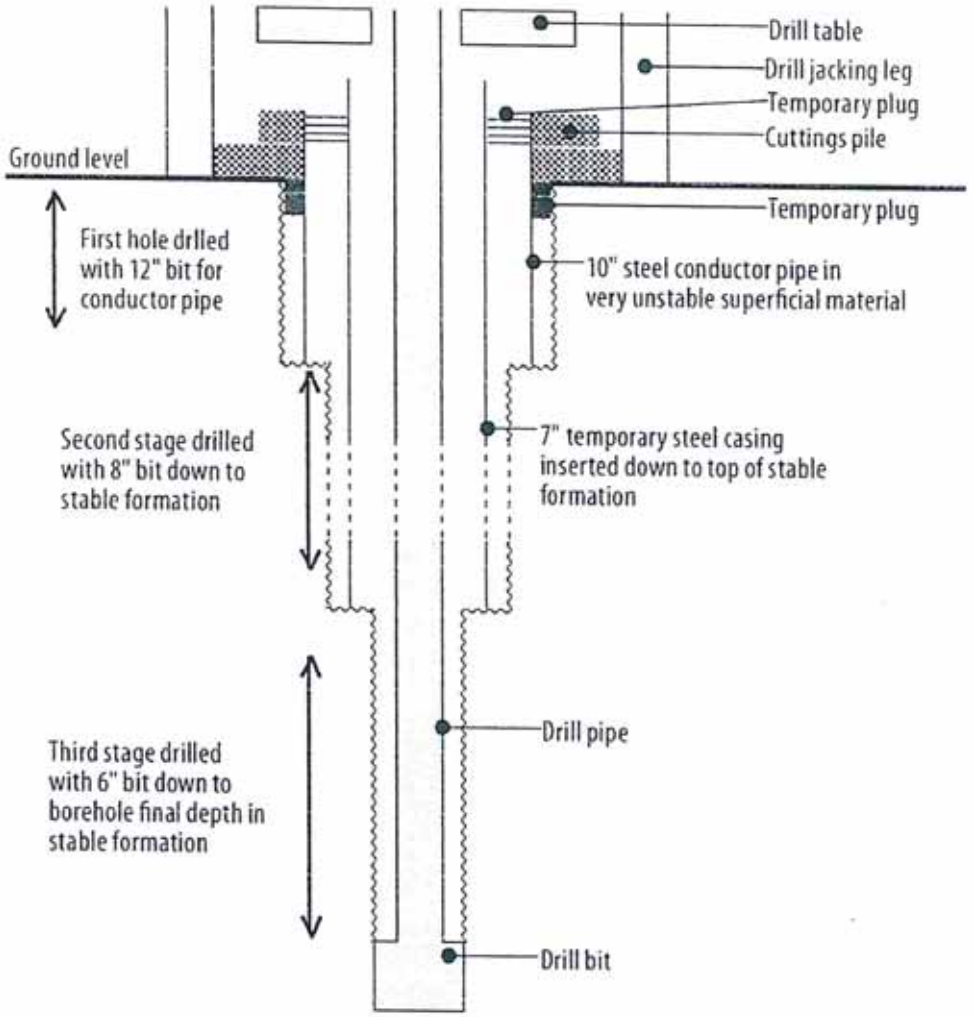
lining in the borehole. A chemical development with Sodium Hexameta Phosphate - SHMP ('*Calgon*') should be initiated to break down and clear of bentonite.

Borehole design

Having drilled a borehole to the required depth, the on-site supervising hydrogeologist should be armed with the following information:

- The depth of the borehole
- A lithological log of the borehole
- Borehole diameter(s) and depths of any diameter reduction
- Depths of water strikes (if any)
- Penetration rate log
- Approximate static water level in the borehole (or some indication of what this might be)

All this data should appear on the borehole log sheet, and should be used while designing the borehole. Some idea of the final design should already be in the mind of the supervisor when he or she is selecting drilling diameters.



Source: Soulsby, (2010)

Figure 11: A schematic section of an example of temporary borehole completion

Borehole Casing

Boreholes are constructed by inserting lengths of protective permanent casing. These are lowered or pushed into the wellbore by the drilling rig to the required depth; the lengths of casing may be joined together by means of screw threads, flange-and-spigot, gluing, riveting, or welding. Casing normally extends up to the surface, with a certain amount (say 0.7 metre) standing above ground level. Lengths of casing may be obtained in mild steel, stainless steel, and plastic (such as *UPVC*). Plastic casings are more fragile and deformable than steel casings (especially the screw threads), and so should be used mainly for low-yield and shallow boreholes. The casing should be capable of withstanding the maximum hydraulic load to which it is likely to be subjected.

On the other hand, steel casing is available in a variety of grades and weights. Low- grade casing

can be used for shallow tube-wells, but heavy- duty, high-grade steel should be used for deeper boreholes (especially those more than 200 metres deep) and when ground conditions hamper insertion (such as coarse gravel/ boulder formations). Special types of casing that can resist aggressive waters are also obtainable, but stainless steel is the best means of combating corrosion. Casing is usually supplied in standard lengths already equipped with screw threads or other jointing methods.

Borehole screens

When a borehole has been dug alongside a water-bearing zone, the casing installed in it must have apertures that allow water to enter as sufficiently as possible while holding back material from the formation. These perforated sections are known as borehole or well screens; they come in sizes and joints similar to casing, so can be interconnected with suitable plain casing in any combination, or 'string.'

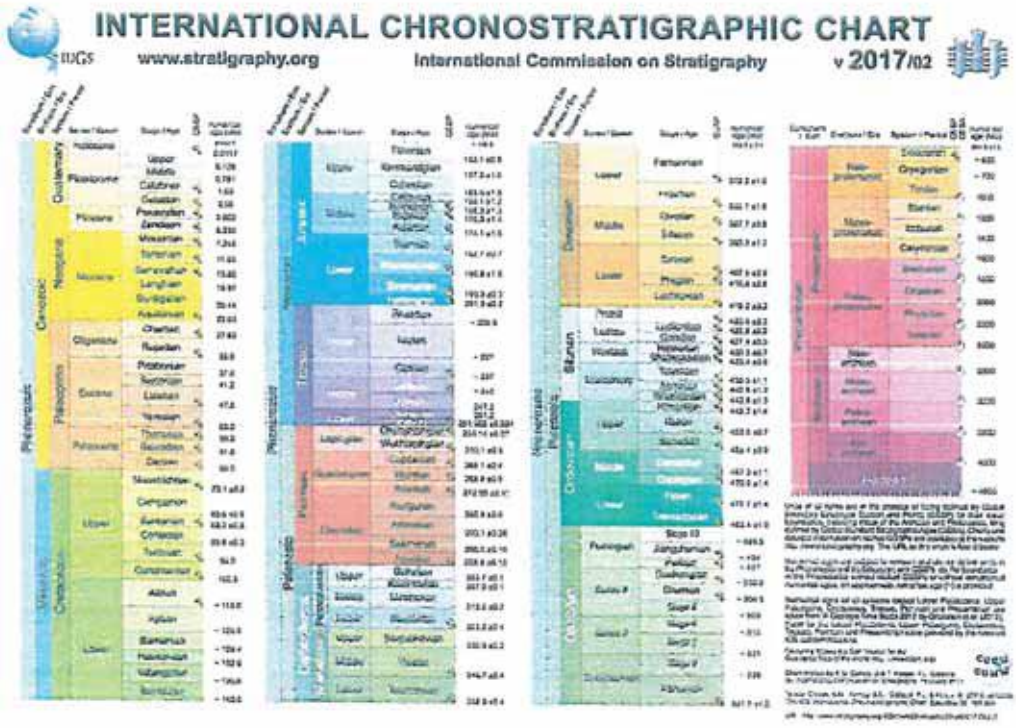
The open area of factory-made plastic screens commonly exceeds 10% of total surface area, but rough-cut holes in mild steel casing rarely take up more than 2 or 3%. Screen slots should be slightly smaller than the average grain size of the aquifer fabric, and should allow water to enter the borehole at a velocity within the range 1 to 6 centimetres/second (0.01 to 0.06 metre/ second). Entrance velocity is de ned as the discharge rate of the well divided by the protective open area of the screen. Too high an entrance velocity may lead to screen incrustation, excessive well losses, and other damaging consequences of turbulent ow conditions.

The most efficient well screens are the well- known '*Johnson screens*' – continuous-slot types manufactured with V-wire wound spirally around a cage of longitudinal support rods. The whole structure may be composed of stainless steel or low-carbon galvanized steel. These wire windings have been constructed such that the slots widen inwards, which significantly reduces rates of screen. The effective open areas of Johnson screens are more than twice that of conventional slots, which allows more water to enter per length of screen. Slot sizes of 0.15 to 3 mm, diameters of 11/2" to 32", and screen lengths of 3 metres and 6 metres are available. Johnson screens allow yields of about 5 to 6 litres/second per metre length, so that a 6-metre-length can give about 30 to 35 litres/second and a 12-metre-length twice as much.

Gravel Pack

After the casing and screen string have been inserted, natural material will tend to fall from the walls of the borehole into the annular space, forming a natural back fill or 'gravel pack' that helps to filter incoming water. The screen slot sizes should be such that only the finer content of this back fill is allowed into the borehole; this can be washed out during development, leaving the coarser portion behind to act as a filter. Thus, an aquifer is suitable for the development of a natural gravel pack if it is coarse-grained and poorly sorted, as many alluvial gravels are (a relatively rare situation). A borehole drilled into an unstable aquifer formation, or into one that is well sorted, and with a high proportion of fines (which would be apparent from the drill samples), will require an artificial gravel pack around the screens. When the only screens available on site are of a slot size larger than the average grain size of the aquifer, then a gravel pack should be installed. Unfortunately, time and other constraints do not normally allow a detailed grain-size analysis of the aquifer fabric to be carried out in the field; so, a degree of intuition is required here. If there is any uncertainty, install an artificial gravel pack.

Appendix 2: Geological Time Scale



Source: Cohen et al., (2013)

BASELINE AMBIENT AIR MEASUREMENT REPORT FOR THE PROPOSED INSTALLATION & OPERATION OF THE THERMAL DESORPTION UNIT-HAZARDOUS WASTE TREATMENT FACILITY ON PLOT NO: MOMBASA/BLOCK 1/588-SHIMANZI, MOMBASA COUNTY

SUBMITTED BY:

ECO CHOICE LIMITED

P.O. BOX 1805-80100

MOMBASA, KENYA.

PREPARED BY:

Polucon

At your service

POLUCON SERVICES KENYA LIMITED

P.O. BOX 99344 – 80107

MOMBASA, KENYA.

NYATI ROAD OFF LINKS ROAD

TEL. NO. 254 41 4470777/3/4

MEASUREMENT DATE(S):

25TH FEBRUARY 2023

REPORT REFERENCE NO.:

202314010020

REPORT QA/QC

REVISION	DATE	PREPARED	REVIEWED	APPROVED
00	28/02/2023	Kelvin Gona	Rashid Bendera	Wilfrida Anganya
01	02/03/2023	Kelvin Gona	Rashid Bendera	Wilfrida Anganya
02				
03				

COMPANY STAMP	SIGNATURE		
POLUCON SERVICES KENYA LTD. P.O. BOX 99344 - 80107, MOMBASA			

CLIENT REPRESENTATIVE

DATE	NAME	COMPANY	SIGNATURE & STAMP
4 MARCH '23	MAURO ZACCARIA	ECO CHOICE	ECO CHOICE LTD. PVT-GYUJ69K / P051727754V P.O. Box 1805 - 80100, MOMBASA

REPORT DETAILS

REPORT TITLE	BASELINE AMBIENT AIR MEASUREMENT REPORT
REPORT REFERENCE	202314010020
NAME & ADDRESS OF THE MEASUREMENT AND TESTING FIRM.	POLUCON SERVICES KENYA LIMITED P.O. BOX 99344 – 80107 MOMBASA, KENYA. NYATI ROAD OFF LINKS ROAD
OPERATOR & ADDRESS	ECO CHOICE LIMITED P.O. BOX 1805-80100 MOMBASA, KENYA.
MEASUREMENT SITE	SHIMANZI
MEASUREMENT DATE (S)	**25TH FEBRUARY 2023**
REPORT DATE	**2 MARCH 2023**
STATUS	**FINAL REPORT**

POLUCON SERVICES KENYA LTD. P.O. BOX 99344 - 80107, MOMBASA

EXECUTIVE SUMMARY

Polucon Services Kenya Limited, a NEMA Designated laboratory, was contracted by ECO CHOICE LIMITED, herein referred to as the client, to carry out Baseline ambient air quality measurement for their proposed Project of Installation & Operation of Thermal Desortion Unit-Hazardous Waste Treatment Facility. Replicate sampling methodology was deployed to get representative data at the time of monitoring. Four monitoring locations were methodologically selected to assess, measure and capture the real time data at the time of monitoring before commencement of the proposed project. Baseline Air Quality Monitoring was done for one hour a weighted time average.

The scope of work was limited to monitoring of Particulate Matter ($PM_{2.5}$ & PM_{10}), Ozone (O_3), Sulphur Dioxide (SO_2), Carbon Monoxide (CO), Nitrogen Dioxide, (NO_2) and Nitric Oxide (NO), Total Volatile Organic Compounds (TVOCs) and Hydrogen Sulphide (H_2S). Additionally, weather parameters were recorded for Wind speed, Temperature, Humidity, and Wind direction. The results obtained were correlated to the Environmental Management and Coordination (Air Quality) Regulations, 2014 to determine compliance.

Results and Discussion

The table below summarize the results obtained for the Baseline air quality measurements carried out at Shimanzi for the proposed Project of Installation & Operation of Thermal Desortion Unit-Hazardous Waste Treatment Facility.

Table 1-1: Summary of air quality measurement results

Pollutants/ Locations	Particulate Matter $PM_{2.5}$ (µg/m³)	Particulate Matter PM_{10} (µg/m³)	Carbon Monoxide CO (mg/m³)	Sulphur Dioxide SO_2 (µg/m³)	Nitrogen Dioxide NO_2 (µg/m³)	Total Volatile Organic Compounds	Hydrogen Sulphide H_2S (µg/m³)	Ozone (µg/m³)
Point I	24	25	2.409	0.110	0.110	48	0.028	0.093
Point II	22	23	2.537	0.024	0.132	32	0.024	0.031
Point I	12	13	2.011	0.010	0.038	22	0.023	0.010
Point IV	13	14	2.006	0.013	0.013	18	0.027	0.009
EMC (Air Quality Regulations, 2014	**75 (mg/m³)**	**100 (µg/m³)**	**10.0 (mg/m³)**	**125 (µg/m³)**	**100 (µg/m³)**	**600 (µg/m³)**	**150 (µg/m³)**	**200 (µg/m³)**

As per EMC (Air Quality), Regulations, 2014, First Schedule-Table 1: Ambient Air Quality Tolerance Limits, the proposed project site falls under the Industrial Area as it is located in Shimanzi.

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Conclusion and Recommendations

Results for both gaseous and particulate matter parameters complied with EMC (Air Quality) regulation 2014 limits. The baseline forms the basis upon which future data can be compared to assess environmental changes during the construction phase and at the end of the project.

All the particulate matter and gaseous parameters monitored were found to be within the EMC (Air Quality) Regulations, 2014. The particulate matter obtained were mainly from fugitive dust from the nearby industries and the tarmac road. Additionally, the proposed site was bare with loose soil that was easily blown by wind, adding to the concentrations of particulate matter.

The gaseous parameters such as SO_2, NO_2 were mainly from exhaust fumes. The Total Volatile Organic Compounds could have been attributed to the industries within which mainly deal with Oil transportation and storage.

Recommendations

The baseline monitoring results for both particulate matter and gaseous parameters

During the construction phase of the project, the client should do interval watering to minimize dust pollution, as the soil within the proposed project site is very fine and easily blown by wind. The locomotive sources which will be used should be well serviced and use the right fuel type to minimize emission of exhaust fumes from combustion of fossil fuels. Trucks carrying construction materials should be fully covered to avoid emission of the materials such as cement and sand.

Monitoring of ambient air should be done at least quarterly during the construction phase to monitor the pollutants levels.

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ABBREVIATIONS AND ACRONYMS

EMC	Environmental Management and Co ordination
NEMA	National Environment Management Authority
PSKL	Polucon Services Kenya Limited
Mg/Nm³	Milligram per Normal meter cubed
SO_2	Sulphur Dioxide
CO	Carbon Monoxides
NO	Nitrogen Monoxide
PM	Particulate Matter
NO_2	Nitrogen Dioxide
TVOCs	Total Volatile Organic Compounds
H2S	Hydrogen Sulphide

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1 INTRODUCTION

1.1 Overview

ECO CHOICE LIMITED contracted Polucon Services Kenya Limited to perform Baseline ambient air measurement for proposed Project of Installation & Operation of Thermal Desortion Unit-Hazardous Waste Treatment Facility. The proposed project site is within Shimanzi area bordered by some industries such as East African Storage and Vivo Energy.

The purpose of the baseline studies is to capture the existing condition within the proposed project site before the commencement of the project activities. The proposed activities will involve construction works, movement of locomotive sources, engineering works, excavations, and land clearing.

Excavations, land clearing, transportation of construction materials will result in emission of dust particles. Most of the locomotive sources will use fossil fuels. Combustion of fossil fuels will result in emission of gaseous parameters such as Sulphur dioxides, Carbon Monoxide and Nitrogen Oxides. Being surrounded by the Oil Companies, the levels of Hydrocarbons in form of Volatile Organic Compounds can affect the ambient air within the project site.

This baseline report will form the basis for future comparisons. Baseline studies are done to get the existing condition while no operation is taking place. Four monitoring locations were selected methodologically selected to get representative data. Replicate sampling was used to cater for changes in meteorological conditions such as wind speed and direction. Temperature and humidity were also monitored at the time of monitoring.

The measurements were carried out on 25th February 2023 at four selected monitoring locations. The following sections of this report details, the scope, objectives, methodologies, legislations, and results of the monitoring exercise carried out at

1.2 Scope of work

The scope of work as agreed with the client involved:

- Conducting baseline ambient air quality measurements at four locations within the proposed project site.
- Collecting data for the following parameters for each site: $PM_{2.5}$, PM_{10}, O_3, SO_2, CO, NO_2, TVOCs, H_2S and NO.
- Correlating the findings to the Environmental Management Coordination (Air Quality), Reguiations, 2014.

  Utilize the baseline findings to evaluate any potential modifications to the environmental conditions that may occur during the construction phase and after the completion of the proposed project.

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1.3 Objectives

- To measure the concentrations of particulates and gaseous parameters at the proposed project site to capture the existing conditions at the time of monitoring.
- To correlate the results with the Environmental Management Coordination (Air Quality Regulations) 2014 to ascertain compliance.
- To document the findings in a comprehensive report that will be used to determine any environmental changes during the construction phase of the proposed project.

1.4 Description of the Proposed Project Site

Eco Choice Limited is proposing to renovate the Kipevu Sewage Treatment Plant. The proposed project location is in Shimanzi-Mombasa County. The proposed project site is bordered by East Africa Storage, Vivo Energy and Ola Energy. The following sections describes the locations monitored to represent the baseline conditions of the proposed site and its environs. It is also worth noting that, at the time of monitoring, trucks were parked within the proposed project site.

Point I- The monitoring location situated at the entry of the proposed project site is anticipated to experience the movement of trucks during the construction phase. These trucks will carry construction materials into the project site. Therefore, it was crucial to obtain the existing particulate matter concentrations to establish future correlations during the construction phase, and to identify any environmental changes and the extent of pollution, particularly during the construction phase.

During the monitoring exercise, a few trucks were observed passing within 10 meters of the monitoring location, where a tarmac road is present.

Plate 1-1: Location I

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Point II- The monitoring location situated at the center of the proposed project site was chosen due to the majority of construction activities scheduled to take place at this point, including the receiving of construction materials. The soil within the proposed project site was identified to be fine and loose, which increases its susceptibility to wind erosion. The prevailing wind speed, which moves from the North to the South East, was observed to average 14 km/hr.

Plate 1-2: Location II

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Point III-This monitoring location is located at the edge of the proposed project site North West of site from Entrance. This monitoring location was selected to capture the boundary concentration so that any emission from the neighbouring industries can be captured and future comparisons can be made during the construction Phase. This monitoring location is bordered Ola Energy and Oil Storage Tanks.

Plate 1-3: Location III

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Point IV-This monitoring location is located at the edge of the proposed project site on the East sides. This monitoring location is bordered by few tall trees and some local hotels. Trucks were parked at the time of monitoring.

Plate 1-4: Location IV

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1.5 Monitoring Locations

Baseline Ambient air quality monitoring of test parameters was done for one-hour weighted time average for the four monitoring locations at the proposed project site on 25th February 2023 Monitoring locations were selected methodically to represent the Baseline ambient air quality levels sensitive locations.

Table 1-1 and Figure 1-1 overleaf, describes the monitoring locations and indicates their GPS coordinates:

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Table 1-1: Description of monitoring locations

NO	SITE NAME	GPS CO-ORDINATES	DESCRIPTION	ONGOING ACTIVITIES
1	Point I	4°2'36.45"S 39°38'44.46"E"	The study location was situated about 15 meters from the tarmac road. This monitoring was at the Main Entrance of the proposed project site. Trucks were passing at the time of monitoring. Wind speed was 13km/hr moving from North to South East.	• Trucks movement at the tarmac road • Normal operations from the neighbouring Industries. • Trucks parking within the proposed project site • This monitoring location is bordered by Vivo Energy and East Africa Storage
2	Point II	4°2'35.12"S 39°38'43.69"E	This was done at the centre of the proposed project site. Truck parking at the time of monitoring. Wind speed was 14km/hr moving from North to South East.	• Trucks parking at the time of monitoring.
3	Point III	4°2'35.41"S 39°38'44.95"E	This Monitoring location was located at the edge of the Proposed Project site on the North West. Wind speed was 16km/hr moving from North to South	• This monitoring location was selected at the edge of the proposed project location on the North West. This location is bordered by storage tanks and Ola Energy.
4	Point IV	4°2'33.39"S 39°38'43.95"E	This monitoring location is located at the edge of the proposed project site on the East sides. Local Hotels borders this point. Wind speed was 15km/hr moving from North to South	• Movement of people around the local eateries

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Figure 1: Aerial presentation of monitoring locations
Source: Google Earth, 2023

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2 METHODOLOGY

2.1 Monitoring Methods

Baseline ambient air quality measurement methodologies vary depending on parameters (analyte of interest) to be monitored as well at the set objectives of the monitoring. Its fundamental that real time and accurate data is collected so that the reported findings can form the basis upon which decision making and environmental audit of project activities can be made. This data can particularly be desirable for air quality effect assessments involving modelling since it enables modelled concentrations for the monitored parameters. This process enables greater confidence to be placed in model predictions.

2.2 Active and Continuous Sampling for gaseous and particulate parameters

Sampling of gases was done using an Instrumex AQM 910 series. Based on advanced sensor technology, the AQM series integrates the main ambient gases and meteorological parameters.

Temperature was measured by way of a highly accurate Air Chip 3000 while humidity was measured using a capacitive humidity sensor (accuracy < 0.8 % / 0.1 K). In order to keep the effects of external influences (e.g. solar radiation) as low as possible, the sensors are located in a ventilated housing with radiation protection.

Measurements for Nitrogen Oxides, Carbon monoxide and Sulfur dioxide was done using the gas sensitive electrochemical methods of active and continuous sampling. The gas sensitive electrochemical sensors generate nano-amp currents proportional to the gas concentration. AQM uses low noise electronics to capture these signals resulting in low detection levels.

Ozone and Carbon Monoxide were measured using a gas sensitive semiconductor sensor. The sensor uses proprietary sensing material, built-in automatic baseline correction and interference rejection. This combination results in ppb resolution and a highly linear response.

The AQM has a laser particle counter (LPC) for Particulate Matter (PM)measurements. It uses optimized signal processing using low noise electronics, it has algorithms that are added to correct for interferences, e.g., humidity. The equipment was mounted at about 1 – 2 M above the ground surface.

2.3 Tools Equipment and materials used

Below is the equipment used during air monitoring survey:

- Instrumex AQM 910 series
- Geographic Positioning System (GPS)
- Digital camera
- Calibration certificates

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2.4 Rationale for Monitoring Parameter Selection

2.4.1 Carbon Monoxide (CO)

Carbon monoxide is a colourless, non-irritant, odorless and tasteless toxic gas. It is produced by the incomplete combustion of carbonaceous fuels such as wood, petrol, coal, natural gas and kerosene. Combustion of fossil fuels such as diesel results in the emission of Carbon Monoxide as a byproduct. At the time of monitoring, less movement of trucks was observed especially at the tarmac road on your way to East African Storage. Being a baseline report, no operational activity was taking place at the time of monitoring within the proposed project site besides the trucks which were parked.

Possible sources of Carbon Monoxide anticipated to occur during the construction phase is emission from exhaust fumes from the locomotive's sources such as trucks, combustion from stationary sources such as generators.

2.4.2 Nitrogen Oxides (NOX)

The oxides of nitrogen (NO_X) comprise nitric oxide (NO) and Nitrogen Dioxide (NO_2), which are gases produced from natural sources, motor vehicles and other fuel burning processes. Nitric oxide is colourless and is oxidized in the atmosphere to form nitrogen dioxide. Nitrogen dioxide has an odour and is an acidic and highly corrosive gas that can affect our health and environment.
Natural sources include volcanoes, oceans, biological decay, and lightning strikes.
At the time of monitoring, the possible primary sources could be emission from the trucks and fugitive gases from the neighbouring industries.

2.4.3 Particulate Matter

Particulate matter refers to is small particles that are classified as PM_{10}, $PM_{2.5}$ or $PM_{0.1}$ depending on their size. These particles have a diameter of less than 10 µm, 2.5 µm and 0.1 µm respectively; particles smaller than 0.1 µm are also called ultrafine particles (UFPs). There is a natural concentration of PM in the atmosphere that consists of marine salt or pollen, but it is enhanced by various human activities such as the burning of fuels or the handling of goods. The combustion of diesel and heavy fuel oil leads to a high amount of PM emissions. PM also develops when certain pollutants meet other substances.

The smaller the particles, the worse the effect on human health. Inhalation of inhalable particulate matter pose a great health risk. These tiny particles get into the lungs and are small enough to pass through tissues and enter the blood stream. They can then trigger inflammations which eventually cause heart and lung failures.

At the time of monitoring, the primary sources of particulate matter could have been attributed to the truck's movements, dispersion of dust from the loose soils within the proposed project site.

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The anticipated sources of particulate dust during the construction phase could be resulted by excavations works, earth works, movement of locomotives sources, transportation of construction materials such as and cement.

2.4.4 Sulphur Dioxides

Sulphur dioxide is a colorless gas with a strong choking odor. Sulphur dioxide is produced mainly from the combustion of fossil fuels that contain Sulphur, such as coal and oil (e.g., coal being burnt in a home fireplace for heating and diesel-powered vehicles). Sulphur dioxide is also produced from some industrial processes (e.g. such as natural gas and petroleum extraction, oil refining, and metal processing. fertilizer manufacturing, Aluminium smelting and steel making). Other examples of sources include motor vehicles, locomotives, ships, and off-road diesel equipment that are operated with fuels that contain high levels of sulfur. In nature, they are also released during volcanic activity and from geothermal fields. They have harmful effects on the human body, as they stimulate nasal and throat nerves causing respiratory problems especially in asthmatic individuals.

2.4.5 Ozone

Ozone is a highly oxidative compound formed in the lower atmosphere from gases (originating to a large extent from anthropogenic sources) by photochemistry driven by solar radiation. Owing to its highly reactive chemical properties, ozone is harmful to vegetation, materials, and human health. In the troposphere, ozone is also an efficient greenhouse gas. A small amount of ozone does occur naturally at ground level. Most of the ozone that is found near the ground comes from vehicle exhaust and emissions from factories, power plants, and refineries. Elevated exposures to ozone can affect sensitive vegetation and ecosystems, including forests, parks, wildlife refuges and wilderness areas. Ozone can harm sensitive vegetation during the growing season.

2.4.6 Hydrogen Sulphide

Hydrogen sulfide (H_2S) is a colourless gas, soluble in various liquids including water and alcohol. It can be formed under conditions of deficient oxygen, in the presence of organic material and sulfate. Most of the atmospheric hydrogen sulfide has natural origins. Hydrogen sulfide occurs around sulfur springs and lakes and is an air contaminant in geothermally active areas. Saline marshes can also produce sulfide.

Human activities can release naturally occurring hydrogen sulfide into ambient air. In industry, hydrogen sulfide can be formed whenever elemental sulfur or sulfur-containing compounds come into contact with organic materials at high temperatures. Hydrogen sulfide is formed, for instance, during coke production, in viscose rayon production, in waste-water treatment plants, in wood pulp

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production using the sulfate method, in sulfur extraction processes, in oil refining and in the tanning industry.

2.4.7 Total Volatile Organic Compounds

Total Volatile Organic Compounds as the group of compounds are not generally used. Total Volatile Organic Compounds is a grouping of a wide range of organic chemicals compounds to simplify reporting when these are present in the ambient air or emissions. These are compounds based on the carbon chains or rings with a vapour pressure greater than 0.001kP at 293.a5 Kelvin. Total Volatile Organic Compounds are produced from a wide range of industrial processes. Significant sources are processes producing or using solvents, paints or use of chemicals. Petrol refining, fuel storage and the manufacturing industry, including machinery, chemical products, wood products, plastic products, oil, fat, petroleum and coal products.

The proposed project site is located in Shimanzi where majority of the neighbouring Industries deal with storage and transportation of fossil fuels such as Vivo Energy, Ola Energy and East African Storage. At the time of monitoring, Oil transportation Trucks were parked at the proposed monitoring location.

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3 LEGISLATION & GUIDELINES

3.1 The Environmental Management Coordination (Air Quality Regulations) 2014

The Kenya Air Quality Regulations 2014 impose limit values as detailed in the SPECIAL ISSUE Kenya Gazette Supplement No.41, Legislative Supplement No.15, Legal Notice No. 34, compliance with the objectives (prevention, control, and abatement of air pollution to ensure clean and healthy ambient air) is a legal requirement in Kenya. Statutory requirements relevant to this study **FIRST SCHEDULE** are detailed in Table 3-1.

Table 3-1: Ambient Air Quality Tolerance Limits

Pollutant		Time weighted Average			
			Industrial area	Residential, Rural & Other area	Controlled areas***
1	Sulphur Oxides (SOx)	24 hours**	125 µg/m³	80 µg/m³	30 µg/m³
2	Oxides of Nitrogen (NOx)	24 hours	150 µg/m³	80 µg/m³	30 µg/m³
3	Nitrogen Dioxide	24 hours	100 µg/m³	0.1 ppm	-
4	Respirable particulate matter (<10 µg/m³) (RPM)	24 hours**	150µg/Nm³	100µg/Nm³	75µg/Nm³
5	$PM_{2.5}$	24 hours	75 µg/m³	-	-
6	Carbon monoxide / carbon dioxide	1 Hour	10.0 mg/m³	4.0 mg/m³	2.0 mg/m³
7	Hydrogen Sulphide	24 hours**	150 µg/m³	-	-
8	Non-methane hydrocarbons	Instant peak	700 ppb	-	-
9	Total VOC	24 hours**	600 µg/m³	-	-
7	Ozone	1 hour	200 µg/m³	0.12 ppm	-

The proposed project site falls under the Industrial Zone as per Table 3-1 according to the EMC (Air Quality), Regulations, 2014 being located at Shimanzi area which is designated to be an Industrial Area.

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4 RESULTS

This section below summarizes the results of air quality monitoring for the two monitoring locations.

Pollutants/ Locations	Particulate Matter $PM_{2.5}$ ($\mu g/m^3$)	Particulate Matter PM_{10} ($\mu g/m^3$)	Carbon Monoxide CO (mg/m^3)	Sulphur Dioxide SO_2 ($\mu g/m^3$)	Nitrogen dioxide NO_2 ($\mu g/m^3$)	Total Volatile Organic Compounds	Hydrogen Sulphide H_2S ($\mu g/m^3$)	Ozone ($\mu g/m^3$)
Point I	24	25	2.409	0.110	0.110	48	0.028	0.093
Point Ii	22	23	2.537	0.024	0.132	32	0.024	0.031
Point I	12	13	2.011	0.010	0.038	22	0.023	0.010
Point IV	13	14	2.006	0.013	0.013	18	0.027	0.009
EMC (Air Quality Regulations, 2014	**75 (mg/m^3)**	**100 ($\mu g/m^3$)**	**10.0 (mg/m^3)**	**125 ($\mu g/m^3$)**	**100 ($\mu g/m^3$)**	**600 ($\mu g/m^3$)**	**150 ($\mu g/m^3$)**	**200 ($\mu g/m^3$)**

4.1 Summary results of air quality monitoring for the selected monitoring locations

Table 4-1: Summary of air quality monitoring results for the four monitoring locations

Figure 2: Table for the average weather conditions at the time of monitoring

Monitoring location	Temperature	Humidity	Wind Speed/Direction
Point I	32.4 °C	53.4%	13km/ hr North to S.E
Point II	31.9 °C	55.5%	14km/hr North to S.E
Point III	32.2	55%	16km/hr North to South
Point IV	32.3 °C	56%	15km/hr North to South

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4.2 Graphical representation & discussion of results

4.2.1 Particulate Matter

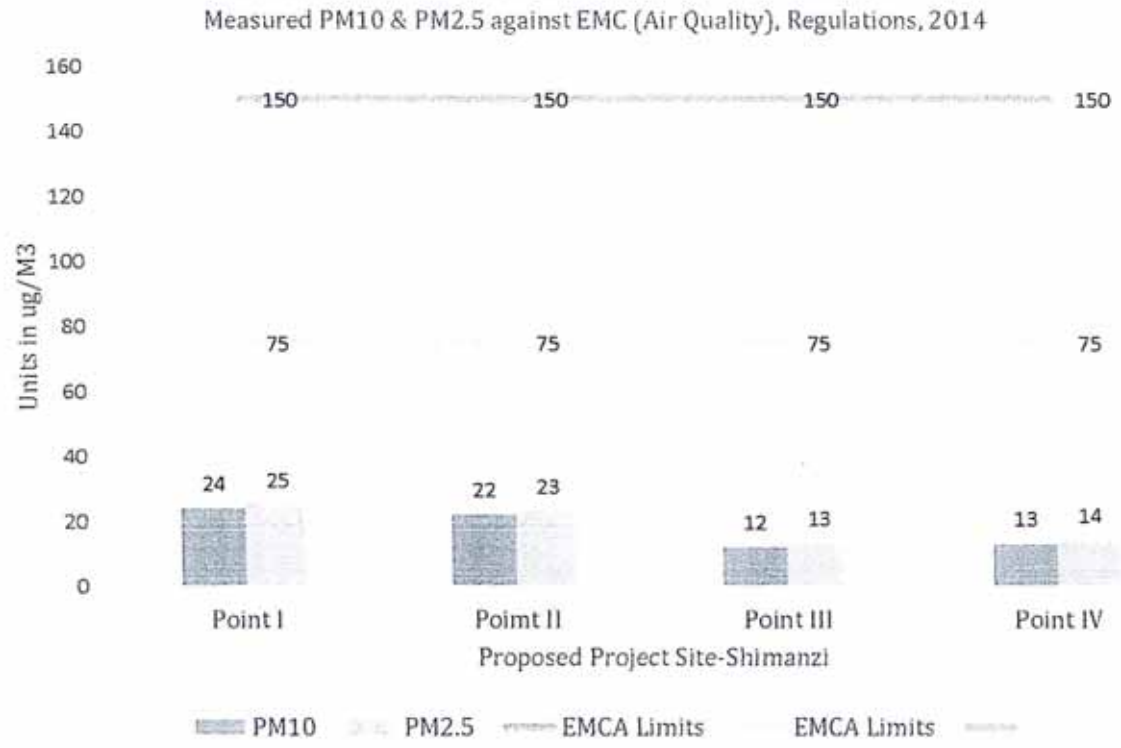

Figure 3- Measured particulate (PM_{10} & $PM_{2.5}$) against EMC (Air Quality) Regulations, 2014

Baseline ambient air quality monitoring was done for four selected monitoring location at the proposed project site. The purpose of the baseline ambient air quality was to asess, measure and record the real time existing data before the commencements of the proposed project site.

All the monitoring location had Particulate Matter (PM10 & PM2.5) within the EMC (Air Quality), Regulations, 2014. The primary sources of particulate dust could be fugitive dust blown by wind, emission from nearby industries and the exhaust emission from the trucks.

Monitoring location I had higher concentration of Particulate Matter (PM01 & PM2.5), at the time of monitoring due to the nearby tarmac where trucks were passing. At the centre of the proposed project site had the second highest due to the fine soil blown by wind. Point three had the lowest concentration of Particulate Matter compared to the other three.

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4.2.2 Carbon Monoxide

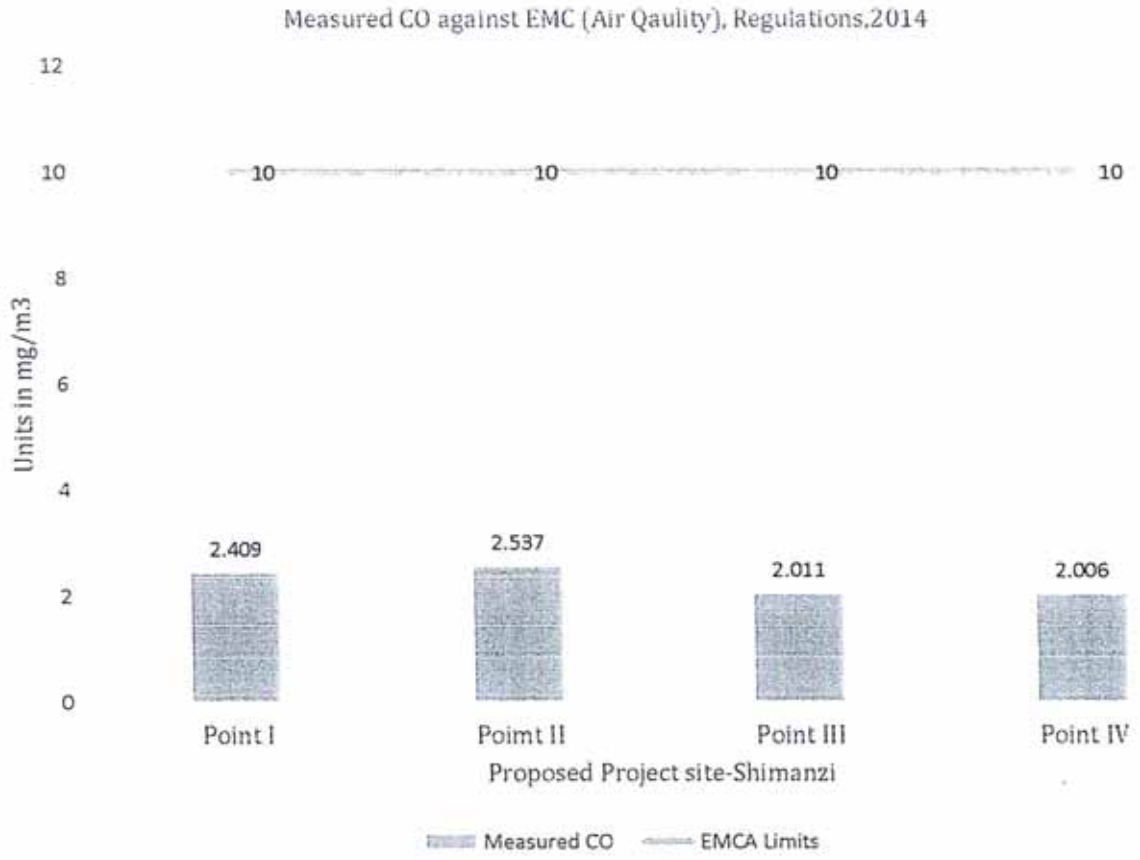

Figure 4: Measured CO against EMC (Air Quality) Regulations, 2014

Baseline ambient air quality monitoring was done for four selected monitoring locations. All the four-monitoring location had Carbon Monoxide Concentrations within the EMC (Air Quality), Regulations, 2014 at the time of monitoring.

Monitoring location II had the highest Carbon Monoxide concentration at the time of monitoring followed by Point, then Point III and Point IV had the least concentrations.

Carbon Monoxide is mainly a by-product of combustion of fossil fuels. Most industries use fossil fuel as energy source. The proposed project site being in the industrial area of Shimanzi, fugitive emission from the industries could be the main source with some percentages at the monitoring location I could have been attributed to the nearby tarmac road where trucks were passing at the time of monitoring.

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4.2.3 Sulphur Dioxide

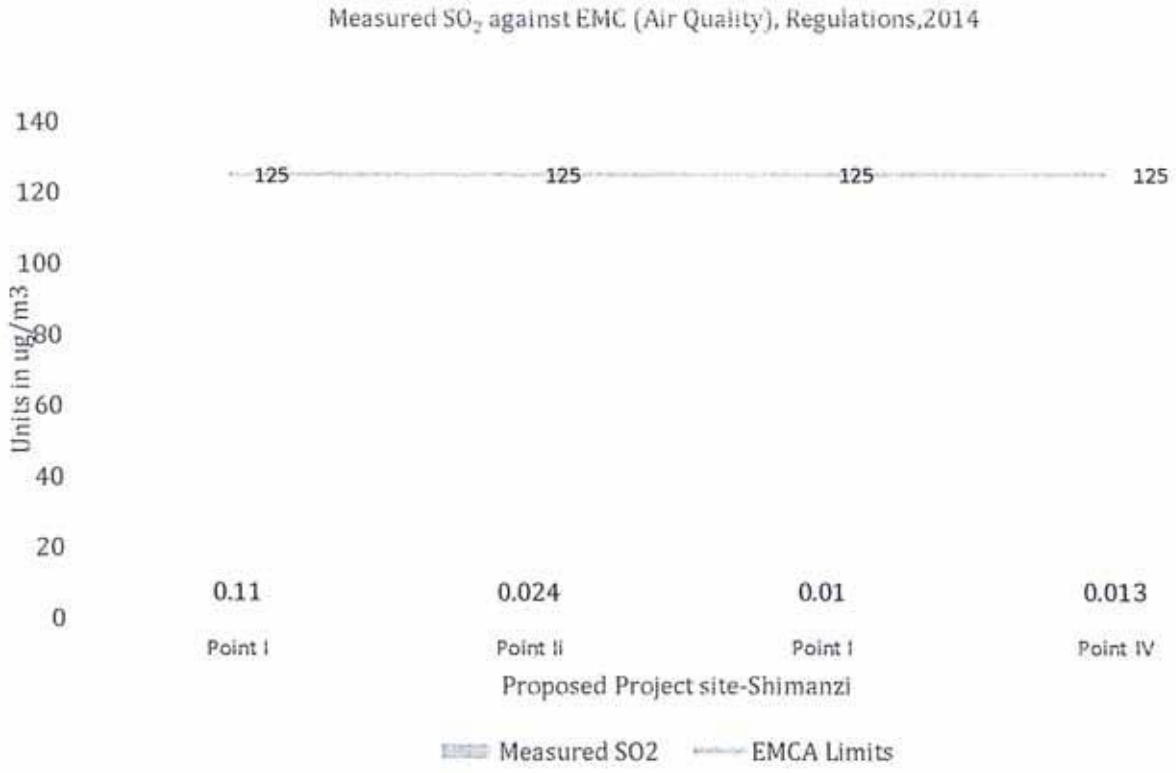

Figure 5: Measured SO_2 against EMC (Air Quality), Regulations, 2014

Baseline ambient air quality monitored was done for all the four selected monitoring locations. All the monitoring location had very low concentration of Sulphur dioxide at the time of monitoring.

All the monitoring locations had Sulphur dioxide within the EMC (Air Quality), Regulations, 2014. Due no movement of locomotives sources within the proposed project site, the Sulphur dioxide obtained were very low.

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4.2.4 Nitrogen Dioxide & Nitrogen oxides

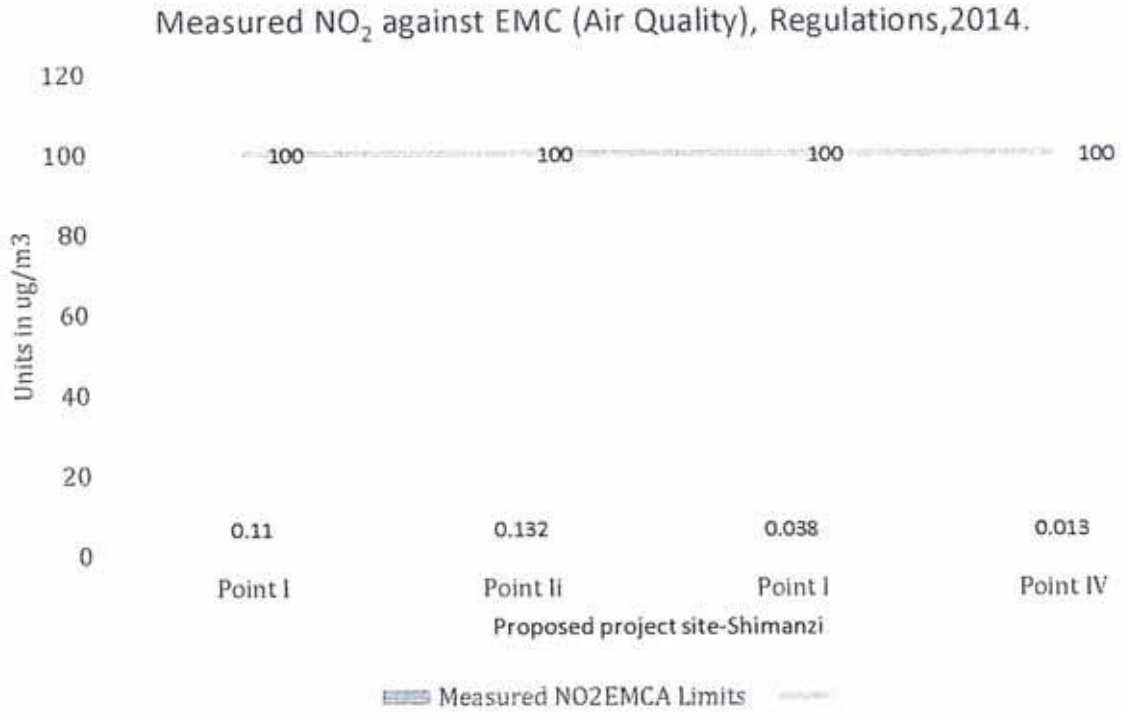

Figure 6: Measured NO_2 and NO against EMC (Air Quality) Regulations, 2014

Very low concentration of Nitrogen dioxides was recorded at the time of monitoring. All the four monitoring locations had Nitrogen dioxides within the EMC (Air Quality), Regulations at the time of monitoring.

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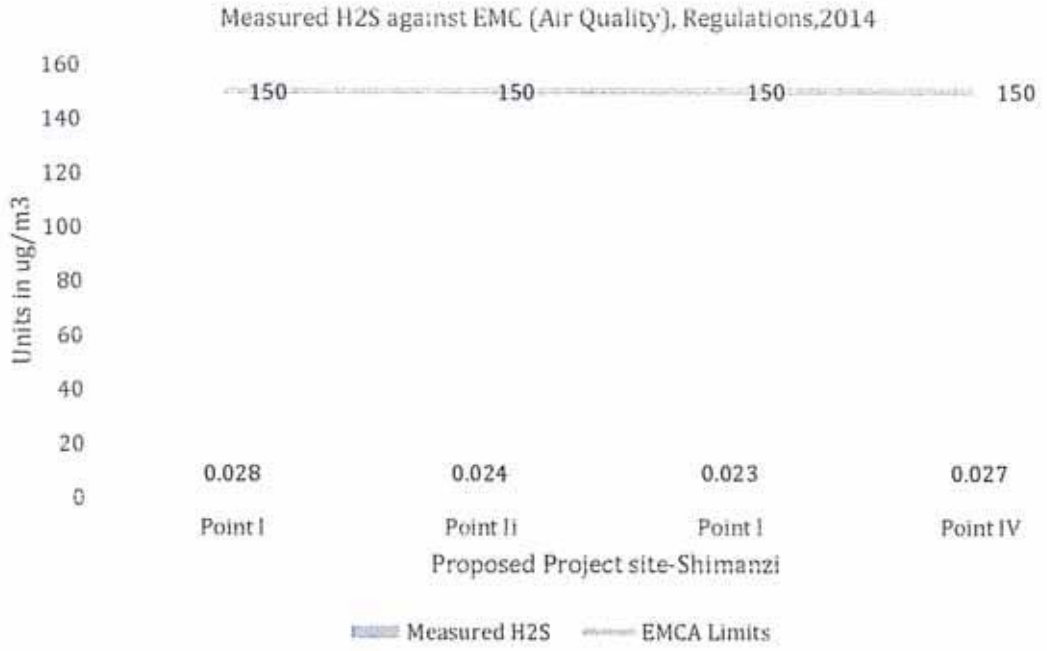
4.2.5 Hydrogen Sulphide



Very low concentrations of Hyrdogen sulphide were recorded at the time of monitoring. All the four monitoring locations had concentrations levels with the EMC (Air Quality), Regulations, 2014 at the time of monitoring.

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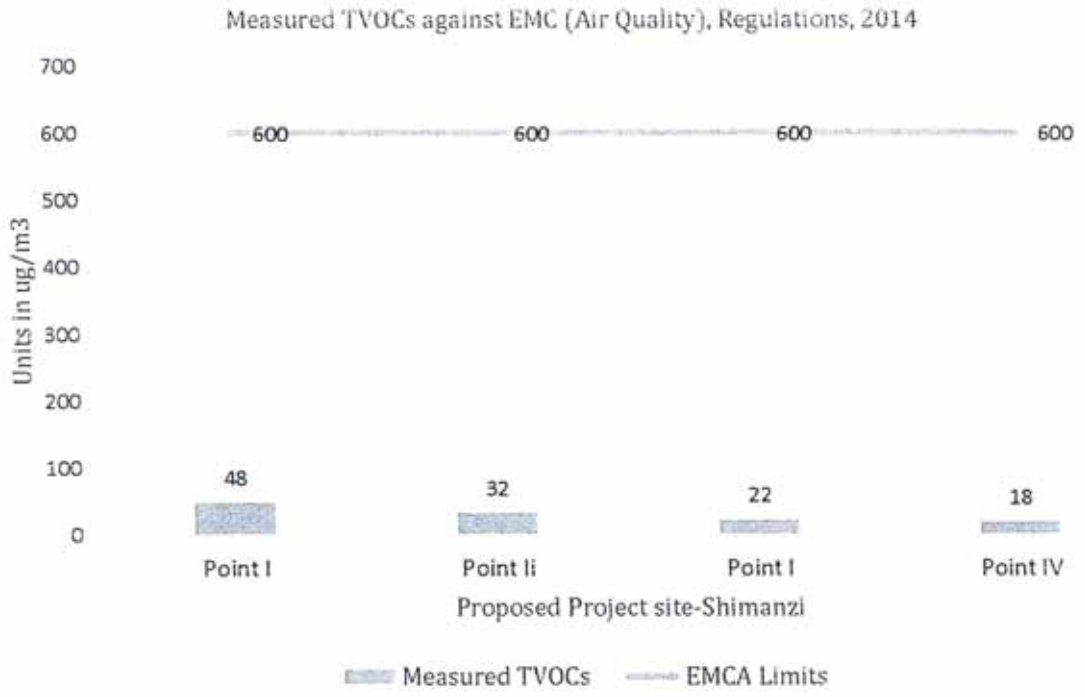
4.2.6 Total Volatile Organic Compounds.



Baseline ambient air quality monitoring was done for four monitoring locations to assess the existing concentration for the Total Volatile Organic Compounds before the commencement of the proposed project.

TVOCs were recorded at all the four monitoring locations, being higher at Point I (Near the proposed project Entrance). This location is bordered by VEVO Energy and East African Storage. Location II had slighter higher concentration than Location III & IV but lower comapred toloation I.

The oil trucks which were parked within the proposed project site could have contributed to the concentrations obtained. Total volatile Organic Compounds being high volatile, they could have been escaping from the tanks at the time of monitoring.

All the monitoring locations had TVOCs concentrations within the EMC (Air Quality), Regulations, 2014 at the time of monitoring.

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5 CONCLUSION

Baseline Ambient air quality measurement was conducted at Shimanzi, which is the proposed location for the project, at four selected monitoring locations. During the monitoring, both Particulate Matter (PM_{10} & $PM_{2.5}$) and gaseous parameters were measured to establish the existing environmental conditions before the commencement of the project activities. This baseline study report will be incorporated into the Environmental Impact Assessment and will serve as a benchmark for detecting any environmental changes during the construction phase. The baseline study was conducted while no operations were taking place within the proposed project site.

Based on the findings, all the Particulate Matter (PM_{10} & $PM_{2.5}$) and gaseous parameters that were monitored met the requirements of the EMC (Air Quality) Regulations, 2014. However, it is possible that the results were influenced by the activities of neighboring industries and the movement of locomotives such as trucks during the monitoring period. Additionally, meteorological conditions such as wind speed and direction could have affected the dispersion of both particulate matter and gaseous parameters during the monitoring period.

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6 REFERENCES

1. Environmental Management Coordination (Air Quality) Regulations 2014

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7 PHOTOGRAPHIC REPORT

Ongoing baseline monitoring at Location I

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Baseline monitoring at Location III

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Storage Tanks at the boundary of the proposed project site

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Truck passing during ongoing monitoring at location I

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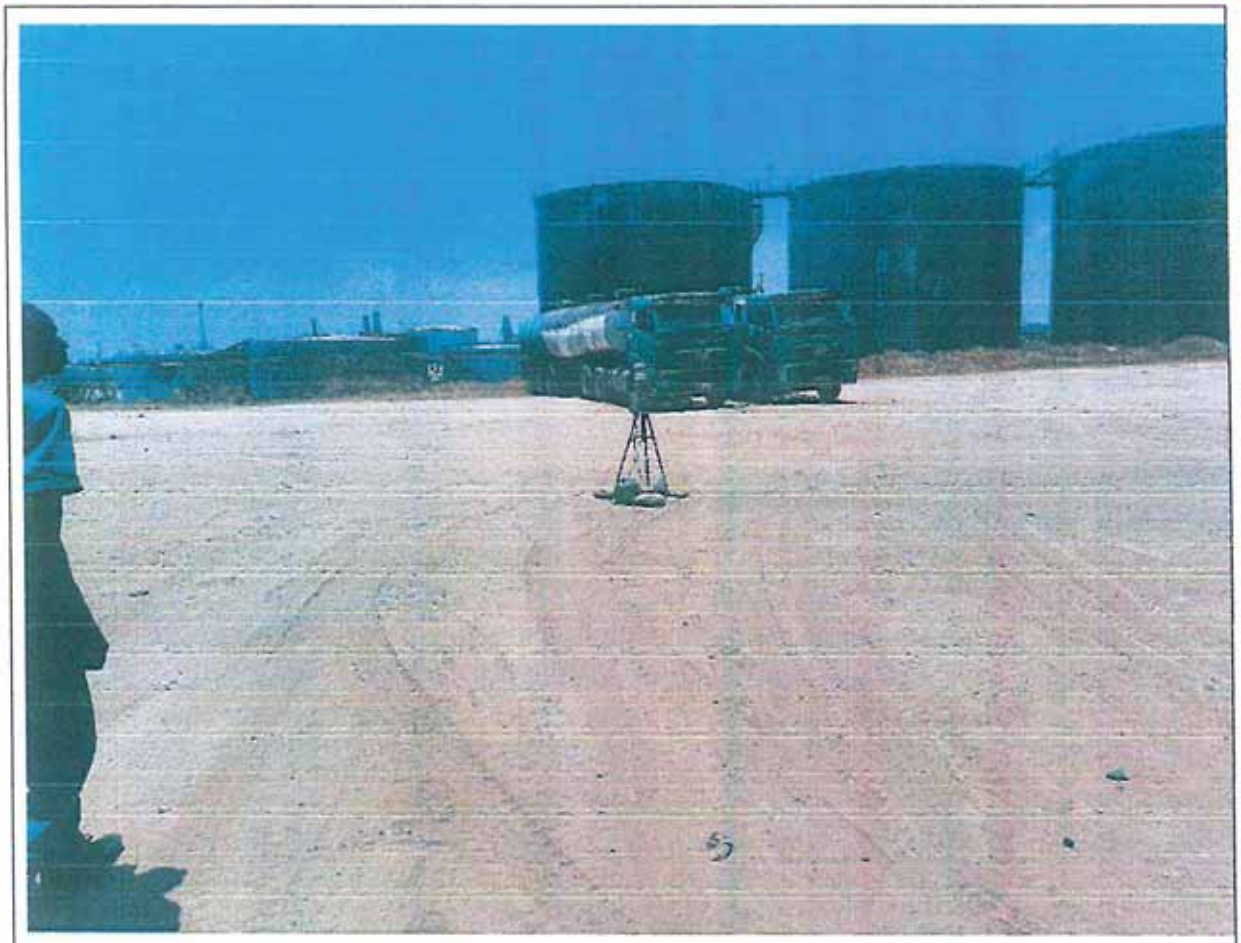

Baseline ambient air quality monitoring at Location II-*Trucks parked during ongoing monitoring*

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Ongoing baseline monitoring at Location II-*Centre of the proposed project site*

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ANNEXES

Calibration certificate

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INSTRUMEX
An ISO 9001-2015 Certified Company

TEST CERTIFICATE FOR AQM-900

Certificate No: AQM900/22-23/RC/645

Name of the Client	: M/s. Polucon Services (K) Limited, Kenya
Model No.	: AQM-900
Serial No.	: 12183
Date of Testing (DD/MM/YYYY)	: 27/06/2022

Sr. #	Parameters	Value on Device Under Test	Standard Value	Deviation	Remarks
		(a)	(b)	(a)-(b)	
1	Temperature in °C	26.5	26.6	-0.1	Acceptable
2	Humidity in %	30.4	29.9	0.5	Acceptable
3	PM2.5 : in µg/m³	97.0	98.0	-1.0	Acceptable
4	PM10 : in µg/m³	66.0	65.0	1.0	Acceptable
5	CO : in mg/m³	1.928	1.931	-0.003	Acceptable
6	SO_2 : in mg/m³	0.100	0.099	0.001	Acceptable
7	NO_2 : in mg/m³	0.006	0.005	0.001	Acceptable
8	O_3 : in mg/m³	0.090	0.088	0.002	Acceptable
9	NO : in mg/m³	0.031	0.032	-0.001	Acceptable
10	H2S : 0 – 139 mg/m3	0.074	0.076	0.002	Acceptable

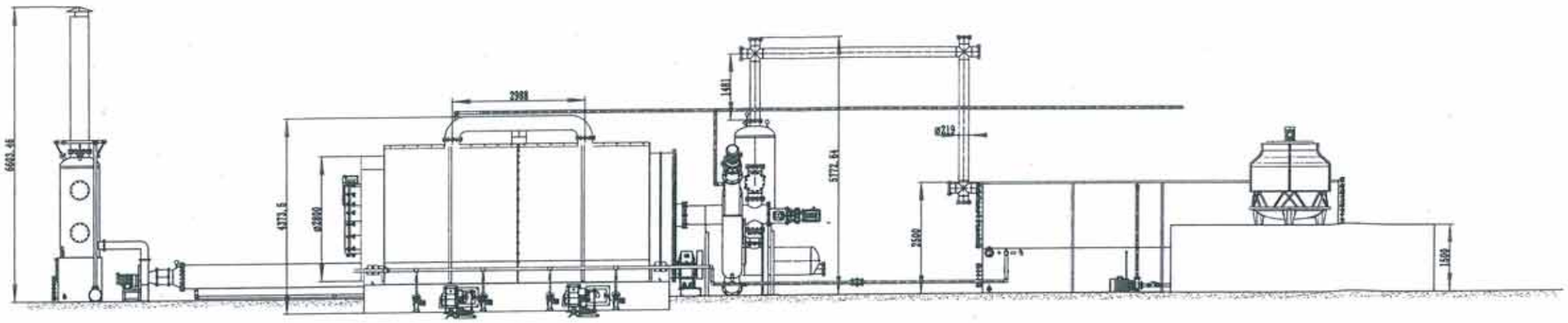
Remark. The average deviation in the above test has been found to be within acceptable limits as per standards

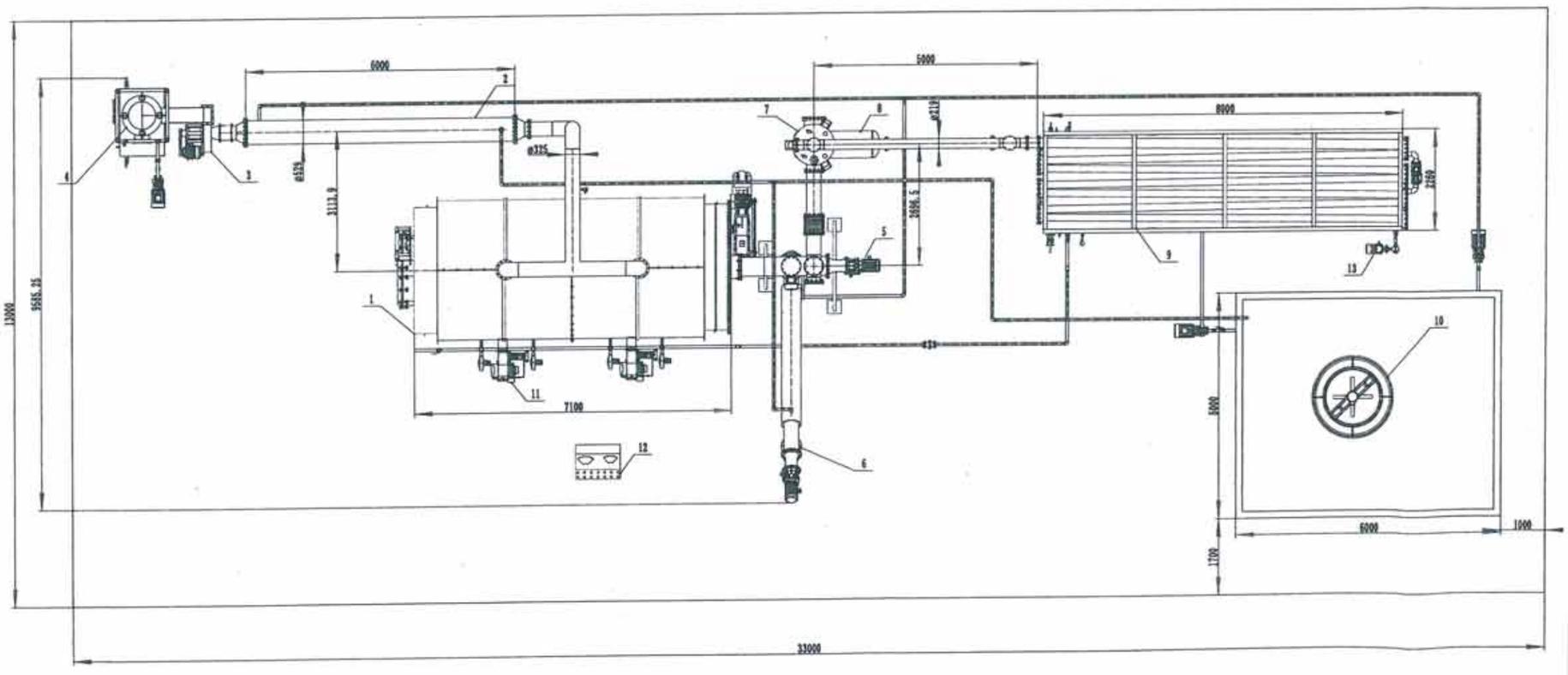
Certificate Prepared by:	
Naeem K	Naeem Khan
Certificate Checked by:	
Radheshyam K	

Factory Certificate Stamp

POLUCON SERVICES KENYA LTD. P.O. BOX 99344 - 80107, MOMBASA
Polucon

106,107, Ashish Udyog Bhavan, Opp. SNDT College, Ram Chandra Ext Lane, Liberty Garden, Malad (W), Mumbai-400 064, India
Tele: +91 22 28442992/9322235281/9322873609/ 720849 7006 Mail to : instrumex@gmail.com, sales@instrumex.net





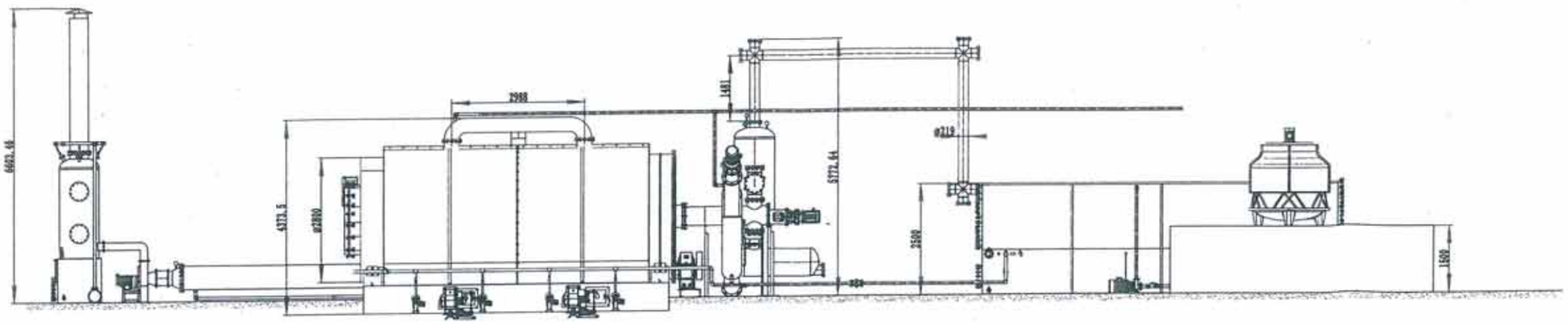
13		防爆油泵-Explosion proof oil pump	1		Match
12		电控柜-Electric control cabinet	1		
11		燃烧器-Burner	2		Match
10		冷却塔-Cooling tower	1		Match
9		三合一-3 in 1 system	1		
8		渣油罐-Slag oil tank	1		Match
7		气包-Gas separator	1		
6		水冷出渣-Water cooled slag discharging	1		Match
5		出渣螺旋-Slag Discharging Screw	1		
4		除尘塔-De-dusting system	1		
3		引风机-Induced Draft Fan	1		
2		烟道冷凝器-Flue condenser	1		
1		主炉-Reactor	1		
序号	代号	名称	数量	尺寸	备注

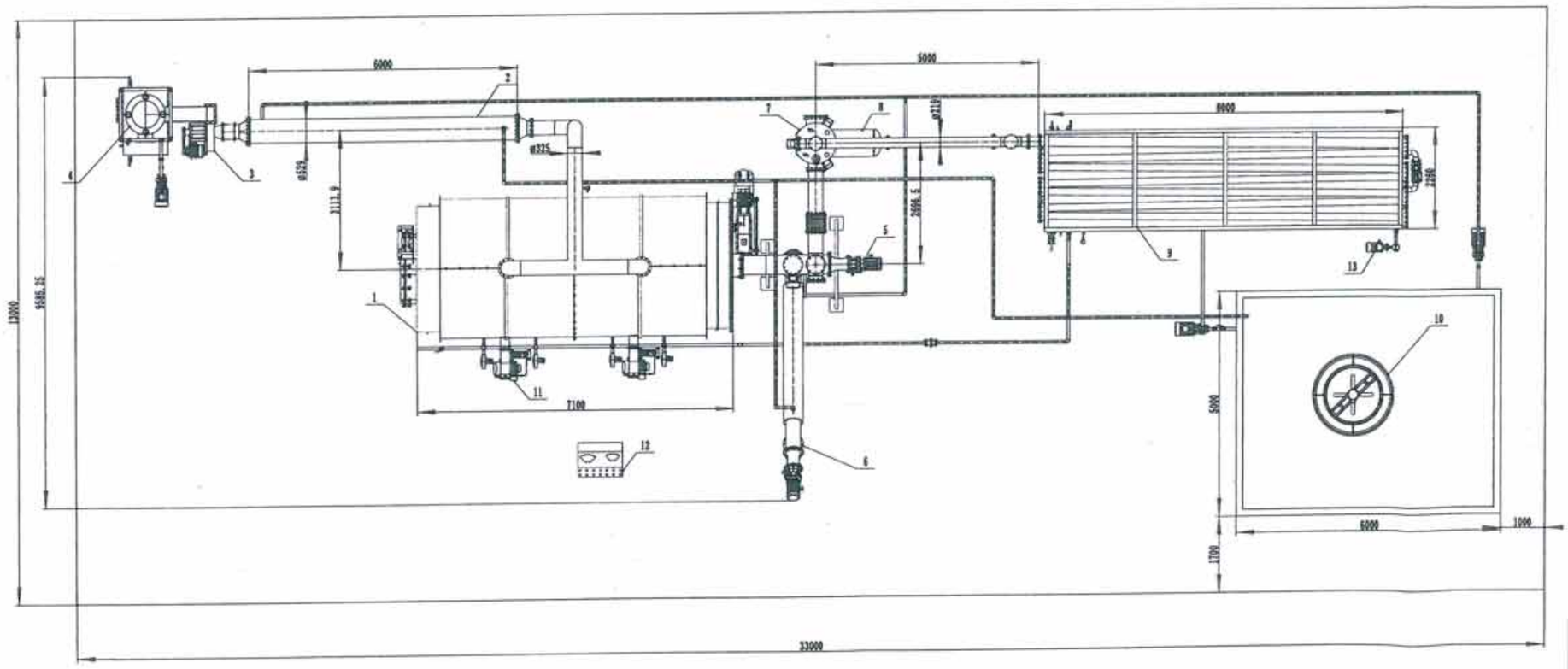
BLJ-16

Beston(Henan)Machinery Co.,Ltd

标记	处数	分区	更改文件号	签名	年.月.日
设计			标准化		
审核					
工艺			批准		

阶段标记	重量	比例
		1:40
共 张	第 张	





序号	代号	名称	数量	尺寸	备注
13		[illegible]-Explosion proof oil pump	1		Batch
12		[illegible]-Electric control cabinet	1		
11		[illegible]-Burner	2		Batch
10		[illegible]-Cooling tower	1		Batch
9		三合一-3 in 1 system	1		
8		[illegible]-Slag oil tank	1		Batch
7		[illegible]-Gas separator	1		
6		[illegible]-Water cooled slag discharging	1		Batch
5		[illegible]-Slag Discharging Screw	1		
4		[illegible]-De-dusting system	1		
3		[illegible]-Induced Draft Fan	1		
2		[illegible]-Flue condenser	1		
1		[illegible]-Reactor	1		

HLJ-16

[illegible] Machinery Co.,Ltd

比例 1:40