Environmental and Social Impact Assessment Study Report for the Proposed Mineral Resources Processing Plant on Plot L.R. No. Kajiado/Dalalekutuk/9729 in Inkiwachani area, Kajiado County.

Proponent	Firm of Experts
Globsil Minerals Limited, P.O. Box 46986 - 00100, Nairobi, Kenya.	Envasses Environmental Consultants Limited, Ralli House, P.O. Box 2013-80100, Mombasa, Kenya.

Version: ESIA Study Report
Date: September 2021

CERTIFICATION

Certification by Lead Experts

We hereby certify that this Environmental and Social Impact Assessment Study Report has been done under our supervision and that the assessment criteria, methodology and content reporting conform to the requirements of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya.

Signed: _____ _____

Names: **Mr. Simon Nzuki** (1350) **Ms. Jane Gitau** (2015)

Contact Details
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Certification by Proponent

We, **Globsil Minerals Limited**, confirm that this Environmental and Social Impact Assessment Study Report has been submitted to NEMA with our authority as the project Proponent.

Signed for and on behalf of **Globsil Minerals Limited**

Name: _____

Signature: _____ Date: _____

Proponent Contact Details **Official Rubberstamp or Seal**

Globsil Minerals Limited,
P.O. Box 46986 - 00100,
Nairobi, Kenya.

ACKNOWLEDGEMENTS

The preparation of this ESIA study report was made possible by a collaborative effort involving the proponent, consultants, neighbors and project stakeholders. We thank the proponent, Globsil Minerals Limited, for providing the requisite logistical, financial, human resources and documentation on the proposed project. We also thank Mr. Lemaron Kuyo for assisting the consultancy team in organizing and facilitating the community and stakeholder meetings.

We acknowledge the contribution from the Ward Administrator-Dalalekutuk Ward, Mr. Abdirahman Ali, the Ministry of Interior and Coordination of National Government through the office of the Assistant County Commissioner – Kajiado Central, Mr. Hanniel Kuria, the office of the Chief –Sajiloni Location, Mr. Joseph Nguyu, and the office of the Sub-chief-Inkiwachani Sub-location, Mr. Vascar Mkupi during the community and stakeholder consultative meetings.

We are indebted to the community members and stakeholders for accepting to participate in the consultative meetings and providing their views, comments and concerns in respect to the proposed project.

Sampling and analysis of environmental media which included air quality, noise levels and soil tests were undertaken by Lahvens (K) Limited. The consultants are grateful for their invaluable input in the preparation of the ESIA study report.

The staff of Envasses Environmental Consultants Limited assisted the lead consultants in data collection and analysis, preparation of the draft and final reports. In this regard, we thank Ms. Rhoda Mutanu, Ms. Cynthia Nduta, Ms. Hellen Maingi and Mr. Omar Said.

EXECUTIVE SUMMARY

Globsil Minerals Limited contracted Envasses Environmental Consultants Limited in July 2021 to prepare an Environmental and Social Impact Assessment (ESIA) Study Report for the proposed Mineral Resources Processing Plant in Inkiwachani area, Kajiado County. The ESIA is prepared pursuant to Section 58 of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya. Processing and manufacturing industries including mineral or ores refining and processing are listed under the Second Schedule (9a) of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya as high risk and should therefore undergo an ESIA Study process.

The proposed project will feature a mineral resources processing plant comprising of quartz, limestone, dolomatic lime and feldspar processing units with estimated production capacity of 100 Metric Tonnes (MT) per day. Other associated amenities will include power, water, site offices and sanitary facilities among others. The sources of raw materials include existing quarries in Bisil, Ngorika and neighboring areas, and Lake Magadi which lie approximately 50km from the proposed project site. Once processed, limestone, dolomatic lime and feldspar will be sold while quartz undergoes further processing to produce water glass. The production of water glass will serve an already growing market in Nairobi where 75% will be sold locally to various manufacturing industries such as KAPA Oil Refineries Limited, UNILEVER, and BIDCO among others while 25% will be exported to East African Countries i.e. Tanzania, Uganda, Ethiopia, Burundi and Rwanda thus earning the country foreign exchange.

The methodology for preparing the ESIA report was guided by the Third Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. Site visits were undertaken in July 2021 for purposes of area reconnaissance, assessing the baseline and environmental risks associated with the proposed project as well as applicable environmental safeguards and standards. Environmental screening criteria was informed by the Second Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. As per this Schedule the issues considered by the experts included; ecological and socio-economic issues, landscape changes, land use character and water. Data collection methods included literature review of relevant documents, observations during site visits and photography. The public and stakeholder engagement strategy included administration of questionnaires to the neighbors, holding a first community consultative meeting on 20th August, 2021 at Tumaini Gardens to obtain comments and concerns regarding the proposed project and holding a second stakeholder consultative meeting on 30th August, 2021 at Enchula Resort to review the ESIA report. Baseline environmental data was collected on ambient air, noise levels and soil in collaboration with a NEMA designated laboratory, Lahvens (K) Limited.

The findings of the ESIA demonstrate that the proposed project is expected to have both positive and negative environmental and social impacts. The positive impacts included mitigating the national and regional demand for processed mineral resources, earning the country foreign exchange through exports, contribution towards industrial development coherent with Kenya's Vision 2030 – Economic and Macro Pillar and the Presidential Big Four Agenda on enhancing the manufacturing sector, improving livelihoods and increasing income from employment opportunities, provision of a market for local goods and services, accruing income to the proponent and a source of revenue to the government to enable in financing its obligations to the county and country.

Negative impacts on the environment will occur throughout the project cycle i.e. construction, operation and possible decommissioning. Prior to the implementation of the project, the proponent should apply for and obtain a change of user from agricultural to industrial from the County Government of Kajiado and the Ministry of Lands.

At construction phase, the main environmental issues will include environmental risks of sourcing raw materials, impact on biodiversity, water demand and effluent generation, solid waste generation and management, occupational safety and health risks, air and noise pollution, and traffic congestion.

Installation of the plant and construction of auxiliary facilities will require raw materials such as steel bars, sand, cement, building blocks, timber, glass and paint among others which will be sourced from the environment. These materials will have negative environmental impacts at their points of origin thus the proponent should source raw materials from sites that are licensed as per the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya and have a procurement plan based on the Bill of Quantities prepared by a Quantity Surveyor to avoid potential oversupply of materials and wastage.

Site preparation will involve clearing of vegetation and civil works. The vegetation cover at the proposed project site includes shrubs, herbs, grasses and acacia trees which will need to be cleared to pave way for construction activities. Vegetation cover plays an important role in preventing soil erosion, carbon sequestration and habitat for other organisms among others. To attenuate the impact on biodiversity, the proponent should retain vegetation cover in areas that will not be excavated as far as practicable and replant trees in the section of the property that will not be developed to compensate for vegetation lost.

During construction, water will be required for concrete mixing, casting and curing works, drinking and sanitation purposes and will be sourced from a borehole. Based on the projected workforce of 100 - 150 people at construction, water demand will be at most 10 m^3 per day. Out of these, 10% (1 m^3) will be used for domestic purposes and will generate 0.7 m^3 of effluent which will need to be disposed off. The rest of the water soaks into ground areas within the project site. Poor disposal of the effluent generated has the potential to pollute underground aquifers and should thus be managed appropriately. To mitigate this, the proponent should apply for and obtain drilling and abstraction permit from Water Resources Authority (WRA), sensitize the workers on the need to conserve the available water resources, procure and deliver to the site mobile toilets from a NEMA licensed waste contractor and ensure compliance with the Environmental Management and Coordination (Water Quality) Regulations, 2006.

Site preparatory and construction activities will generate significant quantities of solid waste in form of biomass, overburden, domestic waste such as plastic containers and construction materials such as wood, building blocks, metal cuttings and wrappings among others. These will need to be disposed off appropriately as poor solid waste management can create breeding grounds for disease causing pathogens. The proponent should procure and strategically place adequate solid waste collection bins with a capacity for segregation, contract a NEMA licensed waste handler to dispose off the solid waste and comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006.

The workforce, visitors and neighbors to the proposed project site will be exposed to potential safety and health risks during installation and construction activities. The potential safety risks will be from the use of machinery, falling objects or even falls, air and noise pollution, and COVID-19 among others. These risks have a potential to cause disturbances, injuries, permanent disability or even death. The proponent should register the site as a workplace with the Directorate of Occupational Safety and Health Services (DOSHS), obtain insurance cover for the workforce, provide and enforce the use of Personal Protective Equipment (PPE), provide the correct equipment for the jobs assigned and train the employees on their use, ensure moving parts of machines and sharp surfaces are securely protected with guards to avoid unnecessary contacts and injuries, provide first aid services and emergency vehicle at the site, regulate the entry of visitors to the construction site by deploying

adequate security measures, comply with the set National Government and County Government Directives and guidelines on prevention of the spread of COVID-19 and comply with the provisions of the Occupational Safety and Health Act (OSHA), 2007.

Both air and noise pollution are inevitable during construction activities. Air pollution will be as a result of dust generated during excavation activities and exhaust fumes from Heavy Commercial Vehicles (HCVs) accessing the site. The most relevant pollutant considered is particulate matter because of its potentially significant increase during the construction phase. Air pollution has health implications on the workers, visitors and the neighboring community as it causes respiratory diseases and is a visual irritant. On the other hand, noise pollution will emanate from machinery operations and vehicles delivering materials to the site. The noise levels produced may be above the stipulated EMCA limits and are a health hazard. The proposed mitigation measures include installation of appropriate and adequate dust screens around the construction site, sprinkling water at the excavation areas to suppress dust and providing Personnel Protective Equipment (PPE) such as dust masks and ear muffs to the workers and visitors to the site. Additionally, the proponent should comply with provisions of the Environmental Management and Coordination (Air Quality) Regulations, 2014 and Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

Heavy Commercial Vehicles (HCVs) delivering construction materials to the site are likely to increase traffic along the Nairobi-Namanga Highway in case of stalling and breakdowns. This will cause inconveniences to other road users. To mitigate this impact, the proponent should prepare and implement a traffic management plan, offload construction materials on the site and not on the road reserves to ensure smooth flow of traffic and comply with the provisions of the Traffic Act, 2016.

At operational phase, the main environmental concerns include air and noise pollution, increased water demand, effluent generation and management, solid waste generation and management, occupational safety and health risks, fire risks and emergency preparedness, exposure to thermal heat, increased energy demand, oil spills and traffic congestion.

Air pollution will mainly result from dust emissions during crushing, grinding and milling of minerals, flue gases (carbon monoxide & sulphur dioxide) during melting of sodium carbonate and silicon dioxide and combustion of coal at the furnace, and exhaust fumes such as carbon monoxide, hydrocarbons, nitrogen oxides and sulfur dioxide from machinery at the plant and vehicles accessing the facility. Air pollution may have health implications on the workers, visitors to the facility and the neighboring properties/community as it causes respiratory diseases and is a visual irritant. As per the design plan, two dust collectors will be installed within the plant to trap fine dust particles and re-used in the water glass production. To control flue gases (carbon monoxide & sulphur dioxide) emissions, the proponent will utilize two technologies i.e. (i) installation of a regenerator made of porous bricks which absorbs the gases forming sodium sulphate along the walls. The regenerator will then be cleaned after every 6 months and the resultant sodium sulphate sold to farmers as fertilizers and (ii) installation of wet scrubbers (7m long & 3.5m width) along the chimney to trap the remaining gaseous particles. To monitor the efficiency of the plant, the proponent should develop and implement an air quality monitoring plan, apply for and obtain emission Licence from NEMA and comply with the provisions of the Air Quality Regulations, 2014.

Noise pollution will emanate from crushing, grinding, milling and screening of raw materials, and combustion of the sodium carbonate and silicon dioxide at the furnace. Other sources of noise will be vehicular movement in and out of the facility, loading and offloading activities. It should be noted that the noise produced at the facility will be in keeping with the background noise emanating from the Nairobi-Namanga Highway. The noise levels and vibrations produced may be above the

stipulated EMCA limits under the Third Schedule Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. This may lead to hearing impairments to workers, visitors to the site and neighbors. The proponent should procure and provide adequate earmuffs to employees working at peak noise producing areas and enforce on their use, reduce the working hours for employees working at peak noise producing areas compared to those working in other areas, service mechanical equipment regularly to ensure that they are in good condition, undertake noise level monitoring in collaboration with a NEMA designated laboratory and comply with provisions of the Noise and Excessive Vibration Pollution (Control) Regulations, 2009.

Water will be required at various sections of the plant for purposes of steam production at the boiler, dissolving cullet (mixture of silicon dioxide and sodium carbonate) to form water glass and cooling among others. Other uses of water will include sanitation, general cleaning and drinking. This will result in increased demand for water estimated at 50 m^3/day. The proposed plant will source water from a borehole and supplemented by rainwater harvesting and natural pond system. The proponent should install water saving systems such as self-closing taps and low flush water closets, display water conservation posters in areas of high water use, carry out regular inspection and maintenance of the water distribution network to ensure zero leaks and damages and keep track of water consumption bills to identify areas of unnecessary use.

Being an industrial development, the effluent will constitute a combination of domestic and industrial wastewater flows. Domestic effluent flows will be generated from sanitation facilities and general cleaning whereas the industrial effluent flows will be generated from the water glass production process. Based on domestic water consumption of approximately 5 M^3 (10% of total water consumption), domestic effluent of 3.5 M^3 will be generated. Seventy percent (70%) of remaining water use (45 M^3) will be generated as industrial effluent. Notably, wastewater flows from the scrubber will be channeled to the pond for recycling purposes. Ground and surface water sources may be polluted if effluent generated is not managed in an appropriate manner. To mitigate this, the proponent should install a bio-digester and an Effluent Treatment Plant (ETP) to manage domestic and industrial wastewater flows respectively, monitor the quality of effluent discharged from the bio-digester and Effluent Treatment Plant (ETP), apply for and obtain an Effluent Discharge License (EDL) from NEMA and comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006.

Solid waste generated will mainly comprise of mill tailings which are extremely fine particles that will be rejected from the grinding, crushing and screening of the minerals, and domestic waste including wrappings, cartons and paper among others. Poor disposal of solid waste degrades environmental quality and should thus be properly managed. The proponent should therefore procure the services of a NEMA licensed waste handler to dispose off the solid waste and comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006.

The operations of the plant will pose safety and health risks to workers, visitors to the site and the neighboring properties/community. This may be in the form of air and noise pollution, musculoskeletal injuries from use of machinery and equipment at the plant, exposure to sodium silicate solutions, citric acid which may lead to skin and respiratory tract irritation, exposure to high heat levels, exhaust fumes from machinery and vehicles accessing the facility, falls and electrocution among others. All these risks have potential to cause injuries, permanent disability or even death and hence the management should be committed to ensuring safety and health of workers and visitors to the plant. The proponent should therefore develop and implement a safety and health policy for the plant, develop and implement an emergency response plan, sensitize employees to adhere to

work procedures to minimize accidents, provide adequate and appropriate PPE such as gloves, goggles, aprons and gumboots to workers and enforce on their use, display precautionary signage at appropriate sections within the plant, conduct first aid training among the workers and provide well-stocked first aid kits, provide and keep an accident/incident register, conduct occupational safety and health audits and implement the recommendations, conduct risk assessment audits annually and comply with the provisions of the Occupational Safety and Health Act (OSHA), 2007.

Fire hazards are real threats to mineral resources processing plant and must be accorded adequate attention and swift action in case of an outbreak. Potential sources include flammable materials, combustion of sodium carbonate and silicon dioxide at the furnace which is carried out at very high temperatures (1100˚C - 1200˚C), oil spills at the fuel tanks, electrical faults or operational negligence among others. Fire occurrence may lead to death, financial losses and loss of livelihoods for the workers and neighbors. The proponent should develop, display and implement a fire and emergency response action plan, provide adequate firefighting equipment, designate a fire assembly point and clearly display emergency exit points, display fire safety and warning signage at appropriate sections of the plant, ensure regular inspection and maintenance of electrical appliances, undertake annual fire audit and fire drills and comply with Occupational Safety and Health Act (OSHA), 2007.

The key exposures to heat in water glass production occurs during combustion of sodium carbonate and silicon dioxide at the furnace (1100°C - 1200°C), and steam production at the boiler. This may expose the workforce to lots of heat leading to heat exhaustion and stroke among other heat related illness. The proponent should take into account proper ventilation of the area, use cooling towers before releasing heat to the environment, procure and provide adequate PPEs and enforce on their use and reduce the amount of working hours for the employees operating around the furnace.

Mineral processing is a highly energy intensive process characterized by high energy consumption. Energy will be required for running machinery at the plant, melting sodium carbonate and silicon dioxide at the furnace, steam production at the boiler and lighting. Energy during operations will be sourced from the National grid supplemented by a diesel powered generator. Other sources of energy will be fuel oil and coal used at the furnace. The proponent should procure plant machinery and equipment that feature the latest technology to ensure power efficiency, supplement electrical supply from the national grid with renewable energy, install compact fluorescent lights in high use areas within the facility, keep records of power consumption, create awareness among employees and visitors on energy conservation and conduct energy audits at least once every three years and implement the recommended actions.

Potential oil spills may occur during the transfer of oil from the storage tanks to the furnace, servicing and maintenance of vehicles and machinery at the plant. A release of petroleum products to the environment threatens ground and surface waters thereby endangering drinking water supplies. The recommended mitigation measures include installing oil water interceptors around the oil storage tanks and maintenance areas, training employees on containment and cleaning of oil spills, providing oil spill response kit to aid speedy clean-up in case of spillage, conducting regular tests on the fuel tanks to curb possible tank failure, contracting a NEMA licensed waste oil handler to manage the waste oil and complying with the Used Oil Guidelines, 2017.

During operations, there will be increased movement of Heavy Commercial Vehicles (HCVs) delivering raw materials and dispatching the finished products to and from the plant. This will increase traffic along the Nairobi - Namanga Highway. To mitigate this impact, the proponent should provide adequate parking areas within the plant, develop and implement a traffic management plan, control entry and exit of vehicles to and from the plant and comply with the Traffic Act, 2016.

A decommissioning phase is possible in the event of closure by government agencies due to non-compliance with environmental and health regulations, end of project life, an order by a court of law due to non-compliance with existing regulations and Change of user. Key environmental and social concerns at this phase will be economic decline, safety and health risks, waste generation and insecurity. The proponent should prepare and submit a due diligence decommissioning audit report to NEMA for approval at least 3 months in advance.

In conclusion, the proposed project is considered important and beneficial to the economy as it will contribute towards industrial development coherent with Kenya's Vision 2030 – Economic and Macro Pillar and the Presidential Big Four Agenda on enhancing the manufacturing sector, mitigate the national and regional demand for processed mineral resources, earn the country foreign exchange, improving livelihood and increasing income from employment opportunities, provision of a market for local goods and services, accruing income to the proponent and a source of revenue to the government to enable in financing its obligations to the county and country. Despite these benefits, environmental concerns are expected to arise at all phases of the project cycle. The ESIA study proposes a suite of comprehensive Environmental and Social Management and Monitoring Plans to address the anticipated negative impacts during the entire project cycle and improve the environmental performance of the proposed project. It is on this basis that we recommend that the project be allowed to proceed alongside conditions which will ensure compliance with the provisions of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya.

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LIST OF ACRONYMNS

ASAL	Arid and Semi-Arid Land
CIDP	County Integrated Development Plan
CO	Carbon Monoxide
COMTRADE	Common Format for Transient Data Exchange
CSR	Corporate Social Responsibility
DOSHS	Directorate of Occupational Safety and Health Services
EDL	Effluent Discharge License
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
EPRA	Energy and Petroleum Regulatory Authority
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plans
ETP	Effluent Treatment Plant
HCVs	Heavy Commercial Vehicles
KMQ	Kenya Marble Quarries
KNBS	Kenya National Bureau of Statistics
MT	Metric Tonnes
NCA	National Construction Authority
NEMA	National Environment Management Authority
NO_2	Nitrogen Dioxide
O_3	Ozone
OSHA	Occupational Safety and Health Act
OWASCO	Olkejuado Water and Sewerage Company
PAH	Polycyclic Aromatic Hydrocarbons
PM	Particulate Matter
PPE	Personal Protective Equipment
SDGs	Sustainable Development Goals
SGR	Standard Gauge Railway
SO_2	Sulphur Dioxide
TORs	Terms of Reference
TPH	Total Petroleum Hydrocarbon
WRA	Water Resources Authority
WRB	Water Services Regulatory Board
WRUAs	Water Resources Users Associations
WSBs	Water Service Boards
WSPs	Water Service Providers

1 INTRODUCTION

1.1 Background information

Kenya is rich in mineral resources with known deposits of soda ash, fluorspar, titanium, gold, coal, manganese, iron ore, gypsum, diatomite, chromite, limestone, and silica sand among others. Indications are that the country is potentially rich in rare earth minerals, and increased exploration is expected to lead to new mineral discoveries. However, inadequate expertise, under development of the mineral processing industry, lack of appropriate technology and high energy costs contribute to the low level of value addition to Kenya's minerals. Due to this, most of the minerals are exported in raw form meaning that the country is not fully benefiting from its mineral wealth.

The proponent, Globsil Minerals Limited, identified the investment gap and proposes to set up a mineral resources processing plant on Plot L.R. No. Kajiado/Dalalekutuk/9729 in Inkiwachani area, Kajiado County. Processing and manufacturing industries including mineral or ores refining and processing are listed under the Second Schedule (9a) of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya as high risk and should therefore undergo an Environmental and Social Impact Assessment (ESIA) Study process. To fulfill this legal requirement, ensure sustainability of the development activities and improve its environmental performance, the proponent contracted Envasses Environmental Consultants Limited to carry out the ESIA Study.

1.2 Overview of mineral resources in Kenya

Kenya is still in early exploration of its mineral potential. Initially, the country was mapped as an agricultural zone which led to reduced exploration for minerals. The country is vastly underexplored for minerals and its mining sector is currently dominated by the production of non-metallic commodities.

Kenya is the third largest producer of soda ash in the world and the seventh producer of fluorspar. Metallic minerals currently produced in the country include titanium, gold and iron ore. Export statistics indicate a constantly growing sector. In 2020, for instance, minerals and mineral products made 6.67% of exports. It is however expected that with increased development, the country could contribute substantially to annual global supply. With further exploration and uptake of mineral rights then, it is estimated that the country will have the capacity to position itself as a regional mining sector hub for Eastern Africa.

Additionally, deposits of rare earth elements were recently discovered in the coastal region of the country. The recent discoveries are estimated to be worth USD 62.4B and will propel the country to the list of top five countries with rare earth deposits in the world.

1.3 Project location and neighbourhood

The proposed mineral resources processing plant will be located on Plot L.R. No. Kajiado/Dalalekutuk/9729 in Inkiwachani area, Kajiado County. It is geo-referenced at **Latitude 1°47'44.35''South** and **Longitude 36°49'07.15''East** (Figure 1). The project site is located along Nairobi – Namanga Highway adjacent to Twyford Tiles Factory. The site is characterized by undulating terrain and stretches across an area of approximately 2.43Ha (Figure 2). It is currently undeveloped with 100% vegetation cover. The vegetation is comprised of grasses, shrubs, herbs and acacia trees.

The neighborhood comprises of mixed land uses. The proposed project site neighbors Twyford Tiles Factory to the North (Figure 3), Umma University to the North West, Ketraco Sub-station to the North East, Naisula School to the South East and Kiwanja Poultry Breeder Farm to the South West.

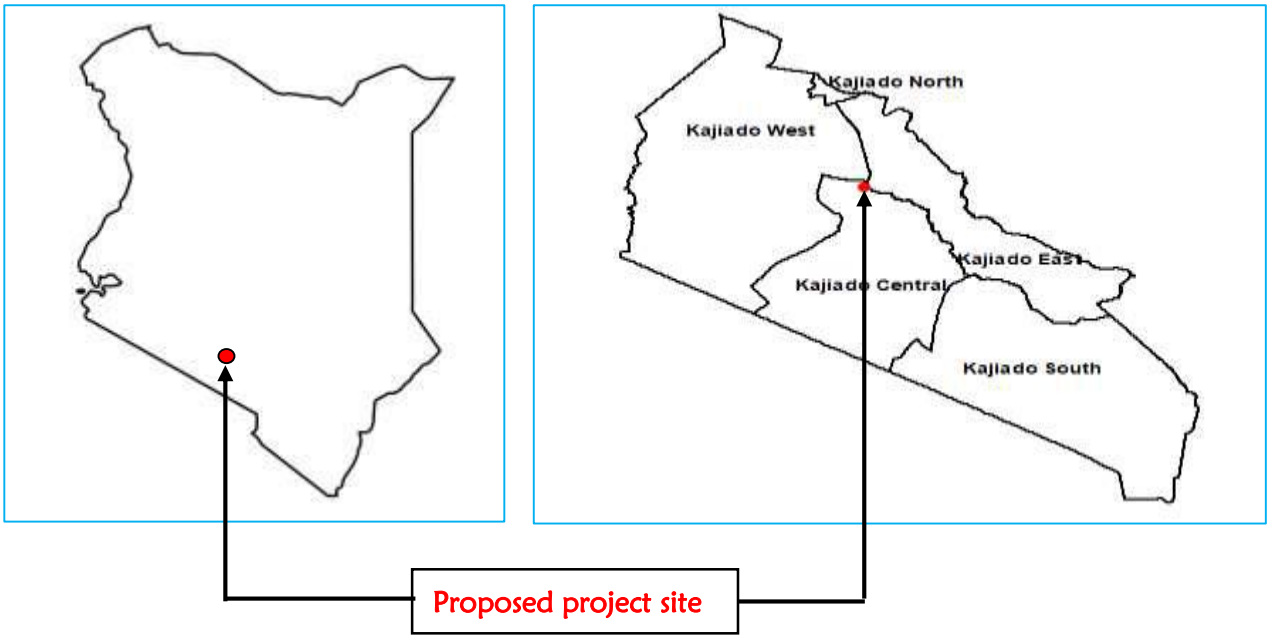

Figure 1: The location of the proposed project site (Source: Google Earth, 2021).

Figure 2: A section of the proposed project site (Source: Site visit, July 2021).

Figure 3: Twyford Tiles Factory neighboring the proposed project site to the North (Source: Site visit, July 2021).

1.4 Project design and description

The proposed project will feature a mineral resources processing plant comprising of quartz, limestone, dolomatic lime and feldspar processing units with estimated production capacity of 100 Metric Tonnes (MT) per day. Other associated amenities will include power, water, site offices and sanitary facilities among others. The sources of raw materials include existing quarries in Bisil, Ngorika and neighboring areas, and Lake Magadi which lie approximately 50km from the proposed project site.

Once processed, limestone, dolomatic lime and feldspar will be sold while quartz undergoes further processing to produce water glass. The production of water glass will serve an already growing market in Nairobi where 75% will be sold locally to various manufacturing industries such as KAPA Oil Refineries Limited, UNILEVER and BIDCO among others while 25% will be

exported to East African Countries i.e. Tanzania, Uganda, Ethiopia, Burundi and Rwanda thus earning the country foreign exchange.

1.4.1 Limestone processing

The processing unit comprises of a loading area, jaw crusher, elevator, screw conveyor, rotary valve, air classifier, hopper, pulveriser and a packing area (Figure 4). Limestone boulders are loaded into the hopper to the jaw crusher for coarse grinding where they are broken into aggregate chips of size 1 inch. The aggregate chips are then carried up by an elevator into the hoppers through the screw conveyor for further grinding of the chips into powder form. From the screw conveyor, the product is transferred to the air classifier where fine dust is removed. The product is then sent to the pulverizer through pipelines where it is subjected to intense grinding. If the product meets the fineness qualification, it is sent out for packaging while the rest goes back to the pulverizer for regrinding.

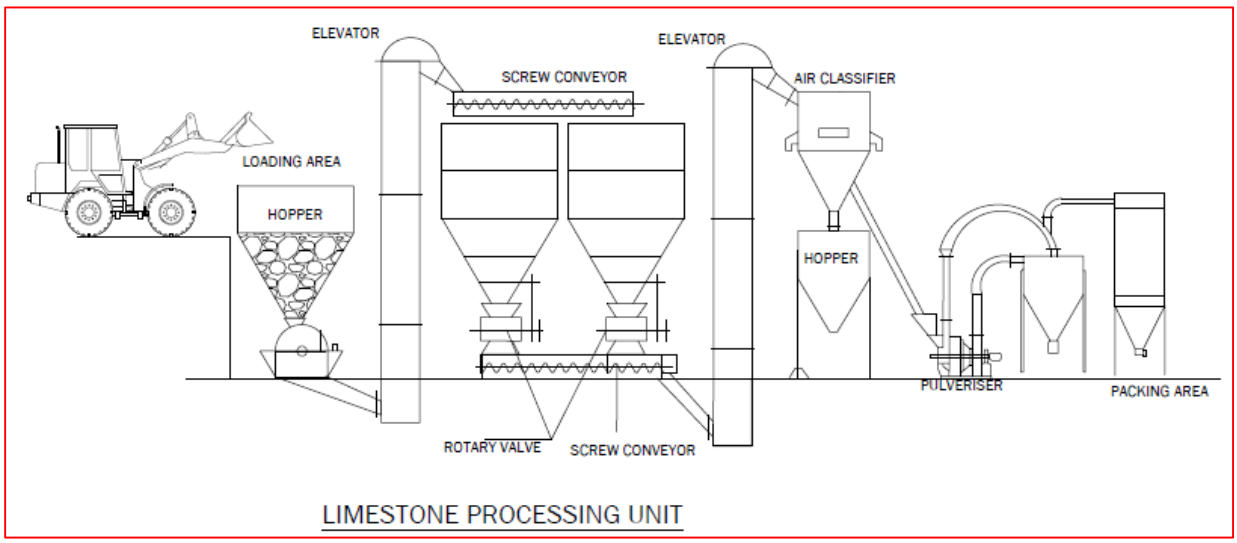

Figure 4: Layout of the limestone processing unit (Source: Globsil Minerals Limited, 2021).

1.4.2 Dolomatic lime and feldspar processing

The chemical composition of dolomite is CaMg $(CO_3)_2$ and the crystal belongs to the trigonal carbonate mineral while feldspar is an aluminosilicate mineral containing calcium, sodium and potassium.

Dolomite and feldspar ores are loaded into the hopper to the jaw crusher for grinding to attain aggregate chips of size 1 inch. The ore is then transferred into the hammer mill using a conveyor belt for fine milling. The milling provides better ore for processing and by this stage the powder index will have increased significantly. The powdered ore is then transferred to the ball mill via a conveyor belt for deep grinding. The ore is then carried up again through the bucket elevator into the air classifier where the purified airflow of the finished powder is collected at the hopper. The powdered ore is then sent to the pulverizer where an external pressure is applied to it to make it finer than it was, the products are discharged through the pipelines. The disqualified products fall back into the hopper and are sent back for remilling while the qualified ones goes into the citric acid coating machine. Here the ore reacts with citric acid to form dolomitic lime and separate it from feldspar. The feldspar and dolomitic lime are then discharged, ready for packaging (Figure 5).

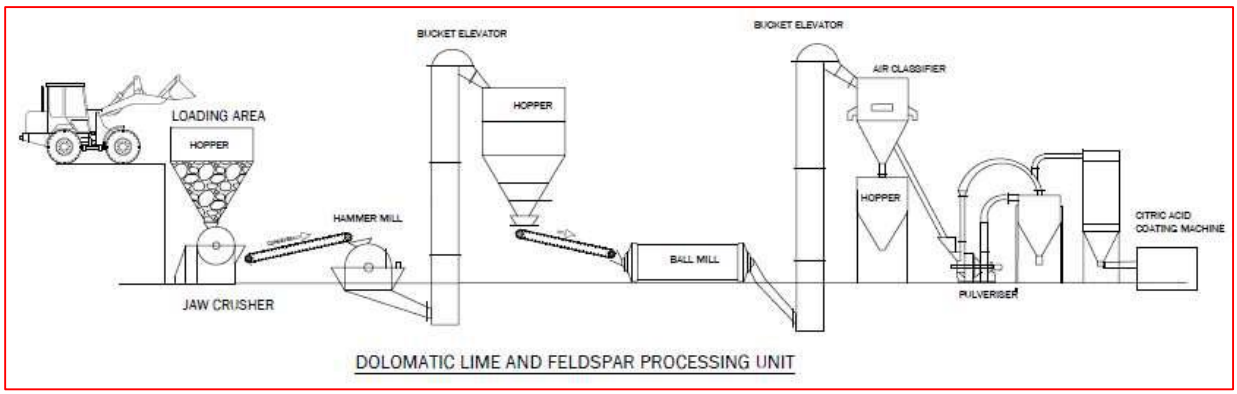

Figure 5: Layout of the dolomatic lime and feldspar processing unit (Source: Globsil Minerals Limited, 2021).

1.4.3 Quartz processing

The processing unit will consist of a loading area, jaw crusher, conveyor, quartz grinder, vibrating screen, dust collector, bucket elevator, silo and packing area (Figure 6). Quartz stones are loaded into the hopper to the jaw crusher for coarse grinding where they are broken into aggregate chips of size 1 inch. From the jaw crusher, the aggregate chips are then transferred via a conveyor belt to the quartz grinder where it will be finely crushed to occupy 60% fineness. Through a conveyor the materials will then be taken to the vibrating screen where they are subjected to more intense grinding. The mill will be equipped with a dust collector to collect fine dust from every production stage through feeder pipelines to meet the environmental protection standards of production. The finished product is then transported up through a bucket elevator into the silos ready for packaging.

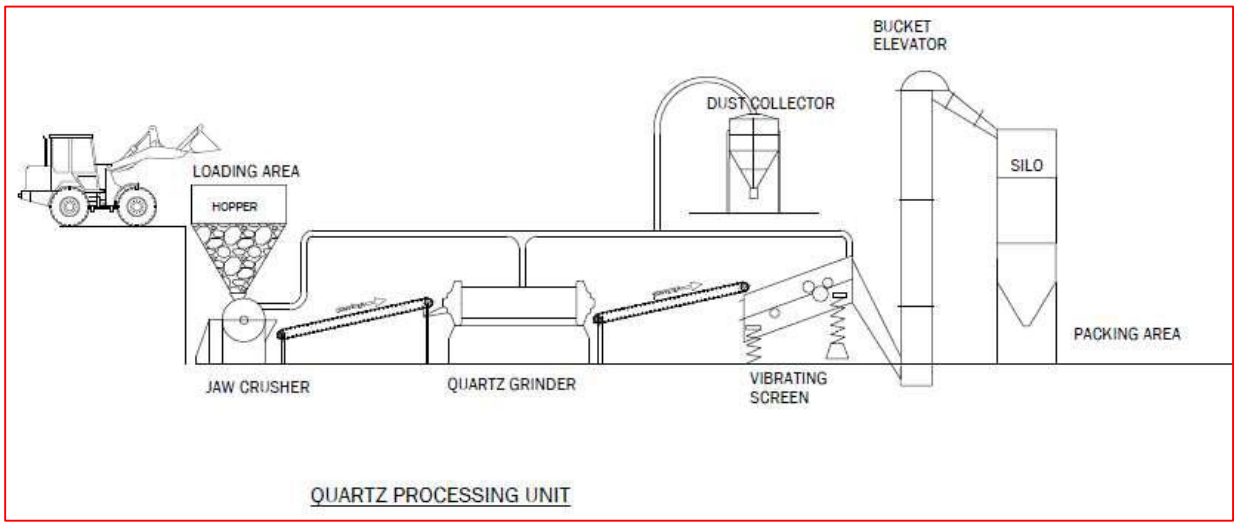

Figure 6: Layout of the quartz processing unit (Source: Globsil Minerals Limited, 2021).

1.4.4 Water glass production process

The production of water glass begins with the inception of raw materials, silica sand (quartz) and sodium carbonate (soda ash). The materials are then weighed in a ratio of 1:2 (quartz: soda ash) and sent to the batch mixer where mixing takes place. The mixed batch is then sent up the elevator into the batch hopper as sulphur dioxide + sodium carbonate (SO_2+Na_2CO_3). The batch hopper has an outlet which acts as the batch feeder.

The batch feeder then delivers the mixture into the furnace section. In the furnace section, the mixture is heated at temperatures of 1100°C-1200°C to obtain a molten product (Figure 7). The furnace oil tank above the furnace section will provide fuel for combustion. During heating, very hot air is produced and the regenerator will be used to recover heat from the preheat compressed air which will later be released through the chimney. The regenerator is important as it increases

the thermal efficiencies of the furnace section. Additionally, wet scrubbers will be installed along the chimney to control flue gas (carbon monoxide and sulphur dioxide) emissions.

The molten product is then sent to a cooler via the conveyor belt for cooling. Cooling is done by adding 50% water and 50% ice cubes to the molten product. Once cooling is done, the product, water glass, is transported to the dissolving unit where water and steam (from the boiler) are fed and the solid product begins to dissolve. Steam and water are continually fed into the dissolver until the products have dissolved and the required concentration of the soluble sodium silicate has been achieved. The product then undergoes filtration and sent to the storage tank. From the storage tank the liquid water glass is ready for packaging.

Liquid water glass will either be neutral or alkaline and will be pumped into the tankers ready for dispatch. The residue from the furnace unit occurs as sodium silicate flakes and will also be transported to the storage area and packaged into trucks ready for dispatch.

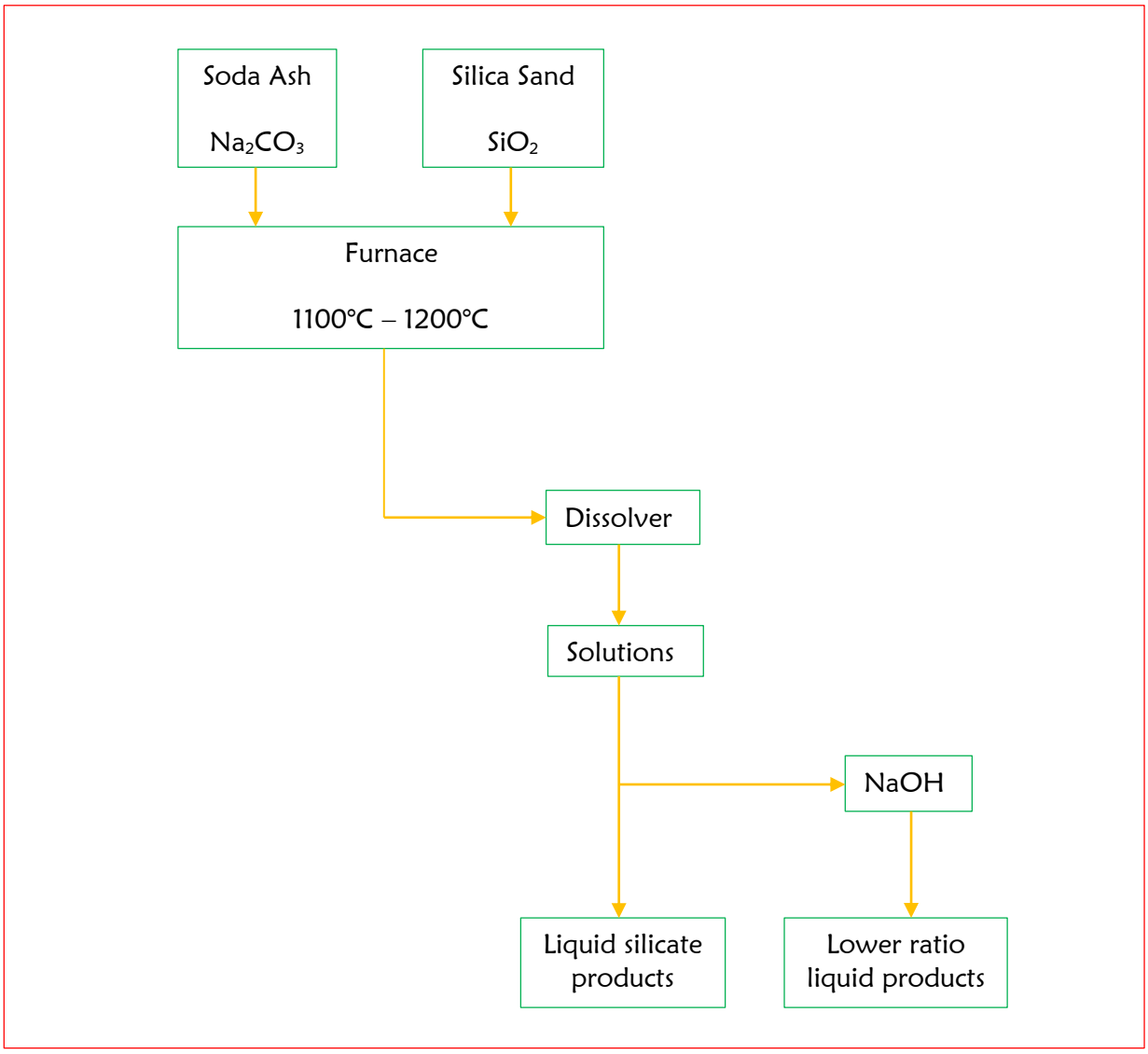

Figure 7: Furnace process for the manufacture and processing of soluble sodium silicate products (Source: Consultant's gallery, 2021).

1.5 Study approach and methodology

1.5.1 Introduction

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

under Regulation 11 of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003 and submitted them to NEMA for consideration for approval. The scoping report and TORs were approved on 16th August 2021 and the consultants began preparation of the ESIA study report.

1.5.2 Data collection

The methods for carrying out the study included site visits and observations, photography, literature review of relevant documents, baseline monitoring of environmental media (air quality, noise levels and soil tests) and public consultations through community and stakeholder consultative meetings, and administration of questionnaires. A site visit was undertaken in July 2021 (Figure 8) for purposes of area reconnaissance, assessing the baseline environmental conditions of the proposed project site and screening of environmental risks associated with the proposed plant as well as the applicable environmental safeguards and standards. Environmental screening criteria was informed by the Second Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. As per this schedule, the issues considered by the experts included ecological impacts, socio-economic issues, landscape changes, land use character and water (Table 1).

Figure 8: A reconnaissance survey at the project site (Source: Site visit, July 2021).

Table 1: Summary of the results from the screening exercise.

Criteria	Results
Ecological impacts	– Excavation and vegetation clearance will occur – No endangered species of trees and plants found at the site – No endemic species reported on site
Social-economic considerations	– Mitigating the national and regional demand for processed mineral resources – Earning the country foreign exchange – Contribution of the project towards attainment of Vision 2030 and the Presidential Big Four Agenda – Creation of employment opportunities – Income to the proponent – Market for local goods and services – Revenue to the government – Transfer of skills

Criteria	Results
	– No cultural or heritage issues at the site
Landscape impacts	– The landscape of the area will be altered and new views created
Land uses	– Land uses include subsistence agriculture, livestock keeping, commercial and industrial establishments
Water	– The construction and subsequent operations of the proposed project will increase water demand and impact on water resources

1.5.3 Baseline monitoring of environmental media

Baseline environmental data was collected on ambient air and noise levels, and soil in collaboration with a NEMA designated laboratory, Lahvens (K) Limited. The results will be used to provide a benchmark for implementing the Environmental Monitoring Plan proposed in the ESIA report. The approaches and methods used for sampling and analysis of baseline environmental media are discussed below.

1.5.3.1 Ambient air quality monitoring

Mobile, static and active monitoring was done by use of real time gas detector-pump suction equipment LB-MS4X (Figure 9) which integrates the main ambient gases and meteorological parameters.

The gas sensitive semiconductor sensor uses proprietary sensing material, built in automatic Correction (ABC) and interference rejection. This combination results in ppb resolution and a highly linear response. The gas sensitive electrochemical sensors generate nano-amp currents proportional to the gas concentration. Aeroqual uses low noise electronics to capture these signals resulting in low detection levels. The non-dispersive infrared sensor uses infra-red light, a narrow band-pass filter and photodiode to measure the intensity of light at the gas absorption band. The light intensity is proportional to the gas concentration.

The laser particle counter for Particulate Matter measurements uses optimized signal processing using low noise electronics added algorithms to correct for interferences. An aerosol particle counter works on the principal of either light scattering or light blocking. An aerosol stream is drawn through a chamber with a light source (either Laser Based Light or White Light). When a particle is illuminated by this light beam, it is redirected or absorbed. Light scattered by a single particle in a specific direction in relation to the original direction has a unique signature which relates to the size of the particle. This allows for sizing and counting of individual particles

1.5.3.2 Baseline noise level measurements

Noise emission survey (Figure 9) was achieved via initial examination of existing road traffic and other noise sources of significance. Noise levels was evaluated using a Sound Level Meter Model AWA 5636 IEC 61672 – 1:2013 class 2 with a built-in ϖoctave / octave band filters which does real time 1/1 and 1/3 octave analysis was mounted on at 2.0m above ground level and at least 3.5m away from any sound reflecting surfaces at a boundary position and measurements taken at timed intervals over 10 minutes and stored in SLM's memory. The sound level meter was placed on the microphone to reduce any wind interference during measurements. The sound level meters, were within its calibration period, at the time of monitoring. In addition, the equivalent noise level (LAeq), the maximum sound pressure level (Lmax) and the minimum sound pressure level (Lmin) during that measurement period were recorded. Factors to consider such as time, duration and predictability of the noise emission, amplitude and frequency of the noise emission, nature of the source, location of noise sensitive receptors, ambient and background noise level, nature and character of the locality, presence of special acoustic characteristics and the incongruity or familiarity of the noise during noise survey and site placement were put into consideration. Furthermore, as each individual measurement was being taken, the nature of the noise climate in the area was assessed and recorded. This comprised an auditory observation by

the surveyor, as well as identifying those noise incidents which influenced the sound level meter readings during that measurement period.

Figure 9: Ambient air quality and noise level monitoring at the proposed project site (Source: Lahvens (K) Limited, August 2021).

1.5.3.3 Soil sampling and analysis

Soil samples were obtained at the proposed project site and analyzed for BTEX, Polycyclic Aromatic Hydrocarbons (PAH) & Total Petroleum Hydrocarbon (TPH). The purpose of soil sampling and analysis was to give a general indication of the existing potential contaminants and for future monitoring of the impact of the proposed project.

1.5.4 Stakeholder mapping

Prior to commencement of the ESIA process, the consultants conducted a stakeholder mapping and analysis to determine the individual, groups and institutions that will be affected by and have an interest in the project in consultation with the proponent, the County Government and the Ministry of Interior and Coordination of National Government. The consultants then prepared a comprehensive list of all the stakeholders in consultation with the proponent and categorized them based on the following:

- Low interest, low influence – those to keep informed
- High interest, low influence – those to involve and consult with
- Low interest, high influence – powerful stakeholders to engage
- High interest, high influence – partners to collaborate with

Nine key stakeholder categories were identified. These are;

1. County and National Government Representation
2. Lead Agencies and community organizations operating directly under them
3. Civil Society
4. Conservation Organisations
5. Local Community and Residents' Associations
6. Opinion leaders including political leaders
7. Faith Based Institutions
8. Special Interest Groups
9. Media

The consultant then identified the key contact persons within the stakeholder categories who will be engaged throughout the ESIA study process. The identification of the key contact persons was done in consultation with the proponent, lead agencies, the County Government of Kajiado, Ministry of Interior and Coordination of National Government, Residents Associations, Community Groups, Non-Governmental Organizations and Conservation groups.

Further, the consultant identified other stakeholders who may not be apparent but needed to be consulted and analyzing the role of each stakeholder in the ESIA study process as well as project implementation. Finally, the consultant determined the tools for engaging with each stakeholder including language of communication and allocation of resources to ensure meaningful participation of the stakeholders in the ESIA process.

Following the analysis, two public consultative meetings were held on 20th and 30th August 2021 at Tumaini Gardens and Enchula Resort respectively.

2 ENVIRONMENTAL SETTING OF THE PROPOSED PROJECT SITE

2.1 Introduction

Baseline conditions of the proposed project site were assessed and documented for the purposes of determining the future impacts of the proposed project on the environment and livelihoods of the local community. The baseline survey was done through literature review, site visits and baseline environmental media monitoring in collaboration with Lahvens (K) Limited. This section details on the findings of the survey which will form a basis for impact monitoring plans and improvement of the environmental and social performance of the proposed project during implementation.

2.2 Climate and vegetation cover

Kajiado County experiences a bi-modal rainfall pattern. The short rains fall between October and December while the long rains fall between March and May. The bimodal rainfall pattern is not uniform across the County. The long rains (March to May) are more pronounced in the western part of the county while the short (October to December) rains are heavier in the eastern part. The rainfall amount ranges from as low as 300mm in the Amboseli basin to as high as 1250mm in the Ngong hills and the slopes of Mt. Kilimanjaro.

Temperatures vary both with altitude and season. The highest temperatures of about 34°C are recorded around Lake Magadi while the lowest of 10°C is experienced at Loitokitok on the eastern slopes of Mt. Kilimanjaro. The coolest period is between July and August, while the hottest months are from November to April. Figure 10 below shows the average temperature and rainfall distribution for Kajiado County.

Inkiwachani area lies in a semi-arid zone thus the vegetation consists of grasses, shrubs, herbs and acacia trees (Figure 11). The fauna is comprised majorly of birds.

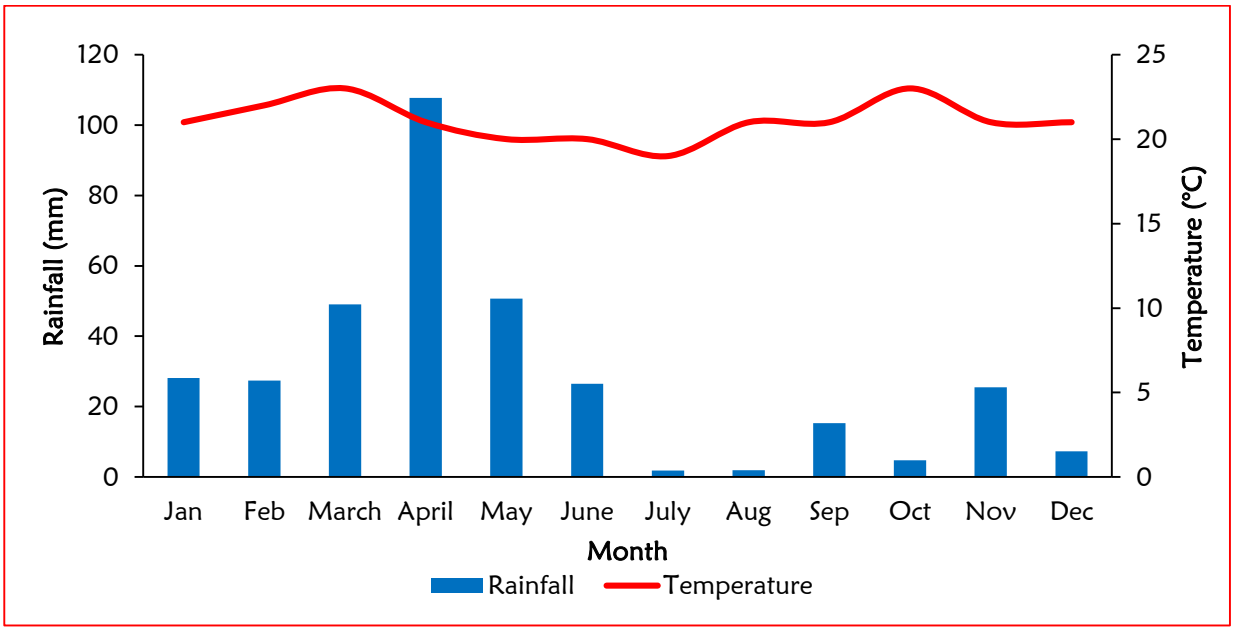

Figure 10: Average rainfall and temperature distribution for Kajiado County in 2020 (Source: World Weather Online, 2021).

Figure 11: Sections of the project site showing the vegetation cover comprising of shrubs (left) and acacia trees (right) (Source: Site visit, July 2021).

2.3 Topography

The main physical features in Kajiado County are plains, valleys and occasional volcanic hills from an altitude of 500 metres above sea level at Lake Magadi to 2500 metres above sea level in Ngong Hills. The landscape within the county is divided into Rift Valley, Athi Kapiti plains and Central Broken Ground. Inkiwachani area lies within the central broken ground stretching 20km to 70km wide from the North-eastern boarder across the County to the South-west where altitude ranges from 1220m to 2073m above sea level.

2.4 Demographic characteristics

According to the 2019 population and housing census report, Kajiado County has a total population of 1,117,840 Million People, up from 687,312 thousand people as per the 2009 census. Kajiado Central Sub-County where the proposed project site lies has a population of 161,862 comprised of 81,514 males, 80,343 females and 5 inter-sex people. The distribution of the population is influenced by availability of water as settlements are concentrated along water points, near urban and rural trading centers as well as along major roads. The Maasai form the bulk of the population but other ethnic groups such as the Kamba and Kikuyu have infiltrated the area.

2.5 Land use patterns and socio-economic activities

Land use patterns in Inkiwachani area feature nomadic pastoralism, livestock rearing, educational and industrial establishments, subsistence agriculture and sparse settlements. The bulk of the population in the County practice nomadic pastoralism owing to the dry weather conditions. The main livestock types reared include goats and sheep. Subsistence agriculture is carried out in small areas by only non-indigenous people in the southern and western parts of the County along rivers and springs. Tourism is a strength that Kajiado holds dear through the current progress with Amboseli National Park.

2.6 Ongoing mining and extraction activities

The major quarrying sites are Kenya Marble Quarries in Loodokilani - Kajiado West; Portland in Ngatataek in Kajiado Central; Kibini, Sholinke, Nkurunka and Kitengela in Kajiado East; and Mbirikani in Kajiado South. The main quarry products are Marble Stones, limestone, sand, ballast and construction stones (Source: Kajiado County Integrated Development Plan, 2018 – 2022).

2.7 Infrastructure

2.7.1 Water resources

Kajiado County is an Arid and Semi-Arid Land (ASAL) characterized by an acute shortage of clean and safe water for drinking and other domestic uses. Inkiwachani area, where the proposed project site lies is served by reticulated supply from Olkejuado Water and Sewerage Company

(OWASCO). The main sources of water in the rural areas are water pans, dams and protected springs with the most reliable source being boreholes. Most of the water sources are fully recharged during the long rains season. There are numerous shallow wells, which provide reliable water supplies, but they are not protected. Most of the rivers are seasonal. Ground water occurs in different and varied rock conditions depending on the geological formation. The proposed project will source water from a borehole and supplemented by rainwater harvesting and natural pond system.

2.7.2 Transport

Kajiado County is served by a well-established network of earth, murram and bitumen roads. The Standard Gauge Railway (SGR) traverses the county through parts of Kajiado East and North. The metre gauge railway is used as a means of transport for soda-ash and other by-products and as well serving residents with commuter services in towns and areas such as Singiraine, Kenya Marble Quaries (KMQ), Kajiado and Elangata-Wuas. Additionally, there are seven airstrips in Kajiado County, with at least one in each Sub-county. The proposed project site lies along Nairobi-Namanga Road (Figure 12) adjacent to Twyford Tiles Factory.

Figure 12: A section of Nairobi – Namanga Highway (Source: Site visit, July 2021).

2.7.3 Energy

The county has great potential in the area of green energy, specifically wind, solar, biogas among others. The major sources of energy are electricity (Figure 13), solar, lantern and and tin lamp. Electricity is limited to a few urban centres of Kitengela, Kajiado, Bissil, Loitokitok, Magadi, Ongata Rongai, Ngong and Kiserian. The proposed project will source energy from the National Grid supplemented by a diesel powered generator. Other sources of energy will include fuel oil and coal.

Figure 13: Reticulated power supply lines near the proposed project site (Source: Site visit, July 2021).

2.8 Baseline environmental data

2.8.1 Ambient air quality measurements

There were notable gaseous concentrations of ozone (O_3) and Carbon monoxide (CO) within the project site. Nitrogen dioxide (NO_2) and Sulfur dioxide (SO_2) concentrations remained below detection limits (<0.001ppm). Notable levels of particulate matter (PM_{10} and $PM_{2.5}$) were also detected. However, the gaseous and particulate parameters measured were all within the stipulated standards under the First Schedule of Environmental Management and Coordination (Air Quality) Regulations, 2014 (Table 2).

Table 2: Baseline air quality measurements for the proposed project site (Source: Lahvens Limited, August/September 2021).

Project site	NO_2 (ppm)	SO_2 (ppm)	O_3 (ppm)	CO (mg/m^3)	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
Run 1	<0.001	<0.001	0.06	2.75	7	10
Run 2	<0.001	<0.001	0.06	2.98	8	13
Run 3	<0.001	<0.001	0.05	1.49	7	11
Average	<0.001	<0.001	0.06	2.41	7.3	11.3
Standard deviation	-	-	0.01	0.80	0.6	1.5
EMCA (Air Quality) Regulations, 2014	**0.5**	**0.191**	**0.12**	**4**	**-**	**100**

2.8.2 Ambient noise level measurements

The results of noise level measurements were within the limits stipulated under the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 (Table 3). No activities were ongoing at the time of measurements. Vehicular movement along the Nairobi-Namanga Highway, occurring wind and breeze, and the rustling vegetation at the site were the likely sources of noise emissions.

Table 3: Baseline noise level measurements for the proposed project site (Source: Lahvens (K) Limited, August/September 2021).

Location	Measured Sound Pressure Level (Noise) (dBA) (1100Hrs-1200Hrs)			EMCA Guidelines (Day time)
	LAeq	Lmin	Lmax	
Proposed project site	46.7	39.9	67.4	55

2.8.3 Soil sampling and analysis

Soil sampling results indicated that BTEX, TPH and PAH were below 0.01mg/kg (Table 4). Kenya has not developed a specific environmental legislation on soil standards but relies on existing legislation on pollution such as the Environmental Management and Coordination (Water Quality) Regulations, 2006 and the Kenya Constitution 2010 to prosecute environmental crimes on soil contamination.

Table 4: Baseline soil tests for the project site (Source: Lahvens (K) Limited, August/September 2021).

Test	Method	Results (mg/kg)	Specifications
BTEX			
Benzene	PQA/LIM/002	<0.01	-
Toluene	PQA/LIM/002	<0.01	-
Ethyl benzene	PQA/LIM/002	<0.01	-
Xylene	PQA/LIM/002	<0.01	-
TPH			
Total Petroleum Hydrocarbon	PQA/LIM/003	<0.01	-
PAH			
Naphthalene	PQA/LIM/004	<0.01	-
Acenaphthylene	PQA/LIM/004	<0.01	-
Acenaphthene	PQA/LIM/004	<0.01	-
Fluorene	PQA/LIM/004	<0.01	-
Phenanthrene	PQA/LIM/004	<0.01	-
Anthracene	PQA/LIM/004	<0.01	-
Fluoranthene	PQA/LIM/004	<0.01	-
Pyrene	PQA/LIM/004	<0.01	-
Benzo(a)anthracene	PQA/LIM/004	<0.01	-
Chrysene	PQA/LIM/004	<0.01	-
Benzo(b)fluoranthene	PQA/LIM/004	<0.01	-
Benzo(k)fluoranthene	PQA/LIM/004	<0.01	-
Benzo(a)pyrene	PQA/LIM/004	<0.01	-

Limit of detection=0.01mg/kg

3 IDENTIFICATION OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The proposed project will have both socio-economic benefits and attendant negative environmental and social impacts. The purpose of the ESIA process is to therefore systematically assess the value of the benefits against the environmental concerns and provide measures to avoid, prevent or reduce the magnitude of the impacts. The following section provides details on these impacts and proposed mitigation measures to address the identified negative environmental and social impacts. The mitigation measures are based on the underlying principle of EIA that everyone is entitled to a clean and healthy environment and a duty to enhance and safeguard the environment.

3.1 Positive impacts of the proposed project

The proposed project will have the following benefits;

1. **Mitigating the national and regional demand for processed mineral resources**

   The minerals resources which will be processed have a wide range of industrial applications. Industrial application of each of the minerals is summarized below.

   - **Limestone**
     - ✓ As a raw material for the manufacture of quicklime (calcium oxide), slaked lime (calcium hydroxide), cement and mortar
     - ✓ Pulverized limestone is used as a soil conditioner to neutralize acidic soils
     - ✓ As a reagent in flue-gas desulfurization, where it reacts with sulfur dioxide for air pollution control
     - ✓ In glass making, particularly in the manufacture of soda-lime glass
     - ✓ For remineralizing and increasing the alkalinity of purified water to prevent pipe corrosion and to restore essential nutrient levels
   - **Dolomitic lime**
     - ✓ Used as an ornamental stone, a concrete aggregate, and a source of magnesium oxide, as well as in the Pidgeon process for the production of magnesium
     - ✓ Used in place of calcite limestone as a flux for the smelting of iron and steel
     - ✓ Used in the production of floatglass
     - ✓ In horticulture, dolomite and dolomitic limestone are added to soils and soilless potting mixes as a pH buffer and as a magnesium source
   - **Feldspar**
     - ✓ As a raw material for the manufacture of glass, ceramics, and as a filler and extender in paint, plastics, and rubber. In glassmaking, alumina from feldspar improves product hardness, durability, and resistance to chemical corrosion while in ceramics, the alkalis in feldspar (calcium oxide, potassium oxide, and sodium oxide) act as a flux, lowering the melting temperature of a mixture.
   - **Water glass**
     - ✓ Water purification: Sodium silicate is used as an alum coagulant and an iron flocculant in wastewater treatment plants. Sodium silicate binds to colloidal molecules, creating larger aggregates that sink to the bottom of the water column. The microscopic negatively charged particles suspended in water interact with sodium silicate. Their electrical double layer collapses due to the increase of ionic strength caused by the addition of sodium silicate and they subsequently aggregate.
     - ✓ Manufacture of detergents: Dissolved water glass is moderately to highly alkaline, and in detergents this property aids in the removal of fats and oils, the neutralization of acids, and the breakdown of starches and proteins.
     - ✓ Steel industry: Used as a sand binder in sand casting of steel. By passing CO_2 through a mixture of sand and sodium silicate in the mould box, which hardens it almost immediately, allows for the rapid development of a solid mould.
     - ✓ Liquid sodium silicate reacts under acidic conditions to form a hard glassy gel. This property makes it useful as a bonding agent in cemented products such

as concrete and abrasive wheels. It is also an excellent adhesive for glass or porcelain.
- ✓ Use in cement in the manufacture of cardboard.
- ✓ Used in drilling fluids to help strengthen borehole walls and prevent them from collapsing.
- ✓ Most masonry products, such as concrete, stucco, and plasters, can be treated with a sodium silicate solution to minimize porosity.

2. **Earning the country foreign exchange**
   According to the United Nations COMTRADE database on International trade (2020), Kenya exports of quartz, limestone, dolomatic lime and feldspar was $184. The total mineral and mineral resource products exported in 2020 made 6.67% of the country's total exports where limestone and other calcareous stones accounted for 0.22%. Implementation of the proposed project will significantly increase the country uptake of mineral wealth through exports where 25% of the water glass will be exported to East African Countries i.e. Tanzania, Uganda, Ethiopia, Burundi and Rwanda. The remaining 75% will be sold to local manufacturing industries such as KAPA Oil Refineries Limited, UNILEVER and BIDCO among others.
3. **Contribution of the project towards attainment of Vision 2030 and the Presidential Big Four Agenda**
   The operations of the plant will help in attainment of the Economic and Macro Pillar sector of Vision 2030 which is the national long-term development blueprint to create a globally competitive and prosperous nation with a high quality of life. It will also support the presidential Big Four Agenda by enhancing the local manufacturing industry to offer employment to Kenyans and reduce the trade deficit that the country is currently experiencing.
4. **Provision of employment opportunities**
   According to the Kenya National Bureau of Statistics (KNBS, 2019), Kenya`s unemployment rate increased to 2.98% in December 2020, from the previously reported figure of 2.60% in December 2019. However, the proposed project will reduce the gap of unemployment within the country through provision of employment opportunities to both skilled and non-skilled personnel throughout its life cycle where 85% of the employees will be sourced from Inkiwachani area while 15% will be sourced from other parts of the Country.
5. **Income to the proponent**
   The facility through its operations will accrue income to the proponent thus enabling expansion of business and creating more employment opportunities to the locals.
6. **Market for local goods and services**
   The proposed project will provide a market for goods and services during construction and operational phases. Goods include cement, sand and aggregate for construction works, raw materials for the plant which will be sourced from existing quarries in Bisil, Ngorika and neighboring areas, and Lake Magadi within Kajiado County while services include energy, telecommunication and environmental audits among others.
7. **Revenue to the government**
   The proposed project will generate revenue to the government through taxes, licences and fees levied on goods/ services. Through the revenues generated, the government will be capable of financing its obligations to the country.
8. **Transfer of skills**
   The proposed plant will facilitate the transfer of skills and technology to local people. Prior to implementation of the project, the proponent will initiate capacity building of the local community employees to improve their upward mobility in employment. As a result the local people will learn new skills and technology from the civil engineers, welders, masons and other experts that will be deployed.

3.2 Anticipated negative environmental and social impacts

Alongside the positive impacts, the proposed project is expected to result in a number of negative environmental and social impacts at the various stages of implementation as discussed below.

3.2.1 Negative impacts at the construction phase of the proposed project

3.2.1.1 Change in land use

The current land use of the area is agricultural. However, the proponent proposes to set up a mineral resources processing plant which is inconsistent with the current land use.

Recommended mitigation measure

1. Apply for and obtain a change of user from agricultural to industrial from the County Government of Kajiado and the Ministry of Lands

3.2.1.2 Environmental risks of obtaining raw materials

Installation of the plant and construction of auxiliary facilities will require raw materials such as steel bars, sand, cement, building blocks, timber, glass and paint among others. These materials will be sourced from the environment and will have a negative impact at their points of origin.

Recommended mitigation measures

1. Source raw materials from sites that are licensed as per the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya
2. Have a procurement plan based on the Bill of Quantities prepared by a Quantity Surveyor to avoid potential oversupply of materials and wastage
3. Re-use construction materials such as wood and metal cuttings which can be salvaged

3.2.1.3 Impact on biodiversity

Site preparation will involve clearing of vegetation and civil works. The vegetation cover at the proposed project site includes shrubs, herbs, grasses and acacia trees which will need to be cleared to pave way for construction activities. Vegetation cover plays an important role in preventing soil erosion, carbon sequestration and habitat for other organisms among others. Therefore, clearance of the vegetation would lead to the loss of these benefits.

Recommended mitigation measures

1. Retain vegetation cover in areas that will not be excavated as far as practicable
2. Replant trees in the section of the property that will not be developed to compensate for vegetation lost

3.2.1.4 Water demand and effluent generation

During construction, water will be required for concrete mixing, casting and curing works, drinking and sanitation purposes and will be sourced from a borehole. Based on the projected workforce of 100 - 150 people at construction, water demand at the site will be at most 10 m^3 per day. Out of these, 10% (1 m^3) will be used for domestic purposes and will generate 0.7 m^3 of effluent which will need to be disposed off. The rest of the water soaks into ground areas within the project site. Poor disposal of the effluent generated has the potential to pollute underground aquifers and should thus be managed appropriately.

Recommended mitigation measures

1. Apply for and obtain drilling and abstraction permit from Water Resources Authority (WRA)
2. Sensitize the workers on the need to conserve the available water resources
3. Procure and deliver to the site mobile toilets from a NEMA licensed waste contractor for use by the workers during construction
4. Comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006

3.2.1.5 Solid waste generation and management

Site preparatory and construction activities will generate significant quantities of solid waste in form of biomass, overburden, domestic waste such as plastic containers and construction materials such as wood, building blocks, metal cuttings and wrappings among others. These will need to be disposed off appropriately as poor solid waste management can create breeding grounds for disease causing pathogens.

Recommended mitigation measures

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

3.2.1.6 Occupational safety and health risks

Workers undertaking installation of the plant and construction of auxiliary facilities, visitors to the project site and neighbours will be exposed to potential safety and health risks during construction activities. The potential safety risks will be from the use of machinery, falling objects or even falls, air and noise pollution, and COVID-19 among others. These risks have a potential to cause disturbances, injuries, permanent disability or even death.

Recommended mitigation measures

1. Register the site as a workplace with the Directorate of Occupational Safety and Health Services (DOSHS)
2. Obtain insurance cover for the workers at the site
3. Provide adequate and appropriate Personal Protective Equipment (PPE) to workers and visitors to the site and enforce on their use
4. Provide employees with correct tools and equipment for the jobs assigned and train on their use
5. Ensure moving parts of machines and sharp surfaces are securely protected with guards to avoid unnecessary contacts and injuries
6. Provide first aid services and emergency vehicle at the site
7. Regulate the entry of visitors to the construction site by deploying adequate security measures
8. Comply with the set National Government and County Government Directives and guidelines on prevention of the spread of COVID-19
9. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.2.1.7 Air pollution

Air pollution during the construction phase will be in form of dust generated during excavations, concrete mixing activities and exhaust fumes from machinery use and Heavy Commercial Vehicles (HCVs) delivering construction materials to the site. The most relevant pollutant considered is particulate matter because of its potentially significant increase during the construction phase. Respirable particulate matter may present respiratory diseases, cause eye irritation and visual intrusion to workers, visitors to the project site and the neighbors if it is in excess of 100 $\mu g/Nm^3$ as per the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

Recommended mitigation measures

1. Procure, provide and enforce the use of dust masks to the workers and visitors to the project site
2. Install dust screens around the project site during construction
3. Sprinkle water at the excavation areas to suppress dust
4. Use of serviceable machinery/equipment and trucks
5. Monitor fugitive emissions to ensure compliance with the limits set under the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014
6. Comply with Environmental Management and Coordination (Air Quality) Regulations, 2014

3.2.1.8 Noise pollution

The installation and construction works, delivery of raw materials by Heavy Commercial Vehicles (HCVs) and the use of machinery including concrete mixers and metal grinders among others may lead to high noise and vibration levels within the construction site and the surrounding area. The noise levels produced may be above the stipulated EMCA limits and may lead to hearing impairments to the workers, visitors to the site and the neighbors. Construction sites such as the proposed project can only emit noise levels of up to 60dB (A) during the day and 35dB (A) at night as per the Second Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

Recommended mitigation measures

1. Delivery of raw materials, excavation and construction work should be limited to day time hours only between 8am to 5pm
2. Locate machinery that are likely to produce noise as far as practical from neighboring properties
3. Procure, provide and enforce the use of earmuffs to workers who will work within peak noise producing areas and visitors accessing the same areas
4. Sensitize truck drivers to avoid unnecessary hooting and running of vehicle engines
5. Comply with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

3.2.1.9 Traffic congestion

Heavy Commercial Vehicles (HCVs) delivering construction materials to the site are likely to increase traffic along the Nairobi-Namanga Highway in case of stalling and breakdowns. This will cause inconveniences to other road users

Recommended mitigation measures

1. Prepare and implement a traffic management plan
2. Provide sufficient parking for HCVs and machinery at the site
3. Offload construction materials on the site and not on the road reserves to ensure smooth flow of traffic
4. HCVs delivering raw materials should observe designated speed limits for the area
5. Erect signage and warnings on the road to forewarn other road users on the use of the road by Heavy Commercial Vehicles (HCVs)
6. Comply with the provisions of the Traffic Act, 2016

3.2.2 Negative impacts at the operational phase of the mineral resources processing plant

3.2.2.1 Air pollution

Air pollution will mainly result from dust emissions during crushing, grinding and milling of minerals, flue gases (carbon monoxide & sulphur dioxide) during melting of sodium carbonate and silicon dioxide and combustion of coal at the furnace, and exhaust fumes such as carbon monoxide, hydrocarbons, nitrogen oxides and sulfur dioxide from machinery at the plant and vehicles accessing the facility. The greater the reduction in size during crushing, grinding and

milling the higher the emissions. Air pollution may have health implications on the workers, visitors to the facility and the neighboring properties/community as it causes respiratory diseases and is a visual irritant. It also reduces growth of vegetation and hampers aesthetics of the area.

As per the design plan, two dust collectors will be installed within the plant to trap fine dust particles and re-used in the water glass production. To control flue gases (carbon monoxide & sulphur dioxide) emissions, the proponent will utilize two technologies i.e. (i) installation of a regenerator made of porous bricks which absorbs the gases forming sodium sulphate along the walls. The regenerator will then be cleaned after every 6 months and the resultant sodium sulphate sold to farmers as fertilizers and (ii) installation of wet scrubbers (7m long & 3.5m width) along the chimney to trap the remaining gaseous particles. To monitor the efficiency of the plant, additional mitigation measures are recommended as summarized below.

Recommended mitigation measures

1. Retain the existing vegetation in areas that will not be developed and plant fast growing trees such as casuarina to act as dust screens
2. Procure and provide adequate dust masks to workers and enforce on their use
3. Develop and implement an air quality monitoring plan to ensure compliance with the limits set under the Third Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014
4. Monitor fugitive emissions to ensure compliance with the limits set under the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014
5. Apply for and obtain emission licence from NEMA
6. Comply with the provisions of the Environmental Management and Coordination (Air Quality) Regulations, 2014

3.2.2.2 Noise pollution

Processing of mineral resources involves several activities which may result into noise and excessive vibration. These include excessive vibrations mainly from crushing, grinding, milling and screening of raw materials, and combustion of the sodium carbonate and silicon dioxide at the furnace. Other sources of noise will be vehicular movement in and out of the facility, loading and offloading activities. It should be noted that the noise produced at the facility will be in keeping with the background noise emanating from the Nairobi-Namanga Highway. The noise levels and vibrations produced may be above the stipulated limits under the Third Schedule Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. This may lead to hearing impairments to workers, visitors to the site and neighbors.

Recommended mitigation measures

1. Procure and provide adequate earmuffs to employees working at peak noise producing areas and enforce on their use
2. Reduce the working hours for employees working at peak noise producing areas compared to those working in other areas
3. Service mechanical equipment regularly to ensure that they are in good condition
4. Undertake noise level monitoring in collaboration with a NEMA designated laboratory
5. Comply with the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

3.2.2.3 Increased water demand

Water will be required at various sections of the plant for purposes of steam production at the boiler, dissolving cullet (mixture of silicon dioxide and sodium carbonate) to form water glass and cooling among others. Other uses of water will include sanitation, general cleaning and drinking. This will result in increased demand for water estimated at 50 m^3/day. The proposed

plant will source water from a borehole and supplemented by rainwater harvesting and natural pond system.

Recommended mitigation measures

1. Install water saving systems such as self-closing taps and low flush water closets
2. Display water conservation posters in areas of high water use
3. Carry out regular inspection and maintenance of the water distribution network to ensure zero leaks and damages
4. Keep track of water consumption bills to identify areas of unnecessary use

3.2.2.4 Effluent generation and management

Being an industrial development, the effluent will constitute a combination of domestic and industrial wastewater flows. Domestic effluent flows will be generated from sanitation facilities and general cleaning whereas the industrial effluent flows will be generated from the water glass production process. Industrial effluent flows will majorly comprise of mineral impurities such as silicate from the plant, wastewater flows from the scrubber, waste oil and grease from machinery operations among others. Based on domestic water consumption of approximately 5 M^3 (10% of total water consumption), domestic effluent of 3.5 M^3 will be generated. Seventy percent (70%) of remaining water use (45 M^3) will be generated as industrial effluent. Notably, wastewater flows from the scrubber will be channeled to the pond for recycling purposes. Ground and surface water sources may be polluted if effluent generated is not managed in an appropriate manner.

Recommended mitigation measures

1. Install a bio-digester and an Effluent Treatment Plant (ETP) to manage domestic and industrial wastewater flows respectively
2. Recycle the treated water from the Effluent Treatment Plant (ETP) for re-use in external cleaning, landscaping and firefighting among others
3. Ensure regular treatment of the pond water to maintain the required pH levels
4. Monitor the quality of effluent discharged from the bio-digester and Effluent Treatment Plant (ETP) to ascertain conformity to the set standards stipulated under the Third Schedule of Environmental Management and Coordination (Water Quality) Regulations, 2006
5. Apply for and obtain an EDL from NEMA
6. Comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006

3.2.2.5 Solid waste generation and management

Solid waste generated will mainly comprise of mill tailings which are extremely fine particles that will be rejected from the grinding, crushing and screening of the minerals, bottom ash, and domestic waste including wrappings, cartons and paper among others. Poor disposal of solid waste degrades environmental quality and should thus be properly managed.

Recommended mitigation measures

1. Sell off the mill tailings to cement manufacturing companies for use as source of pozzolanic material
2. Procure and strategically place adequate solid waste collection bins with a capacity for segregation within the plant
3. Sensitize workers on the process of solid waste collection, segregation and proper disposal
4. Procure a sizeable central solid waste collection bin with chambers to accommodate separated waste
5. Procure the services of a NEMA licensed waste handler to dispose off the solid waste
6. Comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006

3.2.2.6 Occupational safety and health risks

The operations of the plant will pose safety and health risks to workers, visitors to the site and the neighboring properties/community. This may be in the form of air and noise pollution, musculoskeletal injuries from use of machinery and equipment at the plant, exposure to sodium silicate solutions, citric acid which may lead to skin and respiratory tract irritation, exposure to high heat levels, exhaust fumes from machinery and vehicles accessing the facility, falls and electrocution among others. All these risks have potential to cause injuries, permanent disability or even death and hence the management should be committed to ensuring safety and health of workers and visitors to the plant.

Recommended mitigation measures

1. Develop and implement a safety and health policy for the plant
2. Develop and implement an emergency response plan
3. Sensitize employees to adhere to work procedures to minimize accidents
4. Provide adequate and appropriate PPE such as gloves, goggles aprons and gumboots to workers and enforce on their use
5. Display precautionary signage at appropriate sections within the plant
6. Conduct first aid training among the workers and provide well-stocked first aid kits at different sections within the plant
7. Provide and keep an accident/incident register occurring on the site including near misses and actions taken to prevent future occurrences
8. Conduct occupational safety and health audits and implement measures to reduce the risk posed to those working in the plant
9. Conduct risk assessment audits annually
10. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.2.2.7 Fire risks and emergency preparedness

Fire hazards are real threats to mineral resources processing plant and must be accorded adequate attention and swift action in case of an outbreak. Potential sources include flammable materials, combustion of sodium carbonate and silicon dioxide at the furnace which is carried out at very high temperatures (1100˚C - 1200˚C), oil spills at the fuel tanks, electrical faults or operational negligence among others. Fire occurrence may lead to death, financial losses and loss of livelihoods for the workers and neighbors.

Recommended mitigation measures

1. Develop, clearly display and implement a fire and emergency response action plan
2. Procure and provide adequate firefighting equipment such as fire extinguishers, fire hose reels, smoke detectors, fire alarms and fire hydrants and place them strategically within the facility
3. Firefighting equipment should be serviced quarterly by fire service providers.
4. Train employees on the use of fire-fighting equipment
5. Designate a fire assembly point and clearly display emergency exit points at strategic areas within the facility
6. Display fire safety and warning signage at appropriate sections of the plant
7. Ensure proper handling and storage of flammable materials
8. Plant operations should be undertaken by authorized personnel only
9. Ensure regular inspection and maintenance of electrical appliances
10. Conduct annual fire safety audit and fire drills
11. Access to the plant should be controlled to limit exposure to hazards
12. Comply with Occupational Safety and Health Act, 2007

3.2.2.8 Exposure to thermal heat

The key exposures to heat in water glass production occurs during combustion of sodium carbonate and silicon dioxide at the furnace (1100°C - 1200°C), and steam production at the

boiler. This may expose the workforce to lots of heat leading to heat exhaustion and stroke among other heat related illness.

Recommended mitigation measures

1. Installation should take into account proper ventilation of the area as well as optimal configuration of components to effectively dissipate away excess heat and avoid build up
2. Use cooling towers before releasing heat to the environment
3. Procure and provide adequate and appropriate PPEs such as insulated gloves and shoes to workers and enforce on their use
4. Reduce the amount of working hours for the employees operating around the furnace

3.2.2.9 Increased energy demand

Mineral processing is a highly energy intensive process characterized by high energy consumption. Energy will be required for running machinery at the plant, melting sodium carbonate and silicon dioxide at the furnace, steam production at the boiler and lighting. Energy during operations will be sourced from the National grid supplemented by a diesel powered generator. Other sources of energy will be fuel oil and coal used at the furnace.

Recommended mitigation measures

1. The proponent will procure plant machinery and equipment that feature the latest technology to ensure power efficiency
2. Supplement electrical supply from the national grid with renewable energy such as solar to power the lighting system in areas such as offices and walkways
3. Install compact fluorescent lights in high use areas within the facility– they last longer and use 75% less energy than normal light bulbs
4. Keep records of power consumption to inform substantial practical guidelines for continuous improvement of consumption efficiency and identifying cost saving opportunities in energy efficiency
5. Create awareness among employees and visitors on energy conservation such as switching off lights when not in use
6. Conduct energy audits at least once every three years and implement the recommended actions

3.2.2.10 Oil spills

Oil will be required to run the furnace for melting sodium carbonate and silicon dioxide. Potential oil spills may occur during the transfer of oil from the storage tanks to the furnace, servicing and maintenance of vehicles and machinery. A release of petroleum products to the environment threatens ground and surface waters thereby endangering drinking water supplies.

Recommended mitigation measures

1. Install oil water interceptors around the oil storage tanks and maintenance areas to prevent ground water contamination and runoff
2. Train employees on containment and cleaning of oil spills
3. Provide oil spill response kit to aid speedy clean-up in case of spillage
4. Conduct regular tests on the fuel tanks to curb possible tank failure
5. Contract a NEMA licensed waste oil handler to manage the waste oil from the facility
6. Comply with the Used Oil Guidelines, 2017

3.2.2.11 Traffic congestion

During operations, there will be increased movement of Heavy Commercial Vehicles (HCVs) delivering raw materials and dispatching the finished products to and from the plant. This will increase traffic along the Nairobi-Namanga Highway.

Recommended mitigation measures

1. Provide adequate parking areas within the plant

2. Develop and implement a traffic management plan
3. Control entry and exit of vehicles to and from the plant
4. Comply with the Traffic Act, 2016

3.2.3 Negative impacts at possible decommissioning phase of the mineral resources processing plant

A decommissioning phase is possible in the event of end of project life, closure by government agencies due to non-compliance with environmental and health regulations, an order by a court of law due to non-compliance with existing regulations, natural calamities and change of user of land. The proponent will prepare and submit a due diligence decommissioning audit report to NEMA for approval at least three (3) months in advance. For the purposes of prediction and information, the environmental and social concerns which may arise during decommissioning include;

1. Economic decline
2. Safety and health risks
3. Waste generation
4. Insecurity

3.2.3.1 Economic decline

In the event of decommissioning of the plant and the auxiliary facilities, the proponent will incur huge financial loses and the employees will also lose their livelihoods. In addition, the government will lose revenue earned from the operations of the plant.

Recommended mitigation measures

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

3.2.3.2 Safety and health risks

Safety and health risks are likely to emanate from accidental falls and cuts and injuries from machinery use. Noise and air pollution from decommissioning activities may also pose safety and health and safety risks to workers, neighbors and visitors to the site.

Recommended mitigation measures

1. Contract a licensed construction company to carry out demolitions
2. Install signage to forewarn people on ongoing demolition activities
3. Provide adequate and enforce the use of PPE throughout the demolition works
4. Avail first aid kits on site throughout the entire period
5. Ensure the process of demolition is supervised by competent personnel
6. Comply with the provisions of the Environmental Management and Coordination (Air Quality) Regulations, 2014 and (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009
7. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.2.3.3 Waste generation

Demolition activities will result in generation of solid waste. The solid waste will include wood cuttings, roofing waste and building rubbles among others. If not properly managed, these generated waste will pose safety and health risks and environmental pollution. Effluent generated from decommissioning the bio-digester and ETP will also need to be disposed off appropriately.

Recommended mitigation measures

1. Contract NEMA licensed waste handler to dispose both the solid waste and effluent generated from the demolition activities
2. Recover the reusable and recyclable components of the plant
3. All recyclable materials should be collected and sent to NEMA licensed recyclers
4. Sell off the plant machinery to other mineral resources processing companies
5. Comply with the Waste Management and Water Quality Regulations, 2006

3.2.3.4 Insecurity

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

Recommended mitigation measure

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

3.3 Impact analysis

Potential project impacts are predicted and quantified to the extent possible. The magnitude of impacts on resources such as water and air or receptors such as people, communities, wildlife species and habitats is defined. Magnitude is a function of the following impact characteristics;

1. Type of impact (direct, indirect, induced)
2. Size, scale or intensity of impact
3. Nature of the change compared to baseline conditions (what is affected and how)
4. Geographical extent and distribution(e.g. local, regional, international)
5. Duration and/or frequency (e.g. temporary, short-term, long term, permanent)

Magnitude describes the actual change that is predicted to occur in the resource or receptor. It takes into account all the various impact characteristics in order to determine whether an impact is negligible or significant. Some impacts can result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes can be regarded as essentially having no impact and are characterized as having a negligible magnitude (Table 5).

1. **Negligible impact (very low) -** Where a resource or receptor would not be affected by a particular activity or the predicted effect is deemed to be imperceptible or is indistinguishable from natural background variations.
2. **Less than significant impact (Low**) - Is a minor impact where a resource or receptor would experience a noticeable effect but the impact magnitude is sufficiently low (with or without mitigation) and /or the resource or receptor is of low sensitivity. In either case, a less than significant impact must be sufficiently below applicable standard threshold limits.
3. **Potentially significant impact (moderate) -** A moderate impact that meets applicable standards but comes near the threshold limit. The emphasis for such moderate impacts is to demonstrate that the impact has been reduced to a level that is as minor as reasonably practicable so that the impact does not exceed standard threshold limits.
4. **Significant impact (high) -** One where an applicable standard threshold limit would or could be exceeded or if a highly valued or very scarce resource would be substantially affected.

Table 5: Risk and impact significance matrix for the proposed Mineral Resources Processing Plant.

Environmental impact	Magnitude of impact at construction phase	Magnitude of impact at operational phase	Magnitude of impact at possible decommissioning phase
Change in land use	3	0	0
Environmental risks of obtaining raw materials	2	0	0
Impact on biodiversity	2	0	0
Occupational safety and health risks	3	3	3
Air pollution	2	3	2
Noise pollution	2	3	2
Fire risks and emergency preparedness	0	2	0
Exposure to thermal heat	0	2	0
Energy demand	1	3	1
Water demand	2	3	2
Effluent generation	2	2	2
Solid waste generation	2	2	2
Oil spills	0	2	0
Traffic congestion	2	2	1
Economic decline	0	0	3
Insecurity	0	0	2

Legend

Magnitude	Impact score
Negligible	0
Low	1
Moderate	2
High	3

3.4 Public and stakeholders consultations and findings

3.4.1 Introduction

Public and stakeholders participation in the ESIA process is a legislative requirement under Part 2, Section 69 (1d) of the Kenya Constitution 2010 and Regulation 17 of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. The aim of public and stakeholders consultations was to obtain and document comments, views and concerns that the neighbors and stakeholders have regarding the proposed project. For the proposed project, public and stakeholders consultations were undertaken using two strategies i.e. administration of questionnaires and consultative meetings and specifically;

1. Administration of questionnaires to the community members and stakeholders
2. Community and stakeholder consultative meetings held on 20th and 30th August 2021 at Tumaini Gardens and Enchula Resort respectively

Brief details of the comments obtained during administration of questionnaires and consultative meetings are discussed below. The filled in questionnaires and proceedings of the meetings are annexed to this report.

3.4.2 Summary of comments obtained during administration of questionnaires

A total of 76 questionnaires were administered between 20th and 30th August 2021 and the main comments are summarized in Table 6 below. Due to the prevailing COVID-19 pandemic, the questionnaires were filled in by the interviewers where possible. During the interviews, the local community members and stakeholders interviewed cited both positive and negative

environmental impacts that will emanate from the project proposal. The positive impacts identified included;

1. Creation of employment opportunities
2. General development of the area
3. Promoting value addition of minerals
4. Improved standards of living
5. Income to the proponent
6. Revenue to the government

The main potential negative impacts cited included;

1. Air and noise pollution
2. Wastewater generation and management

Notably, the ESIA has proposed measures to ensure that the proposed project possess minimal or no environmental and social impacts cited by the local community and stakeholders. The measures proposed aim at;

- Prevention of environmental pollution
- Minimizing air and noise pollution
- Minimizing the use of environmental resources such as water

Table 6: Summary of comments obtained from neighbors and stakeholders of the proposed project.

No.	Respondents profile			Comments
	Name	Tel contact	ID No:	
1.	Antony Pello	0714825261	29640188	- No objection - Creation of employment opportunities
2.	Nelson Njaro	0726058999	34580618	- No objection - Creation of employment opportunities
3.	Daniel Soloi	0704224661	31050286	- No objection - Creation of employment opportunities - Improvement of living standards
4.	Emmanuel Parsaloi	0703401967	29952777	- No objection - Creation of employment opportunities - Air pollution
5.	Josiah Turanta	0729716145	26069403	- No objection - Promote value addition of minerals - Creation of job opportunities - General development in the area - Air pollution
6.	Pacy Kasirimo	0756646997	26068699	- No objection - Creation of employment opportunities - General development of the area - Air and noise pollution
7.	Elijah Kasirimo	0714029997	33536291	- No objection - Creation of employment opportunities

				- Promote value addition of minerals - Air and noise pollution
8.	Ruth Mayon	0796439209	33314018	- No objection - Improvement of living standards - General development of the area - Air pollution - Wastewater generation
9.	Joseph Lerionka	0717954170	23893264	- No objection - Creation of employment opportunities
10.	Joel Tiampati	0725672163	255334376	- No objection - Creation of employment opportunities - General development of the area - Air and noise pollution
11.	Josiah Ole Mosiany	0722505483	919006	- No objection - Improvement of living standards - General development of the area
12.	Richard Mosiany	0739411095	28854979	- No objection - Creation of employment opportunities - Promote value addition of minerals - Air and noise pollution
13.	Jared Moipei	0724793049	24252607	- No objection - Creation of employment opportunities - General development of the area
14.	Kokuta Nkosiya	0750894354	14607578	- No objection - Creation of employment opportunities
15.	Elton Sambao	0792324926	35230002	- No objection - Creation of employment opportunities - General development of the area - Air and noise pollution - Wastewater generation
16.	Joshua Tupesio	0710221390	-	- No objection - Creation of employment opportunities - General development of the area - Air and noise pollution

17.	Peter Sayaya	0710722635	36507090	- No objection - Promote value addition of minerals - Creation of job opportunities - General development in the area
18.	Paul Nderitu	0715039805	36498183	- No objection - Creation of employment opportunities
19.	Ravine Sampao	0797398250	-	- No objection - Creation of employment opportunities - General development of the area - Air and noise pollution - Wastewater generation
20.	Isreal Pello	0727667687	27982417	- No objection - Promote value addition of minerals - Creation of job opportunities - General development of the area - Air and noise pollution
21.	Michael Lemosian	0716858991	36178305	- No objection - General development of the area - Source of income to the proponent
22.	Violet Mooke	0712613754	20901164	- No objection - Creation of employment opportunities
23.	Kinampet Ayub	0711939257	39288804	- No objection - Creation of employment opportunities - General development of the area - Promote value addition of minerals - Air pollution - Wastewater generation
24.	Violet Dungunyie	0713563263	20275192	- No objection - Creation of employment opportunities - Promote value addition of minerals
25.	Johnstone Sayialel	0724583861	12952340	- No objection - Creation of employment opportunities - General development of the area - Revenue generation - Air pollution

26.	Faith Reson	0700289876	35953316	- No objection - Creation of employment opportunities - Promote value addition of minerals
27.	Kushaai Ene	0754034749	134474	- No objection - Creation of employment opportunities - General development of the area - Wastewater generation - Air and noise pollution
28.	Joshua Saningo	0710432010	25893926	- No objection - Creation of employment opportunities - General development of the area
29.	Lenoi Kimaren	0756253662	217094710	- No objection - Creation of employment opportunities - General development of the area - Promote value addition of minerals
30.	Omar Said	0717307976	33613222	- No objection - Creation of employment opportunities - General development of the area - Air pollution - Wastewater generation
31.	Sussy Maingi	0710360091	5373477	- No objection - Creation of employment opportunities - General development of the area - Revenue generation to the government
32.	Grace Mpuku	0722611929	12651974	- No objection - Creation of employment opportunities - Promote value addition of minerals
33.	Caleb Lemashon	0718882532	39356122	- No objection - Creation of employment opportunities - Air pollution
34.	Milton Melita	0795638800	37626900	- No objection - General development of the area - Source of income to workers - Air and noise pollution

35.	Henry Sabaya	0713359475	37626768	- No objection - Improvement of living standards - Wastewater generation - Air pollution
36.	Jeremiah Konya	0714794355	33854806	- No objection - Creation of employment opportunities - Promote value addition of minerals - Noise pollution
37.	Sukunu Ene	0783232224	12655717	- No objection - Creation of employment opportunities - Improvement of living standards - Air pollution - Wastewater generation
38.	Charles Parmari	0716186294	32549860	- No objection - Creation of employment opportunities - General development of the area - Promote value addition of minerals - Air and noise pollution
39.	Evalyne Moses	0710424650	20843664	- No objection - Creation of employment opportunities - General development of the area - Promote value addition of minerals - Air pollution
40.	Johnson Kadiko	0720160871	20825144	- No objection - Creation of employment opportunities - Improvement of living standards - Wastewater generation - Air and noise pollution
41.	Emmanuel Kapurua	0714062003	24451056	- No objection - Creation of employment opportunities - Promote value addition of minerals - Noise pollution
42.	Elvis Ketende	0712444377	229971364	- No objection - Creation of employment opportunities - Air pollution

43.	Njaro Mosiany	0716112208	9742360	- No objection - Creation of employment opportunities - Improvement of living standards - Promote value addition of minerals - Air pollution
44.	Calvin Lesalon	0796777898	22451141	- No objection - Promote value addition of minerals - Air pollution
45.	John Ngewa	0701481577	28106233	- No objection - Creation of employment opportunities - General development of the area - Noise pollution
46.	Agnes T. Mpuki	0710920649	0088326	- No objection
47.	Kevin Supeyo	0720482208	22985819	- No objection - Creation of employment opportunities
48.	Vascar T. Mpuki	0752055985	12952295	- No objection - Creation of employment opportunities - General development of the area
49.	Damaris Themba	0721560321	1881499	- No objection - Creation of employment opportunities
50.	Kephur Oduor	0790995258	6446732	- No objection
51.	Josephine Sayialel	0726629691	22575832	- No objection - Creation of employment opportunities
52.	Timothy oloputarie	0736735265	22660220	- No objection - Support local business
53.	Elijah Kengu	0794378359	20079878	- No objection - Creation of employment opportunities
54.	Joshua Mpatito	0728757978	27429750	- No objection - Creation of employment opportunities
55.	John Lesimio	0723431553	23829677	- No objection - Creation of employment opportunities
56.	Rastone metamie	0706298424	256131474	- No objection - Creation of employment opportunities
57.	Milau Saisa	0721736591	12952612	- No objection - Creation of employment opportunities
58.	John Tulimo	0718987943	30835916	- No objection

				- Creation of employment opportunities
59.	Alex pose	0722101388	34222055	- No objection - Creation of employment opportunities
60.	Martin Kuya	0722828237	22754963	- No objection - Creation of employment opportunities
61.	Edward Sekenyo	0727604518	21868432	- No objection - Creation of employment opportunities
62.	Pauline Shira	0713024124	23249780	- No objection - Creation of employment opportunities
63.	Sera Nashipai	0726051073	-	- No objection - Creation of employment opportunities
64.	Teelo Masiara	0798299340	21637337	- No objection - Creation of employment opportunities
65.	Elizabeth Serunkai	0702473072	-	- No objection - Creation of employment opportunities
66.	Jorge Supeyo	0711231831	30437273	- No objection - Creation of employment opportunities
67.	Johnathan Kangwes	0727720288	-	- No objection - Creation of employment opportunities
68.	Lawrence Lenana Kuya	0792624206	31950284	- No objection
69.	Tenke Sakoi Kitima	0721349772	-	- No objection - Creation of employment opportunities
70.	Godberry Sirere	0798936505	28988462	- No objection - Creation of employment opportunities
71.	Joe Leyian	0759792899	36857233	- No objection
72.	Rebecca Namunyak	0795020919	22099520	- Creation of employment opportunities
73.	Mugambi Clifford	0725299404	37071245	- No objection
74.	Amos Samande	0758020444	22385552	- Creation of employment opportunities
75.	Johnathan Kanderi	0729658615	30504481	- No objection
76.	Sharleen Naisesoi	0799566011	37762461	- No objection - Creation of employment opportunities

3.4.3 Community and stakeholder consultative meetings

3.4.3.1 First community consultative meeting

The first community consultative meeting was held on 20th August 2021 at Tumaini Gardens (Figure 14). Table 7 summarizes the impacts identified by the local community and their recommended mitigation measures.

Table 7: Impacts identified by the local community and their recommended mitigation measures.

Impact identified by the local community	Recommended mitigation measures proposed by the community
Air pollution	- Implement measures to prevent air pollution
Wastewater generation and management	- Implement measures to prevent wastewater generation and management
Employment opportunities to the locals	- Prioritizing employment opportunities to the locals - Capacity building by offering trainings to the locals
Corporate Social Responsibility (CSR)	- Initiate CSR projects such as construction of a road and equipping learning facilities

Figure 14: Community members during the first consultative meeting at Tumaini Gardens on 20th August 2021 (Source: First community consultative meeting, 20th August 2021).

Notably, the proponent has put in place measures to address the issues raised by the local community. These include;

1. Installation of two dust collectors within the plant to trap fine dust particles.
2. Installation of a regenerator made of porous bricks which absorbs the gases forming sodium sulphates along the walls. The regenerator will then be cleaned after every 6 months and the resultant sodium sulphate sold to farmers as fertilizers.
3. Installation of wet scrubbers (7m long & 3.5m width) along the chimney to trap the remaining gaseous particles.
4. Recycling of the wastewater generated from the production process.
5. There exists a written agreement with the Inkiwachani Committee where 85% of the employees will be sourced from the local community and the remaining 15% will be sourced from other parts of the Country. Additionally, prior to the implementation of the project, the proponent will initiate capacity building of the local community employees to improve their upward mobility in employment.
6. Equipping learning institutions, establishment of a dispensary and construction of a road as part of Corporate Social Responsibility (CSR).

3.4.3.2 Second stakeholders' consultative meeting

The second stakeholders' consultative meeting was held on 30th August 2021 at Enchula Resort to review the draft ESIA Study Report (Figure 15). The proceedings of the meeting involved a detailed presentation of the ESIA study report followed by questions, comments and reactions by the participants. Table 8 summarizes the issues identified by the stakeholders and the response from the proponent.

Table 8: Issues identified by the stakeholders and response from the proponent.

Issues identified by the stakeholders	Response from the proponent
Benefits of the proposed project to the local community	– The project will employ 100 – 150 people where 85% of the unskilled laborers will be sourced locally while the remaining 15% skilled laborers will be sourced from other parts of the country – Initiating capacity building of the local community employees to improve their upward mobility in employment – Plans are underway to construct a road, water supply to the community and establishment of a dispensary as part of Corporate Social Responsibility (CSR)
Timeframe for the implementation of the proposed project, scope of work and size of the parcel of land	– The construction phase will take 4 – 5 months and operations will commence in March 2022 – The land measures approximately 6 acres though the proposed project will only utilize 1 acre
Sources of raw materials for the proposed project	– Soda ash will be sourced from Lake Magadi while quartz will be sourced from Bissil and Ngorika areas

Figure 15: Stakeholders during the second consultative meeting with lead agencies of Kajiado County at Enchula Resort on 30th August 2021 (Source: Second Stakeholders' consultative meeting, 30th August 2021).

3.4.4 Grievances Redress Mechanism

3.4.4.1 Introduction

The affected persons by the proposed project may raise their grievances and dissatisfactions about actual or perceived impacts in order to find a satisfactory solution. These grievances, influenced by their physical, situational and/or social losses, can emerge at the different stages of the project cycle. Not only should the affected persons be able to raise their grievances and be given an adequate hearing, but also satisfactory solutions should be found that mutually benefit both the affected persons and the project. It is equally important that the affected persons have access to legitimate, reliable, transparent and efficient institutional mechanisms that are responsive to their complaints.

3.4.4.2 Grievances prevention

Grievances cannot be avoided entirely, but much can be done to reduce them to manageable numbers and reduce their impacts. This will be achieved by;

1. Providing sufficient and timely information to communities. Many grievances arise because of misunderstandings; lack of information; or delayed, inconsistent or insufficient information. Accurate and adequate information about a project and its activities, plus an approximate implementation schedule, should be communicated to the communities, especially affected parties, regularly.
2. Conduct meaningful community consultations. The project proponent should continue the process of consultation and dialogue throughout the implementation of the project. Sharing information, reporting on project progress, providing community members with an opportunity to express their concerns, clarifying and responding to their issues, eliciting communities' views, and receiving feedback on interventions will benefit the communities and the project management.
3. Overall good management of the facility will ensure a reduction in potential conflicts with the local community and other stakeholders.

During the community consultative meeting, it was noted that the community had formed a four member committee to ensure their grievances were addressed.

3.4.5 Grievances Redress Mechanism Tool

The plant will have a more prompt and efficient resolution on individual and collective complaint and provision of feedback on any grievances and dissatisfaction from stakeholders during operations. The flow chart below (Figure 16) shows a complaint and proposal consideration mechanism for the plant that provides an accessible channel for submission of complaints and feedback to stakeholders.

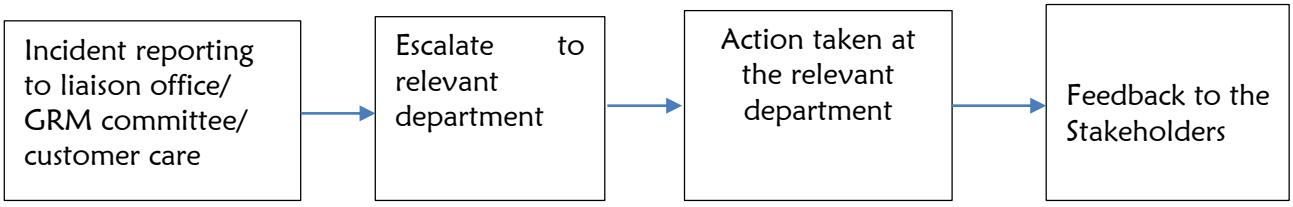

Figure 16: Grievances Redress Mechanism Tool flow chart (Source: Consultant's gallery, 2021).

3.5 Analysis of project alternatives

Analyzing project alternatives is important as it allows the proponent to evaluate possible project options that could mitigate the environmental risks identified during the ESIA process through prevention, elimination of the risks all together or reduction of the severity of an impact. The analysis will also assist NEMA and lead agencies in decision making by either approving the project as proposed or advising the proponent on the need for a particular alternative such as an alternative site or technological and design changes. In the current proposal, the alternatives identified are discussed in detail below.

3.5.1 The 'No project' alternative

The 'No Project' alternative has the advantage of retaining the status quo, meaning that the predicted environmental impacts will not occur and is ideally the best case scenario for mitigation. This alternative is however not viable owing to the fact that the plant will earn the country foreign exchange through exports and mitigate the national and regional demand for processed mineral resources. Additionally, the status quo denies the proponent a viable investment opportunity and thereby income generation translating into profits, denies the local community employment opportunities and also denies both the County and National Government revenue.

The 'No project' alternative is therefore not considered viable in the light of the benefits and deprivations of the project.

3.5.2 The "Yes Project" alternative

This option envisages that the proposal will be implemented. It was considered as the most viable because of the following reasons;

- Mitigating the national and regional demand for processed mineral resources
- Earning the country foreign exchange
- Contribution of the project towards attainment of Vision 2030 and the Presidential Big Four Agenda
- Provision of employment opportunities thus improving the socio-economic profile of Inkiwachani area
- Provision of income to the proponent
- Market for local goods and services
- Revenue to the government
- Transfer of skills to the local community

3.5.3 Alternative project site

An alternative site could be considered for the proposed project if the proposed project would present serious environmental challenges that cannot be effectively managed. However, the proposed mitigation measures are considered adequate to minimize the impacts to levels that do not warrant significant environmental damage. In addition, raw materials are readily available within the County, its close proximity to Nairobi where the demand is high and easier exportation of the products to Tanzania via the Nairobi – Namanga Highway. This alternative is therefore not viable.

3.5.4 Alternative project

An alternative project such as a residential development, farm or a ranch could be possible in the event an industrial development is not feasible. There is availability of adequate land and substantial market demand for the minerals both locally and regionally and this project is deemed economically viable compared to other project alternatives. Additionally, it suits the business needs of the proponent. Thus, an alternative project is not viable.

3.5.5 Alternative technology

The proposed technology for water glass production encompasses the most modern technological process. Soluble silicates are derived from silica (SiO_2) and soluble sodium compounds thus pose minimum potential for harmful environmental effects. The process described produces no effluent or by-products and any spills are contained and pumped to be either reused in the process or go to the effluent system on site. Hence the analysis of alternative technology does not arise.

4 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

4.1 Introduction

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

4.2 Environmental and Social Management Plan for the construction phase

For the construction phase EMP (Table 9), the main environmental issues include change in land use, environmental risks of obtaining raw materials, impact on biodiversity, water demand and effluent generation, solid waste generation and management, occupational safety and health risks, air and noise pollution, and traffic congestion.

4.3 Environmental and Social Management Plan for the operational phase

The main environmental concerns at this phase include air and noise pollution, increased water demand, effluent generation and management, solid waste generation and management, occupational safety and health risks, fire risks and emergency preparedness, exposure to thermal heat, increased energy demand, oil spills and traffic congestion (Table 10).

4.4 Environmental and Social Management Plan for the decommissioning phase

The decommissioning ESMP is important in the event of end of project cycle, natural calamities and non-compliance with environmental and health regulations among others. The key issues of concern at this stage will be the economic decline, safety and health risks, waste generation and insecurity (Table 11).

Table 9: Environmental and Social Management Plan for the construction phase of the proposed project.

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
Change in land use	Apply for and obtain a change of user from agricultural to industrial from the County Government of Kajiado and the Ministry of Lands	Proponent	Prior to commencement	TBD
Environmental risks of obtaining raw materials	Source raw materials from sites that are licensed as per the EMCA Cap. 387 of the Laws of Kenya	Proponent/ contractor	Throughout construction	Nil
	Procure quantities of construction materials in line with the Bill of Quantities	Proponent/ contractor	Throughout construction	Nil
	Re-use construction materials such as wood and metal cuttings which can be salvaged	Proponent/ contractor	Throughout construction	Nil
Impact on biodiversity	Retain vegetation cover in areas that will not be excavated as far as practicable	Proponent/ contractor	Throughout construction	Nil
	Replant trees in the section of the property that will not be developed to compensate for vegetation lost	Proponent/ contractor	During construction	TBD
Water demand and effluent generation	Apply for and obtain drilling and abstraction permit from WRA	Proponent/ contractor	During construction	12,000
	Sensitize the workers on the need to conserve available water resources	Proponent/ contractor	Throughout construction	Nil
	Procure and deliver to the site mobile toilets from a NEMA licensed waste contractor	Proponent/ contractor	Throughout construction	Tender
	Comply with the Water Quality Regulations, 2006	Proponent/ contractor	Throughout construction	Nil
Solid waste generation and management	Procure and strategically place adequate solid waste collection bins with a capacity for segregation within the construction site	Proponent/ contractor	Prior to commencement	100,000
	Procure a sizeable central solid waste collection bin with chambers to accommodate separated waste	Proponent/ contractor	Prior to commencement	100,000
	Sensitize construction workers on the process of solid waste collection, segregation and proper disposal	Proponent/ contractor	Throughout construction	Nil
	Procure the services of a NEMA licensed waste handler to dispose off the solid waste	Proponent/ contractor	Throughout construction	Tender
	Comply with the Waste Management Regulations, 2006	Proponent/ contractor	Throughout construction	Nil

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
Occupational safety and health risks	Register the site as a workplace with the Directorate of Occupational Safety and Health Services (DOSHS)	Proponent/ contractor	Prior to commencement	5,000
	Obtain insurance cover for the workers at the site	Proponent/ contractor	Prior to commencement	1,000,000
	Provide adequate and appropriate Personal Protective Equipment (PPE) to workers and visitors to the site and enforce on their use	Proponent/ contractor	Throughout construction	200,000
	Provide employees with correct tools and equipment for the jobs assigned and train on their use	Proponent/ contractor	Throughout construction	Nil
	Ensure moving parts of machines and sharp surfaces are securely protected with guards to avoid unnecessary contacts and injuries	Proponent/ contractor	Throughout construction	Nil
	Provide first aid services and emergency vehicle at the site	Proponent/ contractor	Throughout construction	1,000,000
	Regulate the entry of visitors to the construction site by deploying adequate security measures	Proponent/ contractor	Throughout construction	Nil
	Comply with the set National Government and County Government Directives and guidelines on prevention of the spread of COVID-19	Proponent/ contractor/ workers	Throughout construction	Nil
	Comply with the provisions of the Occupational Safety and Health Act, 2007	Proponent/ contractor/ workers	Throughout construction	Nil
Air pollution	Procure, provide and enforce the use of dust masks to the workers and visitors to the project site	Proponent/ contractor	Throughout construction	200,000
	Install dust screens around the project site	Proponent/ contractor	Throughout construction	3,000,000
	Sprinkle water at the excavation areas to suppress dust	Proponent/ contractor	Throughout construction	Nil
	Use of serviceable machinery/equipment and trucks	Proponent/ contractor	Throughout construction	Nil
	Monitor fugitive emissions	Proponent/ contractor	Quarterly	30,000

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
	Comply with the Air Quality Regulations, 2014	Proponent/ contractor	Throughout construction	Nil
Noise pollution	Delivery of raw materials, excavation and construction work should be limited to day time hours only between 8am to 5pm	Proponent/ contractor	Throughout construction	Nil
	Locate machinery that are likely to produce noise as far as practical from neighboring properties	Proponent/ contractor	Throughout construction	Nil
	Procure, provide and enforce the use of earmuffs to workers who will work within peak noise producing areas and visitors accessing the same areas	Proponent/ contractor	Throughout construction	200,000
	Sensitize truck drivers to avoid unnecessary hooting and running of vehicle engines	Proponent/ contractor	Throughout construction	Nil
	Comply with the Noise and Excessive Vibration Pollution (Control) Regulations, 2009	Proponent/ contractor	Throughout construction	Nil
Traffic congestion	Prepare and implement a traffic management plan	Proponent/ contractor	Prior to commencement	Nil
	Provide sufficient parking for HCVs and machinery at the site	Proponent/ contractor	Throughout construction	Nil
	Offload construction materials on the site and not on the road reserves to ensure smooth flow of traffic	Contractor/ truck drivers	Throughout construction	Nil
	HCVs delivering raw materials should observe designated speed limits for the area	Contractor/ truck drivers	Throughout construction	Nil
	Erect signage and warnings on the road to forewarn other road users on the use of the road by HCVs	Contractor/ truck drivers	Throughout construction	10,000
	Comply with the Traffic Act, 2016	Proponent/ contractor	Throughout construction	Nil

Table 10: Environmental and Social Management Plan for the operational phase of the proposed project.

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
Air pollution	Retain the existing vegetation in areas that will not be developed and plant fast growing trees such as casuarina to act as dust screens	Proponent	Throughout operations	Nil
	Procure and provide adequate dust masks to workers and enforce on their use	Proponent	Throughout operations	200,000
	Develop and implement an air quality monitoring plan	Proponent	Throughout operations	50,000
	Monitor fugitive emissions	NEMA designated laboratory	Quarterly	30,000
	Apply for and obtain emission licence from NEMA	Proponent	Annually	100,000
	Comply with the Air Quality Regulations, 2014	Proponent	Throughout operations	Nil
Noise and excessive vibration pollution	Procure and provide adequate earmuffs to employees working at peak noise producing areas and enforce on their use	Proponent	Throughout operations	200,000
	Reduce the working hours for employees working at peak noise producing areas compared to those working in other areas	Proponent	Throughout operations	Nil
	Service mechanical equipment to ensure that they are in good condition	Proponent	Monthly	50,000
	Undertake noise level monitoring	NEMA designated laboratory	Quarterly	30,000
	Comply with the Noise Regulations, 2009	Proponent	Throughout operations	Nil
Increased water demand	Install water saving systems such as self-closing taps and low flush water closets	Proponent	During construction	50,000
	Display water conservation posters in areas of high water use	Proponent	Throughout operations	Nil
	Carry out regular inspection and maintenance of the water distribution network to ensure zero leaks and damages	Proponent	Monthly	20,000

	Keep track of water consumption bills to identify areas of unnecessary use	Proponent	Throughout operations	Nil
Effluent generation and management	Install a bio-digester and an Effluent Treatment Plant (ETP) to manage domestic and industrial wastewater flows respectively	Proponent	During construction	1,000,000
	Recycle the treated water from the Effluent Treatment Plant (ETP) for re-use in external cleaning, landscaping and firefighting among others	Proponent	Throughout operations	Nil
	Ensure regular treatment of the pond water to maintain the required pH levels	Proponent	Throughout operations	10,000
	Monitor the quality of effluent discharged from the bio-digester and Effluent Treatment Plant (ETP)	Proponent	Quarterly	60,000
	Apply for and obtain an EDL from NEMA	Proponent	Annually	5,000 fee application
	Comply with the Water Quality Regulations, 2006	Proponent	Throughout operations	Nil
Solid waste generation and management	Sell off the mill tailings to cement manufacturing companies for use as source of pozzolanic material	Proponent	Throughout operations	TBD
	Procure and strategically place adequate solid waste collection bins with a capacity for segregation within the plant	Proponent	Throughout operations	100,000
	Sensitize workers on the process of solid waste collection, segregation and proper disposal	Proponent	Throughout operations	Nil
	Procure a sizeable central solid waste collection bin with chambers to accommodate separated waste	Proponent	Throughout operations	100,000
	Procure the services of a NEMA licensed waste handler to dispose off the solid waste	Proponent	Throughout operations	Tender
	Comply with the Waste Management Regulations, 2006	Proponent	Throughout operations	Nil
Occupational safety and health risks	Develop and implement a safety and health policy for the plant	Proponent	Throughout operations	20,000
	Develop and implement an emergency response plan	Proponent	Throughout operations	20,000
	Sensitize employees to adhere to work procedures to minimize accidents	Proponent	Throughout operations	Nil

	Provide adequate and appropriate PPE to workers and enforce on their use	Proponent	Throughout operations	200,000
	Display precautionary signage at appropriate sections within the plant	Proponent	Throughout operations	50,000
	Conduct first aid training among the workers and provide well-stocked first aid kits at different sections within the plant	Proponent	Throughout operations	100,000
	Provide and keep an accident/incident register occurring on the site including near misses and actions taken to prevent future occurrences	Proponent	Throughout operations	Nil
	Conduct occupational safety and health audits and implement measures to reduce the risk posed to those working in the plant	Proponent	Annually	100,000
	Conduct risk assessment audits	Proponent	Annually	100,000
	Comply with the provisions of the Occupational Safety and Health Act, 2007	Proponent	Throughout operations	Nil
Fire risks and emergency preparedness	Develop, clearly display and implement a fire and emergency response action plan	Proponent	Prior to operations	20,000
	Procure and provide adequate firefighting equipment such as fire extinguishers, fire hose reels, smoke detectors, fire alarms and fire hydrants and place them strategically within the facility	Proponent	Prior to operations	300,000
	Firefighting equipment should be serviced quarterly by fire service providers	Proponent	Quarterly	TBD
	Train employees on the use of fire-fighting equipment	Proponent	Bi-annually	30,000
	Designate a fire assembly point and clearly display emergency exit points at strategic areas within the facility	Proponent	Prior to operations	Nil
	Display fire safety and warning signage at appropriate sections of the plant	Proponent	Prior to operations	20,000
	Ensure proper handling and storage of flammable materials	Proponent	Throughout operations	Nil
	Plant operations should be undertaken by authorized personnel only	Proponent	Throughout operations	Nil

	Ensure regular inspection and maintenance of electrical appliances	Proponent	Monthly	50,000
	Conduct fire safety audit and fire drills	Proponent	Annually	100,000
	Access to the plant should be controlled to limit exposure to hazards	Proponent	Throughout operations	Nil
	Comply with Occupational Safety and Health Act, 2007	Proponent	Throughout operations	Nil
Exposure to thermal heat	Installation should take into account proper ventilation of the area as well as optimal configuration of components to effectively dissipate away excess heat and avoid build up	Proponent	During construction	Nil
	Use cooling towers before releasing heat to the environment	Proponent	Throughout operations	Nil
	Procure and provide adequate and appropriate PPEs such as insulated gloves and shoes to workers and enforce on their use	Proponent	Throughout operations	100,00
	Reduce the amount of working hours for the employees operating around the furnace	Proponent	Throughout operations	Nil
Increased energy demand	The proponent will procure plant machinery and equipment that feature the latest technology to ensure power efficiency	Proponent	During construction	In project costs
	Supplement electrical supply from the national grid with renewable energy such as solar to power the lighting system in areas such as offices and walkways	Proponent	Immediate	100,000
	Install compact fluorescent lights in high use areas within the facility	Proponent	Immediate	5,000
	Keep records of power consumption	Proponent	Throughout operations	Nil
	Create awareness among employees and visitors on energy conservation such as switching off lights when not in use	Proponent	Throughout operations	Nil
	Conduct energy audits	Proponent	Once every three years	30,000
Oil spills	Install oil water interceptors around the oil storage tanks and maintenance areas to prevent ground water contamination and runoff	Proponent	During construction	100,000
	Train employees on containment and cleaning of oil spills	Proponent	Bi-annually	20,000

	Provide oil spill response kit to aid speedy clean-up in case of spillage	Proponent	Prior to operations	20,000
	Conduct regular tests on the fuel tanks to curb possible tank failure	Proponent	Monthly	50,000
	Contract a NEMA licensed waste oil handler to manage the waste oil from the facility	Proponent	Throughout operations	Tender
	Comply with the Used Oil Guidelines, 2017	Proponent	Throughout operations	Nil
Traffic congestion	Provide adequate parking areas within the plant	Proponent	Throughout operations	Nil
	Develop and implement a traffic management plan	Proponent	Throughout operations	Nil
	Control entry and exit of vehicles to and from the plant	Proponent	Throughout operations	Nil
	Comply with the Traffic Act, 2016	Proponent	Throughout operations	Nil

Table 11: Environmental and Social Management Plan for the decommissioning phase of the proposed project.

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
Economic decline	Train employees on alternative livelihoods	Proponent	Prior to decommissioning	50,000
	Prepare and issue recommendation letters to employees to seek alternative employment opportunities	Proponent	Prior to decommissioning	Nil
	Review potential job opportunities in other ongoing contracts by the proponent and recommend the employees who qualify	Proponent	Prior to decommissioning	Nil
	Comply with labor laws by paying the employees their terminal dues	Proponent/ workers	Prior to decommissioning	Nil
Safety and health risks	Contract a licensed construction company to carry out demolitions	Proponent	During decommissioning	Tender
	Install signage to forewarn people on ongoing demolition activities	Proponent/ contractor	Throughout the decommissioning	30,000
	Provide and enforce the use of PPE to workers and visitors	Proponent/ contractor	Throughout the decommissioning	200,000
	Avail first aid kits on site	Proponent/ contractor	Throughout the decommissioning	16,000
	Ensure the process of demolition is supervised by competent personnel	Proponent/ contractor	Throughout the decommissioning	Nil
	Comply with the Air and Noise Regulations gazetted in 2014 and 2009 respectively	Proponent/ contractor	Throughout the decommissioning	Nil
	Comply with the provisions of the Occupational Safety and Health Act, 2007	Proponent/ contractor	Throughout the decommissioning	Nil
Waste generation	Contract NEMA licensed waste handler to dispose both the solid waste and effluent generated from the demolition activities	Proponent/ contractor	Throughout the decommissioning	Tender
	Recover the reusable and recyclable components of the plant	Proponent/ contractor	Throughout the decommissioning	Nil
	All recyclable materials should be collected and sent to NEMA licensed recyclers	Proponent/ contractor	Throughout the decommissioning	Nil
	Sell off the plant machinery to other mineral resources processing companies	Proponent/ contractor	Throughout the decommissioning	TBD

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
	Comply with the Waste Management and Water Quality Regulations, 2006	Proponent/ contractor	Throughout the decommissioning	Nil
Insecurity	Extend the tenure of contracted security firm during the decommissioning phase of the facility	Proponent/ contractor	Throughout the decommissioning	Tender

5 ENVIRONMENTAL MONITORING PLANS

5.1 Introduction

A suite of Environmental Monitoring Plans is required to ensure full and systematic implementation of the Environmental Management Plan. It entails assessment of environmental performance of the proposed project by documenting, tracking and reporting any changes in environmental parameters in space and time. The objective of the monitoring plans is to enhance the environmental performance of the project by providing data and information on compliance with legislative standards and determining the levels of deviation from the values obtained during the baseline monitoring. This in turn informs the corrective measures if any that need to be implemented to comply with the legislative standards. For the proposed project, seven monitoring plans are proposed. These are;

1. Air quality monitoring plan
2. Noise monitoring plan
3. Wastewater quality monitoring plan
4. Domestic water quality monitoring plan
5. Solid waste monitoring plan
6. Occupational safety and health monitoring plan
7. Energy monitoring plan

5.1.1 Air quality monitoring plan

5.1.1.1 Introduction

At construction phase, air pollution will emanate from dust during excavations, concrete mixing activities and exhaust fumes from machinery use and HCVs delivering construction materials to the site. At operational phase, dust emissions during crushing, grinding and milling of minerals, flue gases during melting of sodium carbonate and silicon dioxide, and combustion of coal at the furnace, and exhaust fumes from machinery and vehicles will be the main source of air pollution. Air pollution above acceptable limits are toxic to ecological systems and to human health. The purpose of the air quality monitoring plan is to ensure the concentrations air emissions from the construction and subsequent operations of the facility are within the stipulated standards set under the Environmental Management and Coordination (Air Quality) Regulations, 2014. In addition, the results will be used to evaluate if the adopted air pollution controls and management are effective.

5.1.1.2 Monitoring parameters

The parameters to be monitored for mineral resources processing plants and boilers are listed under the Fourth Schedule of Air Quality Regulations, 2014 and the stipulated standard specified targets for the purpose of environmental monitoring and protection are stipulated under the Third Schedule of the Air Quality Regulations, 2014 (Table 12). The proponent will also monitor fugitive emissions whose standard specified target values are stipulated in the First Schedule of the Air Quality Regulations, 2014 (Table 13).

5.1.1.3 Monitoring location

Air quality monitoring should be carried out within the project site at construction phase, and at the furnace chimney, boiler and minerals processing plant at operational phase.

5.1.1.4 Monitoring frequency

Air quality sampling and analysis will be carried out in collaboration with a NEMA designated laboratory on a quarterly basis.

Table 12: Ambient air quality tolerance limits for mineral processing plants and boilers as per the Third Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

Industry	Opacity	Particulate (Dust) PM10 (mg/Nm^3)	Sulphur oxides (mg/Nm^3)	Nitrogen oxides (mg/Nm^3)	Carbon monoxide (mg/Nm^3)	Carbon dioxide (mg/Nm^3)	Hydrocarbons (mg/Nm^3)	Hydrogen Sulphide (mg/Nm^3)	Dioxins /Furans
Mineral Processing Plants		50							
Boilers	*	50	*	*	*	*	*	*	*

Table 13: Ambient air quality tolerance limits for fugitive emissions as per the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

Pollutant	Time weighted average	Industrial area
Sulphur oxides (SO_x)	Annual Average*	80 $\mu g/m^3$
	24 hours**	125 $\mu g/m^3$
Oxides of Nitrogen (NO_x)	Annual Average*	80 $\mu g/m^3$
	24 hours	150 $\mu g/m^3$
Nitrogen Dioxide	Annual Average	150 $\mu g/m^3$
	24 hours	100 $\mu g/m^3$
Suspended Particulate Matter (SPM)	Annual Average	360 $\mu g/m^3$
	24 hours	500 $\mu g/m^3$
Respirable particulate matter (< 10μm) (RPM)	Annual Average*	70 $\mu g/m^3$
	24 Hours**	150 $\mu g/Nm^3$
$PM_{2.5}$	Annual Average	35 $\mu g/m^3$
	24 Hours	75 $\mu g/m^3$
Lead (Pb)	Annual Average*	1.0 $\mu g/Nm^3$
	24 hours**	1.5 $\mu g/m^3$
Carbon monoxide/ Carbon dioxide	8 hours	5.0 mg/m^3
	One hour	10 mg/m^3
Hydrogen Sulphide	24 hours**	150 $\mu g/m^3$
Non methane hydrocarbons	Instant Peak	700ppb
Total VOC	24 Hours**	600 $\mu g/m^3$
Ozone	One hour	200 $\mu g/m^3$
	8 hour (Instant Peak)	120 $\mu g/m^3$

5.1.2 Noise monitoring plan

5.1.2.1 Introduction

Potential sources of noise pollution includes construction activities, machinery use, crushing, grinding, milling and screening of raw materials, and melting of the sodium carbonate and silicon dioxide at the furnace. Other sources of noise will be vehicular movement in and out of the facility, loading and offloading activities. Noise may lead to hearing impairments which will reduce the workmanship of the employees. The purpose of noise monitoring plan is to therefore ascertain the extent of the impact due to the construction and subsequent operation of the plant in compliance with the Environmental Management and Coordination (Noise and Excessive Vibrations pollution) (control) Regulations, 2009 (Tables 14 and 15).

Table 14: Maximum permissible levels for construction sites as stipulated under the Second Schedule of Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

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

Table 15: The Maximum permissible intrusive noise levels as stipulated under the First Schedule of Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

Zone		Sound Level Limits dB (A) Leq, 14 h		Noise Rating Level (NR) Leq, 14 h	
		Day	Night	Day	Night
A	Silent Zone	40	35	30	25
B	Place of worship	40	35	30	25
C	Residential: Indoor Outdoor	45 50	35 35	35 40	25 25
D	Mixed Residential (with some commercial and places of entertainment)	55	35	50	25
E	Commercial	60	35	55	25

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

5.1.2.2 Monitoring location

Noise monitoring should be carried out within the project site at construction phase, and at the minerals processing plant and furnace area at operational phase.

5.1.2.3 Monitoring frequency

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

5.1.3 Wastewater quality monitoring plan

5.1.3.1 Introduction

Water will be required at various sections of the plant for purposes of steam production at the boiler, dissolving cullet (mixture of silica dioxide and sodium carbonate) to form water glass and cooling among others. Other uses of water will include sanitation, general cleaning and drinking. Being an industrial development, the wastewater will constitute a combination of domestic and industrial flows with a potential to pollute water resources if not well managed. The proponent should thus

put in place a consistent wastewater quality monitoring plan targeting the quality of effluent discharging from the proposed bio-digester and Effluent Treatment Plant (ETP). The objective of the monitoring plan is to provide data and information to improve water quality and management of the effluent in order to comply with the standards prescribed under the Third Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006.

5.1.3.2 Monitoring parameters

Effluent from the bio-digester and Effluent Treatment Plant (ETP) should be monitored pursuant to the Third Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006 (Table 16).

Table 16: Water quality monitoring parameters and the standards prescribed under the Third Schedule of Environmental Management and Coordination (Water Quality) Regulations, 2006.

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

5.1.3.3 Monitoring location

Effluent sampling should target the discharge point of the proposed bio-digester and Effluent Treatment Plant (ETP).

5.1.3.4 Monitoring frequency

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

5.1.3.5 Indicator of success

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

5.1.4 Domestic water quality monitoring plan

5.1.4.1 Introduction

Domestic water quantity and quality monitoring will involve keeping records of water quantities abstracted from borehole, consumption by the facility and analysis of its quality based on the standards prescribed by the First Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006. Quantities will be recorded as borehole discharge, against plant production and discharge in m^3/time period.

5.1.4.2 Monitoring parameters

The water quality monitoring parameters and the specified target values to be monitored for domestic use are stipulated under the First Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006 (Table 17).

5.1.4.3 Monitoring location

Domestic water sampling should be carried out at the borehole.

Table 17: Water quality monitoring parameters and standards for sources of domestic water as per the First Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006.

Parameter	Guide value (Max allowable)
pH Value	6.5-8.5
Suspended solids	30 mg/L
Nitrate NO_3	10 mg/L
Ammonia NH_3	0.5 mg/L
Nitrite NO_2	3 mg/L
Total Dissolved Solids	1200 mg/L
E. Coli colonies count/100ml	Nil
Fluoride	1.5 mg/L
Phenols	Nil
Arsenic	0.01 mg/L
Cadmium	0.01 mg/L
Lead	0.05 mg/L
Selenium	0.01 mg/L
Copper	0.05 mg/L
Zinc	1.5 mg/L
Alkyl benzyl sulphonates	0.5 mg/L
Permanganate value	1.0 mg/L

5.1.4.4 Monitoring frequency

Domestic water sampling and analysis should be undertaken once per month in collaboration with a NEMA designated laboratory.

5.1.5 Solid waste monitoring plan

5.1.5.1 Introduction

Solid waste will emanate from construction activities and during the operational phase of the proposed plant. Poor disposal of the waste will cause odour problems, environmental pollution and therefore a health risk to the workers, visitors to the facility and neighbors. The purpose of the monitoring plan is to therefore ensure solid waste is managed in such a way that it protects both the public health and the environment.

5.1.5.2 Monitoring frequency

The frequency of solid waste monitoring will differ from the collection to the disposal stage in order to ensure reduced odours and accumulated heaps of waste. Table 18 describes the outline for which the activity will be monitored but can be adjusted depending on the amount generated.

Table 18: Sample outline for solid waste monitoring plan.

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

5.1.5.3 Monitoring strategy

The solid waste monitoring plan will document the collection, storage and disposal of solid waste from the proposed plant. There is need to code each of the collection points, note the capacity and critical levels, frequency of disposal and the personnel and contractor responsible. In addition, it will

be important to characterize the waste streams at the collection points to inform investments in segregation infrastructure.

5.1.5.4 Indicator of success

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

5.1.6 Occupational safety and health monitoring plan

5.1.6.1 Introduction

Potential safety and health risks during construction and subsequent operational phases will emanate from the use of machinery, noise and air pollution, potential fire outbreaks and explosions, exposure to high heat levels, sodium silicate solutions, citric acid and inhaling mists of the same. All these have a potential to cause injures, permanent disability or even death to workers, neighbors and visitors to the site. The purpose of health and safety monitoring plan is to assess existing controls alongside potential health and safety risks in order to develop an effective plan of action and to ensure compliance with Occupational Safety and Health Act, 2007.

5.1.6.2 Monitoring strategy

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

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

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

5.1.6.3 Indicator of success

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

5.1.7 Energy monitoring plan

5.1.7.1 Introduction

The proposed development will exert an extra demand on energy mainly electricity for powering machine and equipment and for lighting purposes. The aim of the monitoring plan is to inform substantial practical guidelines for continuous improvement of consumption efficiency and identifying cost saving opportunities in energy efficiency.

5.1.7.2 Monitoring frequency

The monitoring frequency should be conducted once every three years by an energy expert certified by Energy and Petroleum Regulatory Authority (EPRA).

5.1.7.3 Monitoring strategy

Energy consumption should be monitored through power bills from the Kenya Power and the fuel consumption by the standby generators and other machinery on a monthly basis.

6 GOVERNANCE FRAMEWORK

6.1 Introduction

The Third Schedule of EIA/EA Regulations requires that environmental guidelines and standards which include Kenya government policies and strategies, national legislation and the institutional arrangements to render them should be incorporated in an ESIA report. The legal and institutional frameworks provide important safeguards for protection and conservation of fragile environments and vulnerable communities and enhance the implementation of the Environmental and Social Management Plans. Under this section, the ESIA will therefore review the applicable sets of laws, and institutions which environmental compliance requirements for the proposed mineral resources processing plant.

6.2 Policy Framework

6.2.1 National Environment Policy, 2013

The National Policy aims to provide a framework for an integrated approach to sustainable management of Kenya's environment and natural resources. In particular, it proposes to strengthen:

- Legal and institutional framework for good governance
- Integrate environmental management with economic growth, poverty reduction and improving livelihoods
- Research and capacity development
- Promote new environment management tools
- Promote collaboration and cooperation and partnerships in environment management
- Promote domestication, co-ordination and maximization of benefit from Strategic Multilateral Environment Agreements

Chapter 4 of the Policy discusses Management of Ecosystems and Sustainable Use of Natural Resources and part 4.8 elaborates on sustainable utilization of minerals. Chapter 6 of the policy elaborates on environmental quality and health and the need to ensure a clean and health environment for all. The relevant policy statements for the proposed project include: 1) Ensure formulation and implementation of the mineral resources development and exploitation policy; and 4) Encourage equitable exploitation and sound management of mineral resources while ensuring local participation and involvement of indigenous enterprises for investment in mining sector.

6.2.2 The National Industrialization Policy, 2012

Under Kenya vision 2030 and the Big Four Agenda, the manufacturing sector has been identified as the key driver for economic growth and development due to its immense potential in job and wealth creation, and its high potential to the realization of the Sustainable Development Goals (SDG). This policy framework focuses on value addition for both primary and high valued goods; and linkages between industrial sub-sectors and other productive sectors to drive the industrialization process and aims at providing strategic direction for the sector growth and development.

6.2.3 Mining and Minerals Policy, 2016

The overall goal of the Mining and Minerals Resources Policy is to set out frameworks, principles, and strategies to provide for exploration and exploitation of mineral resources for the country's socio-economic development. It strengthens the institutional framework and addresses governance and operational issues, environmental protection, equity, mineral value addition, post-mine closure activities, capacity building and mainstream artisanal and small-scale mining. The policy promotes the use of appropriate technology in order to enhance information on the country's mineral potential and increase investment in the mining sector.

6.2.4 The National Health Policy 2014 - 2030

The goal of the Policy is to attain the highest possible standard of health in a responsive manner. The health sector aims to achieve this goal by supporting equitable, affordable, and high-quality health and related services at the highest attainable standards for all Kenyans. This Policy has six objectives which include; to eliminate communicable conditions, to halt and reverse the rising burden of non-communicable conditions and mental disorders, to reduce the burden of violence and injuries, to provide essential healthcare, to minimize exposure to health risk factors and to strengthen collaboration with private and other sectors that have an impact on health. This policy takes into account the functional responsibilities between the two levels of government (county and national) with their respective accountability, reporting and management lines. It proposes a comprehensive and innovative approach to harness and synergise health services delivery at all levels.

6.2.5 The National Water Services Strategy, 2004

This strategy was prepared so as to ensure sustainable access to adequate and affordable water and sewage services to all Kenyans through rehabilitated and expanded water supply and sewage systems and through efficient, responsive institutions. It aims to increase the urban and rural water supply from current coverage, reduce the unaccounted for water due to both technical and social losses and to increase the urban and rural water borne sewage collection, treatment and disposal coverage.

6.2.6 The National Land Policy, 2009

The National Land Policy guides the country towards efficient, sustainable and equitable use of land for prosperity and posterity. The Mission of the Policy aims at: promoting positive land reforms for the improvement of the livelihoods of Kenyans through the establishment of accountable and transparent laws, institutions and systems dealing with land. The overall objective of the Policy is to secure rights over land and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. Specifically the policy offers a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide: a) All citizens with the opportunity to access and beneficially occupy and use land; b) Economically viable, socially equitable and environmentally sustainable allocation and use of land; c) Efficient, effective and economical operation of land markets; d) Efficient and effective utilization of land and land-based resources; and e) Efficient and transparent land dispute resolution mechanisms. Sustainable land use practices are key to the provision of food security and attainment of food self-sufficiency.

6.2.7 Kenya Vision 2030

The Kenya Vision 2030 is the national long-term development blueprint to create a globally competitive and prosperous nation with a high quality of life by 2030 in a clean and secure environment. It aims to transform Kenya into a newly industrializing middle-income country. The Vision is anchored on the economic, social, and political pillar. The proposed project falls under the economic pillar which aims to achieve an economic growth rate of 10% per annum and sustaining the same until 2030 in order to generate more resources to address the Sustainable Development Goals.

6.2.8 Kajiado County Integrated Development Plan 2018-2022

The overall aim of the County Integrated Development Plan (CIDP) is to increase and expand sustainable development opportunities and build people's capacities to enable them create wealth and transform their lives for growth and prosperity in line with the Kenya's Vision 2030, Big Four Agenda and the Sustainable Development Goals.

6.2.9 United Nations Sustainable Development Goals

The Sustainable Development Goals (SDGs) were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. The proposed project will meet SDG 9; industry, innovation and infrastructure.

6.3 Legislative Framework

6.3.1 The Constitution of Kenya, 2010

The Constitution of Kenya 2010 is the supreme law of the land. Under Chapter IV, article 42 provides for the right to a clean and healthy environment for all. Further, Chapter V of the Constitution deals with Land and Environment. Specifically, Part 2 elaborates on the obligations of the proponent in respect to protection of the environment and enforcement of environmental rights.

Relevance to the proposed project

- The proponent is entitled to a fair administrative decision-making process from NEMA and other State organs.
- The proponent must ensure that the development is carried out in an ecologically, economically and socially sustainable manner.
- The proponent should ensure that construction and operations of the facility do not infringe on the right to a clean and healthy environment for all.

6.3.2 The Environmental Management and Co-ordination Act (EMCA) Cap. 387 of the Laws of Kenya

The Act is the framework environmental law and aims to improve the legal and administrative co-ordination of the diverse sectoral initiatives in the field of environment so as to enhance the national capacity for its effective management. The Act harmonizes the sector specific legislations touching on the environment in a manner designed to ensure greater protection of the environment in line with the National Environment Policy, 2013.

Relevance to the proposed project

Section 58 of the Act requires proponents of a development likely to have deleterious effects on the environment to prepare and submit an EIA report to NEMA for consideration for decision making. This ESIA report is prepared to comply with the provisions of this section.

Regulations under the EMCA Cap. 387 of the Laws of Kenya

To operationalize EMCA, several Regulations have been gazetted since its enactment in 1999 and its amendment in 2015. These relevant ones are;

1. **Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003**

   These Regulations guide the preparation of EIA including how experts should conduct the EIA process and guidelines and standards to be met by the reports. The Regulations were reviewed in 2016 to align them to the Kenya Constitution 2010. They were also recently amended (2019) to address challenges that have been reported since they were gazetted. This report complies with the provisions of these Regulations.

2. **Environmental Management and Coordination (Water Quality) Regulations, 2006**

   These Regulations address the challenges of pollution of water resources and conservation. It consists of VI parts and eleven schedules dealing with protection of sources of water for domestic use to miscellaneous provisions. For the proposed development, the proponent and contractor should implement measures to prevent water pollution from construction

activities and effluent discharge at operational phase. Once the facility is operational, the proponent should apply for and obtain an Effluent Discharge Licence from NEMA.

3. **Environmental Management and Coordination (Waste Management) Regulations, 2006**
   The Regulations focus on the management of solid waste, industrial waste, hazardous waste, pesticides, toxic substances and radioactive substances. In compliance with these Regulations, the proponent should ensure proper solid waste disposal throughout the project cycle and procure the services of a NEMA licensed contractor for solid waste management.

4. **Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009**
   These Regulations were gazetted to manage noise levels to levels that do not cause a disturbance to the public. The operations at the facility especially during construction and from machinery use and vehicles accessing the site during operations are likely to generate noise above the acceptable limits. Appropriate PPE should be provided to employees.

5. **Environmental Management and Coordination (Air Quality) Regulations, 2014**
   These regulations were aimed at controlling, preventing and abating air pollution to ensure clean and healthy ambient air. The activities of the proposed project will have a potential to pollute the air from construction works, dust emissions during crushing, grinding and milling of minerals, flue gases during melting of sodium carbonate and silicon dioxide at the furnace and exhaust fumes from machinery at the plant and vehicles. The proponent should undertake quarterly air quality monitoring, and apply for and obtain air emission license from NEMA.

6.3.3 The Mining Act, 2016

It is an Act of Parliament to give effect to Articles 60, 62 (1)(f), 66 (2), 69 and 71 of the Constitution in so far as they apply to minerals; provide for prospecting, mining, processing, refining, treatment, transport and any dealings in minerals and for related purposes.

Relevance to the proposed project

The proponent should comply with the provisions of this Act.

6.3.4 The Occupational Safety and Health Act, 2007

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

- Docks Rules L.N. 306 of 1962
- Eyes Protection Rules L.N. 44 of 1978
- Building Operations and Works of Engineering Construction Rules L.N. 40 of 1984
- Electric Power Special Rules L.N. 340 of 1979
- First Aid Rules L.N. 87 0f 1964
- Cellulose Solutions Rule L.N. 87 of 1964
- Health and Safety Committee Rules L.N. 31 of 2004
- Medical Examination Rules L.N. 24 of 2005
- Noise Prevention and Control Rules L.N. 25 0f 2005
- Fire Risk Reduction Rules L.N. 59 0f 2007
- Hazardous Substances Rules L.N. 60 of 2007

Relevance to the proposed project
Under OSHA, the proponent should register the site as a workplace with the DOSHS and ensure timely renewal of the same. In addition, the proponent should provide the workers with adequate and appropriate PPE and enforce their use at work, and carry out occupational safety and health audit annually.

6.3.5 Public Health Act, 2012
The Act aims at prohibiting activities that may be injurious to the general public. It outlines the responsibilities for the County Government to maintain a safe and clean environment by controlling the development activities during the construction and subsequent operational phases.

Relevance to the proposed project
The proponent should ensure compliance with the Act by providing clean, healthy and safe environment during construction and subsequent operation of the mineral resources processing plant.

6.3.6 The Water Act, 2016
The Constitution acknowledges access to clean and safe water as a basic human right and assigns the responsibility for water supply and sanitation service provision to the 47 established counties. The purpose of the 2016 Water Act is to align the water sector with the Constitution's primary objective of devolution. The Act establishes several organs to ensure development and sustainable use of water resources. These include the Water Resources Authority (WRA), the Water Sector Trust Fund (WSTF), Water Resources Users Associations (WRUAs), Water Services Providers (WSPs) and Water Works Development Agencies among others.

Relevance to the proposed project
The Water Act provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water, to provide for the regulation and management of water supply and sewerage services. The proponent will source water from a borehole. Hence, he should obtain drilling and abstraction permit from WRA.

6.3.7 The Energy Act, 2019
It's an Act of Parliament to consolidate the laws relating to the production, supply and use of energy and for connected purposes.

Relevance to the proposed project
The proponent should ensure energy audits are carried out at least once every three years.

6.3.8 The National Construction Authority Act, 2014
The Act aims at improving and regulating the construction industry in Kenya. The NCA is mandated to clear builders and contractors as a way of eliminating rogue contractors in Kenya and malpractices in the building and construction industry. The authority is tasked with the responsibility of inspecting construction and building projects around the country to ensure high quality of work and close projects posing health risks and collapse hazards.

Relevance to the proposed project
The proponent will ensure compliance with the provisions of the Act throughout the construction process.

6.3.9 The Physical and Land Use Planning Act, 2019

The Act provides for the planning, use, regulation and development of land and for connected purposes. It was enacted to ensure that every person engaged in physical and land use planning shall promote sustainable use of land and livable communities which integrates human needs in any locality. The Act allows the County Government to prepare a local physical and land use development plan in respect of a city, municipality, town or unclassified urban area.

Relevance to the proposed project

The proponent should apply for and obtain a Change of User from agricultural land to industrial for the plant. Additionally, the proponent should also obtain approvals of the plans for plant and operational licenses from the County Government of Kajiado.

6.3.10 The Occupiers Liability Act Cap. 34

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

Relevance to the proposed project

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

6.3.11 The Energy Act, 2019

The Act stipulates the electrical supply requirements one has to meet and offenses related to supply and use of electricity.

Relevance to the proposed project

The proponent is required to ensure that the energy supplied is consumed in accordance to the provisions of the Act and energy audits carried out after every three years.

6.3.12 The County Government Act, 2012

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

Relevance to the proposed project

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

6.4 Institutional arrangements

To implement the above legal framework the government has established a number of institutions with varying mandates of implementation. These include;

1. The National Environment Management Authority to implement the Environmental Management and Coordination Act and associated Regulations.
2. The Department for Mining to implement the Mining Act and subsidiary legislation.
3. The Directorate of Occupational Safety and Health Services to implement the Occupational Safety and Health Act alongside the subsidiary legislation.
4. The Water Resources Authority to implement the Water Act.
5. The County Government of Kajiado to implement the County Government Act, its by-laws, the Public Health Act, the Physical and Land Use Planning Act and the Occupiers Liability Act.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The proposed project will ensure industrialization and development through the utilization of the country's mineral resources to catalyze diversified industrial development coherent with Kenya's Vision 2030. It is in line with the Kajiado County Integrated Development Plan whose overall aim is to increase and expand sustainable development opportunities and build people's capacities to enable them create wealth and transform their lives for growth and prosperity. In addition, the proposed project will earn the country foreign exchange and meet the national and regional demand for processed mineral resources, contribute towards the socioeconomic growth of the area through employment creation and revenue generation to the county and national governments in terms of taxes generated during the acquisition of statutory licenses. The key concerns that will result from the implementation of the proposed project include air and noise pollution, water demand and effluent generation, solid waste generation and management, occupational safety and health risks, fire risks and emergency preparedness, exposure to thermal heat and increased energy demand. The ESIA study proposes a suite of comprehensive Environmental and Social Management and Monitoring Plans to address the anticipated negative impacts during the entire project cycle and improve the environmental performance of the proposed project

7.2 Recommendations

The main recommendation of the ESIA is the need for concerted implementation of the Environmental Management and Monitoring Plans by the proponent. The specific key ones include;

1. Apply for and obtain a change of user from agricultural to industrial from the County Government of Kajiado and the Ministry of Lands
2. Register the site as a workplace with the Directorate of Occupational Safety and Health Services (DOSHS)
3. Provide adequate and appropriate Personal Protective Equipment (PPE) to workers and visitors to the site and enforce on their use
4. Procure the services of a NEMA licensed waste handler to dispose off the solid waste
5. Conduct occupational safety and health audits and implement measures to reduce the risk posed to those working in the plant
6. Apply for and obtain emission licence from NEMA
7. Undertake noise level monitoring in collaboration with a NEMA designated laboratory
8. Conduct annual fire safety audit and fire drills
9. Apply for and obtain an EDL from NEMA
10. Comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006
11. Comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006
12. Comply with the provisions of the Environmental Management and Coordination (Air Quality) Regulations, 2014
13. Comply with the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009
14. Comply with the provisions of the Occupational Safety and Health Act, 2007
15. Comply with the set National Government and County Government Directives and guidelines on prevention of the spread of COVID-19

On the basis of a commitment by the proponent to implement the proposed mitigation measures and the Environmental Management Plan, we recommend the issuance of an EIA License as per the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya and Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003.

8 REFERENCES

1. County Government of Kajiado, (2018). *Kajiado County Integrated Development Plan, 2018-2022*.
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3. Government of Kenya Policies
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   - Mining and Minerals Policy, 2016
   - National Environment Policy, 2013
   - National Health Policy, 2014 – 2030
   - National Land Policy, 2009
   - National Water Services Strategy, 2004
4. Republic of Kenya Statutes:
   - 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) Regulation, 2009
   - Environmental Management and Coordination (Waste Management) Regulations, 2006
   - Environmental Management and Coordination (Water Quality) Regulations, 2006
   - Environmental Management and Coordination Act Cap 387 of the Laws of Kenya
   - Environmental Management and Coordination Act No. 8 of 1999 (Rev. 2015)
   - The Constitution of Kenya, 2010
   - The County Government Act, 2012
   - The Energy Act, 2019
   - The Mining Act, 2016
   - The Occupational Safety and Health Act, 2007
   - The Occupiers Liability Act, 2012
   - National Construction Authority Act, 2014
   - The Physical and Land Use Planning Act, 2019
   - The Public Health Act, 2012
   - The Water Act, 2016

9 LIST OF ANNEXTURES

1. Copy of the Title deed for the proposed project site
2. Copy of the layout of the plant and process flowchart
3. Copy of approval of the scoping report and Terms of Reference for the ESIA study
4. Copies of the baseline monitoring reports for air quality, noise level measurements and soil tests
5. Letter of invitation and evidence of receipt by the Area Chief inviting the community members for the consultative meeting
6. Copy of the community consultative meeting programme
7. Proceedings of the community consultative meeting held at Tumaini Gardens on 20th August 2021
8. Letters of invitation and evidence of receipt by the stakeholders to review the draft ESIA study report
9. Copy of the stakeholders' consultative meeting programme
10. Proceedings of the stakeholders' meeting to review the draft ESIA study report held at Enchula Resort on 30th August 2021
11. Copies of the public consultation questionnaires
12. Copy of NEMA practicing license for the firm, Envasses Environmental Consultants Limited
13. Copies of NEMA practicing licenses for Lead Experts, Mr. Simon Nzuki & Ms. Jane Gitau