Environmental Impact Assessment (EIA) Study Report for the proposed small scale private power plant on Plot L.R. No. 145/R Section IV MN, Kikambala, Kilifi County

Proponent

Pwani Oil Products Limited
81927-80100,
Mombasa, Kenya.

Consultants

Envasses Environmental Consultants Limited
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Report date: 11th April, 2017

CERTIFICATION

Certification by Lead Experts

We hereby certify that this Environmental Impact Assessment (EIA) 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 (EMCA), Rev 2015 and Legal Notice No. 101 of 2003 (Rev 2016).

Signed: _____ _____

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

Date: 11th April 2017

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Certification by Proponent

We, **Pwani Oil Products Limited** confirm that this EIA study report for the proposed small scale private power plant has been forwarded to NEMA with our authority as the proponent.

Signed for and on behalf of: **Pwani Oil Products Limited**

Name: _____

Signature: _____ **Date:** _____

Proponents Contact Details

Pwani Oil Products Limited
81927-80100,
Mombasa, Kenya.

Official Rubberstamp or Seal

Project site location: Along Mombasa Malindi Road, Kikambala, Kilifi County

ACKNOWLEDGEMENTS

The successful completion of this EIA Study report was made possible by contributions from various individuals and institutions. We acknowledge the proponent; **Pwani Oil Products Limited** who provided project documentation, coordinated site visits and provided the financial resources required by the consultants to undertake the EIA process.

We thank the local community neighboring the project site and also the employees of the facility, for supporting the public consultative process by accepting to respond to questionnaires and participating in semi-structured interview sessions.

Baseline information on the proposal was obtained from site visits and previous EIA reports prepared by the consultants either from the neighboring areas or of technical relevance.

The staff of Envasses Environmental Consultants assisted the consultants in data and information collection, interpretation and analysis, draft material write-up and the printing of the final report. In this regard, we acknowledge the support of Ms. Dorcas Mutei, and Mr. Kenneth Otieno.

EXECUTIVE SUMMARY

Introduction

This EIA Study report outlines the results of the EIA study process for the proposed small scale private power plant at Kikambala area, Kilifi County in compliance with Section 58 of EMCA, 1999 (Rev. 2015) and Legal Notice No. 101 of 2003 (Rev 2016). The assessment findings are presented in terms of the environmental and socio-economic considerations and observations recorded during site visits and report preparation. Prior to the EIA study, we prepared and submitted Terms of Reference (TORs) which were approved by NEMA for the purposes of undertaking the full EIA process.

The proponent

The proponent, Pwani Oil Products Limited, is one of the largest manufacturers of high quality edible vegetable oils and fats, laundry and toilet soaps in the East and Central African region. The company was founded in 1985 when their first plant in Mombasa started production of corn and coconut oil and later evolved into a palm oil refining plant. Presently, the company has modern state of the art factory at Jomvu, Mombasa, with a capacity to refine over 500 metric tonnes of oil a day, prepared to the highest international standards. Of interest to this EIA study is the company's soap manufacturing facility at Kikambala where the project will be undertaken.

The project site and neighbourhood description

The project will be undertaken within Pwani Oil Products Ltd's plant situated on Plot L.R. No.145/R Section IV MN in Kikambala area, along Mombasa Malindi Highway, Kilifi County. The geo-reference points are **Latitude 3° 53´ 09.35´´ South** and **Longitude 39° 46´20.93´´ East**, at an elevation of **82 ft** above Sea Level. The area set aside for the proposed small scale private power plant is currently undeveloped, the vegetation mainly consists of grass and marsh, no trees were spotted on site.

The immediate neighbourhood consists of poorly drained soil which retains water during the rainy season. The existing facility is fenced all round and all proposed activities will be within the precincts of the facility. The Neighborhood depicts a mix of land uses, i.e. commercial for the immediate neighbor to the North, residential, and retail businesses across the highway.

Project activities

The project activities include;

- Drawing, design and engineering
- Acquisition of pertinent approvals from relevant government agencies
- Site preparation activities
- Installation of the small scale private power plant

- Commissioning of the facility
- Possible decommissioning of the project

Project design

The proposed power plant will have an output of 1.5Mw and will mainly comprise of a boiler, turbine and Alternator (Generator) aimed at reducing production costs and reliance on the national grid. The turbine will be run by steam generated at the rate of 9.8 MT/hr. at 46.1 bar pressure. Bleed steam from the turbine at 1 MT/hr. at 9.56 bar pressure and extraction steam from the turbine at 3.48 MT/hr. at 3.6 bar pressure will be used for powering the Pwani oil plant. Exhaust steam from the turbine will be 5.32 MT/hr. and will condense using cooling tower and fed back to the boiler.

Justification of the proposed project

The proposed small scale private power plant will bears a number of valuable benefits that not only provide power solutions to Pwani Oil Products Ltd, but also provide solutions to some of the pertinent environmental challenges. The proposed power plant is justified on the basis of cleaner energy production, reduced production costs and better quality of environment

Existing facility description

The Pwani Oil Products Limited soap plant constitutes the following major areas: Administration Block; Staff canteen, staff recreational area, and staff parking; Finished goods storage area and trucks parking and truck loading bay; Soap plant with two production lines; Warehouses; Workshop; Covered shed area; Boilers Cooling towers; Biomass processing plant; Reverse osmosis water treatment plant; Water storage tanks on tank farm; Waste water treatment Plant

Facility products, raw materials and by products

The facility produces bar soaps, beauty soaps, toilet soaps, soap noodles and glycerine to the highest pharmaceutical quality. The major raw material for the production process is palm oil which the company imports in bulk. The plant uses biomass as fuel in the boilers and electricity to operate the refining and fractionating machines. Water is used for cooling and in other production stages. The major by products are soap residue and oil. Oil is reused in the boiler while the soap residue is fed back to the plant for reprocessing.

Project's benefits

Socio-economic benefits:

The direct investment in this proposal will see the overall revenue of the country increase through payment of income tax, Pay-As-You-Earn, (PAYE), VAT, and Import Tax.

Potential Direct Benefits

- Direct capital investment
- Stimulation of skills transfer: Due to the nature of their operations, the proponent will have to implement a training programme for plant staff.
- Stimulus for technology transfer to Kenya:
- Stimulation of economic development
- Environmental benefits include the advantages associated with the provision of clean and efficient energy
- Reduced energy costs to the proponent that could translate to reduced cost of products
- Job creation/employment opportunities will be realized due to the proposed investment

Potential Indirect Benefits

- More competitive conditions that could lower costs of consumer goods;
- Expansion of trade and industrial activity in the Kilifi County;
- Inducement of additional investments;

Negative impacts of the project and mitigation measures

Against the background of the above positive impacts there will be negative impacts emanating from construction of the extensions, subsequent use and possible decommissioning as discussed below.

Negative Impacts at Installation Phase

Impact of raw materials at points of origin

Raw materials for the construction of the foundations, platforms and support structures will include sand, ballast, building blocks, cement, steel, wood etc. These materials will have an impact on the environment at their point of origin either through extraction or industrial pollution associated with their production.

Mitigation measures

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

Destruction of the physical environment

Destruction to the physical environment during this stage is inevitable. It will include land clearance to pave way for excavation works thus destroying habitats for floral and faunal species. Excavation for laying foundations will create loose soil that may easily be carried away by water or wind. This causes soil erosion and disturbance in soil quality.

Soil compaction, a characteristic of construction activities, seals the soil on the surface hence hindering the penetration of air or water beneath the surface. This limits the aerobic activities of the organisms underneath the soil, hence affecting soil productivity. Compaction also hinders the infiltration of water into the surface hence increasing the surface run-off

Mitigation measures

- Compacted areas to be ripped to prevent erosion
- Restore degraded areas through landscaping using trees and sediment binding grasses
- Controlling of earthworks to prevent compacting the loose soils.

Occupational health and safety hazards

The movement of materials into the construction site by workers and during construction per se may cause accidents with potential to cause injury, permanent disability or even death. This will affect the health of the worker(s) and their potential to work thereby impacting negatively economically. The responsible contractor must ensure that all the site workers are briefed about the potential risks of injuries on site and psychologically prepared on how to handle them

Mitigation measures

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

Air pollution

In the installation phase dust will be expected from excavation of soil and movement of vehicles. The dust generated may be aggravated especially during the south east monsoon (SEM) months (March-August) when strong winds

occur. If generated in large quantities dust may present a respiratory hazard and also cause visual intrusion hence presenting accident risks. Dust is also a mechanical irritant to the eye.

Air emissions would also be expected from exhausts of vehicles delivering material. Stand-by generators that may be brought in to serve during power outages are likely to release some emissions to the atmosphere. The health impacts as a result of the air quality will reduce the production of workers at the site and also have financial impacts on their treatment and medication.

Mitigation measures

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

Workforce sanitation

Workforce at the site during installation phase will require sanitation facilities

Mitigation measures

- Workforce will use the existing sanitary facilities at the site.

Solid waste generation

Large amounts of solid waste will be generated during installation phase of the project. This will include cuttings, rejected materials, surplus materials, surplus spoil, excavated materials, plastic paper bags, empty containers etc

Mitigation measures

- Procure the services of a NEMA licensed waste handler to manage solid wastes from the construction site
- The contractor will install segregation bins and a receptacles that encourage separation of wastes at source to promote re-use and re-cycling
- The contractor will adhere to the 6Rs principle of waste management (i.e. **R**efuse, **R**educe, **R**euse, **R**ecycle **R**ecover energy and **R**ot)
- The contractor will endeavor to comply with the Waste Management Regulations

Noise and excessive vibrations

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

Mitigation measures

- Serviceable machines will be used for excavation to ensure vibrations are kept at below risk levels.
- Construction work and delivery of raw materials will be limited to daytime on weekdays only.
- Employees using equipment that produce peak sounds shall be provided with earmuffs
- The contractor will deploy compact machinery and fit them with mufflers and vibration dampers
- The contractor will deploy acoustic screens around noisy working areas to contain noises
- The contractor will endeavor to comply with Noise Regulations, 2006.

Traffic impact

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

Mitigation measures

- Heavy commercial vehicles delivering material shall observe designated speed limits for the area.
- Proper signage and warnings shall be placed at appropriate places along the Mombasa-Malindi Road to forewarn other motorists of HCVs turning and transportation of abnormal loads
- Delivery of material for the installation shall only be undertaken off-peak hours
- All materials will be offloaded on the site and adequate space for that have been provided for
- Deploy flagmen at the entrance to guide traffic

Increased water demand

Construction projects utilize significant quantities of water for mixing and casting concrete. Water will also be required for human use including drinking and sanitary needs. This will put a strain in the borehole yield

Mitigation measures

- The contractor will ensure water conservation and in all activities
- Water will be recycled as far as is practice without compromising on quality and health

- The contractor to ensure prudential use of water resources during construction by avoiding wastage such as running pipes and taps
- The proponent in collaboration with WRMA will determine the yields of the borehole and its capability to accommodate the elevated demands

Negative Impacts at Operational phase

Air quality concerns

Air quality concerns emanate from emissions from the site machinery, transportation, flue gasses and particulates. Transport vehicles and installed machinery such as generators, shovels and other fossil fuel powered equipment release exhaust fumes that contain harmful elements such as Sulphur, Lead, Carbon dioxide and Nitrous Oxides which cause effects to the health of plants and people.

Flue gases generated by the boilers will also be a source of pollutant emissions, especially Carbon dioxide and Carbon Monoxide. In addition particulates, mainly ash, will also be generated from the chimneys and fugitive releases from boilers & conveyance pipes

Mitigation measures

- Install electrostatic precipitators and bag houses to arrest fugitive ash
- Conduct regular maintenance of the plant to optimize processes and minimize fugitive emissions
- Regulate fuel combustion in the boilers to achieve complete and efficient combustion of biomass
- Conduct regular air quality monitoring to ascertain the levels of emissions in compliance with Schedule I of Legal Notice No. 34-Air Quality Regulations, 2014 and the Occupational Safety and Health Act (OSHA).
- Regularly service delivery vehicles trucks and machinery to minimize pollutant emissions
- Use unleaded and low suphur fuels in installed machinery and delivery vehicles

Noise and excessive vibrations

Noise pollution is inevitable the power plant and impacts to the project site neighbors and a direct impact on worker safety. Noise at the facility will be attributed to movement of vehicles, site equipment, turbines and generators. While noise levels may be permissible for the individual components and activity, the cumulative impact of noise taking into account the duration of exposure will have adverse impact on the workers and neighbours. Vibrations will emanate from heavy installations including rotary & reciprocating machinery E.g turbines, generator, gear boxes etc

Mitigation measures

- The will install equipment indicated by the manufacturer as having low noise emissions and complies with international safety standards.

- Noisy equipment will be fitted with noise reduction devices (i.e. mufflers). Additionally acoustic screens should be deployed around noisy installations
- The proponent will install compact equipment and install vibration dampers on fixed heavy machinery
- Supply workers operating noisy equipment with appropriate personal noise protection gear (e.g. ear muffs, ear plugs, etc.) and enforce their usage
- Conduct regular spot checks and maintenance on all installations and ensure top notch working conditions.
- Conduct noise level mapping at least quarterly and carry out daily monitoring
- Endeavor to comply with the provisions of LN. No. 61 (Noise and Excessive vibration) Regulations at all times

Excessive Heat

Heat will mainly generated by the burner/furnace, boiler, generator and the cooling tower. The issue of heat stress with regard to worker safety is a potential impact. While heat generation and dissipation is a controlled phenomenon in individual installations, heat build-up due to poor ventilation and configuration far presents greater threats to worker safety. Plant heat loss and build up is not only an environmental concern but also a cause for plant inefficiency.

Mitigation measures

- Installation will 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
- Workers will be provided with sufficient PPE and their operational duration will be limited
- Monitor the time spent by workers in areas with elevated temperatures to ensure that they are not exceeding the prescribed work times
- The proponent will endeavor to automate risky processes to minimize human exposure to heat hazards
- Steam conveyors will be lagged to standards to prevent heat loss into the environment

Increased water demand

The existing installation relies on borehole supply to meet demand for water resource. Similarly the proposed small scale private power plant will rely on the borehole water. Water will be pumped and held in reservoir tanks prior to supply to the boilers, once the steam power has been extracted the steam will be condensed in cooling towers and fed back to the boilers.

The proposed power plant will invariably place a strain on the facility's water budget; this will have a direct effect of increased extraction of water with that could result in salt water intrusion or declining borehole yield

Mitigation measures

- Condensed water will be fed back to the boilers to militate over extraction of water resources
- The proponent will put in place structural provisions for rain water harvesting to supplement huge demand by the power plant
- The proponent will monitor water demands against recorded borehole yield. Extraction ceiling will be determined in collaboration with WRMA
- Proponent to consider adequately treating waste water at the STP to standards acceptable for use in the boilers to compensate for evaporation losses

Effluent generation and possible water quality degradation

The operational stage of the project will generate wastewater. However, the proposed power plant is not expected to significantly increase the waste water as the demand for sanitation water will only marginally increase with the additional staff. The power plant will not generate any waste water since the utilized steam is condensed and fed back into the system. There exists a waste water treatment plant at the facility. An EDL has also been acquired and the resultant effluent is reused within the facility.

Mitigation measures

The following are additional measures recommended to reduce waste water at source

- The proponent should consider using technological options that promote usage of less water within the facility to reduce waste water generation at source.
- The proponent will continue to monitor the quality of water discharged or recycled to ensure that it meets the standards specified under Schedule III of Legal Notice No. 120 of 2006
- Install water saving systems e.g. automatic water tap turnoffs, less water capacities cisterns, etc.
- Proponent to consider adequately treating waste water at the STP to standards acceptable for use in the boilers to compensate for evaporation losses

Solid waste

The major solid wastes generated at the facility are soap waste which is reprocessed. Minimal waste require disposal, mainly administrative waste and organic waste from staff canteen. However, the waste requires to be handled appropriately in order to maintain the aesthetic value of the neighborhood. Effects associated with solid waste include injury, odor and air pollution, attraction of flies and vermin, harbouring of breeding grounds for mosquitoes during rainy seasons, water pollution and engendering waterborne diseases etc.

The company has in place a detailed tracking and analysis of reported waste data from each section to monitor waste generation. The major wastes at the facility are reused in the boilers ie soap waste and oil. Glycerine containers are reused within the facility as litter bins.

Mitigation measures

Additional measures include the following

- Contracting a NEMA licensed waste handler to empty the central bin on a weekly basis,
- Generally solid wastes will be managed in line with Legal Notice No. 121 of 2006.
- The proponent will provide for solid waste management through a hierarchy of options that includes reduction at source, separation of wastes to make it easier to undertake recycling.
- Comply with the provisions of Legal Notice No. 121 of 2006

Ash management

Large volumes of ash will be generated from the burner/furnace (bottom ash) as well as from the chimneys in form of fly ash. Ash will be collected in ash banks of the burners and stockpiled for collection and disposal. Fly ash that will be generated will be capture by electrostatic precipitators and bag houses that will be installed in the chimney system. Once collected the ash stock pile will be periodically sprayed with water to prevent blowing. Both the fly ash and the bottom ash will be collected by contractor for disposal

Mitigation measures

- The proponent will install bag houses and electrostatic precipitators in the chimney system to capture fly ash
- The proponent will contract a NEMA licensed solid waste handler to manage the ash
- The consider supporting local youth groups that put ash to profitable use e.g. brick making
- Provide PPE to workers handling the ash. Health monitoring program should also be initiated
- Conduct regular air quality monitoring to ascertain the levels of emissions in compliance with Schedule I of Legal Notice No. 34-Air Quality Regulations, 2014 and the Occupational Safety and Health Act (OSHA).

Occupational Health and safety hazards

The main factors of occupational health in plant are fugitive dust and noise and occupational accidents. Safety of employee during operation and maintenance of equipment and handling of materials are proposed to be taken care of as per regulations. To avoid any adverse effects on the health of workers due to dust, heat, and noise sufficient measures have been provided in the project. During operation of the plant, care should be taken to ensure healthy and safe working conditions for ail workers.

Potential health and safety impact are regarded as significant. Some of the health hazards and risks associated with the operations of the facility are mainly likely to be in form of musculoskeletal injuries, electrocution and shock burns for those working, fatigue from long working hours, exposure to particulates atc

Mitigation measures

- The proponent will continue to implement a risk-based approach that identifies, evaluates and prioritizes hazards, and then acts to correct and prevent them. The company carries out on (scheduled basis) hazard close-out programmes focusing on major injury causes
- The proponent will sustain occupational medical examinations for its staff to establish any occupational health anomalies in line with Legal Notice no. 24 of 2005
- Establish baseline conditions for heat, particulates and noise and monitored against local safety regulations and, in the absence of the latter, against OSHA standards.
- Prominently display warning and informative signage throughout the facility
- Enforce use of the provided PPE as appropriate and that the procedures on safe handling of machinery and tools are strictly adhered to.
- The proponent will contract a reputable operations and maintenance company to oversee day-to-day operation at the power plant
- The proponent will fully comply with the Occupational Safety and Health Act No. 15 of 2007

Fuel, oil and grease spillage/leakage

The installed machinery and heavy duty equipment used alongside the power plant have the potential to leak fuels, oils, lubricants and greases while working especially if not well maintained. Other sources of leakage and spill may be from lubricant drips from bearings, gear boxes, on-site maintenance of the machinery and poor on-site storage of the oils and greases.

Mitigation measures

- Designate a specially equipped maintenance area within the premises
- Install direct waste oil harnessing system during servicing minimize spillage
- Oily replacements such as used oil filters should be segregated, sheltered away and disposed by the contracted solid waste handler
- Sell off extracted used oils and grease to NEMA licensed dealers for recycling purposes

Fire hazards and emergency preparedness

Flammable substances may ignite into fires which can cause considerable losses in terms of injury to persons and damage to property. The most likely causes of fire at the facility include malfunctions at the burners, boilers,

generator/alternator and electric faults. An elaborate fire action plan and an evacuation plan is an important requirement to militate fire and emergencies

Mitigation measures

- The proponent will develop a comprehensive fire action and evacuation plan and implement it at the facility
- The proponent will conduct annual Fire safety audits and risk assessment, for all operation sites pursuant to Legal Notice no. 59 of 2007, in which work procedures and activities that have a likelihood of causing fire hazards are examined, with the aim of providing remedial measures.
- The fire audit also involved evaluating the existing fire emergency preparedness levels of the company.
- Customize the existing fire safety systems and emergency response plan to accommodate the power plant.
- Firefighting equipment such as extinguishers and hydrants to be provided be maintained by reputable fire company and employees trained on how to use them
- Fire equipment inspections and drills will be scheduled and conducted at least quarterly and annually respectively
- Precautionary signage will be mounted on strategic areas which are visible to everybody.

Possible decommissioning impacts

Due to the high risks associated with a decommissioning process for the facility, environmental dynamics and the long-term nature of the project lifespan, we recommend that a decommissioning audit will be undertaken at the end of project life and approved by NEMA at least three months prior to the decommissioning activity.

Environmental Monitoring Programme (EMP)

In order to sustain a healthy and safe environment for the proposed development, a plan for environmental monitoring is proposed. Monitoring will involve measurements, observations, evaluations, assessment and reporting on various environmental attributes including, waste management environmental quality.

The monitoring programme will involve the following parameters.

- Water quality and quantity monitoring
- Wastewater monitoring program
- Solid waste and Ash monitoring plan
- Social Monitoring Plan
- Environmental audits
- Occupational Health and safety

Conclusion and recommendations

The proposed development of small scale private power plant is a strategic investment that directly contributes to the growth of the national economy and complements government efforts in mitigating short falls in electricity demand. It will also reduce the operational costs on part of the proponent with possibility of reduction in prices of finished products. It is therefore considered important and beneficial. The environmental impacts associated with the proposed development can be effectively mitigated managed to satisfactory levels through a concerted implementation of the EMP and continuous improvement of the environmental performance.

It is therefore the recommendation of this report that the project be allowed to proceed on the basis that the Environmental Management Plan for the project is fully implemented, monitored and that follow-up is made to ensure compliance as may be directed by NEMA and relevant lead agencies.

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LIST OF ACRONYMS

CDA	Coast Development Authority
EA	Environmental Audit
ECR	Energy Regulatory Commission
EDL	Effluent Discharge License
ETP	Effluent Treatment Plant
EHS	Environmental Health and safety
EIA	Environmental Impact Assessment
EMAP	Environmental Management and Action Plan
EMCA	Environmental Management and Coordination Act
GIS	Geographic Information System
GoK	Government of Kenya
MW	Megawatts
MT	Metric Tonnes
NEC	National Environmental Council
NEMA	National Environment Management Authority
NWCPC	National Water Conservation and Pipeline Corporation
PCPB	Pest Control Products Board
PPA	Participatory Poverty Assessment
PPE	Personal protective equipment
TORs	Terms of Reference
UNEP	United Nations Environment Programme
VAT	Value Added Tax
WRMA	Water Resources Management Authority

1. PROJECT BACKGROUND AND CONTEXT

1.1. Introduction

This EIA Study report outlines the results of the EIA study process for the proposed small scale private power plant at Kikambala area, Kilifi County in compliance with Section 58 of EMCA, 1999 (Rev. 2015) and Legal Notice No. 101 of 2003 (Rev 2016). The assessment findings are presented in terms of the environmental and socio-economic considerations and observations recorded during site visits and report preparation. Prior to the EIA study, we prepared and submitted Terms of Reference (TORs) which were approved by NEMA for the purposes of undertaking the full EIA study process.

1.2. The proponent

The proponent, Pwani Oil Products Limited, is one of the largest manufacturers of high quality edible vegetable oils and fats, laundry and toilet soaps in the East and Central African region. The company was founded in 1985 when their first plant in Mombasa started production of corn and coconut oil and later evolved into a palm oil refining plant. Presently, the company has modern state of the art factory at Jomvu, Mombasa, with a capacity to refine over 500 metric tonnes of oil a day, prepared to the highest international standards. Of interest to this EIA is the company's relatively new soap manufacturing facility at Kikambala where the project will be undertaken.

1.3. Project activities

The project activities include;

- Drawing, design and engineering
- Acquisition of pertinent approvals from relevant government agencies
- Site preparation activities
- Installation of the small scale private power plant
- Commissioning of the facility
- Possible decommissioning of the project

1.4. EIA study objectives

The EIA process aims to ensure that environmental concerns are integrated in all phases of the proposed project cycle in order to contribute to sustainable development.

The specific objectives for undertaking this EIA study were as follows;

- To identify and assess the potential environmental, health and safety impacts of the small scale private power plant

- To propose appropriate mitigation measures for the management of environmental, health and safety impacts emanating from the small scale private power plant,
- To make appropriate recommendations for environmental management organization and legislative compliance for small scale private power plant,
- To ensure that issues raised by neighbors and project stakeholders are mainstreamed into the Environmental Management Plan proposed for the project cycle.
- To generate baseline data for monitoring and evaluation of how well the mitigation measures are being implemented during the project cycle,
- To present results of the EIA in such a way that they can guide informed decision making by NEMA.
- To enable NEMA make an informed decision regarding the application for an EIA licence by the proponent

1.5. Screening criteria

In line with the second Schedule of Legal Notice No. 101 of 2003, the following considerations were taken into account in determining the environmental screening criteria.

- Ecological considerations (Biological diversity, sustainability, ecosystem maintenance)
- Social considerations (economic impacts, social cohesion and disruption, effect on human health, communication, effects on culture and objects of cultural value)
- Landscape impacts (views opened up or closed, visual impacts, compatibility with surrounding area)
- Land uses (effect of proposal on current land uses and land use potentials in the project area, possibility of multiple use, effects of proposal on surrounding land uses and land use potentials)
- Water (impact of proposal on water resources and drainage patterns or systems)

1.5.1. Results of screening criteria

The following table (1-1) summarizes the results of the screening criteria.

Table 1-1: Summary of the results of the screening criteria

Criteria	Results	Significance
Ecological impacts	– Raw materials will such as building blocks and sand will have ecological impacts at points of origin – Vegetation removal will occur prior to construction works – Excavations will be undertaken and will impact on the soil profile of the area	– Low ecological significance
Social considerations	– Investment will accrue income to proponent – Project will potentially reduce costs of finished products owing to reduced energy costs – Project will create employment – Revenue to the government in the form of levies and taxes – No cultural or heritage issues at the site	– Medium
Landscape impacts	– No new significant impacts on landscape taking into consideration that the power plant will be installed within an existing manufacturing plant	– Low
Land uses	– The area is characterized by mixed land use comprising residential and commercial uses – The proposed project is consistent with the land use	– Medium
Water	– Site will mainly rely on borehole water supply – Water used in the power plant will be condensed and fed back into the system – Abstraction will have an impact on water resources in the area	– Low

1.6. The Scope of EIA proposal

1.6.1. Geographical scope

The geographical scope of the EIA focused on the project site at Kikambala area and the immediate surroundings.

1.6.2. Technical scope

The technical scope of the proposal considered all the environmental concerns of the project during construction, operation and possible decommissioning phases. Therefore the scope of this EIA proposal covered the following aspects;

- The nature and character of activities and processes at the site
- The baseline environmental and physical conditions of the project area,
- Detailed description of the project,
- Provisions of the relevant environmental, health and safety laws,
- Identification and analysis of any adverse impacts to the environment and neighboring communities likely to emanate from the project,
- Consultation with the immediate neighbors and key lead agencies on their opinion about the project,
- Development of proposals for implementation and monitoring of mitigation measures, and
- Provision of an outline of a detailed environmental management plan.

1.7. Assessment methodologies and materials

The methodology for preparing the EIA project report followed on the guidelines provided by NEMA through Legal Notice No. 101 of 2003. Project description and technological appraisal was undertaken through an analysis of the project documentation such as plans, title deeds, planning briefs, approvals from government agencies and copies of project documents provided by the client.

Baseline data and information was collected using a two pronged strategy i.e. site visits/observations and review of existing literature of the project site as well as other reports prepared by the consultants.. Site visits were further guided by a predetermined checklist prepared by the lead experts. A camera and a hand-held GPS system were used to record observable details of the project site area. Policy and legislative analysis were undertaken with the input of a legal expert on environmental issues and review of published legislation for Kenya under the new constitution.

We consulted the immediate neighbors through;

1. Administration of a semi-structured questionnaire
2. Informal discussions

The information gathered using the above strategies was evaluated and data analyzed to determine the required level of environmental performance and make recommended environmental action plans for the development proposal.

1.8. EIA Project Report format

Legal Notice No. 101 of 2003 specifies the manner in which EIA reports shall be conducted and the format to be adopted as follows;

- The nature of the project,
- The location of the project including the physical area that may be affected by the proponent's activities,
- The activities that shall be undertaken during the project construction, operation and decommissioning phases,
- The design of the project,
- The materials to be used, products and by-products including waste to be generated by the project and methods of their disposal,
- The potential environmental impacts of the project and the mitigation measures to be taken during and after implementation of the project,
- An action plan for the prevention and management of possible accidents during the project cycle,
- A plan to ensure the health and safety of the workers and neighboring community,
- The economic and socio-cultural impacts to the local community and the nation at large,
- Any other information that NEMA may require.

1.9. Reporting and documentation

The reporting and documentation follows on the format provided by NEMA through both EMCA, 1999 (Rev. 2015) and the Environmental Impact Assessment and Audit Regulations- Legal Notice No.101 of 2003 (Rev. 2016). The proponent was continually informed throughout the period of report preparation to ensure that he was aware of the issues raised and the recommendations that were likely to be made regarding the best practices to mitigate environmental impacts.

2. PROJECT DESCRIPTION

2.1. Project location

The project will be undertaken within Pwani Oil Products Ltd's plant situated on Plot L.R. No.145/R Section IV MN along Mombasa Malindi Highway, Kikambala area, Kilifi County. The geo-reference points are **Latitude 3° 53´ 09.35´´ South** and **Longitude 39° 46´20.93´´ East**, at an elevation of **82 ft** above Sea Level. The area set aside for the proposed small scale private power plant is currently undeveloped, the vegetation mainly consists of grass and marsh. No trees were spotted on site.

2.2. Neighbourhood description

The immediate neighbourhood consists of poorly drained soil which retains water during the rainy season. The existing facility is fenced all round and all proposed activities will be within the precincts of the facility. The Neighborhood depicts a mix of land uses, i.e. Commercial land use: immediate neighbor to the North; Residential land use: settlements and retail businesses across the highway.

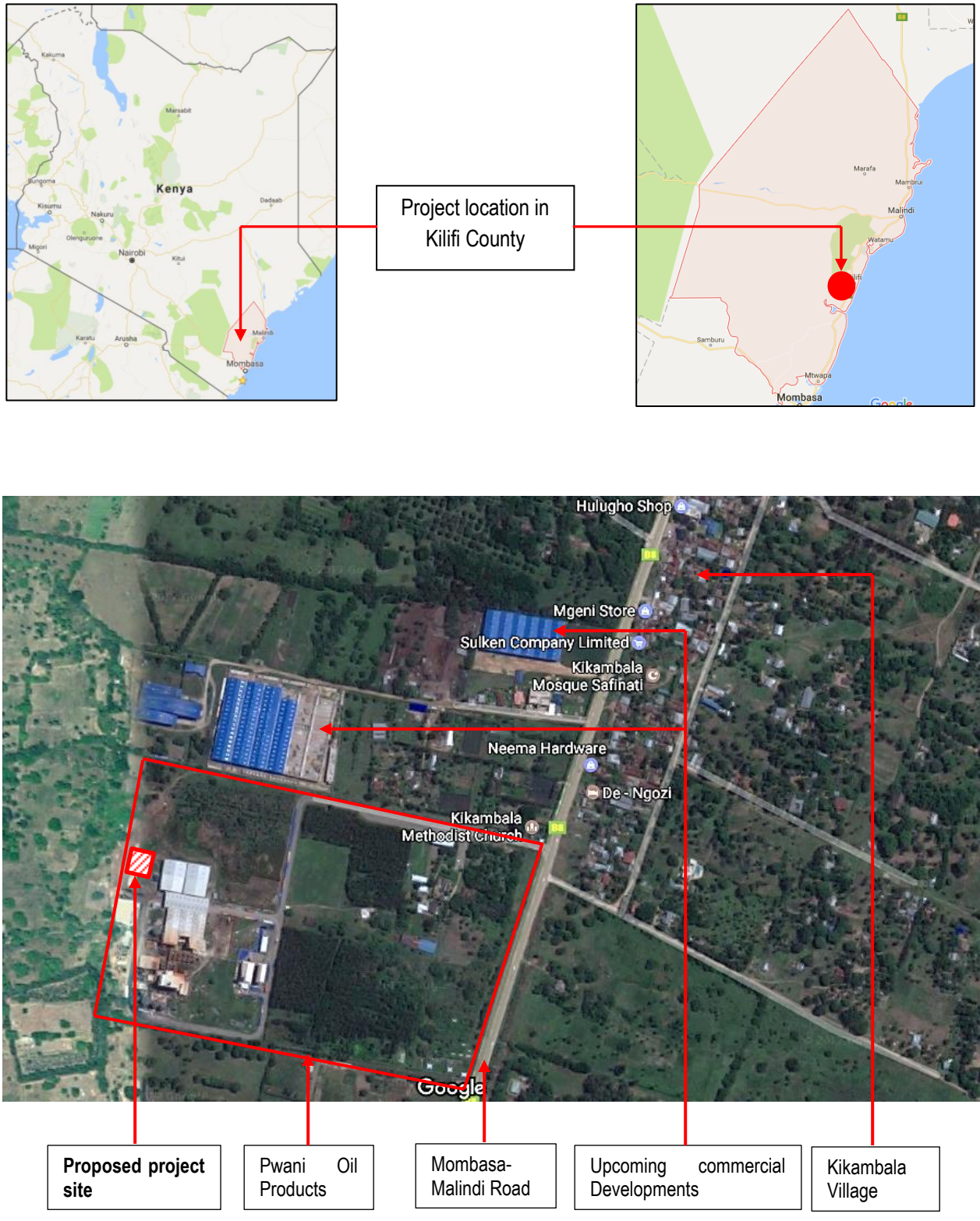

Fig 1: Google earth image showing the location of the proposed project site, at Kikambala.

Figure 2: A section of the proposed project site showing the current status

Figure 3: A section of the neighbourhood showing Mombasa-Malindi road serving the area

2.3. Project design

The proposed power plant will have an output of 1.5Mw and will mainly comprise of a boiler, turbine and Alternator (Generator) aimed at reducing production costs and reliance on the national grid. The turbine will be run by steam generated at the rate of 9.8 MT/hr. at 46.1 bar pressure. Bleed steam from the turbine at 1 MT/hr. at 9.56 bar pressure and extraction steam from the turbine at 3.48 MT/hr. at 3.6 bar pressure will be used for powering the Pwani oil plant. Exhaust steam from the turbine will be 5.32 MT/hr. and will condense using cooling tower and fed back to the boiler.

2.4. Use of environmental resources

2.4.1. Energy resource

The proposed small scale private power plant will be fired by biomass. There is already pre-existing supply of the biomass resource currently used to fire the existing boilers. The proponent will utilize cashew nut husk, coconut husks, agricultural residue and other types of 'waste' biomass to fire the power plant. Once operational the power plant will provide sufficient steam power to run the turbines and be used in the soap plants as a cogeneration strategy. This will have a net effect of efficient energy generation and usage as well as reduced reliance on on-grid supply.

Currently the proponent pays approximately 5 million shillings to the utility service provider, Kenya Power on a monthly basis. At operation of the power plant the proponent projects savings in the order of 3 million shillings monthy

2.4.2. Water resources

The existing installation relies on borehole supply to meet demand for water resource. Similarly the proposed small scale private power plant will rely on the borehole water. Water will be pumped and held in reservoir tanks prior to supply to the boilers, once the steam power has been extracted the steam will be condensed in cooling towers and fed back to the boilers.

2.5. The existing facility

The existing facility is composed of the following major components

- Administration Block
- Staff canteen, staff recreational area, and staff parking
- Finished goods storage area and trucks parking and truck loading bay
- Soap plant with two production lines
- Warehouses
- Workshop

- Covered shed area
- Boilers Cooling towers
- Biomass processing plant
- Reverse osmosis water treatment plant
- Water storage tanks on tank farm.
- Waste water treatment Plant

2.5.1. Facility products, raw materials and by products

The facility produces bar soaps, beauty soaps, toilet soaps, soap noodles and glycerine to the highest pharmaceutical quality. The major raw material for the production process is palm oil which the company imports in bulk. The plant uses biomass as fuel in the boilers and electricity to operate the refining and fractionating machines. Water is used for cooling and in other production stages. The major by products are soap residue and oil. Oil is reused in the boiler while the soap residue is fed back to the plant for reprocessing.

Figure 4: A section of the existing installations at the facility

Figure 5: Showing the existing boilers and cooling towers installed at the facility

2.6. Justification of the proposed project

The proposed small scale private power plant will bears a number of valuable benefits that not only provide power solutions to Pwani Oil Products Ltd, but also provide solutions to some of the pertinent environmental challenges. The proposed power plant is justified on the basis of the following:

2.6.1. Cleaner energy production

The proposed power plant by design will generate reliable and renewable electrical power. The system will operate in an enclosed fashion entailing the use of biomass (renewable resource) to fire boilers generating steam which is used and condensed back into water for reuse. Importantly the power plant will ease dependence on on-grid supply which is sourced from a mix that constituted polluting and non-renewable sources. A key factor is that the power plant will eliminate the need for use of the existing boilers and generate enough steam power to run both the turbine and serve the existing plant as means of cogeneration

2.6.2. Reduced production costs

Installation of the small scale private power plant will provide alternative source of electrical power. The plant will operate supplementary to the utility supply effectively reducing overreliance to on-grid supply. Coupled with cogeneration strategy (see section 2.6.1), the plant has the potential to significantly offset the energy demand by the facility.

Currently Pwani Oil Products Ltd spends on average Kshs 60 million annually on utility power supply. With the plant in place the proponent projects a reduction in expenses on power to Kshs 36 million annually representing a **40%** drop. This significant drop will translate to lower cost of production, high profit margins and possibly reduced cost of products

2.6.3. Better quality of environment

The small scale power plant will utilize biomass such as cashew nut husk, coconut husks, agricultural residue and other types of 'waste' biomass to fire the power plant. This will provide will fit into the waste management hierarchy and the 6Rs principle of waste management (i.e. **R**efuse, **R**educe, **R**euse, **R**ecycle **Recover energy** and **R**ot). Biomass will be outsourced from suppliers, as well as from within the existing plant in form unusable spoils.

2.7. Installation process

The preparatory activities to be undertaken at the site will be site clearance followed by the excavation to create trenches for use in laying footings for the power plant. Foundations will then be laid, and eventually the boilers, turbines and generator will be installed. There will be use of machinery mainly for concrete mixing and lifting installations during the installation phase.

2.8. Installation technology

Concrete mixing and lifting equipment will be used during the installation process. Other equipment will include dump trucks and an assortment of hand tools. As such dust and noise will arise from the operations of the equipment and are likely to be issues of concern. This requires the contractor to undertake the use appropriate technology that will reduce the impact of both noise and dust at the site.

2.9. Wastewater management

To manage effluent from the development, the proponent has installed a waste water treatment plant. The proponent has also acquired an Effluent Disposal License in line with Legal Notice No. 120 Water Quality Regulations. The resultant effluent from the plant is used to irrigate the *casaurina* trees planted within the facility. Any effluent generated by the proposed power plant and its associated facilities will be connected to the existing water management regime.

Figure 6: Waste water treatment plant installed at the facility

2.10. Noise and excessive vibrations pollution control technology

Use of machinery at the site will be a source of noise for the neighbors. The contractor will therefore have an obligation to use suitable noise reduction strategies. The contractor could fit silencers and vibration dampers to machines that produce noise and vibrations. Another strategy will be for the contractor to locate noise producing machines as far away as practical from the residential area and make them as compact as possible. However due to the open field and the existing background noises, the impact of noise at the construction site are expected to be minimal.

3. BASELINE INFORMATION FOR THE PROPOSED PROJECT SITE

3.1. Overview

The following baseline information details on environmental, socio-economic and bio-physical characteristics of the site. It is meant to provide for a benchmark for continued monitoring and assessment of the impact, of implementing the proposal, on the environment.

3.2. Introduction

This section presents a status report on the situation of the project site within the context of Kilifi County while narrowing down to Kikambala area, where the project is located. It discusses the environmental, socioeconomic, and bio-physical characteristics of the area and acts as a basis for continued monitoring and assessment of the impacts of the proposed development to the environment as well as the surrounding communities.

3.3. Project site location

The project site lies along the Mombasa- Nairobi Highway in Kikambala area, in Kilifi County. Kikambala is a small town right after the bigger Mtwapa town. Kikambala is known for beach tourist hotels and a few industrial developments such the site for the proposed project and the Kitchen King utensils making facility.

3.4. Climate

Generally, tropical and monsoon climate characterize the Kenyan coastline with temperatures high throughout the year. Maximum and minimum temperatures range between 26.5-34 and 22.5-24.5 respectively. The coastline experiences more than 6 hours of sunshine daily and exceeds 8 hours between October and March. The rainfall pattern is bimodal with rainfall averaging at between 900-1200mm annually. The long rains come between March and July while the short rains are experienced between November and December.

3.5. Topography, geology and soils

The soils on much of the facility's site area were observed to be mainly composed of rock outcrop with patches of brown loamy soil existing on area that have been farmed overtime. In general, however, the lithology of Kilifi County is composed of sedimentary rocks of the Mesozoic and cainozoic eras. The sedimentary rocks consist of a variety of sandstones, siltstones, shales and limestone.

3.6. Land use

Agriculture, mostly of subsistence nature, is the main land use in the district. Tourism is also conspicuously present with tourism supporting facilities concentrated in the creeks, (Mida Kilifi and Mtwapa). The main commercial centres in the Kilifi County are Kilifi, Mtwapa, Malindi and Mariakani towns.

A major challenge to the management of land use patterns in Kilifi is the lack of a master plan to guide development activities and dictate land use activities. Development and land use activities have largely been uncontrolled leading to the proliferation of informal settlements.

3.7. Demographic characteristics

3.7.1. Introduction

The population of Kilifi especially in its urban centers has been on the rise mainly due to rural urban migration, tourism and the influx of foreigners. In the Kenyan Coast as a whole, population distribution in the hinterlands is mainly affected by rainfall distribution, altitude, agro-ecological zones and administrative policy through which a number of settlement schemes have been created.

The Coastal population in Kenya is culturally heterogeneous. The largest indigenous ethnic group being the Mijikenda which is comprised of nine sub-tribes namely: Giriama, Digo, Rabai, Duruma, Kauma, Chonyi, Kambe, Ribe, and Jibana. Other indigenous Coastal ethnic groups are: Taita, Pokomo, Bajuni, Orma, Sagala, and Swahili. Due to its socio-economic dynamics which offer great opportunities for livelihoods and leisure, the Kenyan Coast and Mtwapa in particular has over the years attracted a multiplicity of ethnic and racial groups.

3.7.2. Settlement patterns

Settlement patterns in Kilifi are influenced by infrastructure network (roads, water, and electricity) and high agricultural potential zones. High population densities are found in Bahari, Kikambala and Kaloleni divisions along the tarmac road of Mombasa-Malindi and Mombasa-Nairobi up to Mariakani urban town. These areas are also well supplied with piped water and electricity. High population clusters are also found in Chonyi division and some parts of Kaloleni division where there are high potentials for agricultural production. Sparsely populated divisions in the district are Ganze, Vitengeni, Bamba and some parts of Kaloleni division. These areas are rangelands and are less productive agriculturally. The three larger towns in the district (Kilifi, Mariakani & Mtwapa) have a total population of more than 15% of the total district (Kilifi) population.

3.7.3. Poverty

The immediate cause of poverty in the Kilifi has been attributed to landlessness, high and increasing cost of living, inaccessibility to credit facilities, lack of entrepreneurial skills, unemployment, low incomes and HIV/AIDS and discrimination at places of work.

In general, poverty has led to over-use and destruction of natural resources where short-term development goals are pursued at the expense of long-term environmental sustainability. There is need to ensure that environmental

concerns are integrated into development planning and that development plans lead to empowerment of local communities to engage in sustainable livelihood activities.

3.8. Environmental quality

3.8.1. Water availability

Kilifi is generally water scarce both in terms surface and ground water and largely depend on piped water from the Mzima springs and Baricho water. The only permanent river is the Sabaki River which feeds the feeds the Baricho water works and crosses the northern part of Kilifi district. The others are temporary due to few catchment areas, sandy soils which have high infiltration rates and high evapo-transpiration rates. Ground water resources are exploited along the coastline through shallow wells and bore holes but diminish as one move inland. This is because inland boreholes have to be deep and in most cases the water quality is poor; hard, mineralized and saline.

Most development in Kikambala area source water from boreholes, as is the case with the proposed project site.

3.8.2. Solid waste and sewerage issues

The main waste generation sources are domestic, commercial ventures, hotels, markets, industries and institutions including health facilities. The types of waste that are generated can be classified as follows.

- Mixed heavy plastics -Soft drink bottles, detergent bottles, cooking oil/fat bottles, household plastics etc
- Mixed light plastics - Shopping bags, wrapping films, waste collection bags
- Rubber - Old tires, shoe soles etc
- Mixed paper - Books, office paper, newspapers carton pieces etc
- Metals -Pieces and sheets of aluminum, steel and other metals
- Mixed glass - Coloured and non-coloured, broken or whole glass bottles, panes, household glass items etc
- Organics - Food remnants, wooden debris, yard waste etc
- Biomedical waste- waste from hospitals, dispensaries and medical clinics.

All types of waste are transported to the site including hazardous types containing pesticides, heavy metals, oils, batteries, acids, domestic and hospital wastes. The private sector has initiated ways to address the problem of waste management through construction of compost pits in areas where collection is limited and providing waste disposal services to complement those provided by the County Government.

The Kikambala has no sewerage infrastructure. Hence the common methods for disposal of human wastes is through pit latrines and septic tank and soak pit systems.

However, the proponent for this EIA Pwani Oil Products Limited, has installed a waste water treatment plant for the facility.

The problem is compounded by the fact that the municipal council has not developed by-laws guiding generation and disposal of liquid waste. It relies on the Public Health Act Cap 242, which is inadequate in seeking lasting solutions to the problem of liquid waste. There is little evidence of adherence to the Water Act 2002 that stipulates the requirements for boreholes and pit latrines are located at far distances to protect ground water sources from contamination.

3.9. Protected areas, Flora and Fauna

3.9.1. Protected areas

Gazetted forests, kayas and marine parks constitute the protected areas in Kilifi District. The gazetted forests include a section of the Arabuko Sokoke forest and mangrove forests mainly found at Takaungu, Kilifi creek, Mtwapa creek and part of the Mida creek in Uyombo, with an area of approximately 880 Ha.The kayas (sacred forests) include Chonyi, Kambe, Ribe, Jibana, Kauma and Kaya fungo. The marine parks and reserves include, part of the Mombasa marine and National Reserve, Watamu-Malindi Marine National park and Reserve (coral gardens) and part of the Malindi Marine and National Reserve. The part of Arabuko Sokoke forest which falls in Kilifi District constitutes 19,000 Ha out of the 37,000 Ha.The forest is situated between Kilifi creek and The Sabaki River. The forest has a very high biological diversity. It is one of the important sites for bird conservation in Kenya (Ksley and Langton). Six of the bird species listed as rare in the ICBP/IUCN Bird red data book occurs in this forest. Two of these bird species, the Sokoke Owl (Otus arena) and the clerk's weaver (Ploceus golandi) are found nowhere else in the world except in this forest. In addition to the endemic bird species, Arabuko Sokoke is also home to other terrestrial fauna. For instance it is the only known home for the endangered Cephalophus adersi, the frog Leptopelis flavomacculatus, and two butterfly species, the Charaxes protocles and the Charaxes lasti.

3.9.2. Flora and Fauna

Human interference and particularly agriculture have greatly modified the original floral and faunal status of the County. Several vegetation types including coastal dunes, woodlands, bush lands and savannas are encountered from the shoreline inland.

Part of the proposed project site constitutes a swampy area, which will be drained for construction of new warehouses. No faunal or floral species of endangered or threatened wildlife was observed at the site.

3.10. Infrastructure

3.10.1. Roads

Most rural areas at the coast are served with a dilapidated and narrow road network contrary to most urban centers such as Mombasa, Kilifi and Kwale which are well served by both classified and non-classified roads. The road networks are greatly influenced by existence of important industrial, tourism and commercial centers. Most of the roads in Mtwapa converge at the city due to its importance as an industrial, tourism and commercial hub. The town is relatively well-served by both classified and unclassified roads. The facility is off the major road traversing the area, Mombasa- Malindi Highway.

3.10.2. Telecommunications

The site being in a commercial residential, and tourism area is served by all types of telecommunication facilities. All mobile networks are available.

3.10.3. Energy supply

The main source of energy supply in the area is electricity from the Kenya Power and Lighting Company. However, this is mostly supplemented with diesel powered generators in times of power blackouts. A number of facilities have also ventured into harnessing solar energy by use of solar panels and accumulators. Wind energy has also been sparsely used especially in pumping water from boreholes in the remote parts of the County. In the rural areas, main energy sources are fuel wood, charcoal and paraffin.

The facility uses both electricity from the national grid, and biomass fuel for the boilers, in its operations.

4. INSTITUTIONAL AND LEGISLATIVE FRAMEWORK

4.1. Introduction

The Kenya parliament enacted the Environmental Management and Coordination Act (EMCA) No. 8 of 1999 (Rev 2015) as the supreme law in environmental management. Part VI Sec. 58 details on the need for EIA to be undertaken prior to commencement of any project. The Act was meant to comprehensively address the challenges of environmental degradation. Later Legal Notice No. 101 was gazetted in 2003 as attendant Regulations to EMCA. Regulations 4-30 deals with the EIA process in Kenya in that they outline the processes, standards, decision making and timelines as well as obligations of the Proponent, NEMA and Lead Experts in discharging the EIA process responsibilities.

4.2. Institutional Arrangements Relevant to the Project

Several institutions will be involved in the activities of the proposed project. They will for instance have to approve the project prior to commencement of operations, conduct inspections and issue improvement orders during operations and ensure compliance with relevant legislative provisions. The key ones and their roles are as tabulated below.

Table 4-1. Main institutions relevant to the proposed development

Institution	Role in project cycle
NEMA	– Issuance of EIA license – Monitoring project compliance with approval conditions – Environmental auditing – Monitoring for compliance with all applicable legislations under EMCA.
County Government of Kilifi	– Approval of building plans – Inspections during project implementation – Issuance of Occupational Permits
Water Resources Management Authority	– Permit for extraction of water resources for the borehole on site
Directorate of Occupational Health and Safety	– Registration of the construction site and facility as a work place – Enforcing compliance with Occupational Health and Safety Regulations at the facility
Energy Regulatory Commission	– Licensing of the small scale private power plant – Monitoring and enforcing regulations relevant to the plant

4.3. Legal Framework

The following section provides a description of the required levels of legislative compliance for the proposed extensions.

4.3.1. The Constitution of Kenya, 2010

The Constitution of Kenya 2010 is the supreme law of the land. Any other law that is inconsistent with the Constitution is null and void to the extent of its inconsistency. Further any action by an individual or a State organ that contravenes the Constitution is null and void. Chapter V of the new constitution states the need for conservation and protection of the environment.

Relevance to the project

- The proponent has a right to carry out the project within legal limits.
- The proponent must ensure that the development is carried out in an ecologically, economically and socially sustainable manner.
- The proponent is entitled to a fair administrative decision making process from NEMA and other State organs.
- The proponent must ensure that all the applicable provisions of the Constitution are observed at all times.

4.3.2. The Environmental Management and Co-ordination Act, 1999 (Rev 2015)

The purpose of this Act aims at improving the legal and administrative co-ordination of the diverse sectored initiatives in the field of environment so as to enhance the national capacity for its effective management. To administer the Act, two major institutions have been established. They include the National Environmental Council (NEC) and the National Environmental Management Authority (NEMA). It has several Regulations that are discussed in the proceeding sections.

Relevance to the proposed project

- Part V recognizes the importance of protection and conservation of the environment. This EIA study report is prepared in compliance with Part VI Section 58 of the Act.
- The project is listed under schedule II item 9(a) as among those that require to undergo the EIA process

4.3.3. EMCA Regulations

A number of regulations have been formulated and gazetted over the years to enable NEMA implement the Environmental Management and Coordination Act No. 8 of 1999 as discussed below.

4.3.3.1. The Environment Impact (Assessment and Auditing) Regulations, 2003 (Rev 2016)

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

Relevance to the proposed project

- This EIA report is prepared in compliance with Regulation 4 of Legal Notice No. 101 of 2003 (Rev 2016)
- The small scale private power plant will be subject to environmental audits in compliance with Regulation 34 of Legal Notice No. 101 of 2003.

4.3.3.2. Water Quality Regulations (Legal Notice No. 120), 2006

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

- Standards for discharge into the environment,
- Standards for discharge monitoring, and
- Application for effluent discharge license.

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

Relevance to the proposed project

- The proponent must ensure that effluent meets the standards set out under Schedule III of Legal Notice No. 120 of 2006. Monitoring activities will follow the guide values provided under schedule IV.
- Effluent from the existing facility will is discharge into the environment or used for trees irrigation, the proponent will ensure that such effluent meets the standards set out under Schedule III and Schedule IX and obtain an Effluent Discharge License from NEMA. Monitoring activities will follow the guide values provided under Schedule IV, and VII.

4.3.3.3. Waste Management Regulations (Legal Notice No.121 of 2006)

In pursuit of the provisions of the Environmental Management and Coordination Act, 1999, (Rev 2015) the Minister for Environment in 2006 gazetted the waste management regulations focusing on management of solid wastes, industrial wastes, hazardous wastes, pesticides and toxic substances and radioactive substances The regulations are aimed at addressing the following concerns;

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

Relevance to the proposed project

- Ensure there exists proper contractual agreement with licensed solid waste handlers and that solid wastes are disposed on the manner prescribed.

4.3.3.4. Noise Regulations (Legal Notice No. 61) 2009

These Regulations were gazetted to manage noise levels to levels that do not cause a disturbance to the public. The proposed activities will however have a potential for the production of noise above the acceptable limits. The background noise along links road is also comparatively higher than that which is likely to be produced by machinery at the construction site.

Relevance to the proposed project

- Ensure compliance with the set noise level limits for the site during construction and operation.
- Provide suitable personnel protection equipment (ear protective devices) to workers in noisy places
- Fit all noisy machinery with silencers
- Provide suitable personnel protection equipment (ear protective devices).

4.3.3.5. Legal Notice No. 34: Air Quality Regulations, 2014

These regulations were aimed at controlling, preventing and abating air pollution to ensure clean and healthy ambient air.

Relevance to the project

- The proponent will ensure that all operations at the site do not generate dust, particulates and other emissions beyond the allowable limits.
- Proponent should conduct air quality monitoring to ascertain compliance with the regulations.

4.3.3.6. E-waste guidelines

NEMA has developed E-waste guidelines to manage wastes emanating from information technology and household as well as industrial activities. For the proposed development, the types of e-waste that are likely to be generated will include electronic and electrical components including cabling, transformers, relays, computers etc.

Relevance to the proposed project

- The proponent will comply with the e-waste guidelines as issued by NEMA, especially with regard to disposal of obsolete electronic and electrical equipment (EEE) through approved recycling facilities

4.3.4. The Energy Act, 2006

The Energy Act is an Act of Parliament to amend and consolidate the law relating to energy, to provide for the establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority, and for connected purposes.

Section 27 of the Act requires a license or licenses for the generation, importation or exportation, transmission or distribution of electrical energy; or supply of electrical energy to consumers. For undertakings involving a capacity not exceeding 3,000 kW sub section (2) requires a permit for all (i) undertakings intended for the supply of electrical energy to other persons or consumers; and (ii) generating plant of over 1000 kW intended for own use. Sub sections (3) and (4) specify the requirement for permit or not, in case power transmission or distribution network is required/used.

Relevance to the proposed facility

- The proponent will ensure that all operations of the plant are duly licensed by the ERC in compliance with the Energy Act, 2006. This should be done prior to commencement of operations.

4.3.5. The Water Act No. 8 of 2002

While developing the National Water Policy, the Government also established a National Task Force to review the Water Act, Chapter 372 and draft a Bill to replace the Water Act, Chapter 372. The Water Bill 2002 was published on 15th March 2002 and passed by Parliament on 18th July 2002. It was gazetted in October 2002 as the Water Act, 2002 and went into effect in 2003 when effective implementation of its provisions commenced. The legal framework under the Water Act 2002 provides the guidelines in line with the existing policy changes, four key institutions with separate functions and decentralized decision making systems. These institutions are summarized in the table below.

Table 4-2. Water Resources Management Institutions and their roles as established under the Water Act, 2002.

Institution	Role under the revised Water Act, 2002
Water Service Boards (WSBs)	Development and maintenance of regional water provision infrastructure
Water Service Providers (WSPs)	Provision of water to households
Water Resources Management Authority (WRMA)	The Authority is responsible, among other things, for the allocation of water resources through a permit system. The framework for the exercise of the water resources allocation function comprises the development of national and regional water resource management strategies which are intended to outline the principles, objectives and procedures for the management of water resources.
Water Services Regulatory Board (WSRB)	The Regulatory Board is mandated to license all providers of water and sewerage services who supply water services to more than twenty households

In furtherance to the Water Act 2002, the Ministry of Water and Irrigation and Water resources Management Authority (WRMA) in collaboration with other stakeholders has prepared a set of Regulations which have now been gazetted under the Legal Notice No. 171 of 28th September 2007 to give guidelines on water permit acquisition and adherence to conditions attached and also enforcement of the user fee charges.

Relevance to the proposed project

- The proponent should ensure that water usage in all phases of the project cycle is in line with the provisions of this Act and obtain a permit from WRMA for the borehole in use.

4.3.6. Occupational Health and Safety Act No. 15 of 2007

The Act covers provisions for health, safety and welfare within and outside a work place.

The Act repealed the Factories Act, Cap 514 Laws of Kenya which had been originally adopted in 1962 and revised in 1972, underwent further and extensive amendments in 1990. The provisions of OSHA have far reaching implications on safety and health at the work place. The OSHA sets out to make provisions that aim to eradicate or minimize accidents at the work place.

Of particular importance to the proposed project is the requirement that all work places must be registered with the Department of Occupational Safety and Health Services. Further, there is a requirement that a Safety and Health Committee must be put in place and that employees and members of this committee must be inducted and trained on the provisions of the Act accordingly. The Act imposes various obligations on both employers and employees.

4.3.6.1. Health

- There should also be sufficient and suitable sanitary facilities provided.
- Provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances.

4.3.6.2. Safety

Training and supervision of inexperienced workers, protection of eyes with goggles or effective screens must be provided in certain specified processes.

4.3.6.3. Welfare

An adequate supply of both quantity and quality of wholesome drinking water must be provided as well as maintenance of suitable sanitary facilities. Section 25 provides for development and maintenance of an effective programme of collection, compilation and analysis of occupational safety. This will ensure that health statistics, which shall cover injuries and illness including disabling during working hours, are adhered.

Relevance to the proposed project

- Strict provisions are made for self-acting machines, hoists and lifts and the requirement for supervision and training of inexperienced workers during construction period.
- Register the site as a workplace with the Directorate of Occupational Health and Safety
- Undertake Annual Health and Safety Audits and implement recommendations.
- Provision of personal protective equipment (PPE) to all workers and ensuring their use.

4.3.7. The Public Health Act- Laws of Kenya, Chapter 242

The Act prohibits activities that may be injurious to health. It then becomes the responsibility of the local authority to maintain clean and sanitary conditions. This affects the following:

- The cleanliness of a premise,
- The quality of water supplied for drinking purposes,
- The types of wastes discharged, and
- The possible air emissions that may be injurious to health.

Under this act the proposed facility should be cleaned regularly, daily removal of accumulated dust from floors sould be done, be free from effluvia arising from any drain, provide adequate sanitary convenience, cause no nuisance to the public

Relevance to the proposed project

- Applicable during the entire project cycle in ensuring those proper and hygienic methods are used.
- Maintain the facility according to standards, ensure access to safe drinking water and put measures to prevent activities that would be a nuisance to the public.

4.3.8. The Physical Planning Act, Cap. 286

The local authorities are mandated under section 29 of the Act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section therefore allows for the prohibition or control of the use and development of land and buildings in the interests of proper and orderly forms of development in the area.
Section 36 of the Act allows local authorities to order for the project to comply with NEMA regulations i.e. EIA reports if the authority deems that the project has injurious impacts on the environment.

EMCA, 1999 stipulates the procedures for conducting the EIA process and recommends annual audits to monitor progress of implementation and environmental performance. In general, this Act provides for the preparation and implementation of physical development plans. They formulate national, regional and local development policies, guidelines and strategies. The director also advises the Commissioner of Lands on appropriate uses of land and land management. The Act directly prohibits or controls the use and development of land and buildings in accordance to the projected development plans of the area.

Relevance to the proposed project

- Applicable during the entire project cycle. The proponent will ensure that all requirements as per the by laws of the County Government of Kilifi are met.

4.3.9. County Government Act

Prescribes the necessary easements required for the establishment of any project within Kilfii County

Relevance to the project

- This Act is useful during the entire project cycle. The proponent should ensure that none of the operations of the facility contravene provisions of this Act.

5. PUBLIC CONSULTATIVE PROCESS AND RESULTS

5.1. Introduction

Public consultations were held through two strategies to obtain the views and comments of neighbors regarding the development. These were;

- Administration of semi-structured questionnaires with major headings on the environmental impacts of the development on neighbors. The questionnaires also collected information on the profile of neighbors including proximity to the site and whether there were any benefits associated with the development. The questionnaires were distributed on a door to door basis by personnel employed by the consultants.
- Informal discussions with neighbors to the project site

5.2. Neighborhood responses and concerns

The table below gives a summary of the issues raised by the neighbours interviewed. The filled in questionnaires from the neighbors and their comments are appended in this report.

Table 5-1: Summary of issues raised by project neighbors

Respondents' profile				**Comments**
No.	***Name***	***Tel contact***	***ID No:***	
1.	**Nancy Kirui**	**0717669939**	**27294272**	– Poor drainage in front of the factory – Creation of job opportunities – Possible reduction of product prices due to reduc – Possible air pollution due to smoke – Possible accidents at the facility – Improve waste water drainage at the gate – Provide comprehensive compensation for the wo
2.	**Martin Opiyo**	**-**	**28547289**	– Creation of job opportunities – Poor waste water disposal- the water drains into – Safety problems and accidents at the facility – Put in place adequate measures to mitigate safet – The management to consider workers' welfare in working hours – Rest times for workers to be established.
3.	**Geoffrey Mung'ori**	**0722796197**	**2118141**	– Waste water drainage into the nearby plots and i – Employment opportunities to the locals – Increase of amount of waste water disposal into t
4.	**Mercy Ngome**	**0715807593**	**31858569**	– Creation of job opportunities – Reduction of electricity cost in the factory – Possible air pollution due to smoke
5.	**Doreen Mwagambo**	**0706134007**	**39118570**	– Poor drainage in front of the factory – Creation of job opportunities – Possible reduction of product prices due to reduc – Possible air pollution due to smoke – Possible accidents at the facility – Improve waste water drainage at the gate – Provide comprehensive compensation for the wo
6.	**Robert Wafula**	**-**	**30122916**	– Creation of job opportunities – Poor waste water disposal- the water drains into

				– Safety problems and accidents at the facility – Put in place adequate measures to mitigate safet – The management to consider workers' welfare in working hours – Rest times for workers to be established.
7.	**Wabwile Wanyonyi**	**0707910211**	**29620986**	– Creation of job opportunities – Poor waste water disposal- the water drains into – Safety problems and accidents at the facility – Put in place adequate measures to mitigate safet – The management to consider workers' welfare in working hours – Rest times for workers to be established.
8.	**Anonymous**	**-**	**-**	– Creation of job opportunities – Poor waste water disposal- the water drains into – Safety problems and accidents at the facility – Put in place adequate measures to mitigate safet – The management to consider workers' welfare in working hours – Rest times for workers to be established.
9.	**Mike Kithinji**	**0721757674**	**-**	– Waste water drainage into the nearby plots and i – Employment opportunities to the locals – Increase of amount of waste water disposal into t
10.	**Joyce Deche**	**0727889837**	**-**	– No benefits to me – Possible generation of fumes from the industry – Increased development in the area will attract a

6. IMPACT IDENTIFICATION, ANALYSIS AND MITIGATION MEASURES

6.1. Introduction

The purpose of this section is to identify and consider the most pertinent environmental impacts and to provide possible mitigation measures that are expected from the development, operation and maintenance activities. Two different phases are associated with the proposed development. The installation and the operational phase of the small scale private power plant are being covered by this assessment. Should the facility close or expand in the future, a decommissioning audit or an EIA respectively will need to be conducted to deal with the associated changes to the power plant. Mitigation measures for the identified impacts are also provided in this Section.

6.2. Positive impacts

6.2.1. Socio-economic benefits

The direct investment in this proposal will see the overall revenue of the country increase through payment of income tax, Pay-As-You-Earn, (PAYE), VAT, and Import Tax.

6.2.2. Potential Direct Benefits

- Direct capital investment
- Stimulation of skills transfer: Due to the nature of their operations, the proponent will have to implement a training programme for all staff. Training programmes will be advanced and staff will permanently benefit from these training programmes. Many of the training programmes will target specifically semi-skilled local workers
- Stimulus for technology transfer to Kenya: The new plant includes state-of the-art technology, the operation, maintenance and support of these new technologies will expose local artisans and industries to these. The net effect will be a workforce and supporting services, which is internationally more competitive than what it is at the moment.
- Stimulation of economic development (e.g. supply of materials and goods for construction purposes; new businesses, employment, housing, better markets and access to public services etc.).
- Environmental benefits include the advantages associated with the provision of clean and efficient energy
- Reduced energy costs to the proponent that could translate to reduced cost of products
- Job creation/employment opportunities will be realized due to the proposed investment

6.2.3. Potential Indirect Benefits

- More competitive conditions that could lower costs of consumer goods;

- Expansion of trade and industrial activity in the Kilifi County;
- Inducement of additional investments;

6.3. Negative Impacts at Installation Phase

6.3.1. Impact of raw materials at points of origin

Raw materials for the construction of the foundations, platforms and support structures will include sand, ballast, building blocks, cement, steel, wood etc. These materials will have an impact on the environment at their point of origin either through extraction or industrial pollution associated with their production.

Mitigation measures

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

6.3.2. Destruction of the physical environment

Destruction to the physical environment during this stage is inevitable. It will include land clearance to pave way for excavation works thus destroying habitats for floral and faunal species. Excavation for laying foundations will create loose soil that may easily be carried away by water or wind. This causes soil erosion and disturbance in soil quality.

Soil compaction, a characteristic of construction activities, seals the soil on the surface hence hindering the penetration of air or water beneath the surface. This limits the aerobic activities of the organisms underneath the soil, hence affecting soil productivity. Compaction also hinders the infiltration of water into the surface hence increasing the surface run-off

Mitigation measures

- Compacted areas to be ripped to prevent erosion
- Restore degraded areas through landscaping using trees and sediment binding grasses
- Controlling of earthworks to prevent compacting the loose soils.

6.3.3. Occupational health and safety hazards

The movement of materials into the construction site by workers and during construction per se may cause accidents with potential to cause injury, permanent disability or even death. This will affect the health of the worker(s) and their

potential to work thereby impacting negatively economically. The responsible contractor must ensure that all the site workers are briefed about the potential risks of injuries on site and psychologically prepared on how to handle them

Mitigation measures

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

6.3.4. Air pollution

In the installation phase dust will be expected from excavation of soil and movement of vehicles. The dust generated may be aggravated especially during the south east monsoon (SEM) months (March-August) when strong winds occur. If generated in large quantities dust may present a respiratory hazard and also cause visual intrusion hence presenting accident risks. Dust is also a mechanical irritant to the eye.

Air emissions would also be expected from exhausts of vehicles delivering material. Stand-by generators that may be brought in to serve during power outages are likely to release some emissions to the atmosphere. The health impacts as a result of the air quality will reduce the production of workers at the site and also have financial impacts on their treatment and medication.

Mitigation measures

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

6.3.5. Workforce sanitation

Workforce at the site during installation phase will require sanitation facilities

Mitigation measures

- Workforce will use the existing sanitary facilities at the site.

6.3.6. Solid waste generation

Large amounts of solid waste will be generated during installation phase of the project. This will include cuttings, rejected materials, surplus materials, surplus spoil, excavated materials, plastic paper bags, empty containers etc

Mitigation measures

- Procure the services of a NEMA licensed waste handler to manage solid wastes from the construction site
- The contractor will install segregation bins and a receptacles that encourage separation of wastes at source to promote re-use and re-cycling
- The contractor will adhere to the 6Rs principle of waste management (i.e. **R**efuse, **R**educe, **R**euse, **R**ecycle **R**ecover energy and **R**ot)
- The contractor will endeavor to comply with the Waste Management Regulations

6.3.7. Noise and excessive vibrations

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

Mitigation measures

- Serviceable machines will be used for excavation to ensure vibrations are kept at below risk levels.
- Construction work and delivery of raw materials will be limited to daytime on weekdays only.
- Employees using equipment that produce peak sounds shall be provided with earmuffs
- The contractor will deploy compact machinery and fit them with mufflers and vibration dampers
- The contractor will deploy acoustic screens around noisy working areas to contain noises
- The contractor will endeavor to comply with Noise Regulations, 2006.

6.3.8. Traffic impact

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

Mitigation measures

- Heavy commercial vehicles delivering material shall observe designated speed limits for the area.
- Proper signage and warnings shall be placed at appropriate places along the Mombasa-Malindi Road to forewarn other motorists of HCVs turning and transportation of abnormal loads
- Delivery of material for the installation shall only be undertaken off-peak hours
- All materials will be offloaded on the site and adequate space for that have been provided for
- Deploy flagmen at the entrance to guide traffic

6.3.9. Increased water demand

Construction projects utilize significant quantities of water for mixing and casting concrete. Water will also be required for human use including drinking and sanitary needs. This will put a strain in the borehole yield

Mitigation measures

- The contractor will ensure water conservation and in all activities
- Water will be recycled as far as is practice without compromising on quality and health
- The contractor to ensure prudential use of water resources during construction by avoiding wastage such as running pipes and taps
- The proponent in collaboration with WRMA will determine the yields of the borehole and its capability to accommodate the elevated demands

6.4. Negative Impacts at Operational phase

6.4.1. Air quality concerns

Air quality concerns emanate from emissions from the site machinery, transportation, flue gasses and particulates. Transport vehicles and installed machinery such as generators, shovels and other fossil fuel powered equipment release exhaust fumes that contain harmful elements such as Sulphur, Lead, Carbon dioxide and Nitrous Oxides which cause effects to the health of plants and people.

Flue gases generated by the boilers will also be a source of pollutant emissions, especially Carbon dioxide and Carbon Monoxide. In addition particulates, mainly ash, will also be generated from the chimneys and fugitive releases from boilers & conveyance pipes

Mitigation measures

- Install electrostatic precipitators and bag houses to arrest fugitive ash
- Conduct regular maintenance of the plant to optimize processes and minimize fugitive emissions
- Regulate fuel combustion in the boilers to achieve complete and efficient combustion of biomass
- Conduct regular air quality monitoring to ascertain the levels of emissions in compliance with Schedule I of Legal Notice No. 34-Air Quality Regulations, 2014 and the Occupational Safety and Health Act (OSHA).
- Regularly service delivery vehicles trucks and machinery to minimize pollutant emissions
- Use unleaded and low suphur fuels in installed machinery and delivery vehicles

6.4.2. Noise and excessive vibrations

Noise pollution is inevitable the power plant and impacts to the project site neighbors and a direct impact on worker safety. Noise at the facility will be attributed to movement of vehicles, site equipment, turbines and generators. While noise levels may be permissible for the individual components and activity, the cumulative impact of noise taking into account the duration of exposure will have adverse impact on the workers and neighbours.

Vibrations will emanate from heavy installations including rotary and reciprocating machinery E.g turbines, generator, gear boxes etc

Mitigation measures

- The will install equipment indicated by the manufacturer as having low noise emissions and complies with international safety standards.
- Noisy equipment will be fitted with noise reduction devices (i.e. mufflers). Additionally acoustic screens should be deployed around noisy installations

- The proponent will install compact equipment and install vibration dampers on fixed heavy machinery
- Supply workers operating noisy equipment with appropriate personal noise protection gear (e.g. ear muffs, ear plugs, etc.) and enforce their usage
- Conduct regular spot checks and maintenance on all installations and ensure top notch working conditions.
- Conduct noise level mapping at least quarterly and carry out daily monitoring
- Endeavor to comply with the provisions of LN. No. 61 (Noise and Excessive vibration) Regulations at all times

6.4.3. Excessive Heat

Heat will mainly generated by the burner/furnace, boiler, generator and the cooling tower. The issue of heat stress with regard to worker safety is a potential impact. While heat generation and dissipation is a controlled phenomenon in individual installations, heat build-up due to poor ventilation and configuration far presents greater threats to worker safety. Plant heat loss and build up is not only an environmental concern but also a cause for plant inefficiency.

Mitigation measures

- Installation will 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
- Workers will be provided with sufficient PPE and their operational duration will be limited
- Monitor the time spent by workers in areas with elevated temperatures to ensure that they are not exceeding the prescribed work times
- The proponent will endeavor to automate risky processes to minimize human exposure to heat hazards
- Steam conveyors will be lagged to standards to prevent heat loss into the environment

6.4.4. Increased water demand

The existing installation relies on borehole supply to meet demand for water resource. Similarly the proposed small scale private power plant will rely on the borehole water. Water will be pumped and held in reservoir tanks prior to supply to the boilers, once the steam power has been extracted the steam will be condensed in cooling towers and fed back to the boilers.

The proposed power plant will invariably place a strain on the facility's water budget; this will have a direct effect of increased extraction of water with that could result in salt water intrusion or declining borehole yield

Mitigation measures

- Condensed water will be fed back to the boilers to militate over extraction of water resources
- The proponent will put in place structural provisions for rain water harvesting to supplement huge demand by the power plant
- The proponent will monitor water demands against recorded borehole yield. Extraction ceiling will be determined in collaboration with WRMA
- Proponent to consider adequately treating waste water at the STP to standards acceptable for use in the boilers to compensate for evaporation losses

6.4.5. Effluent generation and possible water quality degradation

The operational stage of the project will generate wastewater. However, the proposed power plant is not expected to significantly increase the waste water as the demand for sanitation water will only marginally increase with the additional staff. The power plant will not generate any waste water since the utilized steam is condensed and fed back into the system

There exists a waste water treatment plant at the facility. An EDL has also been acquired and the resultant effluent is reused within the facility.

Mitigation measures

The following are additional measures recommended to reduce waste water at source

- The proponent should consider using technological options that promote usage of less water within the facility to reduce waste water generation at source.
- The proponent will continue to monitor the quality of water discharged or recycled to ensure that it meets the standards specified under Schedule III of Legal Notice No. 120 of 2006
- Install water saving systems e.g. automatic water tap turnoffs, less water capacities cisterns, etc.
- Proponent to consider adequately treating waste water at the STP to standards acceptable for use in the boilers to compensate for evaporation losses

6.4.6. Solid waste

At operation phase waste generation from the power plant will be minimal and generation will be infrequent. The main solid waste at the power plant will be in form of packaging materials including plastic bags, boxes, excess cable cut offs; spoilt electrical components and paper. However albeit minimal, the waste requires to be handled appropriately in order to maintain the aesthetic value of the neighborhood. Effects associated with solid waste include injury, odor and air pollution, attraction of flies and vermin, harbouring of breeding grounds for mosquitoes during rainy seasons, water pollution and engendering waterborne diseases etc.

Mitigation measures

Additional measures include the following

- Contracting a NEMA licensed waste handler to empty the central bin on a weekly basis,
- Generally solid wastes will be managed in line with Legal Notice No. 121 of 2006.
- The proponent will provide for solid waste management through a hierarchy of options that includes reduction at source, separation of wastes to make it easier to undertake recycling.
- Comply with the provisions of Legal Notice No. 121 of 2006

6.4.7. Ash management

Large volumes of ash will be generated from the burner/furnace (bottom ash) as well as from the chimneys in form of fly ash. Ash will be collected in ash banks of the burners and stockpiled for collection and disposal. Fly ash that will be generated will be capture by electrostatic precipitators and bag houses that will be installed in the chimney system

Once collected the ash stock pile will be periodically sprayed with water to prevent blowing. Both the fly ash and the bottom ash will be collected by contractor for disposal

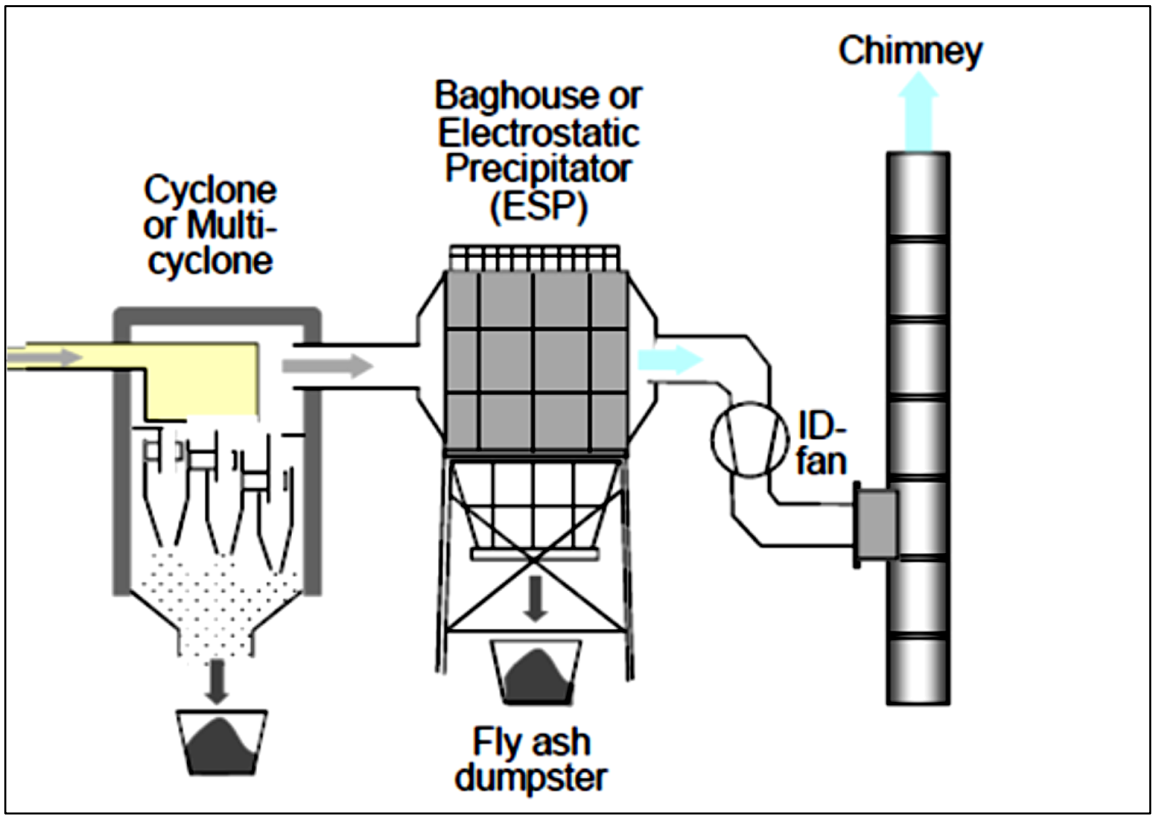

Figure 7: A typical particulate filter technology

Mitigation measures

- The proponent will install bag houses and electrostatic precipitators in the chimney system to capture fly ash
- The proponent will contract a NEMA licensed solid waste handler to manage the ash
- The consider supporting local youth groups that put ash to profitable use e.g. brick making
- Provide PPE to workers handling the ash. Health monitoring program should also be initiated
- Conduct regular air quality monitoring to ascertain the levels of emissions in compliance with Schedule I of Legal Notice No. 34-Air Quality Regulations, 2014 and the Occupational Safety and Health Act (OSHA).

6.4.8. Occupational Health and safety hazards

The main factors of occupational health in plant are fugitive dust and noise and occupational accidents. Safety of employee during operation and maintenance of equipment and handling of materials are proposed to be taken care of as per regulations. To avoid any adverse effects on the health of workers due to dust, heat, and noise sufficient measures have been provided in the project. During operation of the plant, care should be taken to ensure healthy and safe working conditions for ail workers.

Potential health and safety impact are regarded as significant. Some of the health hazards and risks associated with the operations of the facility are mainly likely to be in form of musculoskeletal injuries, electrocution and shock burns for those working, fatigue from long working hours, exposure to particulates etc.

Mitigation measures

- The proponent will continue to implement a risk-based approach that identifies, evaluates and prioritizes hazards, and then acts to correct and prevent them. The company carries out on (scheduled basis) hazard close-out programmes focusing on major injury causes
- The company has been undertaking occupational medical examinations for its staff to establish any occupational health anomalies. These are carried out for all permanent workers in accordance with the medical examinations rules, Legal Notice no. 24 of 2005 and focus on audiometric tests, clinical assessment and lung function tests.
- Establish baseline conditions for heat, particulates and noise and monitored against local safety regulations and, in the absence of the latter, against OSHA standards.
- Prominently display warning and informative signage throughout the facility
- Enforce use of the provided PPE as appropriate and that the procedures on safe handling of machinery and tools are strictly adhered to.
- The proponent will contract a reputable operations and maintenance company to oversee day-to-day operation at the power plant
- The proponent will fully comply with the Occupational Safety and Health Act No. 15 of 2007

6.4.9. Fuel, oil and grease spillage/leakage

The installed machinery and heavy duty equipment used alongside the power plant have the potential to leak fuels, oils, lubricants and greases while working especially if not well maintained. Other sources of leakage and spill may be from lubricant drips from bearings, gear boxes, on-site maintenance of the machinery and poor on-site storage of the oils and greases.

Mitigation measures

- Designate a specially equipped maintenance area within the premises
- Install direct waste oil harnessing system during servicing minimize spillage
- Oily replacements such as used oil filters should be segregated, sheltered away and disposed by the contracted solid waste handler
- Sell off extracted used oils and grease to NEMA licensed dealers for recycling purposes

6.4.10. Fire hazards and emergency preparedness

Flammable substances may ignite into fires which can cause considerable losses in terms of injury to persons and damage to property. The most likely causes of fire at the facility include malfunctions at the burners, boilers, generator/alternator and electric faults.

An elaborate fire action plan and an evacuation plan is an important requirement to militate fire and emergencies

Mitigation measures

- The proponent will develop a comprehensive fire action and evacuation plan and implement it at the facility
- The proponent will conduct annual Fire safety audits and risk assessment, for all operation sites pursuant to Legal Notice no. 59 of 2007, in which work procedures and activities that have a likelihood of causing fire hazards are examined, with the aim of providing remedial measures.
- The fire audit also involved evaluating the existing fire emergency preparedness levels of the company.
- Customize the existing fire safety systems and emergency response plan to accommodate the power plant.
- Firefighting equipment such as extinguishers and hydrants to be provided be maintained by reputable fire company and employees trained on how to use them
- Fire equipment inspections and drills will be scheduled and conducted at least quarterly and annually respectively
- Precautionary signage will be mounted on strategic areas which are visible to everybody.

6.5. Decommissioning phase

A third phase of the project i.e. decommissioning is possible. A number of factors may contribute to the need for decommissioning including;

- End of project life,
- An order by a court of law due to non-compliance with existing Regulations,
- Change of user, and
- Natural calamities.

6.5.1. Positive impacts

6.5.1.1. Income to hired workers

Besides the consultants who would undertake a decommissioning audit, those hired to carry out the actual demolition will also earn an income thereby bettering their lives.

6.5.1.2. Recovery of construction material

Upon demolition re-usable materials will be recovered. These can be used in other constructions and thus reduce the pressure on environmental resources.

6.5.2. Negative impacts

6.5.2.1. Economic decline

The proponent will suffer huge losses and the workers at the power plant will be rendered jobless. The impact of affordable energy and efficient energy usage will be forgone. This could carry the effect of high production costs and higher commodity prices

6.5.2.2. Solid wastes

Decommissioning activities will be accompanied by generation of solid wastes especially due to the end of project life or change of user. Solid wastes expected at this phase include among others; rubble, metal, electrical components and cabling, building blocks, among others.

6.5.2.3. Safety risks

Decommissioning of projects would normally be accompanied by safety risks from any leftover electrical cables and exposed parts of previous development. There may also be environmental hazards from exposed left over substances which may cause soil and water contamination or generate noxious odor which can result to diseases.

6.5.3. Environmental management at decommissioning phase

At the decommissioning stage, the proponent will prepare a due diligence decommissioning audit report in line with Legal Notice No. 101 of 2003 and submit it to NEMA for approval at least three months in advance. All hazards such as exposed electrical wiring, residual gas in tanks etc to be safely removed and all hazardous materials disposed appropriately

7. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

7.1. EMP outline

The tables below outline the environmental management plan for the proposed development cycle. The plan considers the following;

- Predicted environmental impact
- Proposed mitigation measures,
- Responsible party / parties
- The timeframe
- The costs (Kshs) of implementing and/or monitoring the mitigation measures

A decommissioning phase is possible, but due to the high risk potential of the establishment, we recommend a decommissioning audit that will have a specific EMP for that purpose. The audit should be prepared and submitted to NEMA for approval at least three months in advance.

7.2. Construction phase Environmental Management Plan.

Environmental Impact	Mitigation Measures	Implementing Party	Timeframe	Cost (Kshs)
Sourcing of raw materials	– The contractor will obtain raw materials for the construction from sources that are compliant with NEMA Regulations. – The contractor will procure quantities that are sufficient for the intended works only and recycle as far as practical to curtail wastage. – The contractor will commit to extensive use of recycled raw materials as will be appropriate and in a manner that does not compromise the safety of the facility.	Contractor	Prior to commencement of construction works	Nil
Destruction of the physical environment	– Compacted areas to be ripped to prevent erosion – Restore degraded areas through landscaping using trees and sediment binding grasses – Controlling of earthworks to prevent compacting the loose soils.	Proponent and contractor	During installation	Internal costs
Occupational Health and Safety of Workers	– Provision of adequate and appropriate Personal Protective Equipment (PPE) including safety shoes, helmets, gloves and overalls. – Employees to be given the correct tools and equipment for the jobs assigned. – Employees to be trained in the use of all equipment that they will be required to operate. – The contractor will conduct periodic safety inspection and risk assessment	Contractor HSE officer Employees DOSHS	During installation works	200,000 for provision and enforcement of use of full PPEs

Environmental Impact	Mitigation Measures	Implementing Party	Timeframe	Cost (Kshs)
	– First aid services and an emergency vehicle to be readily available at site. – Moving parts of machines and sharp surfaces to be securely protected with guards to avoid unnecessary contacts and injuries during installation phase. – The contractor will fully implement the provisions of the Occupational Safety and Health Act, No. 15 of 2007.			
Air pollution	– The contractor will implement sound project management strategies to ensure that installation works are completed in the shortest possible time taking advantage of low wind velocities – Contractor to deploy fine dust screens at the site during construction – Sprinkle dust producing materials such as ballast with water on site – Retain vegetation as much as possible to reduce bare areas exposed to wind – Use low Suplhur fuels to power delivery vehicles and site machinery – Truck drivers will maintain low speeds to avoid raising dust – Employees will be provided with dust masks and goggles.	Contractor Employees Drivers	During installation works	50,000 for dust screen Internal cost for other dust suppression interventions
Workforce sanitation	– Workforce will use the sanitary facilities on site	Proponent	During installation phase	Nil
Solid wastes at construction site	– Procure the services of a NEMA licensed waste handler to manage	Contractor Workers	During installation works	15,000 monthly for waste

Environmental Impact	Mitigation Measures	Implementing Party	Timeframe	Cost (Kshs)
	solid wastes from the construction site – The contractor will install segregation bins and a receptacles that encourage separation of wastes at source to promote re-use and re-cycling – The contractor will adhere to the 6Rs principle of waste management (i.e. **R**efuse, **R**educe, **R**euse, **R**ecycle **R**ecover energy and **R**ot) – The contractor will endeavor to comply with the Waste Management Regulations	NEMA licensed waste contractors		management services
Noise and excessive vibrations	– Serviceable machines will be used for excavation to ensure vibrations are kept at below risk levels. – Construction work and delivery of raw materials will be limited to daytime on weekdays only. – Employees using equipment that produce peak sounds shall be provided with earmuffs – The contractor will deploy compact machinery and fit them with mufflers and vibration dampers – The contractor will deploy acoustic screens around noisy working areas to contain noises – The contractor will endeavor to comply with Noise Regulations, 2006.	Contractor & Project manager Workers Truck drivers	During installation phase	Cost of PPE factored elsewhere Market costs of compact machinery 100,000for acoustic screening
Traffic impact	– Heavy commercial vehicles delivering material shall observe designated speed limits for the area.	Contractor and all drivers to the site	During delivery of raw materials	10,000 for road signage

Environmental Impact	Mitigation Measures	Implementing Party	Timeframe	Cost (Kshs)
	– Proper signage and warnings shall be placed at appropriate places along the Mombasa-Malindi Road to forewarn other motorists of HCVs turning and transportation of abnormal loads – Delivery of material for the installation shall only be undertaken off-peak hours – All materials will be offloaded on the site and adequate space for that have been provided for – Deploy flagmen at the entrance to guide traffic			Internal costs
Increased demand for water f	– The contractor will ensure water conservation and in all activities – Water will be recycled as far as is practice without compromising on quality and health – The contractor to ensure prudential use of water resources during construction by avoiding wastage such as running pipes and taps – The proponent in collaboration with WRMA will determine the yields of the borehole and its capability to accommodate the elevated demands	Contractor WRMA	During installation phase	Internal costs

7.3. Operational Phase Environmental Management plan

Environmental impact	Mitigation measure	Implementing Party	Timeframe	Cost (Kshs)
Air quality concerns	– Install electrostatic precipitators and bag houses to arrest fugitive ash – Conduct regular maintenance of the plant to optimize processes and minimize fugitive emissions – Regulate fuel combustion in the boilers to achieve complete and efficient combustion of biomass – Conduct regular air quality monitoring to ascertain the levels of emissions in compliance with Schedule I of Legal Notice No. 34-Air Quality Regulations, 2014 and the Occupational Safety and Health Act (OSHA). – Regularly service delivery vehicles trucks and machinery to minimize pollutant emissions – Use unleaded and low suphur fuels in installed machinery and delivery vehicles	Plant engineer & Plant operator Proponent NEMA designated laboratory	During operations	Market costs for electrostatic precipitators and bag houses 30,000 for air quality sampling
Noise and excessive vibrations	– The will install equipment indicated by the manufacturer as having low noise emissions and complies with international safety standards. – Noisy equipment will be fitted with noise reduction devices (i.e. mufflers). Additionally acoustic screens should be deployed around noisy installations – The proponent will install compact equipment and install vibration	Plant engineer & Plant operator HSE officer NEMA designated	During the operational phase of the plant	Market costs for mufflers, acoustic screens vibration dampers

Environmental impact	Mitigation measure	Implementing Party	Timeframe	Cost (Kshs)
	dampers on fixed heavy machinery – Supply workers operating noisy equipment with appropriate personal noise protection gear (e.g. ear muffs, ear plugs, etc.) and enforce their usage – Conduct regular spot checks and maintenance on all installations and ensure top notch working conditions. – Conduct noise level mapping at least quarterly and carry out daily monitoring – Endeavor to comply with the provisions of LN. No. 61 (Noise and Excessive vibration) Regulations at all times	laboratory		3000 periodically for noise mapping and monitoring
Excessive Heat	– Installation will 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 – Workers will be provided with sufficient PPE and their operational duration will be limited – Monitor the time spent by workers in areas with elevated temperatures to ensure that they are not exceeding the prescribed work times – The proponent will endeavor to automate risky processes to minimize human exposure to heat hazards – Steam conveyors will be lagged to standards to prevent heat loss into the environment	Plant engineer & Plant operator HSE officer	During the operational phase	Cost of PPE factored elsewhere Internal costs

Environmental impact	Mitigation measure	Implementing Party	Timeframe	Cost (Kshs)
Increased water demand	– Condensed water will be fed back to the boilers to militate over extraction of water resources – The proponent will put in place structural provisions for rain water harvesting to supplement huge demand by the power plant – The proponent will monitor water demands against recorded borehole yield. Extraction ceiling will be determined in collaboration with WRMA – Proponent to consider adequately treating waste water at the STP to standards acceptable for use in the boilers to compensate for evaporation losses	Proponent in conjunction with WRMA	During operational phase	Accommodated within the operation costs Market costs
Effluent generation and possible water quality degradation	– The proponent should consider using technological options that promote usage of less water within the facility to reduce waste water generation at source. – The proponent will continue to monitor the quality of water discharged or recycled to ensure that it meets the standards specified under Schedule III of Legal Notice No. 120 of 2006 – Install water saving systems e.g. automatic water tap turnoffs, less water capacities cisterns, etc. – Proponent to consider adequately treating waste water at the STP to standards acceptable for use in the boilers to compensate for evaporation losses	Proponent and a reputable fire safety company	During operational phase	Market costs for water saving systems 10,000 quarterly for effluent monitoring Accommodated within STP operation costs

Environmental impact	Mitigation measure	Implementing Party	Timeframe	Cost (Kshs)
Solid waste	– Contracting a NEMA licensed waste handler to empty the central bin on a weekly basis, – Generally solid wastes will be managed in line with Legal Notice No. 121 of 2006. – The proponent will provide for solid waste management through a hierarchy of options that includes reduction at source, separation of wastes to make it easier to undertake recycling. – Comply with the provisions of Legal Notice No. 121 of 2006	Plant operator HSE officer & NEMA licensed waste handler	During the operational phase	15,000 monthly for waste handling
Ash management	– The proponent will install bag houses and electrostatic precipitators in the chimney system to capture fly ash – The proponent will contract a NEMA licensed solid waste handler to manage the ash – The consider supporting local youth groups that put ash to profitable use e.g. brick making – Provide PPE to workers handling the ash. Health monitoring program should also be initiated – Conduct regular air quality monitoring to ascertain the levels of emissions in compliance with Schedule I of Legal Notice No. 34-Air Quality Regulations, 2014 and the Occupational Safety and Health Act (OSHA).	Plant operator HSE officer & NEMA licensed waste handler	During the operational phase	Market costs for electrostatic precipitators and bag houses 30,000 for air quality monitoring Cost of waste management already factored

Environmental impact	Mitigation measure	Implementing Party	Timeframe	Cost (Kshs)
Occupational Health and safety hazards	– Sustain implementation of a risk-based approach health and safety concerns and hazard close-out programmes focusing on major injury causes – Sustain implementation of occupational medical examinations for its staff to establish any occupational health anomalies. – Establish baseline conditions for heat, particulates and noise and monitored against local safety regulations and, in the absence of the latter, against OSHA standards. – Provide and enforce use of the provided PPE as appropriate and that the procedures on safe handling of machinery and tools are strictly adhered to. – Prominently display warning and informative signage throughout the facility – The proponent will contract a reputable operations and maintenance company to oversee day-to-day operation at the power plant – The proponent will fully comply with the Occupational Safety and Health Act No. 15 of 2007	Plant management HSE officer in conjunction with DOSHS	During operational phase of the project cycle	500,000 for staff PPE Varying internal costs 10,000 periodically for signage Varying costs of Health and safety auditing and medical services
Fuel, oil and grease spillage/leakage	– Designate a specially equipped maintenance area within the premises – Install direct waste oil harnessing system during servicing minimize spillage – Oily replacements such as used oil filters should be segregated,	Plant engineer and operator NEMA licensed waste	Throughput operational phase	Internal costs

Environmental impact	Mitigation measure	Implementing Party	Timeframe	Cost (Kshs)
	sheltered away and disposed by the contracted solid waste handler – Sell off extracted used oils and grease to NEMA licensed dealers for recycling purposes	oil handler		
Fire hazards and emergency preparedness	– The proponent will develop a comprehensive fire action and evacuation plan and implement it at the facility – The proponent will conduct annual Fire safety audits and risk assessment, for all operation sites pursuant to Legal Notice no. 59 of 2007, in which work procedures and activities that have a likelihood of causing fire hazards are examined, with the aim of providing remedial measures. – The fire audit also involved evaluating the existing fire emergency preparedness levels of the company. – Customize the existing fire safety systems and emergency response plan to accommodate the power plant. – Firefighting equipment such as extinguishers and hydrants to be provided be maintained by reputable fire company and employees trained on how to use them – Fire equipment inspections and drills will be scheduled and conducted at least quarterly and annually respectively – Precautionary signage will be mounted on strategic areas which are visible to everybody.	Contracted specialty consultant HSE Officer in conjunction with the plant Engineer Plant management Reputable fire company	Throughput operational phase	Internal costs Market costs for fire equipment maintenance

7.4. Decommissioning EMP

Due to the high risks associated with a decommissioning process for the facility, environmental dynamics and the long-term nature of the project lifespan, we recommend that a decommissioning audit will be undertaken at the end of project life and approved by NEMA at least three months prior to the decommissioning activity.

8. ANALYSIS OF PROJECT ALTERNATIVES

8.1. Overview

An analysis of the project alternatives represents an opportunity to examine other options for the development that have a potential to contribute to mitigating the negative impacts associated with the proposal.

8.2. The 'No Project' alternative

Though this alternative presents no additional environmental impacts, it does not add value to the status of the facility under consideration. This alternative will in addition to denying the Proponent, contractors, and other workers a reliable income, deny the government revenue from the tax obtained on materials and licenses related to construction of the extensions.

Importantly the 'No Project' alternative would retain the status quo of energy situation within the existing plant. This means that the proponent will continue to place strain in mains power supply while still relying in the conventional boilers for thermal energy

8.3. The "Yes Project" alternative

This option was considered as the most viable because of the following reasons;

- There will be employment creation,
- Proponent will benefit from increased profits due to low cost of production
- The project will boost the energy budget of the plant with possible trickle-down effect on prices of finished products
- The project will engender technology and skills transfer
- The proposal is consistent with the existing land use character of the area,

8.4. Alternative site

An alternative site could be considered for the development if site suitability presents serious environmental challenges that cannot reasonably be effectively mitigated. The proposed site is however considered suitable. Additionally the proximity of the proposed power plant to the existing plant is an important consideration. An alternative site would require power evacuation lines that would present additional environmental challenges

8.5. The Yes project alternative

This is the preferred option on the part of the proponent and is recommended subject to a committed implementation of the environmental management plan developed for the entire project cycle.

9. ENVIRONMENTAL MONITORING PROGRAMME

9.1. Overview of the monitoring programme

A monitoring plan is essential to assess the impact of the development on the environmental setting of the area. The principles underlying an environmental monitoring plan as it relates to any given development is to document, track and report any changes in environmental parameters over time that would be associated with the project. These changes would in principle vary over time in both magnitude and direction. In the case of the latter it is important to bear in mind that changes in environmental parameters may be positive or negative.

Thus in principle a monitoring program for the project would not necessarily focus only on the perceived or anticipated negative changes precipitated by a given development activity, but also on the positive or beneficial changes. The parameter chosen are those that have been identified in the analytical process as being affected in the most significant way by the proposed small scale private power plant.

9.2. Specific monitoring issues

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

- Water quality and quantity monitoring
- Wastewater monitoring program
- Solid waste and Ash monitoring plan
- Social Monitoring Plan
- Environmental audits
- Occupational Health and safety

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

9.2.1. Water quality and quantity monitoring

The proponent will have a water monitoring programme that examines

- The quality of the water discharging from the borehole
- The quantity of water (yields) from the borehole

Pollution from all the different sources can pose a serious threat to the water resources in the area and therefore considering the negative impacts, the proposed development will have to incorporate a complete water quality monitoring program. This program, which will further be developed by the proponent and WRMA in collaboration with accredited laboratories. Water samples will be collected and analyzed on a quarterly basis for the following parameters using the recommended protocol required by Water Quality Regulations (Legal Notice No. 120 of 2006).

9.2.1.1. Insitu measurements

In situ measurements will include;

- Salinity
- Turbidity
- Temperature
- Total Dissolved Solids
- Dissolved Oxygen
- Conductivity
- Ph

9.2.1.2. Lab analysis

This will include the determination of the following effluent characteristics.

- BOD
- COD
- Total Suspended Solids
- Total Nitrate
- E. Coli
- Total Phosphate
- Total and Fecal Coliform

9.2.2. Wastewater monitoring program

Just as with the water resources monitoring program the proposed development intends to develop a wastewater monitoring program. This program among others will monitor the quantity and quality of treated effluent (wastewater) discharged into the environment or used for irrigation.

In addition, the program will also develop a maintenance plan encompassing structural failures, inspections, monitoring of equipment (sewer conveyance pipes, treatment plant, grease traps, oil/water separators, etc.) short and long term repairs as well as training for new employees in charge of supervising the plant.

Samples of the treated wastewater will be collected and sent to a NEMA designated laboratory for testing. In any event, the proponent will comply with all applicable laws relating to this matter. The parameters (BOD, COD, TSS, Nitrates, and E. Coli etc) to be incorporated in the monitoring programme are those included under Schedule III of Legal Notice No. 120 of 2006. The only addition to the monitoring template will be the date that the sample was taken.

9.2.3. Solid waste and Ash monitoring plan

As part of the overall management structure, the proposed development plans to undertake an intensive solid waste and as monitoring plan in order to address all the relevant issues that can arise from the collection, storage and disposal of garbage and ash. Table 9-1 describes the outline for which the activity will be monitored. Indicators will be developed to keep track of this activity and report to the property managers on a monthly basis.

Table 9-1. Outline for solid waste monitoring plan

Parameter	Frequency
Collection	Daily
Disposal	Weekly
Storage	Daily
Management	Daily

The plan can become more dynamic if columns on critical levels and targets as well as responsible persons are added. This can be done once the development is at full operations.

9.2.4. Social Monitoring Plan

The proponent will have a social monitoring plan that targets to ensure compliance with the environmental mitigation measures that address neighborhood concerns. In this regard, the proponent will keep a record of all complaints and comments coming from third parties and action taken to remedy the situation.

9.2.5. Environmental audits

The proponent will undertake annual environmental audits aimed at;

- Complying with Legal Notice No. 101 of 2003
- Testing the efficacy of the EMP
- Addressing neighborhood concerns on environmental performance of the development

9.2.6. Occupational Health and safety

The monitoring schedule regarding occupational health and safety will basically involve conducting occupational health and safety audits, fire safety audits, energy audits and any other that be necessitated by operational activities of the facility .

10. CONCLUSIONS AND RECOMMENDATIONS

10.1. Conclusion

The proposed development of small scale private power plant is a strategic investment that directly contributes to the growth of the national economy and complements government efforts in mitigating short falls in electricity demand. It will also reduce the operational costs on part of the proponent with possibility of reduction in prices of finished products. It is therefore considered important and beneficial. The environmental impacts associated with the proposed development can be effectively mitigated managed to satisfactory levels through a concerted implementation of the EMP and continuous improvement of the environmental performance.

10.2. Recommendations

It is therefore the recommendation of this report that the project be allowed to proceed on the basis that the Environmental Management Plan for the project is fully implemented, monitored and that follow-up is made to ensure compliance as may be directed by NEMA and relevant lead agencies.

11. REFERENCES

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11. The National Water Services Strategy (NWSS) 2007-2015, May 2007.

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13. Reference to other EIAs of the area prepared by the consultants.

12. APPENDICES

1. Copy of company's certificate of corporation
2. Copy of company's PIN Certificate
3. Copy of title deed
4. Evidence of public consultations (questionnaires appended).
5. Copies of practicing licenses of lead experts and firm of experts
6. Copies of drawings of the proposed power plant