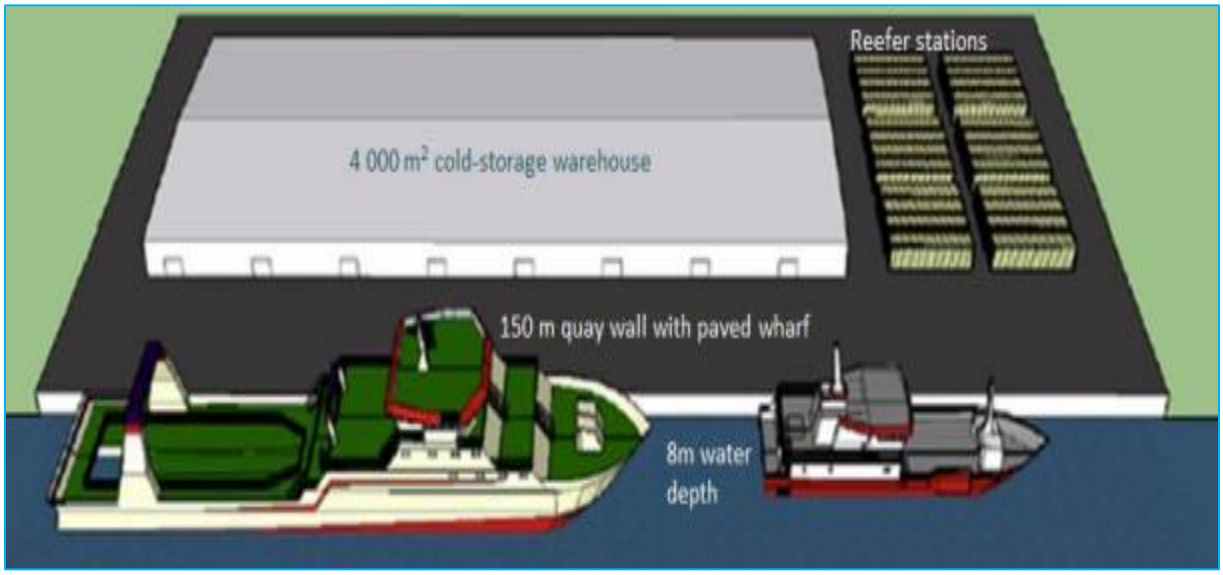
Environmental and Social Impact Assessment Study Report for the Proposed Shimoni Port, Kwale County



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CERTIFICATION

Certification by Lead Experts

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

Signed: _____ _____

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Certification by Proponent

We, **Kenya Ports Authority**, confirm that this Environmental and Social Impact Assessment (ESIA) Study Report has been submitted to NEMA with our authority as the project proponent.

Signed for and on behalf of **Kenya Ports Authority**

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EXECUTIVE SUMMARY

Kenya Ports Authority contracted Envasses Environmental Consultants Limited in August 2020 to prepare an Environmental and Social Impact Assessment (ESIA) Study Report for the proposed Shimoni Port development. The ESIA is prepared pursuant to Section 58 of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya. Transportation and related infrastructure projects including harbors and ports, activities in natural conservation areas including any project in environmentally sensitive area and any other project which possess high environmental risks are listed under the Second Schedule of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya (4e, 13i and 15 respectively) and should undergo ESIA study process.

The project activities to be carried out are; construction of a jetty, renovation of a section of the fisheries buildings which will involve the removal and disposal of asbestos, potential dredging/dumping and construction of a fully-fledged industrial fishing port. The design and implementation of the proposed port will be in two distinct phases. Phase 1 will involve the construction of between 86-150m long jetty (actual length will be determined based on the findings of an ongoing bathymetric survey for Shimoni Channel) with a platform of 75m to the west of the existing Shimoni Jetty. The rationale for the construction of an additional jetty is based on a need to separate the handling of fish from conventional cargo as happens at the current jetty. Hence the existing jetty will handle conventional cargo while the new jetty will be dedicated exclusively to handle fish landings. The new jetty will also allow the berthing of large fishing vessels such as purse seiners and trawlers and ease pressure on the Mombasa Port. Alongside the construction of the jetty, KPA will develop auxiliary infrastructure including offices, cold storage shed, fish auction market and warehouse among others. These infrastructural developments will be carried out on the landward area which measures 3.6 acres belonging to Kenya Fisheries Service. A section of the existing fisheries offices and staff houses are roofed with asbestos sheets which are classified as hazardous wastes. Hence as part of the project activities, the proponent will remove and dispose off these asbestos sheets measuring approximately 600m^2.

Phase 2 will involve an addition 75m platform to the new Jetty (bringing the total length to 150m and hence able to dock two fishing vessels at a go), the construction of a fully-fledged industrial fishing port comprised of 150m quay wall with a wharf, a cold storage facility measuring 4,000m^2 and reefer facilities. The construction of the industrial fishing port will be carried out in four potential locations identified during a feasibility study conducted by KPA in 2018 and which is currently being updated. These locations are Kibuyuni (No.1), Site to the west of the current jetty and next to Shimoni Gardens (No.2), existing jetty (No.3) and the KPA owned land in Shimoni (No.4). Some of these sites such as Nos. 1 & 2, construction of the industrial port would involve dredging and dumping activities to achieve the desired draft of -8m to allow berthing of target fishing vessels such as purse seiners and trawlers.

The methodology for preparing the ESIA report was guided by the Third Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. They included data collection through site visits and observations, literature review, bathymetric survey, baseline monitoring of water quality, sediment quality and classification, biological communities' assessment through diving and snorkelling, monitoring of ambient air, noise level measurements and holding consultative meetings with stakeholders. The stakeholder engagement strategy included five community consultative meetings in Shimoni, Kibuyuni, Majoreni, Mkwiro and Wasini villages, two meetings to review the draft ESIA report and a stakeholders'meeting to validate the ESIA study report.

In carrying out the baseline biological communities monitoring seven sites were sampled by various methods including diving, snorkelling, laying of transects, taking measurements and observations among others. Among the key habitats at the project sites are corals, mangroves, seagrass and seaweeds. Results of the monitoring show that hard corals dominated the substrate cover at Kibuyuni and Mkwiro sites with mean cover of 59.3 % ± 1.3 and 29.3 % ± 1.8 respectively. Nyuli site was dominated by soft corals with a mean cover of 24.0% ± 3.1. Twelve (12) seagrass species were recorded while mangroves species included *Sonneratia alba*, *Ceriops tagal* and *Rhyzophora mucronata.* These habitats support marine food chains and local livelihoods which include a thriving artisanal fishery, tourism and seaweed farming. During the baseline survey, a total of 67 Phytoplankton, 57 Zooplanton genera and 14 benthic invertebrates were recorded at all the seven monitoring sites. Ninety-six (96) fish species from 25 families were recorded across three of the sites i.e. Mkwiro (63 species), Nyuli (51 species) and Kibuyuni (41 species).

The proposed fishing port will impact on the above habitats in both positive and negative ways. According to the feasibility study carried out by the proponent in 2018, the economic benefits from the port are estimated at Kenya Shillings 28.3 billion over a 5-year horizon which will accrue from revenues to the government, fish sales and business opportunities in hinterland transport. The construction and operation of the fishing port will create over 1,000 direct employment opportunities in fishing, fish trade, processing and value addition and ship chandling among others. The County and National Governments will benefit from increased revenue streams as the port will enhance local investments in infrastructure to harness the blue economy sector in the country. At a national level, the opportunities and revenue from the proposed fishing port will contribute towards attainment of Vision 2030 and the Presidential Big Four Agenda on food security.

Negative impacts on the environment will occur throughout the project cycle i.e. construction, operation of the fishing port and possible decommissioning. At the onset it is important to note the proximity of the auxiliary infrastructure for phase 1 such as the proposed warehouses to the Shimoni Slave Caves which was gazetted as a monument in 1992 under the Antiquities and Monuments Act, Cap. 215. The siting of the warehouse on the draft design layout should be ascertained to ensure that it doesn't sit on top of the underground cave leading to the sea and which National Museums intends to rehabilitate. The ESIA recommends an alternative location for the warehouse away from the cave.

During the construction phase, potential dredging and dumping activities will impact negatively on the marine ecosystem through water quality degradation, potential bioavailability of heavy metals, impact on phytoplankton and zooplankton populations, bioaccumulation of polycyclic aromatic hydrocarbons by aquatic organisms from oil spills and complete loss of marine habitats. To mitigate these, dredging should be conducted during high tide for optimal flushing of the channel to reduce turbidity levels, deploying silt curtains during dredging to reduce turbidity in adjacent environments and water quality monitoring to ensure critical limits for survival and habitats are not exceeded. Other measures will include sampling and analysis of fish, invertebrates and mollusks for potential heavy metal bio-accumulation, prevention of oil spills and ensuring the dredger is compliant with the Marpol Convention 73/78 and Kenya Maritime Act, 2012.

The dredged material will need to be disposed off responsibly. Following on the London Convention 1972 / Protocol 1996 (ANNEX III) criteria, the ESIA experts in consultation with the proponent and based on previous experience at Mombasa Port identified a suitable site for the dumping of the dredged material from the Shimoni Channel. The site is located 17 Km offshore (04.652388°S/ 39.529794°E) from the existing Shimoni jetty/proposed project site and has a depth of -400m. Dumping of dredged materials should therefore be restricted offshore at the identified

site to prevent potential pollution of the key biodiversity areas such as the Kisite- Mpunguti Marine Park and Reserve and the Community Conservation Areas.

The proposed project lies within Shimoni Channel which connects to the Kisite - Mpunguti Marine Park and Reserve, a Marine Protected Area (MPA) gazetted under the Wildlife Conservation and Management Act, 2013. The MPA harbours a rich marine ecosystem with species of international importance such as the endangered sea turtles and dolphins. Besides supporting livelihoods, the MPA drives various economic activities including tourism and fisheries among others, which make significant contributions to the local and national economy. The MPA is currently under threat from various causes including pollution, over-exploitation of the reserve, destructive fishing practices and climate change among others. This means that any upstream developments and activities that occur within the Shimoni Channel where the proposed project will be undertaken will exacerbate these threats through pollution from potential dredging and dumping activities, potential oil spills from the dredging ship or potential running aground which which will degrade water quality and can affect affect the biodiversity of the MPA or interfere with their movement patterns of the MPA fauna such as dolphins. Existing literature and interviews with Kenya Wildlife Service and the local fishermen indicates that the frequency of cetacean sightings at the MPA is highly seasonal, for example humpback whales are frequently sighted between the months of July to October coinciding with the peak breeding and calving periods. It is therefore recommended that potential dredging should only be carried out during the off season of the migratory marine megafauna i.e. from November to June. In addition, the proponent and contractor will collaborate with the Kenya Wildlife Service to either establish a hotline or use existing one to report marine fauna sightings and strandings to expedite appropriate action.

Further potential dredging activities during phase 2 (this impact will not manifest during phase 1) of the project may restrict access to traditional fishing grounds by local fishermen leading to loss of livelihoods. According to the State Department of Fisheries, Aquacultue and Blue Economy Catch Data 2010-2019, the total number of fishermen utilizing the study area is over 1000 with an average annual estimated catch of ≈281.3 Mt valued at over KES 50 million and ≈118.28Mt valued at KES 21 million per year respectively during NEM and SEM seasons respectively. Restricted access to the traditional fishing grounds and water quality degradation during potential dredging could reduce these earnings and lead to loss of livelihoods. Apart from the socioeconomic effects, these dredging impacts may lead to conflicts between the dredging company, proponent, the local community, fishermen and the business community. To mitigate this impact, potential dredging activities should be undertaken during the South East Monsoon season when there is reduced fishing activities. The proponent should also constitute a committee comprising of the State Department of Fisheries, Aquacultue and Blue Economy, the County Fisheries Office and the BMUs for conflict resolution and implementation of the KPA Grievances Redress Mechanism Tool.

The BMUs within the study area have established three (3) Community Conserved Areas (CCA) also locally known as *Tengefu* in Mkwiro, Wasini and Kibuyuni. These no-take zones are fully protected with no extraction or fishing allowed. In Mkwiro and Wasini CCAs, the communities in collaboration with other stakeholders are carrying out coral reef restoration and establishment projects. Dredging activities during phase 2 (this impact will not manifest during phase 1) will potentially impact on these CCAs through water quality degradation which will in turn affect coral reefs and fisheries resources. The most affected would be the Wasini and Mkwiro CCAs which coincides with the proposed site for the industrial fishing port. In addition to the recommended measures to prevent water quality degradation, the ESIA proposes transplanting the corals in these areas to a new site identified in consultation with the local fishermen and other stakeholders.

Other issues that may impact on local fishermen include maritime accidents. For instance, their boats can drift into the construction areas, collide with the dredger or ships or pillars at night thereby causing accidents. These can be prevented by creating awareness among the local fishermen and other channel users on dredging activities and the construction of the jetty/port and the area to be covered, mapping out navigational routes, ensuring placement of marker buoys and hazard demarcations during construction to warn fishermen and other maritime traffic on the potential hazards and ensuring that construction areas are well lit at night.

Apart from fishing, seaweed farming has been identified as a good prospect for social and economic development of the project area and especially in Kibuyuni. Data obtained from the local women groups involved in seaweed farming indicates that approximately 20 Mt of seaweeds are harvested quarterly from the farmers. Each kilogram of seaweed is sold at KES 25 translating to KES 15million per year. During phase 1 which involves the construction of the jetty, seaweed farming will not be impacted. However, dredging activities at phase 2 will have environmental impacts which include water quality degradation and pollution (oil spills and wastes) from dredger and ships docking at project site 2 in Kibuyuni. The ESIA recommends the use of silt curtains during dredging, prevention and management of oil spills and supporting the local women groups to re-establish affected seaweed farms in suitable locations.

Besides the impacts on livelihoods, the proposed project will impact on mangroves and terrestrial vegetation cover. The mangroves forest cover are only limited to two project site namely Kibuyuni area with an area of ≈1.57ha and next to Shimoni Garden Cottages with an area of ≈0.57ha. The National Mangrove Forest Management Plan estimates the average stocking rates of mangroves in the area as 3,327 stems/ha translating to a potential total loss of 5,223 trees and 1,896 trees in Kibuyuni and next to Shimoni Garden Cottages respectively. The environmental goods and services provided by mangroves i.e. Total Economic Value is 12,600/ha/year which translates to a loss of KES 19,782 /year in Kibuyuni and KES 7,182/year in Shimoni Garden Cottages if the sites are used for port development. However, phase 1 will not clear any mangroves and hence there will be no loss. To mitigate the loss, the proponent will replant twice the number of mangroves cleared in other areas in Shimoni to compensate for the loss. This will be in addition to obtaining a Special User Licence from the Kenya Forest Service (KFS). Similar mitigation measures are recommended for the restoration of terrestrial vegetation that may be cleared for the construction of the fish auction market, offices and warehouses among other infrastructure. These measures include replanting trees and landscaping the port area after completion of construction works.

Actual port construction activities such as piling, building of quay, office, fish auction market, warehouses and sanitation blocks among others will require raw materials such as building blocks, aggregates, cement, steel, timber and sand. The raw materials will be sourced from the environment and will have negative environmental impacts at their points of origin. Recommended mitigation measures include procuring quantities of construction materials in line with the Bill of Quantities prepared by a Licensed quantity surveyor, sourcing raw materials from sites that are licensed as per the EMCA Cap. 387 of the Laws of Kenya and recycling of construction wastes where practical. Transporting raw materials such as sand, ballast, cement and steel for the construction of the jetty on water poses environmental risks due to the potential of transportation boats running aground and consequently polluting the sea. Recommended mitigation measures include using sea worthy vessels certified by Kenya Maritime Authority (KMA) during construction and employing competent and certified coxswains to pilot the vessels during construction of the jetty and the port.

The construction activities including excavation and other civil works will create loose soils that are susceptible to erosion. This will contribute to sedimentation within the adjacent marine waters hence water quality degradation. Other potential sources of water quality degradation is solid waste and poorly managed effluent. Piling works have the potential to impact the marine environment through disturbance of the seabed and accidental spillages and discharges. This will in turn affect the biological communities such as fish, marine mammals and benthic habitats. Notably, a baseline survey on benthic habitat was conducted within the proposed project area and the critical habitats identified lied within Nyuli, Mkwiro and Kibyuni areas. Civil works near shore areas should therefore be carried out during the low tide. Additionally, the proponent should contract a NEMA licensed contractor to manage both solid waste and effluent, carry out observations on marine mammals prior to the commencement of piling activities and develop and implement a water quality monitoring plan.

During the construction phase, water will be required for concrete mixing, casting and curing works, drinking and sanitation purposes which will lead to increased demand for water. Water will be supplied by water bowsers or the proponent can opt to sink a borehole for that purpose. Seventy percent (70%) of the water used for domestic purpose will generate effluent whereas the rest soaks into ground areas within the project site or drain to the channel. Poor disposal of the wastewater will have the potential to pollute underground aquifers and the ocean. To attenuate the impact of water use and effluent generation,workers and contractors should be sensitized on the need for water conservation and implement penalties for wastage, procure mobile toilets for the workforce and comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006.

The construction activities will generate solid waste such as biomass, overburden, cuttings and rejected materials among others. Workers at the site will generate domestic waste such as food leftovers, plastics and wrappings among others. These will need to be disposed off appropriately. Potential dredging activities would also generate both domestic and commercial wastes from the dredging vessel which will need to be disposed off responsibly. The contractor should comply with the Marpol Convention 73/78, the EMCA Cap. 387 of the Laws of Kenya and the KMA Act, 2012 and the Environmental Management and Coordination (Waste Management) Regulations, 2006.

The operations of the dredger and the construction of the port will employ personnel who will be exposed to potential occupational safety and health hazards. Additionally, the channel is used as a transport corridor locally thus the dredger may pose navigational safety risks to other maritime traffic including local fishing boats. Recommended mitigation measures include registering the site as a work place with the Directorate of Occupational Safety and Health Services (DOSHS), providing life jackets to all workers working within the sea area and train personnel on proper use, provide a well-trained rescue and first aid team as well as a standby boat to act as an ambulance in the event of accidents in the sea and ensuring the dredger is licensed by the IMO and KMA. The proponent should create awareness among the channel users on the presence of the dredger and its activities as well as the required safety precautions, provide Personal Protective Equipment (PPE) for ship crew, workers and visitors to the port and comply with the Merchant Shipping Act, 2009, the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 and the Occupational Safety and Health Act, 2007.

The construction works, delivery of construction materials by heavy trucks and the use of machinery will lead to high levels of noise and vibration within the construction site and the surrounding area. Additionally, air pollution will be as a result of dust generated during excavation, concrete mixing activities and exhaust fumes from heavy commercial vehicles accessing the site.

The proponent should comply with the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 and the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

During the implementation of the proposed project, it is expected that the contractors will source labour from the local community and elsewhere in the country when the skills required are not available locally. The influx of workers will potentially lead to increased demand and competition for goods, social and health services, which can lead to price hikes and crowding out of local consumers, increased volume of traffic and higher risk of accidents, increased demands on the ecosystem and natural resources, social conflicts within and between communities, increased risk of spread of communicable diseases, and increased rates of illicit behavior and crime. Prior to starting construction, the contractor should prepare a site-specific Labor Influx Management Plan, establish a liaison committee for its implementation in collaboration with the Ministry of Interior and Coordination of National Government, County Government of Kwale, BMUs, Community Based Organizations, Kenya Fisheries Service and Hoteliers among other stakeholders.

As part of the construction phase activities, the proponent intends to renovate some of the existing buildings at the project site at phase 1. The renovation activities include removal and disposal of asbestos roofing sheets covering about 600m^2 to reduce the risks they may pose to staff and the general public. Asbestos fibers have been shown to cause asbestosis, lung cancer and mesothelioma. Therefore, removal and handling of asbestos sheets should be undertaken by a NEMA licensed contractor, comply with the Environmental Management and Coordination (Waste Management) Regulations, 2006 and the National Guidelines on the Safe Management and Disposal of Asbestos, 2011 by NEMA.

Potential environmental and social impacts at operational phase include climate change adaptation, pollution from fish processing activities, introduction of invasive species, wastewater generation and management, solid waste generation and management, oil and grease spills, potable water and energy demand, occupational safety and health, air pollution, noise pollution, fire risks and emergencies, potential sources of conflicts, potential impacts on visual quality and potential collapse of Port infrastructure.

Maritime transport is a contributor to climate change, accounting for approximately 2.7% of annual global CO_2 emissions in 2014, and potentially rising to 10% of total global GHG emissions by 2050 if other sectors make significant reductions (Source: National Climate Change Action Plan 2018-2022). Kenya aims to address climate change in the transport sector by working to reduce greenhouse gas emissions while encouraging development of transport infrastructure that accounts for the effects of climate change. Among the risks that the port faces are sea level rise caused by climate change. However, port activities can exacerbate these impacts. The proponent should implement measures to ensure low carbon foot at Shimoni Port and comply with the Climate change Act 2016, the National Climate Change Action Plan 2018-2022 and the Marpol Convention 73/78 (MARPOL Annex VI).

Fish processing activities can cause pollution of the environment from wastewater discharge, biological decomposition of fish guts and associated organic matter. These can potentially lead to odour due to poor housekeeping, overloaded or improperly run wastewater treatment and disposal facilities and prolonged storage of wastes. The facility should maintain a clean environment to ensure that the activities carried out during processing cause minimal pollution and ensuring the by-products are sealed in covered, leak-proof containers.

The shipping industry has the potential to inadvertently bring invasive species to ports through various means. Organisms become hitchhikers on ships by being carried in ballast water, attaching to vessel hulls and anchor chains on ships. Invasive species impose ecological, economic, and health-related damages that can be severe and intensify over time. In the absence of natural predators and competitors, invasive species can overtake available resources, disrupt the local food web, alter habitat structures and act as secondary vectors of parasites and disease. The proponent should enforce flushing and refilling ballast tanks with water from the open ocean before the ships arrive at the port as well as ensure that the resultant water from on-board treatment is not toxic when discharged in the destination port. Additionally, all vessels docking at the Port to comply with the provisions of the Marpol Convention 73/78.

Wastewater will emanate from the sanitation facilities, cleaning operations and vessels docking at the port which will need to be desludged. Poor effluent management will have the potential to pollute underground aquifers, the marine environment and can harbor disease causing pathogens and vectors. Recommended mitigation measures include designing and constructing a bio-digester to manage effluent, applying for and obtaining an Effluent Discharge License from NEMA, comply with the Environmental Management and Coordination (Water Quality) Regulations, 2006 and the Marpol Convention 73/78 and the KMA Act, 2012.

Waste during operations will consist of plastics, paper, organic wastes, oil and grease containers used for machinery maintenance, cargo residues and ship wastes among others. Poor disposal of the wastes will cause pollution and degradation of water quality, harbor pathogens and vectors. The proponent should sensitize employees, visitors, ship crew and the community neighboring the port on the importance of proper solid waste management, procure infrastructure for handling solid wastes and comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006 and the Marpol Convention 73/78 and the KMA Act, 2012.

Oil and grease may be introduced within the port during maintenance and servicing of water vessels, illegal discharge of tank washings and oil-contaminated ballast water, tanker accidents, dumping of wastes among others. Leaked oils, oily wastes and mixtures will potentially be transported into the channel through runoff, cleaning activities or direct introduction by ships and maritime crafts leading to water quality degradation. Degraded water quality will in turn impact on fishery resources and the marine ecosystem. The ESIA recommends establishing a well-equipped pollution control center and implementation of an oil spill contingency plan for the port.

During the operation of the Port, water will be required for drinking, general cleaning and sanitation purposes among other day to day uses. Ships docking at the facility will also require portable water. It is predicted that water demand will increase during the operational phase of the port. Energy will be required for lighting, operation of equipment and machinery and auxiliary facilities. To address increased water demand, the proponent will sink 3 boreholes at the project site, connect the port to the reticulated supply by Kwale Water and Sewerage Company or install a sea water desalination plant. Mitigation of increased power demand is in the process whereby Kenya Power and Lightning Company is upgrading the power infrastructure to avoid straining the existing community supply once the port development activities and operation commence. In addition, the proponent will install solar panels at the port area for lighting purposes.

Occupational health and safety risks associated with the operations of the port such as navigational accidents, injuries and effects of air and noise pollution can be mitigated through installation of navigational aids, marker buoys, providing adequate PPE to workers and enforce on their use as

well as controlling access to the port area. Additionally, the proponent should undertake Occupational Safety and Health audits annually and comply with the provisions of the Occupational Safety and Health Act, 2007, Environmental Management and Coordination (Air Quality) Regulations, 2014 and the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009.

Fire risks and emergencies at the Port can occur due to operational negligence, electrical faults and spillage/leakage of flammable and ignitable chemicals. These can be mitigated through developing, clearly display and implement a fire and emergency response action plan, provide a fully equipped fire station, ambulances and firefighting equipment, training employees on the use of fire-fighting equipment, ensuring proper handling and storage of flammable materials and conducting annual fire safety audit and implement the recommendations.

There is a potential of the port infrastructure to collapse if the construction is not undertaken in conformity with the engineering designs and Kenya's building code. This may lead to loss of lives and potential economic decline. The contractor should therefore ensure that the design and construction of the jetty as well as the industrial fishing port conforms to the building code and implementation is supervised by registered engineers. Regular inspections of the jetty should be undertaken to ensure structural integrity.

A decommissioning phase of the Shimoni Port project is possible in the event of end of project life, closure by government agencies due to non-compliance with environmental and health Regulations, an order by a court of law, natural calamities or change of user of the land. Key environmental and social concerns at this phase will be economic decline, demolition waste and safety and health risks. To address these, the proponent will prepare and submit a due diligence decommissioning audit report to NEMA for approval at least three (3) months in advance.

In conclusion, the proposed project is considered important and beneficial as it will contribute towards socio-economic growth of the area through employment creation, increased revenues from fishing activities and trade and ensuring utilization of the country's Exclusive Economic Zone (EEZ) and growth of the Blue Economy Sector. Despite these benefits, there will be negative environmental and social impacts which will accompany the development of Shimoni Port. The key concerns include the impact of dredging and dumping on the marine ecosystem, oil spills and their management, loss of livelihoods and pollution. The ESIA has recommended mitigation measures and monitoring plans to address the negative impacts which include use of silt curtains during dredging, aligning dredging activities to coincide with low risk annual periods for migration of mega fauna such as whales and during the South East Monsoon period when fishing activities are at their lowest. It is important to note that these key impacts will not manifest during phase1 of the Shimoni Port Development as dredging is not expected unless otherwise advised by the on-going bathymetric survey. Further during phase 2 where dredging and dumping is expected, potential conflicts may arise in respect to access to traditional fishing grounds and impact on Community Conservation Areas. To mitigate these conflicts, the proponent will avail resources to implement the Environmental Management and Monitoring Plans recommended by the ESIA and the KPA Grievance Redress Mechanism Tool. It is on this basis that we recommend that the ESIA recommends that the project be allowed to proceed alongside conditions which will ensure compliance with the provisions of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya.

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ACRONYMNS

BMU	Beach Management Unit
BOD	Biological Oxygen Demand
CCA	Community Conservation Area
CFA	Community Forest Association
CITES	Convention on International Trade in Endangered Species
COD	Chemical Oxygen Demand
COMRED	Coastal and Marine Resource Development
CSR	Corporate Social Responsibility
DO	Dissolved Oxygen
DOSHS	Directorate of Occupational Safety and Health Services
EA	Environmental Audit
ECD	Early Childhood Development
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Economic Stimulus Programme
FS	Frame survey
GDP	Gross Domestic Product
GHG	Greenhouse gas
GOK	Government of Kenya
GPS	Global Positioning /system
GPS	Global Positioning System
GRM	Grievance Redress Mechanism
HC	Hydrocarbon
HCV	Heavy Commercial Vehicle
HDPE	High Density Polyethylene
ICT	Information and Communications Technology
ICZM	Integrated Coastal Zone Management
IFC	International Finance Corporation
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
KCDP	Kenya Coastal Development Programme
KESCOM	Kenya Sea Turtle Conservation Committee
KFS	Kenya Forest Service
KMA	Kenya Maritime Authority
KMFRI	Kenya Marine and Fisheries Research Institute
KMMPR	Kisite-Mpunguti Marine Park and Reserve
KNBS	Kenya National Bureau of Statistics
KPA	Kenya Ports Authority
KWAWASCO	Kwale Water and Sewerage Company Limited
KWS	Kenya Wildlife Service
LAT	Lowest Astronomical Tide
LOI	Loss of Ignition

MARPOL	International Convention for the Prevention of Pollution from Ships
MEA	Multilateral Environmental
MNPR	Marine National Park and Reserve
MPA	Marine Protected Area
MT	Metric Tons
NCCAP	National Climate Change Action Plan
NEM	North East Monsoon
NEMA	National Environment Management Authority
NPV	Net Present Value
OM	Organic matter
OSHA	Occupational Safety and Health Act
PAH	Polycyclic aromatic hydrocarbons
PIT	Point Intercept Transect
PPE	Personal Protective Equipment
ROV	Remotely Operated Vehicle
SCUBA	Self-Contained Underwater Breathing Apparatus
SD	Standard Deviation
SDG	Sustainable Development Goal
SEM	South East Monsoon
SI	Système international
SPM	Suspended Particulate Matter
TBD	To be Determined
TDS	Total Dissolved Solids
TEUs	Twenty-foot equivalent units
TM	Trademark
TORs	Terms of References
TSS	Total Suspended Solids
UN	United Nations
UNCLOS	United Nations Law of the Sea
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
USGS	United States Geological Survey
UVC	Underwater Visual Census
WIO	Western Indian Ocean
WRA	Water Resources Authority
WWF	World Wide Fund for Nature

1 INTRODUCTION, PROJECT DESCRIPTION AND ESIA METHODOLOGY

1.1 Background information

The proponent of the Environmental and Social Impact Assessment (ESIA) study is Kenya Ports Authority (KPA), a state corporation mandated to maintain, operate, improve and regulate all scheduled seaports in Kenya. As part of this mandate, KPA has prepared a master plan for all scheduled seaports in Kenya and carried out a feasibility study on the viability of Shimoni Port. According to the feasibility study, Kenya's Exclusive Economic Zone (EEZ) has a catch potential of upto 300,000 tonnes per annum. The EEZ potential provides an opportunity to develop a fishing port and harness the benefits of the Blue Economy. The feasibility study findings demonstrate that the development of Shimoni Port will improve Kenya's maritime competitiveness. For instance, the port will enable the berthing of large fishing vessels such as purse seiners and trawlers, improve turn-around times and consequently ease pressure on Mombasa Port. Additionally, the development of the fishing port will enhance compliance with the Fisheries Management and Development Act, 2016 which requires all foreign fishing vessels to offload 30% of their total catch taken from Kenya's Economic Exclusive Zone. In the light of these benefits, KPA proposes to construct and operate a fishing port in Shimoni by first constructing a jetty and later a fully fledged industrial fishing port with a capacity of handling 50,000 tonnes of fish annually.

Prior to development of the port, KPA is required to obtain an EIA Licence from NEMA. Under the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya, transportation and related infrastructure projects including harbors and ports, activities in natural conservation areas including any project in environmentally sensitive area and any other project which possess high environmental risks are listed under the Second Schedule (4e, 13i and 15 respectively). The development of Shimoni Port is therefore a high-risk activity that should undergo an Environmental and Social Impact Assessment (ESIA) Study process. To comply with this legal requirement, Kenya Ports Authority contracted Envasses Environmental Consultants Limited to carry out the ESIA Study whose findings are detailed in the proceeding sections.

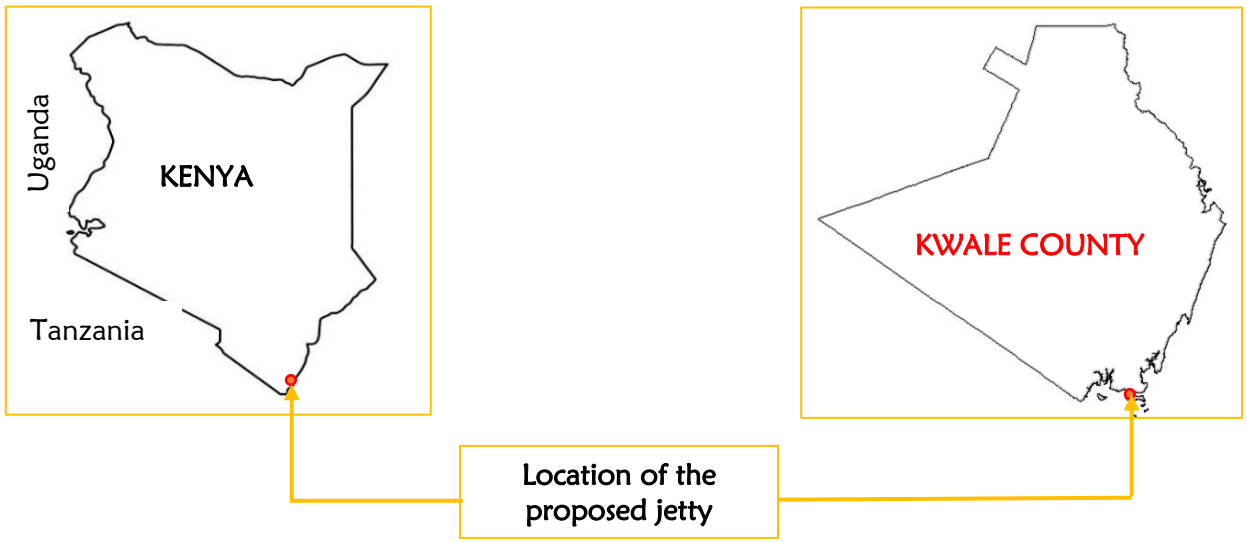
1.2 The location of the Shimoni Port

As discussed above, the shimoni port project will be implemented in two phases i.e. phase 1 will involve the construction of a Jetty and phase 2 a fully fledged industrial fishing port. The locations of the two phases are as follows.

1.2.1 Location of the proposed jetty

The proposed jetty will be located in Shimoni, Pongwe-Kidimu location, Lunga Lunga Sub-County of Kwale County at Latitude 4°38'51.78"S and Longitude 39°22'47.98"E (Figure 1). This site is located along a well sheltered ≈4Km Creek fringed by patchy mangrove stands which opens into the Kisite-Mpunguti Marine Park and Reserve; a major conservation area and a popular tourist's destination (Figure 1). The Park has rich marine life including fish, corals, seagrass, and sea mammals. In addition, the project sites overlook the Wasini Island at the opposite side of the Shimoni Channel (Figure 2). Notably, the project area has three other existing jetties i.e. the Shimoni, Kenya Wildlife Service and Wasini Island View Hotel jetties (Figure 3). The Shimoni Jetty is used for fish landing site and cargo handling including imports and exports while the other two jetties service the tourism sector by providing boarding and landing facilities for tourists' boats visiting Wasini Island and the Kisite-Mpunguti Marine Park and Reserve among other attractions.

The site neighbors the County Department of Fisheries offices, County staff houses, Wasini Island View Hotel (Figure 4), Kenya Wildlife Service (Figure 4), Shimoni landing site (Figure 5), Shimoni Slavery museum, Shimoni Slave caves, Shimoni Dispensary and Shimoni market area.



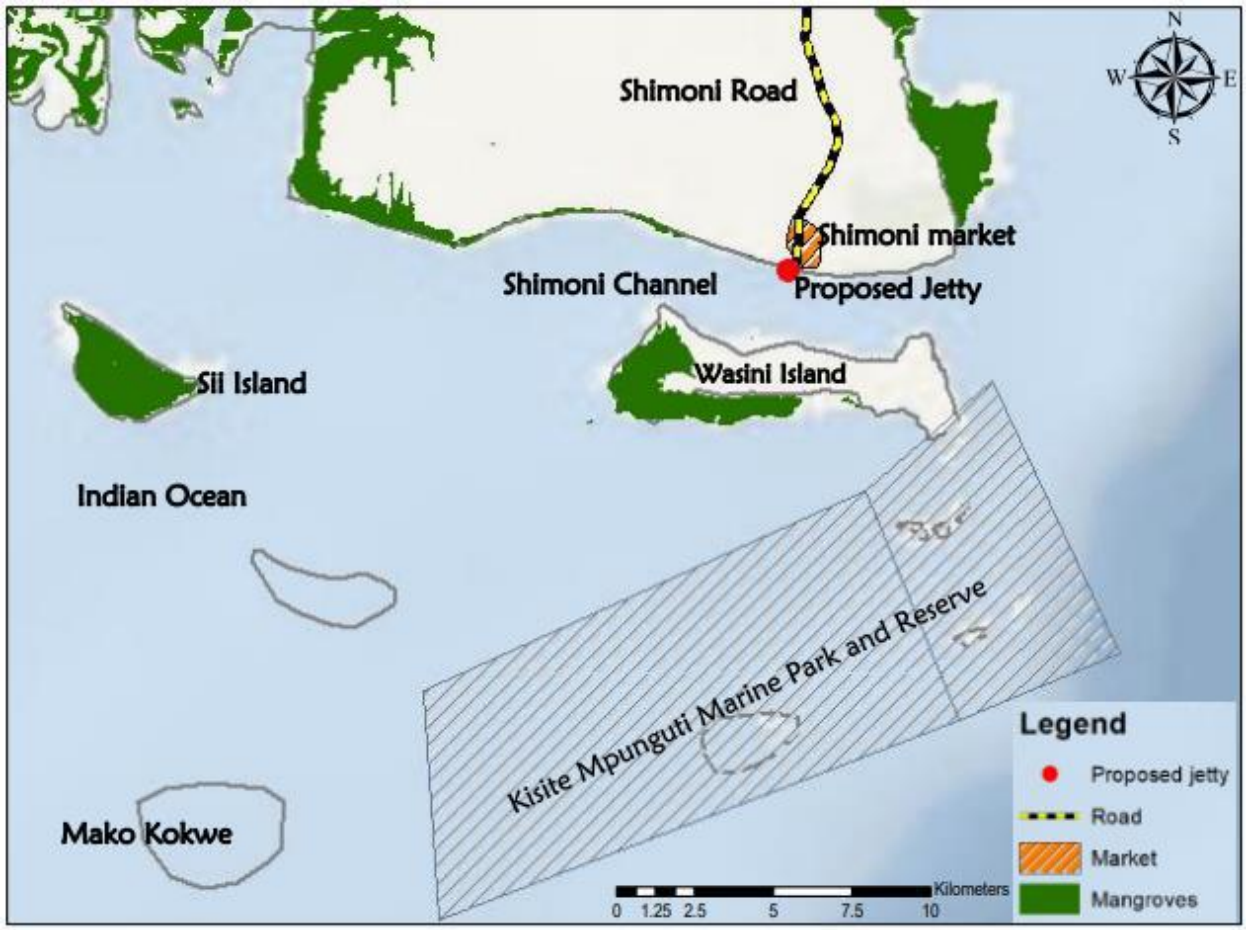


Figure 1: The location of the proposed jetty site (Source: Site visit, September 2020).

Figure 2: Wasini Island at the opposite side of the proposed project site (Source: Site visit, September 2020).

Figure 3: Wasini Island View Hotel's jetty (Left) and KWS floating Jetty (Right) which lies between the two proposed project sites. Both jetties service the tourism sector by providing boarding and landing facilities for tourists' boats (Source: Site visit, September 2020).

Figure 4: The Wasini View Hotel (Left) and the entrance to the Kenya Wildlife Service offices (Right) (Source: Site visit, September 2020).

Figure 5: The Shimoni fish landing site (Source: Site visit, September 2020).

1.2.2 Potential locations for the fully fledged industrial fishing port

From the Feasibility study conducted in 2018, there are four potential sites for development of the industrial fishing port (Table 1; Figure 6). These are;

- The far most west location of the Shimoni coastline (Kibuyuni area)-**Plot 1**
- The location west of the existing jetty (Next to Shimoni Garden Cottages)- **Plot 2**
- The location of the existing jetty and surrounding area- **Plot 3**
- The KPA owned land and surrounding area- **Plot 4**

Table 1: A description of the potential project location (Source: Maritime and Business Transport Solutions, 2018).

Plot	Description
Plot 1 (Kibuyuni area)	The project site is approximately 10km away from the Wasini channel estuary situated on the east hence this site is well protected from open sea influences. Since this site is located furthest away from the Shimoni village centre, an additional 8km of road needs to be constructed to guarantee a sufficient road connection. Since the amount of urban development in this area is limited, there is ample space available for future development. The land consists mainly of swamp/mangrove area hence not sufficient to build a port due to constructual difficulties. The cost to prepare the land in such a way it is able to absorb the required amount of pressure to construct the quay and the building is expected to be substancial. Additionally, the environmental impact to construct a port on this location is expected to be substantial, the highest among all identified locations on the Shimoni coastline.
Plot 2 (Next to Shimoni Garden Cottages)	The project site is approximately 6 to 7km away from the Wasini channel estuary situated on the east hence this site is well protected from open sea influences. However, the distance between Shimoni village centre and this particular site is about 3km for which an additional road needs to be developed to guarantee sufficient road connection. This location provides ample space for future port development. Compared

	to the location of the KPA owned land or the location next to the existing jetty, this specific land location holds substantially more mangrove area. The land is also within Changai landing site and a section of it is a seaweed farmland (3 blocks). The site is neighbored by some few settlements approximately 100m East.
Plot 3 (Next to the existing jetty)	The existing jetty and surrounding area are located approximately 2.5 km away from the Wasini channel estuary situated on the east. This location hence provides sufficient protection for open sea influences. The type of soil of the land and in front of the coast seems to consist mainly of coral and sand. Such type of soil is considered to be a solid foundation for future port construction. Since the village of Shimoni is directly located next to the existing jetty area, the available space for future port location is limited. Substantial relocation activities would be required to take place to build a future port at this location. There is limited amount of mangrove on the coastline in front of this site.
Plot 4 (KPA owned land)	The land is located East of Shimoni village; approximately 1Km away from Wasini Island thus susceptible to open sea influences compared to the sites located further in the channel. Moreover, there is no sufficient road connection from this site to Shimoni village and this will increase the cost for road development. The site offers ample space for current and future development. The environmental input at this site is expected to be minor since the amount of mangroves situated here is limited.

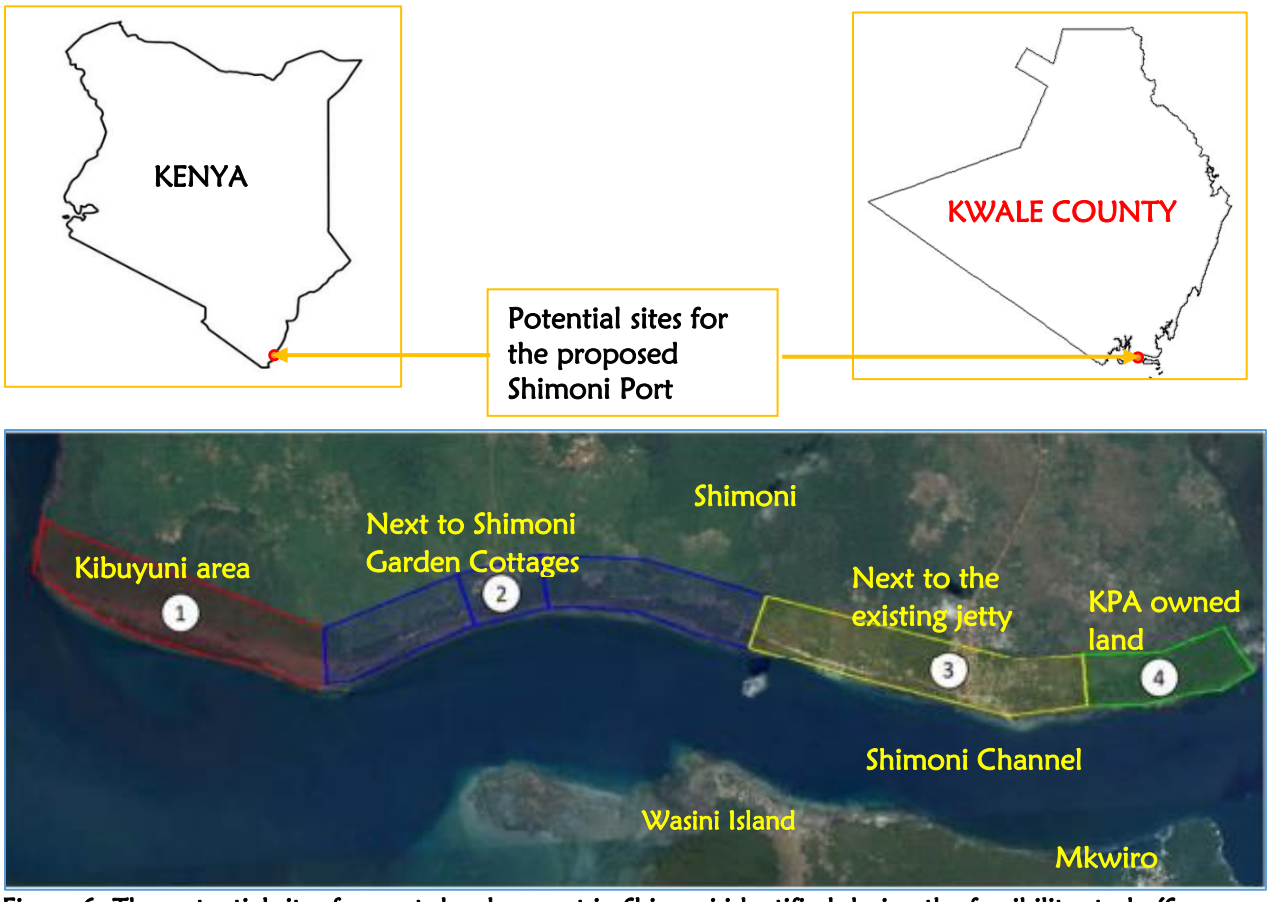


Figure 6: The potential sites for port development in Shimoni identified during the feasibility study (Source: Maritime and Business Transport Solutions, 2018).

1.3 Description of the proposed project activities

The project activities to be carried out are; construction of a jetty, renovation of a section of the fisheries buildings which will involve the removal and disposal of asbestos, potential dredging/dumping and construction of a fully-fledged industrial fishing port. The design and implementation of the proposed port will be in two distinct phases.

Phase 1 will involve the construction of between 86-150m long jetty (actual length will be determined based on the findings of an ongoing bathymetric survey for Shimoni Channel) with a platform of 75m to the west of the existing Shimoni Jetty (Figure 7). The rationale for the construction of an additional jetty is based on a need to separate the handling of fish from conventional cargo as it happens at the current jetty. Hence the existing jetty will handle conventional cargo while the new jetty will be dedicated exclusively to handle fish landings. The new jetty will also allow the berthing of large fishing vessels such as trawlers and purse seiners (Figure 8) and ease pressure on the Mombasa Port. Alongside the construction of the jetty, KPA will develop auxiliary infrastructure including offices, cold storage shed, fish auction market and warehouse among others. These infrastructural developments will be carried out on the landward area belonging to Kenya Fisheries Service.

A section of the existing fisheries offices and staff houses are roofed with asbestos sheets which are classified as hazardous wastes. Hence as part of the project activities, the proponent will remove and dispose off these asbestos sheets measuring approximately 600m^2 (Figure 9).

Phase 2 will involve an addition 75m platform to the new Jetty (bringing the total length to 150m and hence able to dock atleast two fishing vessels at a go), the construction of a fully-fledged industrial fishing port comprised of 150m quay wall with a wharf, a cold storage facility measuring 4,000m^2 and reefer facilities (Figure 10; Table 2). The construction of the industrial fishing port will be carried out in four potential locations identified during a feasibility study conducted by KPA in 2018 and which is currently being updated. These locations are Kibuyuni (Plot 1), Site to the west of the current jetty and next to Shimoni Gardens (Plot 2), existing jetty (Plot 3) and the KPA owned land in Shimoni (Plot 4). Some of these sites such as Plots 1 & 2, construction of the industrial port would involve dredging and dumping activities to achieve the desired draft of -8m to allow berthing of target fishing vessels such as purse seiners and trawlers.

The proponent is conducting a bathymetric and hydrographic survey which will further inform the decision on whether there is a need to dredge the channel or not. Potential dredging will improve navigation. The proposed dredger is shown in Figure 11. The dredged material will need to be disposed off responsibly. Following on the London Convention 1972 / 1996 Protocol (ANNEX III) criteria, the ESIA experts in consultation with the proponent and based on previous experience at Mombasa Port identified a suitable site for the potential dumping of the dredged material from the Shimoni Channel. The site is located 17 Km offshore (04.652388°S/ 39.529794°E) from the existing Shimoni jetty and has a depth of -400m.

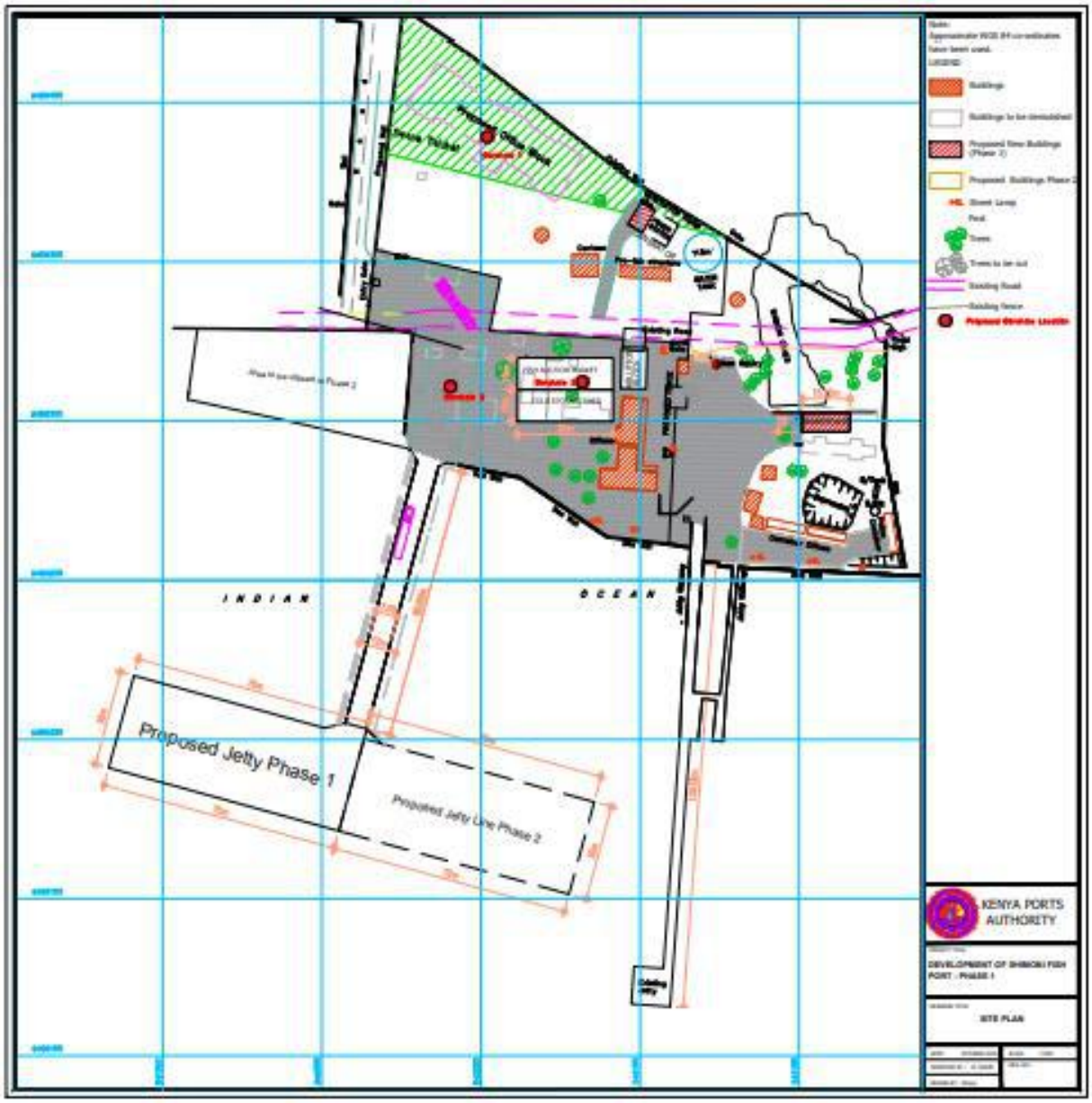


Figure 7: A conceptual draft layout of the proposed jetty (Source: KPA Master plan, 2019)

Figure 8: A trawler (left) and a purse seiner (right) (Source: divebuzz.com)

Figure 9: Fisheries staff houses covered with asbestos roofing sheets (Source: Site visit, September 2020).

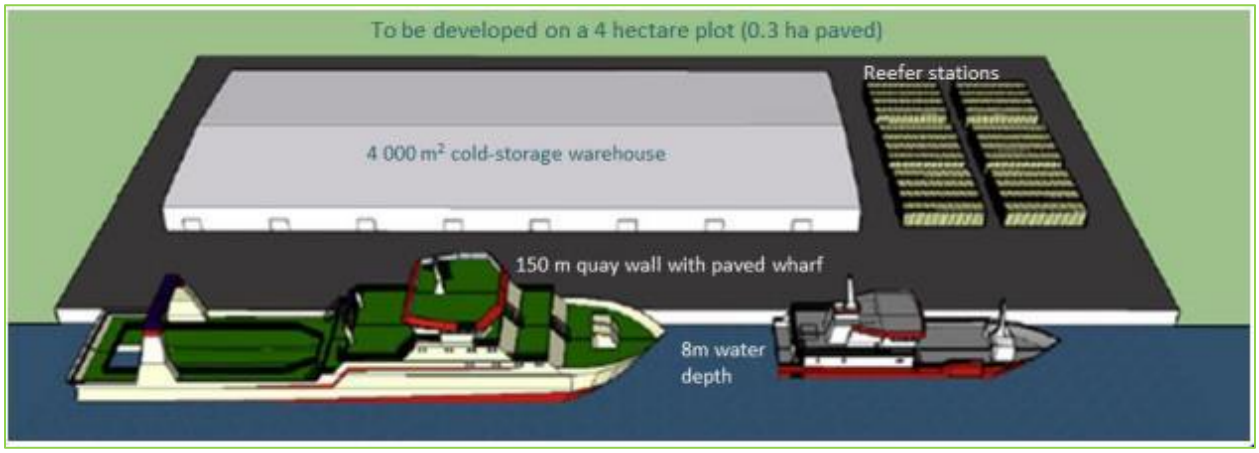


Figure 10: Conceptual design for the development of Shimoni industrial fishing Port (Source: KPA Master plan, 2019).

Table 2: Proposed Port facilities at Shimoni (Source: KPA Master plan, 2019).

Facility	Benchmark/rationale	Proposed dimensions
Plot size	0.13m^2 per ton of throughput (e.g. Port Victoria, Seychelles and Port Louis, Mauritius)	0.625 ha (minimum) (proposed 4 ha for future expansions or added activities)
Quay wall	2 x 90 m design vessel	150m long quay
Water depth	Vessel draft of 7.5 m	8m depth
Cold storage	0.08m^2 per ton of throughput (e.g. Port Victoria, Seychelles and Port Louis, Mauritius)	4,000m^2

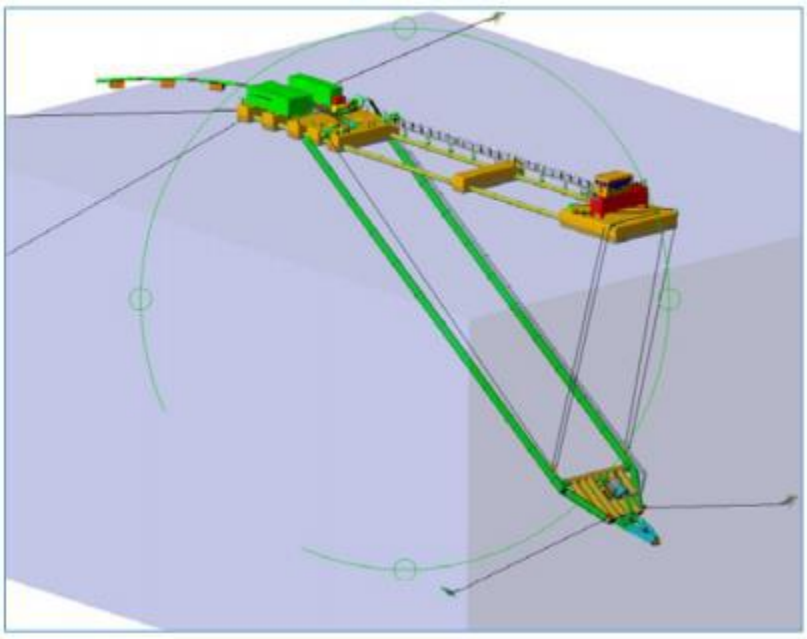


Figure 11: A sample modular dredger for dredging and offshore dumping of dredged material (Source: ESIA report for Kisumu Port, 2019)

1.4 Study approach and methodology

1.4.1 Introduction

The ESIA study report methods were guided by the Third Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. The consultants prepared a scoping report and Terms of Reference (TORs) as required under Regulation 11 of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003 and submitted them to NEMA for consideration for approval. The scoping report and TORs were approved on 10th September, 2020 and the consultants began preparation of the ESIA study report.

1.4.2 Data collection

The methods for carrying out the study included site visits and observations, literature review, bathymetric survey, baseline monitoring of water quality, sediment quality and classification, biological communities' assessment through diving and snorkelling, monitoring of ambient air, noise level measurements and holding consultative meetings with stakeholders. Site visits were carried out in September 2020 for purposes of area reconnaissance, assessing the baseline environmental conditions of the proposed project site and screening of environmental risks associated with the proposed development as well as the applicable environmental safeguards and standards. Environmental screening criteria was informed by the Second Schedule of the

Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. As per this schedule, the issues considered by the experts included ecological impacts, socio-economic issues, landscape changes, land use character and water (Table 3).

Table 3: Summary of the results from the screening and scoping exercise.

Criteria	Results
Ecological impacts	– Potential dredging will change the nature of marine habitat and reduce the biodiversity in the short run – Increased suspended sediments will affect filter feeding organisms as well as distribution of fish – Potential environmental risks to Kisite-Mpunguti Marine Park and Reserve and Community Conservation Areas – Water quality degradation of Shimoni channel
Social-economic considerations	– Contribution of the project towards attainment of Kenya Vision 2030 – The port will support the vision on the strategic development of the Kenyan Ports thus facilitating growth of the local, national and regional economies through increased capacity to handle exports and imports to and from Kenya – Increase fish processing capacity which is a key part of the blue economy hence ensuring food security – Employment creation – Revenue to the government through taxes & licenses – The project will improve artisanal fishing – The project may impact seaweed farming – Project will lead to influx of migrants into the area – Workers will be exposed to safety and health risks – Potential conflicts with local fishermen and tour operators if construction activities affect traditional fishing grounds and/or access to these areas is restricted or affect tourism operations
Landscape impacts	– The proposed project is not out of character with the surrounding – The landscape of the area will be altered and new views created
Land uses	– Land uses in Shimoni include residential, commercial and recreational – Project is consistent with land-uses in the area
Water	– There is a potential to pollute the marine environment from sedimentation during dredging and dumping activities, actual construction activities and waste water from the operational phase

1.4.3 Baseline environmental data

Baseline data focused on water quality, sediment quality and classification, biological communities' assessment, ambient air quality and noise levels measurements. The findings from the baseline survey will inform the critical limits for survival of species and the impact of the limits on livelihoods and communities. The approaches and methods used during the baseline survey are discussed below.

1.4.3.1 Water quality sampling and analysis

Baseline water quality sampling was carried out at the six (6) monitoring stations as per the baseline sampling points on 11th September 2020 by Polucon Services (K) Limited in collaboration with the consultants (Table 4, Figures 12 and 13). In each of these stations, three water samples were obtained at depths of -0.5m, -3m and at -6m depths. The water samples were then analyzed for

physicochemical parameters and microbial tests as per the Third Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006. The test parameters included pH, Temperature, Turbidity, Dissolved Oxygen, Perspective Degree, Total Suspended Solids, Chemical Oxygen Demand, Biological Oxygen Demand, Total Plate Count, Total Coliforms and *Escherichia coli,* Ammonia and Oil and grease.

Table 4: Water Quality Monitoring Stations selected within the Shimoni Channel.

Sampling site code	Location description	Coordinates
Monitoring Station 1	Shimoni Jetty	-04.648928°S / 39.380985°E
Monitoring Station 2	Kibuyuni	-04.644000°S / 39.335550°E
Monitoring Station 3	Madyoka Island	-04.642854°S / 39.297651°E
Monitoring Station 4	Mkwiro	-04.656756°S / 39.380417°E
Monitoring Station 5	Nyuli	-04.658323°S / 39.461767°E
Monitoring Station 6	Potential dumping site	-04.652388°S / 39.529794°E

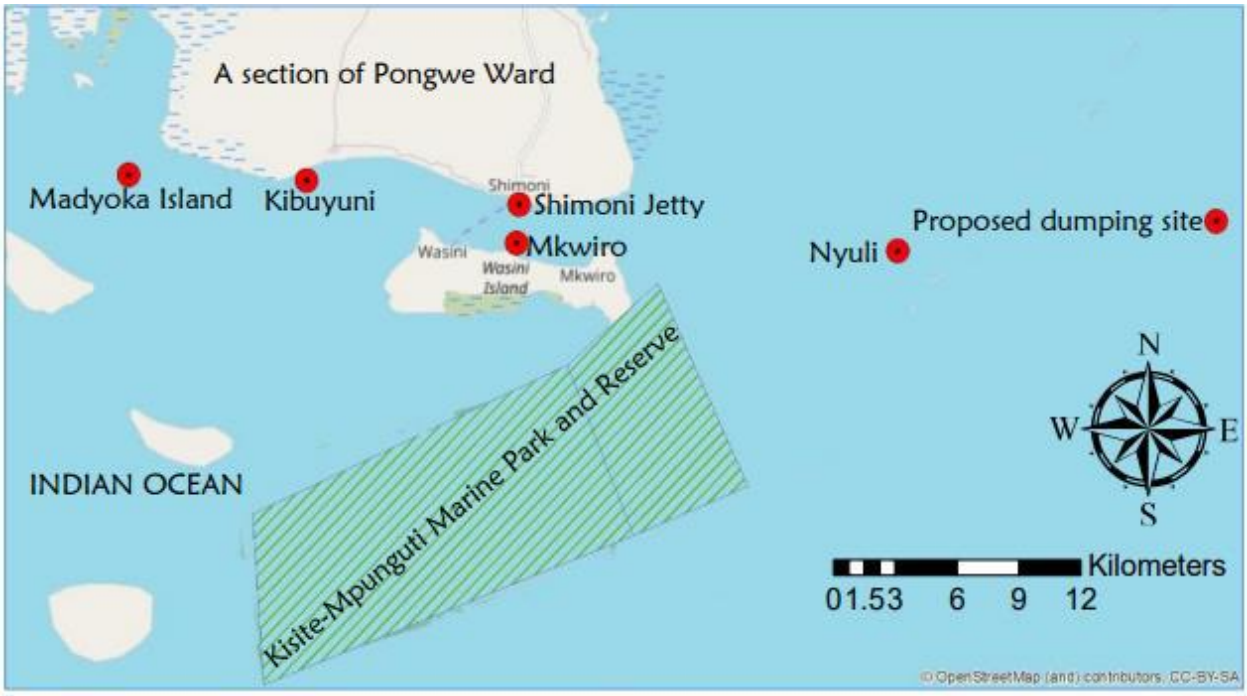


Figure 12: Water quality monitoring stations selected within the Shimoni Channel (Source: Field survey, September 2020).

Figure 13: Baseline water quality monitoring at MS4 (left) and MS6 (right) on 11th September 2020 (Source: Site visit, September 2020).

1.4.3.2 Biological communities' assessment

To assess and address issues and concerns of the impacts of the proposed port development project, and the associated dredging and dumping activities, a biological baseline study was conducted with careful selection of study site locations focusing on flora and fauna in 3 communities: water column, soft sediment and hard substrate habitats, critical habitats and the Marine Protected Area. The following section details on the biodiversity survey conducted.

1.4.3.2.1 Plankton surveys

1.4.3.2.1.1 Phytoplankton Distribution & Diversity

In order to ascertain the baseline status of the phytoplankton community in the Shimoni Channel and the vicinity of the proposed Shimoni port, samples were collected by filtering 20 litres of surface seawater through a 20-micron mesh phytoplankton net, and fixed using Lugol's reagent at the sampling site (Figure 14). The samples were then transported to the laboratory at Kenya Marine & Fisheries Research Institute analyses, encompassing taxa identification and enumeration using the sedimentation technique as described by (Utermöhl, 1958; Arhonditsis G.B et al., 2004). In the laboratory, an Inverted microscope was used for observation and the phytoplankton genera identified using keys by Botes, (2003) and Carmelo, (1997). Whenever possible, identification was carried out to the species level, although in most cases, the keys identifications were limited to the genus level.

Figure 14: Baseline phytoplankton sampling within the monitoring stations on 10th and 12th September 2020 (Source: Site visit, September 2020).

1.4.3.2.1.2 Zooplankton Distribution and Diversity

The zooplankton community is an important element of the marine food chain and the zooplankton act serve as intermediary species in the food chain, transferring energy from planktonic algae (primary producers) to the larger invertebrate predators and fish who in turn feed on them. Consequently, the zooplankton community is a key indicator of the health of the fisheries in coastal marine environments.

To decipher the status of the zooplankton community within the proposed Shimoni port, a zooplankton net of 250-micron mesh size and 30cm diameter fitted with a flowmeter on the mouth opening was towed horizontally at 6-10 m depth at 4 knots towing speed for 20 minutes. At the end of the tow, the flowmeter reading was recorded before emptying the sample for processing, and then a replicate tow was conducted.

During sampling, zooplankton captured on the net code end were washed thoroughly and transferred into a sample bottle and preserved in 5% v/v buffered formaldehyde and seawater solution for laboratory analysis (Figure 15). The Zooplankton samples were then identified to the lowest taxa possible, generally species or genus with a stereo-microscope and referenced to identification kit. “Guide to the coastal and surface zooplankton of the south-western Indian Ocean” by (Conway, White, Hugues-dit-Ciles, Gallienne, & Robins, 2003).

Figure 15: Baseline zooplankton sampling within the monitoring stations on 10th September 2020 (Source; Site visit, September 2020).

1.4.3.2.2 Coral reef biodiversity

1.4.3.2.2.1 Introduction

Underwater Visual Census survey (UVC) were conducted using SCUBA gear (Figure 16), with clear focus on coral reef habitats lying between 5-14 m, spanning the depth range of the main coral reef habitats in the Wasini/Shimoni Channel. At each site, data on fish assemblage (abundance and diversity), benthic characteristics and invertebrates were collected using standard underwater visual census (UVC) techniques for coral reef biodiversity adopted from Samoilys and Carlos (1992), English et al, 1997 and Obura and Grimsditch (2009). Detailed methods for each variable collected are described below.

Three sites, namely Kibuyuni, Mkwiro and Nyuli were selected for the baseline survey based on the distribution of coral reefs and healthy benthic habitats from published literature (Bolton et. al, 2007; KWS, 2015a; 2015b). The three (3) sites were considered as representative of the coral reef ecosystems around the Shimoni Channel in terms of depth, habitat conditions and exposure, in addition to being in close proximity to the proposed site for the Shimoni Port sites (Figure 17).

Nyuli is an exposed site located at S 04°41.438', E 039°25.775 and consists of rich coral growing area (hard corals and soft corals) interspersed with sandy and rubble areas from depth of 8m to

15m. Mkwiro is a sheltered shallow coral reef area located at S 04°39.562', E 039°23.369 adjacent to Mkwiro Village at Wasini Island. The main coral reef growing areas starts at a depth of about 5m to 8m and this changes to sandy habitat as you move to the deep areas towards the middle of Shimoni channel. Kibuyuni is sheltered and located at S 04°38.640', E 039°20.133' south of Shimoni village and consisted of a shallow reef adjacent to the seaward farm. The reef is narrow strip and runs parallel to the shore and is bordered by fine sand/silt on the south seaward side and seagrass and high sediment areas towards the shore. Nyuli is close to the reserve within Kisite Mpunguti Marine Park and Reserve while Mkwiro and Kibuyuni are within the community conservation areas of the Mkwiro and Kibuyuni BMUs, respectively.

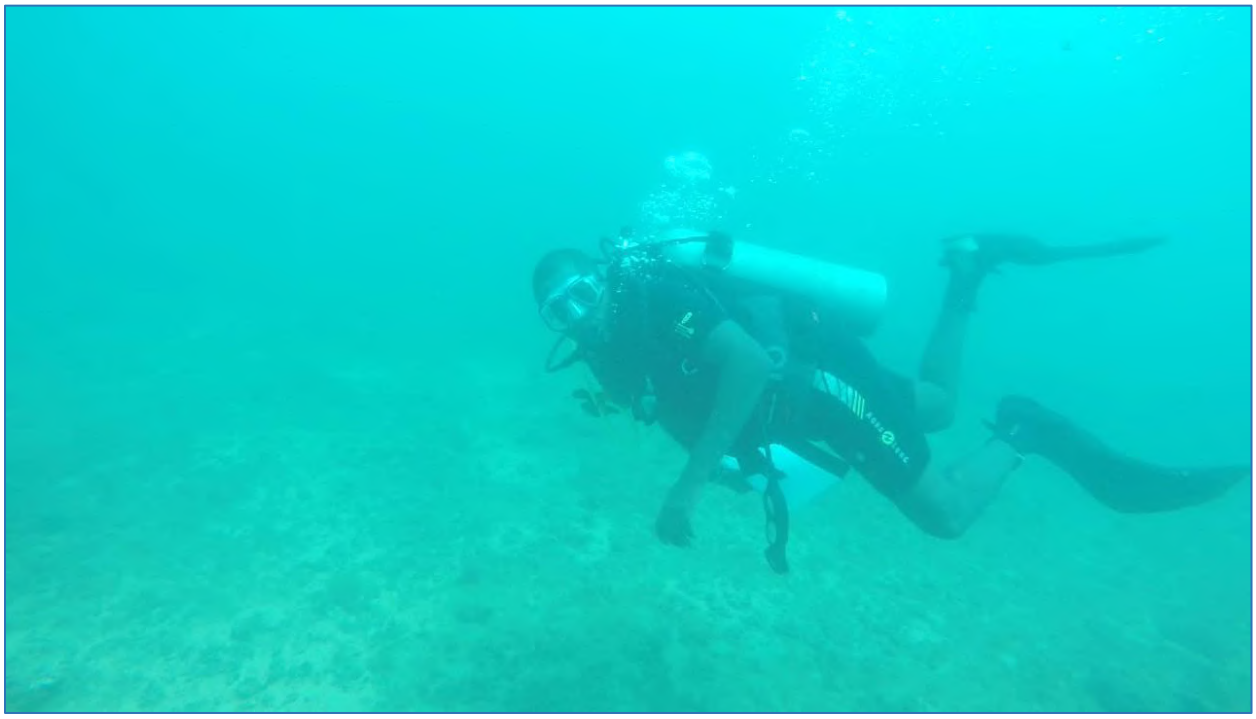


Figure 16: A diver carrying out baseline biological monitoring at Shimoni Channel (Source: Site visit, September 2020).

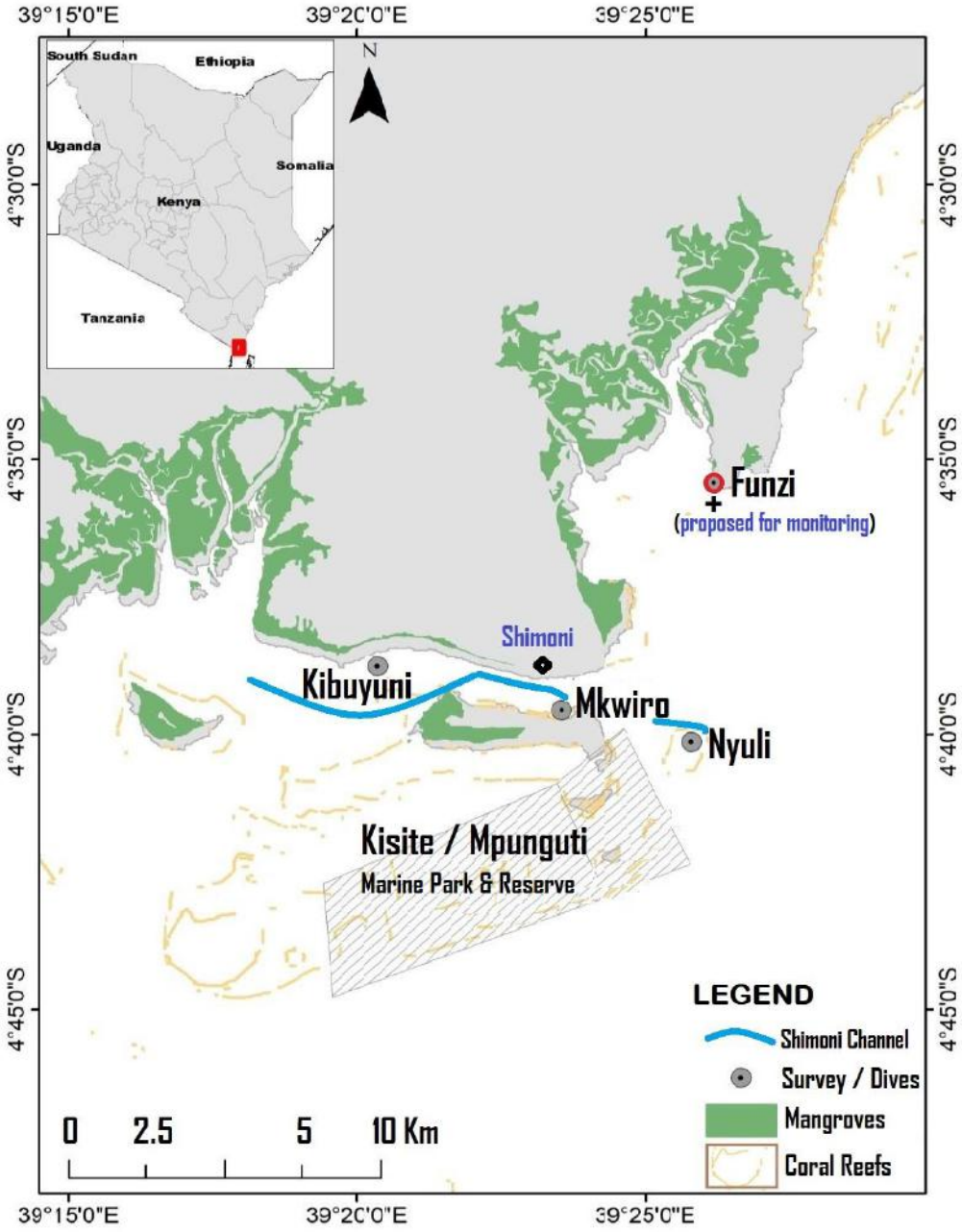


Figure 17: A map of Kenya (inset) showing location of Shimoni village, the Shimoni channel and the survey/dive sites for benthic (corals / Seagrass) habitat monitoring.

1.4.3.2.2.1 Fish abundance and diversity

For abundance data, a belt transects measuring 50 x 5m was placed randomly on the reef substrate. Along the transect, species from 13 preselected families were identified and enumerated. The 13 preselected families are known indicators of coral reef biodiversity (*Acanthuridae*, *Chaedontidae*, *Scarinae*, *Lutjanidae*, *Caesionidae*, *Balistidae*, *Kyphosidae* and *Pomacanthidae*), fishery importance (*Lethrinidae*, *Haemulidae*, *Siganidae* and *Nempteridae*) and large vulnerable families (*Serranidae*). These families also encompass various trophic groups that influence important ecological processes. Density was standardized to individuals per hectare. All other species encountered throughout the dive were recorded (not enumerated) to provide presence and absence data for fish community diversity. Species identifications were checked using taxonomic references (Lieske and Myers 1996).

1.4.3.2.2.2 Benthic characteristics

Benthic characteristics indicates the state of reef condition and important in assessing phase shifts of coral reef communities to other forms and their health status. Point-intercept method was used in assessing the benthic characteristics, where the substrate directly below the transect tape was recorded every 50 cm along 25 m transect. This gave a total of 50 points per transect and a total of 150 points per site. Points were standardized to 100 giving the percentage cover of each benthic category. Major benthic categories namely hard coral, dead coral (defined as recently dead coral skeleton with intact corallite structure), soft coral, crustose coralline algae, fleshy macroalgae, turf algae, invertebrates, sand, rubble, silt and seagrass were recorded. Hard corals were surveyed to the genus level.

1.4.3.2.2.3 Benthic invertebrates

Benthic invertebrates are important indicators of benthic health as well as other external disturbances such as sedimentation. Belt transect measuring 50 x 5m was used to assess the diversity and abundance of invertebrates. All invertebrate taxa identified to the lowest level possible are counted. Underwater video transects were recorded using a gopro Hero4 camera in an underwater housing on a medium field of view. The video was taken at approximately 1m above the substrate at a constant speed covering a 50m transect in 5 minutes. The videos were analysed and all coral genera and fish species not recorded in the transects were recorded. This provided a coral general and species richness on a wider scope that the $25m^2$ and $250m^2$ respectively. A total of 3 transects and 18 quadrats were carried out across all the sites.

1.4.3.3 Bathymetric survey of the potential dumping site

Bathymetric survey was carried out at MS6 (potential dredged material dumping site) on 12th September 2020 by Kenya Marine and Fisheries Research Institute in collaboration with the consultants. Depth soundings were obtained using a Raymarine Dragonfly echo sounder mounted on the mid-section of an outboard vessel at a depth off-set of 0.5m, and which was subsequently recovered during the data analysis (Figure 18). The depth soundings were activated as soon as the echo sounder was sub-merged and operated on the Sonar/Map mode. All the readings were in SI units. Prior to the survey, geographic coordinates were generated on the WGS84 datum without projections and subsequently uploaded into a GPS. These points were used to navigate the vessel using the map mode of the GPS so that the tracking lines may be visible at all times. Subsequent soundings were adjusted to the Lowest Astronomical Tide (LAT) based on the Mombasa Chart datum.

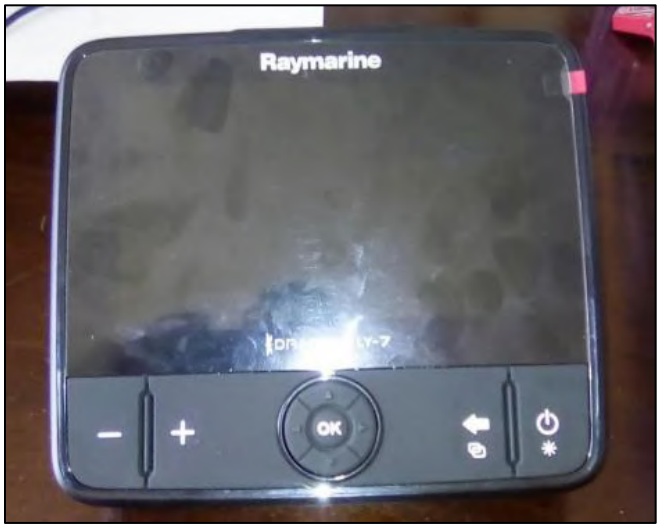


Figure 18: The Raymarine-Dragonfly Eco Sounder display and controls unit used during the bathymetric survey at MS6 on 12th September 2020 (Source: Site visit, September 2020).

1.4.3.4 Sediment quality sampling and analysis

Surface sediment samples were collected from the sampling stations using a KC Denmark A/S Van Veen Grab 250 cm², KC Denmark Oceanography Limnology sediment sampler (Figure 19). Replicate grab samples were homogenised to give surface samples and stored plastic containers for particle size and organic matter analysis in KMFRI laboratories. The sediment particles distribution analyses were conducted using leaser Mastersizer 3000 and Mastersizer 3000E particle characterisation system and referenced to Wentworth (1922) grain size classification. While carbon content was determined by combustion method, Loss of Ignition (LOI) as described by; (Howard et al., 2014).

Figure 19: Baseline sediment quality sampling at MS2 on 10th September 2020 (Source: Site visit, September 2020).

1.4.3.5 Ambient air quality measurements

A Fixed-Point monitoring strategy was used to obtain baseline ambient air quality for the proposed project which was conducted on 11th September, 2020. Air monitoring was conducted at the Proposed Project Site 1 over a 1-hour duration weighted average period and a calculated 24-hour time weighted average period for the measurements of Nitrogen dioxide, Sulfur dioxide, particulate matter (dust particles), Hydrogen Sulphide and Carbon Monoxide (CO). Sampling of gases was done by use of Instrumex AQM 910 series (Figure 20) which uses a mix of sensor technologies. Sampling for nitrogen dioxide, sulfur dioxide, hydrogen sulphide and carbon monoxide (CO) was done using the gas sensitive electrochemical methods of active and continuous sampling. Dust was sampled using the laser particle sensors. The results interpretation and analysis as well as sampling duration information was used to calculate the gases concentrations.

1.4.3.6 Baseline noise levels measurements

Noise measurements were conducted at the Proposed Project Site 1 for 24 hours. Prior to recording the noise measurements, an inspection of the monitoring points and implicated activities of the area was undertaken. Noise levels were determined using TES-1358C Sound analyzer (Figure 20), with an inbuilt, ⅓octave/octave band filter which does real time and octave analysis. The noise level meter was raised 2 meters above the ground and fitted with a ½" electrets condenser microphone with a measurement range of between 30 - 130dB and a frequency range and

weighting of 25Hz – 10KHz and A, C & Z respectively. For all measurements taken to establish the ambient noise levels, the equivalent noise level (LAeq), the sound pressure level at 5%, 50% & 95% (L5), (L50), (L95) respectively during that measurement period at 1-hour interval. The noise levels were measured in terms of the A-weighted equivalent continuous sound pressure level Leq. Each individual measurement were taken simultaneously with the nature of the noise climate of the area. This involved an auditory observation and identification of noise incidents influencing the noise level meter readings by the surveyor.

Figure 20: Baseline air and noise monitoring conducted at the existing Shimoni jetty (Source: Site visit, September 2020).

1.4.3.7 Stakeholder engagement strategy

1.4.3.7.1 Introduction

Public and stakeholder participation in the ESIA process was conducted pursuant to the following International and National legal instruments;

A) International Legal Instruments that make Stakeholder Consultation and Public participation during Environmental Impact Assessment process mandatory
   1. Aarhus Convention
   2. United Nation Conference on Environment and Development
   3. Convention on Environmental Impact Assessment in a Trans-boundary Context
   4. Principle 17 of the 1992 Rio Declaration on Environment and Development
   5. Agenda 21

B) National Legal instruments that make Stakeholder Consultation and Public participation during Environmental Impact Assessment process mandatory
   1. Constitution of Kenya 2010 Article 69 (1) (d)
   2. Section 59 of the Environmental Management and Coordination Act (EMCA), 1999

3. Regulation 35 of the Environmental (Impact Assessment and Audit) Regulations, 2003

1.4.3.7.2 Stakeholder mapping

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

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

Nine key stakeholder categories were identified. These are;

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

The consultant then identified the key contact persons within the stakeholder categories who will be engaged throughout the ESIA study process. The identification of the key contact persons was done in consultation with the proponent, lead agencies (State Department of Fisheries, Aquacultue and Blue Economy, Kenya Wildlife Service, Kenya Marine and Fisheries Institute, Kenya Forest Service, Ministry of Tourism, NEMA among others), the County Government of Kwale, Ministry of Interior Coordination of National Government, Residents Associations, Community Groups, Non-Governmental Organizations and Conservation groups who include international conservation organizations such as World Wide Fund for Nature (WWF).

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

a) Stakeholder management outline

Table 5 presents the stakeholder management plan outline focusing on the stakeholder categories and responsibilities.

Table 5: Stakeholder engagement plan outline.

Stakeholder category	Engagement strategy	Responsibility
County and National Government	Invitation letters and participation in consultative meetings	Consultant and KPA
Lead agencies and community organizations	Invitation letters, courtesy calls and participation in data and information gathering and consultative meetings	Consultant and KPA
Civil society	Invitation letters, courtesy calls and participation in consultative meetings	Consultant and KPA
Conservation groups	Invitation letters, courtesy calls and participation in consultative meetings	Consultant and KPA
Local community and residents' associations	Invitation letters, courtesy calls and participation in the consultative meetings	Consultant, KPA, Ministry of Interior and Coordination of National Government
Opinion leaders	Invitation letters, courtesy calls and participation in consultative meetings	Consultant, KPA, County Government of Kwale, Ministry of Interior and Coordination of National Government
Faith Based Institutions	Invitation letters, courtesy calls and participation in consultative meetings	Consultant and KPA
Special Interest Groups	Invitation letters, courtesy calls and participation in consultative meetings	Consultant and KPA
Media	Invitation letters and courtesy calls	Consultant and KPA

Following the analysis, eight public consultative meetings were held with the local community and the key stakeholders. These included;

- A series of community consultative meetings held on 10th September 2020 in Shimoni and Kibuyuni villages, on 14th September 2020 in Majoreni village, on 15th September in Mkwiro village and on 2nd October 2020 at the County Fisheries' offices in Shimoni for the residents of Wasini.
- Two stakeholder consultative meetings to review the draft ESIA report held on 2nd and 6th October 2020 at the County Fisheries' offices in Shimoni.
- A stakeholders' meeting to validate the ESIA study report held on 14th October 2020 at the County Fisheries' offices in Shimoni.

Prior to the ESIA process, the proponent had engaged the National Government, County Government of Kwale and the Kwale County Assembly as shown in Table 6 below.

Table 6: The proponent's framework for stakeholders' consultation prior to the ESIA Study (Source: Kenya Ports Authority).

Stakeholder	Method of consultation	Remarks
National Government	Board Room meeting	A board room presentation was conducted to the County Commissioner, his deputies and security heads in Kwale Matuga on Thursday 12th september 2019. The story ran in the Daily nation of 13th September.
County Government of Kwale	Board Room Meeting	A board room presentation was made to the Governor, his cabinet and chief officers in Kwale Matuga on Thursday 12th september 2019. The story ran in the Daily nation of 13th September
Kwale County Assembly	Conference Meeting	A conference was held at bahari beach in Mombasa with all the County Assembly members and the speaker

2 BASELINE INFORMATION ON SHIMONI PORT AREA AND MONITORING FINDINGS

2.1 Climate

The project site lies in the hot tropical region where the weather is influenced by the Migratory Inter-Tropical Convergence Zone (ITCZ) characterized by monsoon winds. Climate and weather systems are dominated by large-scale pressure systems of the Western Indian Ocean (WIO) with two distinct monsoon periods. The weather is dominated by the Northeast Monsoon (Kaskazi) which is comparatively dry from November to early March.

During March and April, the monsoon winds blow in an east to south-easterly direction (Kusi) with strong incursions of air from the Indian Ocean bringing heavy rains. Between May and August, the South-easterly monsoon gradually sets in and the weather becomes more stable comparatively cooler temperatures. There is a 1 – 2 month's transition period between the two seasons characterized by variable and weaker winds. Annual rainfall follows a strong seasonal pattern peaking between late March and early June. Another smaller peak of rain occurs between October and November but decreases rapidly from December to a minimum during January and February. The average annual rainfall for the area has been recorded as 940mm. Temperatures are fairly constant throughout the year ranging from 23°C to 28°C. The warmest temperatures are generally recorded during the months of November to April (mean daily temperature of 27°C) while slightly cooler temperatures are experienced from May to October (mean daily temperature of 24.5°C). Relative humidity is high all year round, reaching its peak during the wet months of April to July (Figure 21).

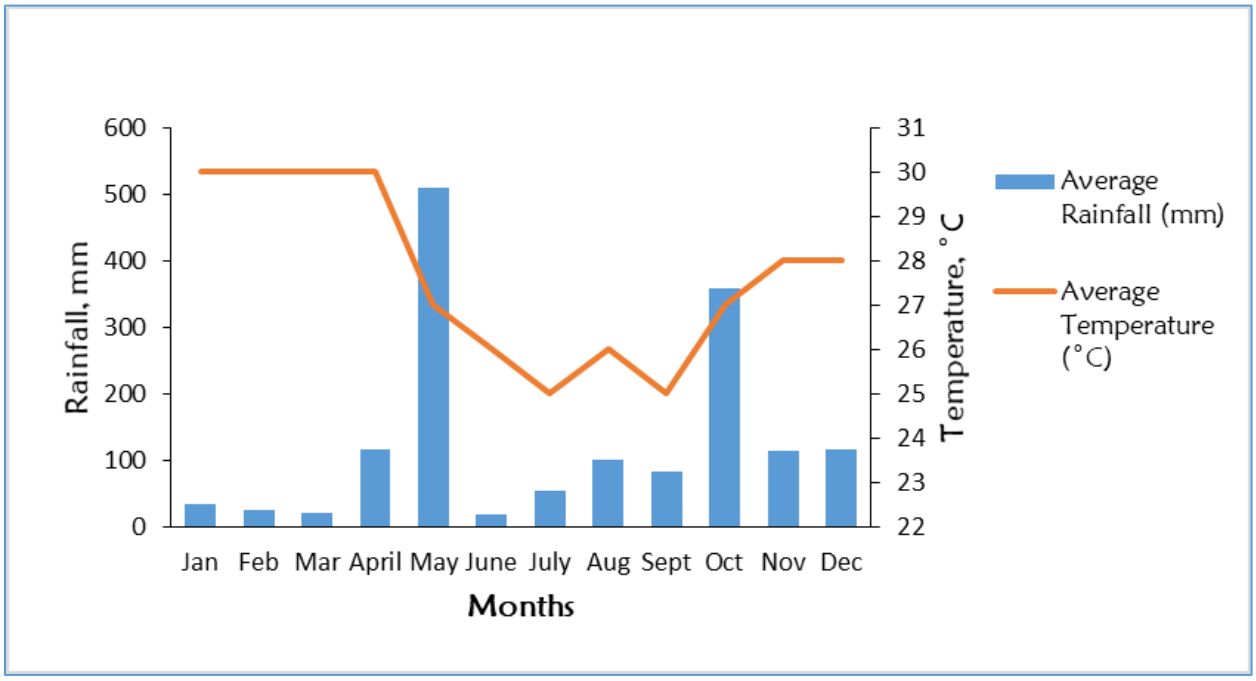


Figure 21: Average rainfall and temperature distribution of Shimoni area in 2019 (Data Source: World Weather Online).

2.2 Land use and Land cover

The land-use/ land-cover within the project area comprises of built-up areas, agriculture, mangroves, mudflat, water body (Indian Ocean), vegetation (trees, shrubs and grass) and bare land as presented in the map below (Figure 22). The classification was done using a 2019 Landsat image downloaded from USGS earth explorer website and applied maximum likelihood algorithm with

a supervised signature extraction. The community in Shimoni area is heavily reliant on fisheries and tourism.

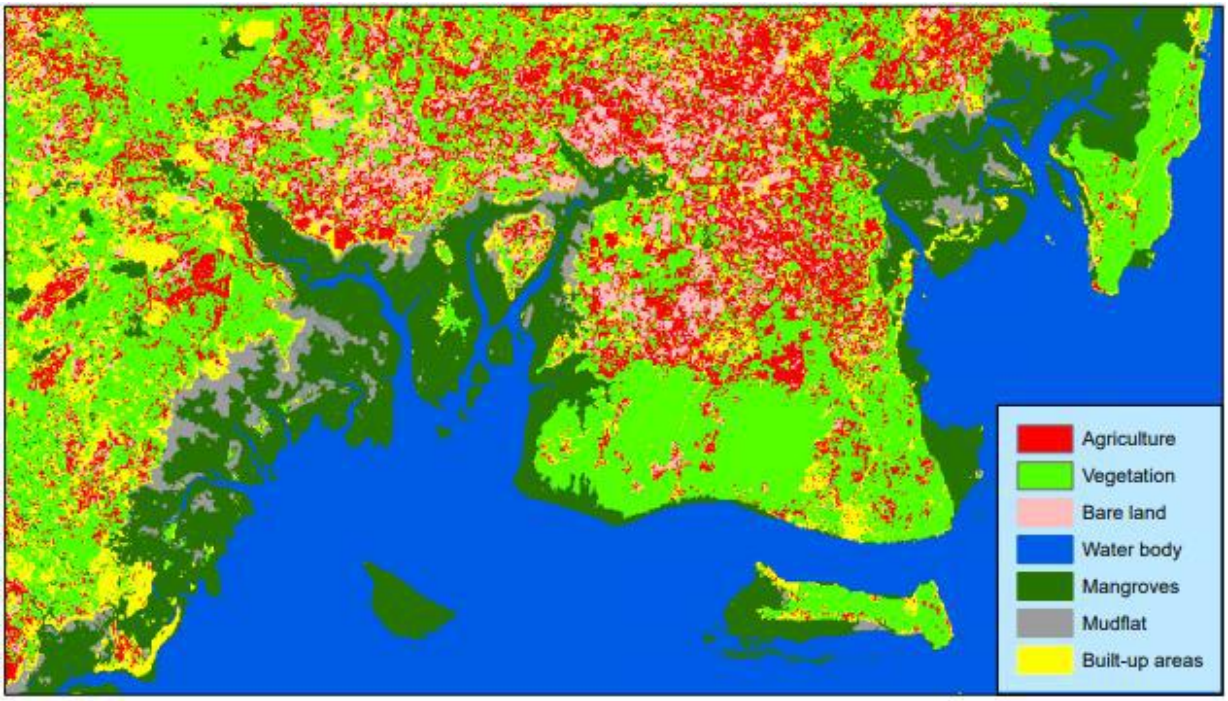


Figure 22: Land-use/ land cover within the project area (Source: Envasses Environmental consultants Limited, September 2020).

2.3 Terrestrial flora and fauna

The terrestrial flora within the project site and neighborhood include the Indian almond - *Terminalia catappa* (Figure 23), Red Jacaranda (Figure 23), Neem trees- *Azadirachta indica* (Figure 24), Baobab tree- *Adansonia digitata* (Figure 25), Pine tree, coconut trees, mango trees, shrubs and grasses among others (Figure 26). The fauna is mainly comprised of birds and domesticated animals.

Figure 23: Indian almond tree (Left) and Red Jacaranda tree (Right) at the County Fisheries' offices in Shimoni (Source: Site visit, September 2020).

Figure 24: Neem (Left) and Baobab (Right) trees at the County Fisheries' offices in Shimoni (Source: Site visit, September 2020).

Figure 25: Baobab trees within the project area (Source: Site visit, September 2020).

Figure 26: Some vegetation cover near Shimoni Garden Cottages comprising of coconut trees, mango trees, shrubs and grasses among others (Source: Site visit, September 2020).

2.4 Population and livelihood

According to the 2019 census results, the population of the larger Kwale County has risen from 649, 931 in 2009 to 866,820 people in 2019. The population density has also increased from 105 persons per square kilometer in 2009 to 108 persons per square kilometer in 2019. While it may appear that this population density is way below the county population density of 108 persons per sq. km, all the villages within the project area of Pongwe-Kidimu location have relatively higher population densities as high as 393 persons per sq. km (Table 7). The majority of the population relies heavily upon traditional fishing, tourism (Figure 27), curio trade, tour vending (Figure 28), subsistence agriculture, and exploiting forest resources.

Table 7: Population by Sex, Number of Households and density in project area (Pongwe Kidimu) Location (Source: 2019 census report).

Sub-county	Male	Female	Households	Density
Shimoni	3,370	3,150	1,618	393
Wasini/Mkwiro	963	957	327	474
Majoreni	4,439	4,698	1,681	151
Kibuyuni	10,396	10,780	40,211	159

Figure 27: Water vessels used for fishing and ferrying cargo (left) and tourism (right) purposes anchored at the existing Shimoni Jetty (Source: site visit, September 2020).

Figure 28: Vending activities as observed within the project area (Source: Site visit, September 2020).

2.5 Oceanography

The inshore waters of Kenya experiences semi-diurnal tides with a spring tidal range not exceeding 4 m (Brakel 1982; Tychsen 2006). The coastal offshore waters experiences swell whose magnitude varies in different periods of the year. During the Northeast monsoon season, 80% of the swells originate from the Northeast with a maximum significant height of 6m. The sea is usually calm during the inter-monsoon period (March-April) and wave height drops significantly to 2.5m shifting clockwise to a southerly approach with large fluctuations. The waves are usually very large with a maximum significant height of 8m during the Southeast monsoon (May-October) approaching the coast predominantly from Southeast and Southwest direction. Calm conditions follow during the inter-monsoon period and waves tend to approach the coast from a Northeast direction.

The offshore current system off the Kenyan coast is part of the alternating cycle of the Southeast monsoon and the Northeast monsoon (Knox and Anderson 1985, Schott and McCreary 2009). The cycle is caused by alternating high and low pressure systems over central Asia and south of 20˚S latitude (Okoola, 1999).The predominant monsoon-driven surface currents off the Kenyan coast are the East Africa Coastal Current, the Somali Current and the Equatorial Counter Current. The East Africa Coastal Current flows northward throughout the year. On the other hand, the Somali current is a typical seasonally reversing current with the current flowing northward during the South East monsoon at a maximum speed of about $2ms^{-1}$. During the Northeast monsoon, the Somali current flows southward at a speed of $1.5\text{-}2ms^{-1}$. The reversed Somali Current meets the East Africa Coastal Current at latitude 2.25˚S to form the eastward flowing Equatorial Counter Current which flows as an undercurrent. The width of East Africa Coastal Current is 160-200km with its maximum depth at about 400m.

2.6 Geology, soil and topography

The geology of the Kenyan coast is composed of sediments from the Tertiary, Cretaceous, Jurassic, Triassic to the Precambrian ages. Kwale County has a mixed geology which can be attributed to East African Rift System that is characterized by intense geological processes. The coastal region is generally low-lying and characterized by an extensive fossil reef, which lies a few meters above present sea level. The coastal environment is set in a passive continental margin.

Kwale County is divided into four major topographic features namely the Coastal Plain, Foot Plateau, Coastal Uplands and Nyika Plateau. The project site is located along the Coastal Plain which is a strip of land that consists of corals, sands and alluvial deposits. The Foot Plateau has a flat plain surface with high potential permeable sand hills and loamy soils. It is composed of Jurassic rocks and sandy hills consisting of Magarini sands ideal for sugar cane growing.

The rocks within the project area are essentially of sedimentary origin and range in age from late Carboniferous to Recent. Most parts of the area is underlain by the coral reef which are in turn overlaid by sands whikle the subsurface is composed of coral breccias and exposure of coral reef and sand at the surface. Watering and sedimentation from the tide action has resulted in the coral gravel between the coral rock sections.

The county is also known for its white sand beaches. The Coastal Uplands which is also known as Shimba Hills is an area of medium to high agricultural potential. It is made up of five sand stones hills namely Shimba Hills, Tsimba, Mrima and Dzombo. The Nyika Plateau is a semi-arid area with largely poor soil. The Nyika Plateau is characterized by basement rock system with the exception of occasional patches of reddish sandy soils and occupies over a half of the county.

2.7 Water resources

Water forms one of the basic natural resource for the sustainable development and human wellbeing. In the coast of Kenya, most of the water consumed is obtained from rivers, lakes, springs, ground water aquifers, sand dunes and shallow wells. The main water resources in Kwale County comprise of rivers (7), shallow wells (693), springs (54, protected and unprotected), water pans, dams (6), rock catchments and boreholes (110). However, most of the rivers are seasonal thus cannot be relied upon to supply the much needed water in the county for both agriculture and household uses. Kwale Water and Sewerage Company is mandated by the Coast Water Services Board to supply/distribute, control and manage all the water supply schemes within the county. Private water service providers in liaison with the Kwale water services board have been supplying water to the community to ensure water is available for all. Other water supply schemes include community owned and managed boreholes, dams and even water pans. Shimoni area lacks reliable supply of fresh water thus many locals depend on wells for water, which they pump into storage tanks and use for domestic purpose.

2.8 Kisite - Mpunguti Marine Park and Reserve

Kisite - Mpunguti Marine Park and Reserve is also a Marine Protected Area (MPA) gazetted under the Wildlife Conservation and Management Act, 2013. The park covers 6Km^2 whereas the reserve covers 213Km^2 (Figure 29). The MPA harbours a rich marine ecosystem that includes fringing mangroves, seagrass beds, coral reefs, marine species of international importance such as the endangered sea turtles and dolphins, humpback whales (Figure 30) and open sea marine resources among others. Besides supporting livelihoods, the MPA drives various economic activities including tourism and fisheries among others, which make significant contributions to the local and national economy. The MPA is currently under threat from various causes including pollution, over-exploitation of the reserve, destructive fishing practices and climate change among others.

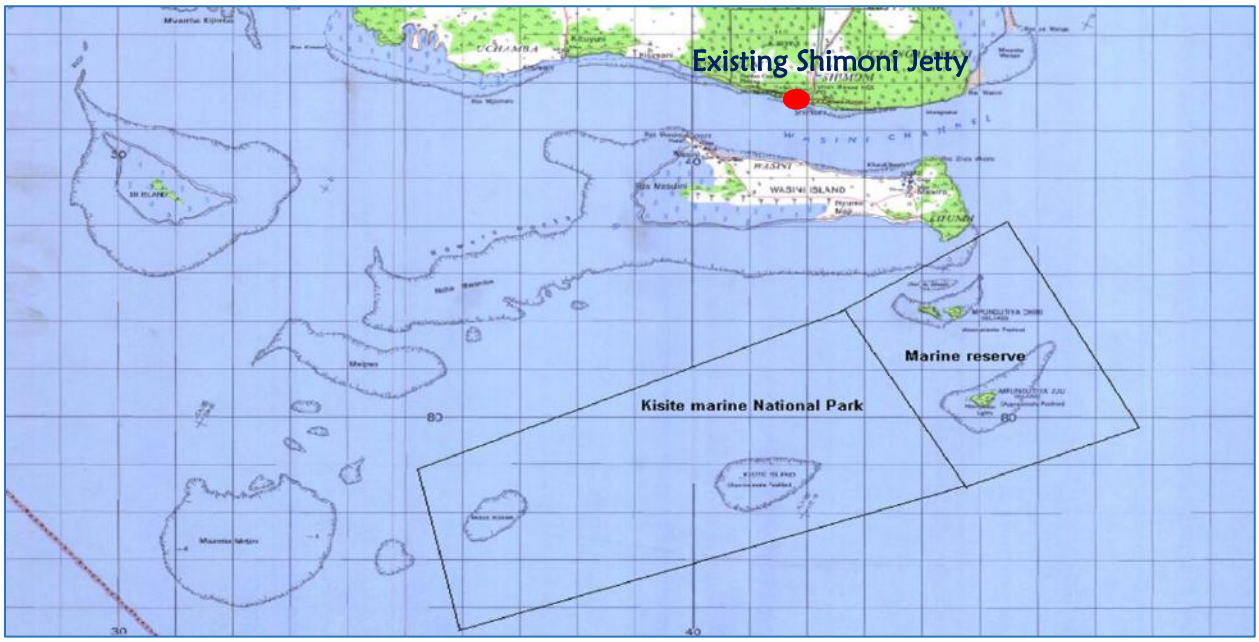


Figure 29: Spatial extent of the Kisite-Mpunguti Marine Park and Reserve (Source: Kenya Wildlife Service).


Figure 30: Dolphins (Left) and Humpback whale (Right) as seen in Kisite – Mpunguti Marine Protected area (Source: Google Images of Kisite-Mpunguti MPA).

2.9 Species of conservation concern

According to GOK (2017), species of conservation concern include those that are rare, endemic or show evidence of local population declines. The species are generally long lived, slow growing, late maturing and produce few young ones making them vulnerable to anthropogenic impacts. Some are listed under the IUCN Red List of Threatened Species as critically endangered, endangered, vulnerable, or near threatened species. They include marine mammal species (Cetaceans and Sirenians), sea turtles, bony fishes and elasmobranchs (sharks and rays), and terrestrial species (mammals, reptiles, birds, amphibians, and plants).

The Indo-Pacific bottlenose dolphins and humpback whales are the most sighted within the South coast area along Diani to the Pemba channel. The frequency of cetacean sightings is highly seasonal, for example humpback whales are frequently sighted between the months of July to October coinciding with the peak breeding and calving periods. Turtles have also been observed within Mpunguti/Wasini.

2.10 Critical marine habitats

2.10.1 Mangrove ecosystems

There are nine mangrove species in Kenya, with *Rhizophora mucronata* (mkoko) and *Ceriops tagal* (mkandaa) being the most dominant. The National Mangrove Management Plan (GOK, 2017) and indicates that mangroves in Kwale are estimated to cover 8354ha accounting for 14% of the total cover in Kenya. From the site survey undertaken in September 2020, the approximate mangrove cover is 6,624ha accounting for 21% loss. These mangrove forest are dominated by mixed stands of *Ceriops* and *Rhizophora*; as well as pure stands of *Avicennia*. Figure 31 shows the spatial distribution of mangroves within the Shimoni channel and adjacent areas. The fringing mangrove stands at the Shimoni Channel are dominated by *Sonneratia alba* (Figure 32).

Mangrove forests are critical habitat for a variety of fish species and invertebrates, which depend on it for feeding and nursery grounds. The habitat also hosts a wide variety of bird life, act as carbon sinks and provides a line of defence against shoreline erosion. The artisanal fishers rely on the mangrove ecosystem for a substantial part of their catch. Other non-consumptive uses of mangrove forests include spiritual and cultural functions, aesthetic use of forest bio-diversity in eco-tourism and bee keeping. Extractive uses of mangrove forests include exploitation for timber, construction poles, wood fuel and herbal medicines. Threats to mangrove forests include over-exploitation of wood and non-wood products, conversion of mangroves areas to other land uses such solar salt works, infrastructure development, and pollution effects (GOK, 2017). Other threats

include encroachment by human settlements, siltation and clearing to create space for aquaculture activities.

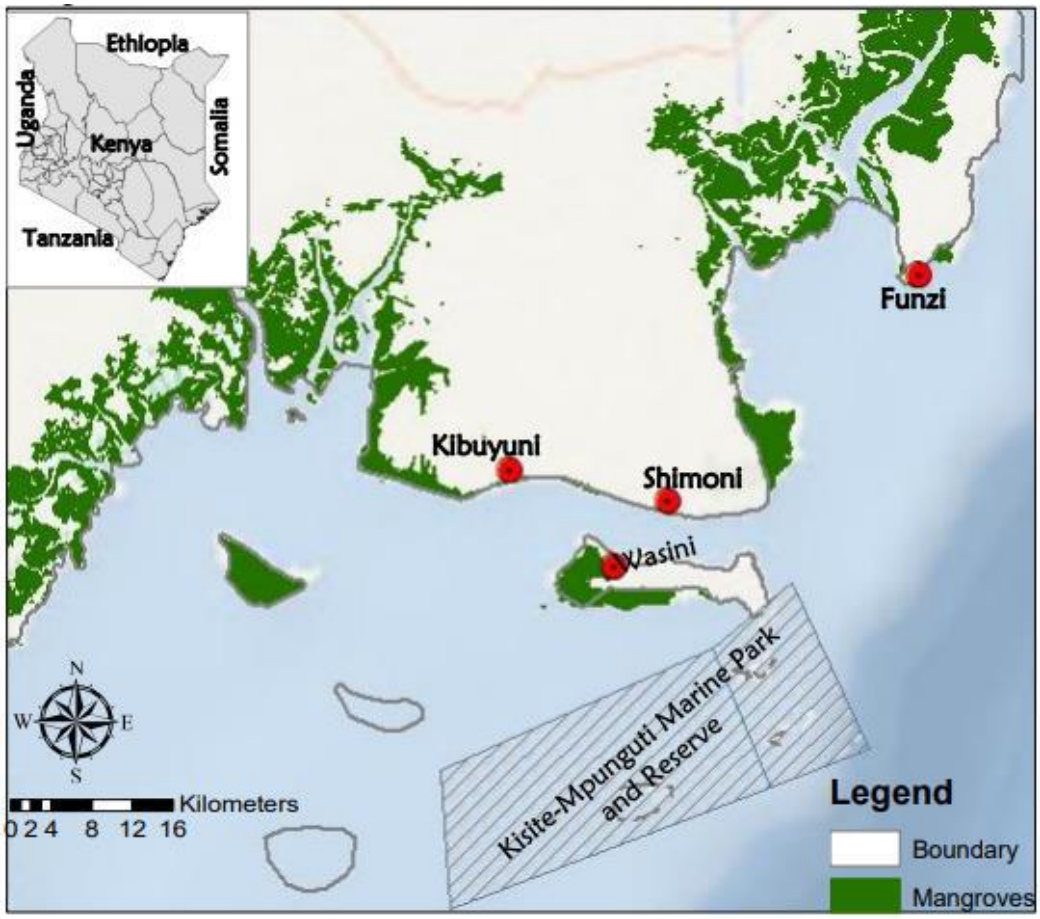


Figure 31: Spatial distribution of the mangrove forest within the Shimoni channel (Source: Site visit, September 2020).

Figure 32: A section of *Sonneratia alba* along the Shimoni channel (Source: Site visit, September 2020).

2.10.2 Seagrass

Seagrasses are marine angiosperms with a worldwide distribution. In Kenya, seagrasses occur in sheltered tidal flats, lagoons and creeks with the exception of the coastal stretch adjoining the Tana Delta (UNEP, 1998). Seagrass play an important role by providing nurseries, breeding, and feeding grounds for commercially important fishery species, supporting marine food webs thus important in nutrient cycling and carbon sequestration, serving as a primary food source for threatened and endangered species such as the green turtle (*Chelonia mydas*), the hawksbill turtle (*Eretmochelys imbricata*) and the dugong (*Dugong dugon*) (IUCN, 2010). In addition, seagrasses buffer wave action reducing coastal erosion, while the structure of their leaves act as traps for suspended sediments.

Twelve species of seagrasses have been reported in the project area i.e. *Halophila ovalis, Halophila minor, Cymodocea rotundata, Cymodocea serrulata, Halodule uninervis, Halodule wrightii, Halophila stipulacea, Syringodium isoetifolium, Zostera capensis, Enhalus acoroides, Thalassia hemprichii,* and *Thalassodendron ciliatum*. Seagrass ecosystems are threatened by fishing activities including beach seining and trawling, pollution, dredging and boating activities exacerbated by climate change effects.

2.10.3 Coral reefs

Coral reefs ecosystems are some of the most bio-diverse and productive marine ecosystems that provide an array of ecological goods and services (Odum & Odum, 1955; Moberg & Folke, 1999; Costanza et al., 2007; 2014). They are complex ecosystems limited to shallow and nutrient deficient coastal waters of the tropics and subtropics lying between latitudes 30°N and 30°S of equator (Odum & Odum 1955; Gattuso et al., 1998). The dynamic coral reef ecosystem results from multiple interactions among the diversity of physico-chemical, environmental and species interactions (Done, 1999). Coral reef health status is usually assessed by the abundance of key organisms such as the diversity of corals, algae, herbivores, and predators (Pandolfi et al., 2003; Wilkinson, 2008). According to these authors, a stable coral reef ecosystem is usually coral-dominated and characterized by low macroalgae biomass and large numbers of herbivores. High coral cover and grazing of macroalgae promote the production and successful recruitment of juvenile corals, maintaining coral dominance (Hughes, 1994; Carpenter & Edmunds, 2006; Mumby & Steneck, 2008).

The degradation of coral reefs has been associated with dwindling fishery production and incomes among coastal fishing communities. Generally, coral reef degradation can result from both natural and anthropogenic stressors, such as increased suspended sediments, nutrients imbalance, climate change, predation pressure from herbivores, diseases and fishing activities (Buddemeier et al., 2004). These stressors enhance mortality of corals which often precedes their replacement by alternative assemblages through monopolization of potential settlement sites by macroalgae, smothering of recruits and loss of broodstock. Impacts of climate change have been a big contributor to reef degradation and consequently diversity loss. The most extensive bleaching event on record occurred in 1998 when reefs in most geographical every region of the world experienced bleaching (Wilkinson, 2000), with Kenya's coral reefs being severely impacted, with up to 50 - 90% coral mortality (Wilkinson, 2000; Obura, 2002; Oliver et al., 2009; Jackson et al., 2014). Over the subsequent years, temperature induced coral bleaching events have also been recorded in 2005 and 2010 (Oliver et al., 2009; Jackson et al., 2014). It should however be noted that coral reef degradation is dynamic and multivariate phenomena and can involve various cycles of benthic community changes key among them being coral loss and seaweed gain (Bruno et al., 2009).

The blooming of macroalgae and other weedy species, often at the expense of reef-building corals, is one of the most obvious signs of coral reef degradation (McClanahan & Muthiga, 1998; McManus et al., 2000; Bellwood et al., 2004). In majority of the environments, only one dominant substrate dominates, resulting in change in reef community structure from coral to macroalgae dominated reef (Done, 1992). Macroalgae are major contributors to the primary productivity of coastal waters and form an important basis for secondary production.

There are ongoing coral restoration programmes in Wasini and Mkwiro village. The primary objective of the project is to improve reef health and fish biomass of the reefs around Wasini and Mkwiro, thus providing livelihoods for present and future generations through sustainable management. The destroyed coral reefs in the area are reportedly under siege from a number of environmental pressures, including climate change, bleaching, over-exploitation, poor fishing methods and coral diseases. The restoration programme in Wasini is carried out by Wasini Beach Management Unit with technical support from Kenya Marine Fisheries Research Institute (KMFRI), Kenya Wildlife Service (KWS)and civil society organizations such as Coastal and Marine Resource Development (COMRED), Seacology whereas in Mkwiro, the restoration is carried out by Mkwiro Beach Management Unit in collaboration with REEFolution and Pilli Pipa.

2.11 Fisheries and other livelihoods

2.11.1 Fisheries

Fisheries form an important part of the livelihoods of the local community (GOK, 2018). Exploitation of the fishery resources continues to be traditional through rudimentary gears and vessels that mainly fish within the reef and thus cannot exploit huge fisheries outside the reef to support food security. The offshore fishery is continuously exploited by licensed and unlicensed vessels from distant water fishing nations from Asia and Europe.

The main species of fish exploited include Scavengers (*Lethrinidae, Lutjanidae* and *Haemulidae*), parrot fish (*Scaridae*), rabbit fish (*Siganidae*), grunters (*Terapon* spp.) and pouters (Gerres spp.). Others include pelagic species such as Baracuda (*Sphyraena* spp.), Kingfish (*Scomberomorus* spp.) and Mullets (*Mugil* spp.) (Figure 33). The crustacean fisheries are dominated by mangrove crabs (*Portunidae*) harvested in the shallow waters and mangroves areas. Spiny lobsters of the family *Palinuridae* are also caught in the shallow water fishing grounds although in small quantities. Cephalopod fisheries mainly target squids (*Loliginidae*) and octopus (*Octopodidae*).

Figure 33: Some of fish species caught by artisanal fishers in the fishing grounds around Shimoni (Source: Site visit, September 2020).

Key fishing grounds in Shimoni include Nyuli, Waga, Kombeni, Kimundu, Mnazi, Mpunguti, Mwamba Mkuu, Mnazi, Nduwa and Wasini Channel (Figure 34). According to records from the State Department of Fisheries, Aquacultue and Blue Economy the total number of fishermen utilizing Shimoni area is estimated at 1000 (Catch Assessment Survey, 2016). Records from the Chairpersons of the Beach Management Units in Shimoni area estimate the number to about 1534 registered fishermen. It is however important to note that these figures are not an actual representation since there is uncaptured data on the number of unregistered fishermen who are involved in illegal fishing practices.

Figure 34: Key fishing grounds in Shimoni area (Source: Envasses Environmental consultants Limited, September 2020).

The artisanal fishery in the area is dominated by the hand line fishery compared to other areas of the Kenyan Coast (GOK, 2012). Other common fishing gears used in the fishery include gill nets, reef net, basket traps, monofilament, spear gun, ring net, beach seine, fishing weir, basket trap and sail lining (Figure 35). The modes of access to the fishing grounds and fishing crafts employed in the fishery range from foot, dugout and plank canoes, double outrigger canoes, motorboats and fiberglass boats (Figure 36). Most of the vessels are individually owned.

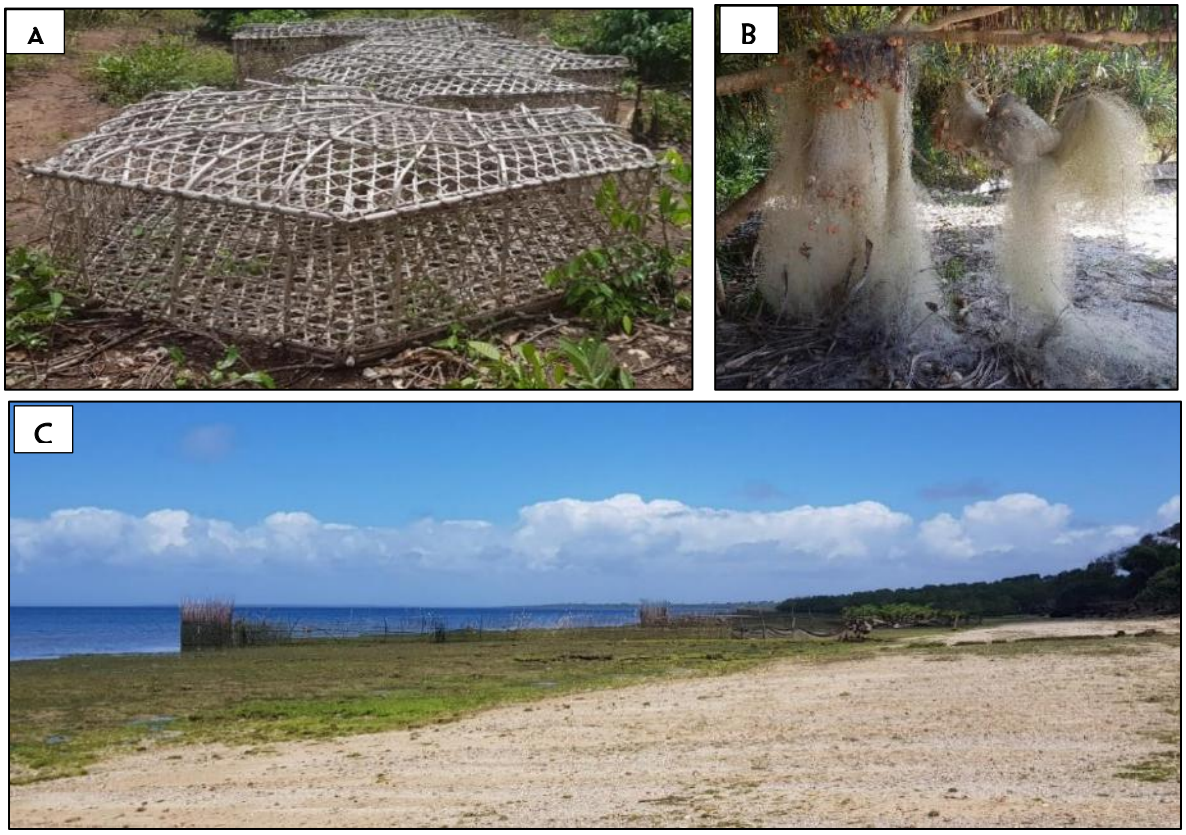


Figure 35: (A) basket traps, (B) monofilament nets and (C) fishing weir used by the local community in the fishing grounds (Source: Site visit, September 2020).

Figure 36: Some of the fishing crafts used by the fishermen (Source: Site visit, September 2020).

Fisheries management in East Africa is changing rapidly with partnership and shared responsibility between stakeholders and the Government under a co-management approach hence the establishment of Beach Management Units (BMUs). BMUs consist of fishers, fish traders, boat owners, fish processors and other beach stakeholders who traditionally depend on fisheries activities for their livelihoods. The main objective of the BMUs is to strengthen the management of fish-landing sites, fishery resources and aquatic environment. There are seven (7) BMUs in Shimoni-Vanga area which have a total of 19 fish landing sites ranging between 1 and 5 landing sites per BMU (Marine Fisheries Frame Survey, 2016). Majoreni and Shimoni BMUs have the highest number of fish landing sites each with 5, Mkwiro with only 1 landing site and the majority with 2 landing sites each. Within the study area, there are five BMUs (Table 8).

Table 8: Beach Management Units (BMUs) in Shimoni area, number of members and composition of each BMU (Source: BMU chairpersons, 2020).

BMU	Total BMU members	Fishers	Dealers	Loaders	Mama Karanga	Boat Operators	Hotelier	Seaweed farmers	Mangrove farmers
Shimoni	730	598	25	30	35	32	10	0	0
Wasini	333	120	30	30	28	80	45	0	0
Mkwiro	309	176	6	0	6	30	0	86	0
Kibuyuni	745	454	23	0	25	0	0	172	71
Majoreni	147	60	87	0	0	0	0	0	0

Fishers from most of these landing sites often share the same fishing grounds some of which are within the proposed project site. The distribution of fish landing sites that are recognized by the Fisheries Department are shown in Table 9 and Figure 37. Over the years, the area has experienced an influx of migrant fishermen from Pemba Island in Tanzania.

Table 9: Gazetted landing sites and licensed fisher folks (Source: Kenya Fisheries Service/ County Fisheries Office).

Village/ BMU	Landing Sites	No. of Fisher folk
Kibuyuni	Kibuyuni, Kijiweni, Ngomani, Kiromo, Huawen and Mtibwani	96
Mkwiro	Mkwiro	13
Wasini	Wasini front, Nyama Maji and Mundini	4
Shimoni	Bati, Mwazaro, Kiwambali, Anzwani, Shimoni, Changai and Mkuyuni	28

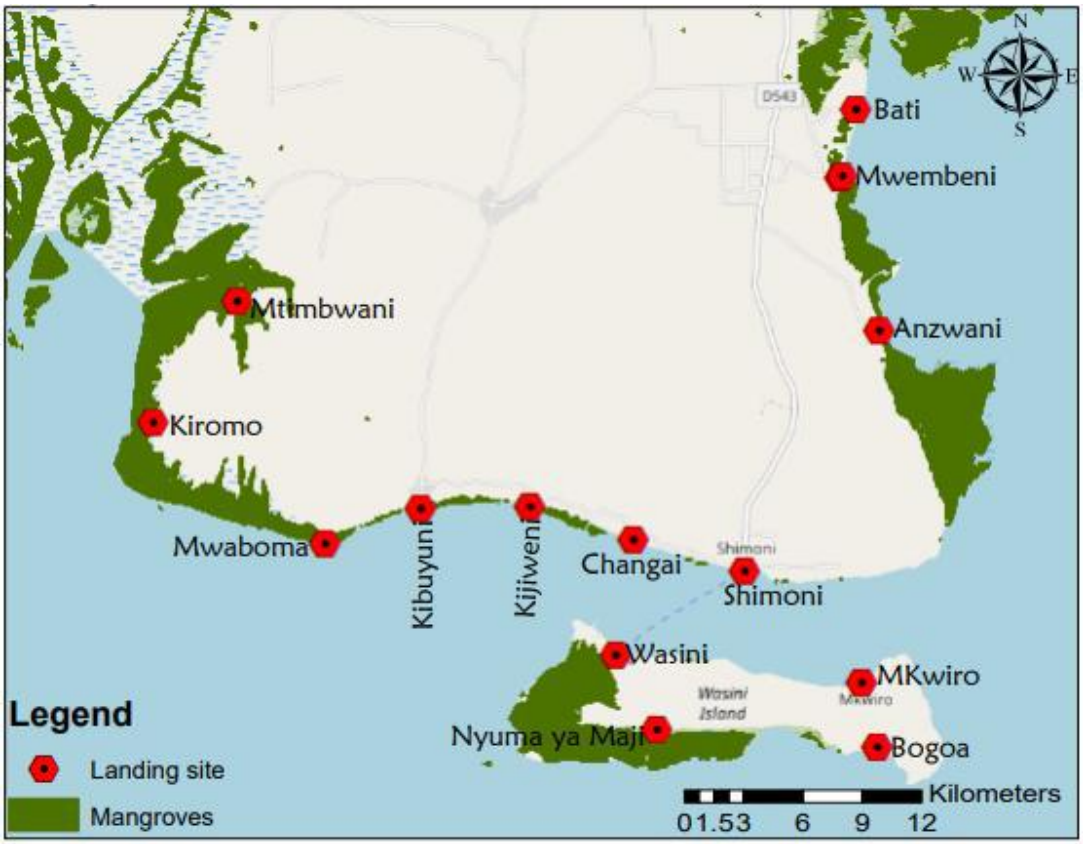


Figure 37: Spatial distribution of landing sites within the Shimoni channel (Source: Site visit, September 2020).

On average, fish landed in Shimoni main landing site has increased from 26,000 metric tons in 2010 valued at KES 30,180,000 to 30,000 metric tons of fish in 2019 valued at KES 62,175,400. During the Northeast monsoon approximately 281.31 metric tons of fish valued at KES 50,767,624 were landed in Shimoni whereas 118.28 metric tons valued at KES 21,202,686 were landed during the Southeast monsoon (Figures 38 and 39) (Fisheries Department, 2010 - 2019). About 70% of the fish landed are sold to other areas such as Ukunda, Diani and Mombasa town.

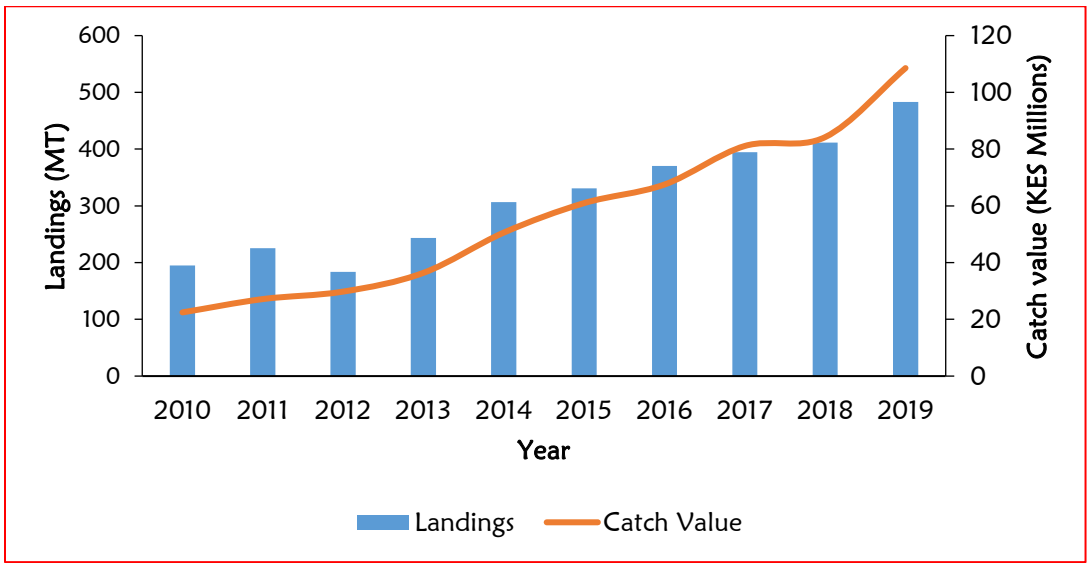


Figure 38: Landings and catch value of fish during NEM from the year 2010-2019 (Source: Fisheries data, 2020).

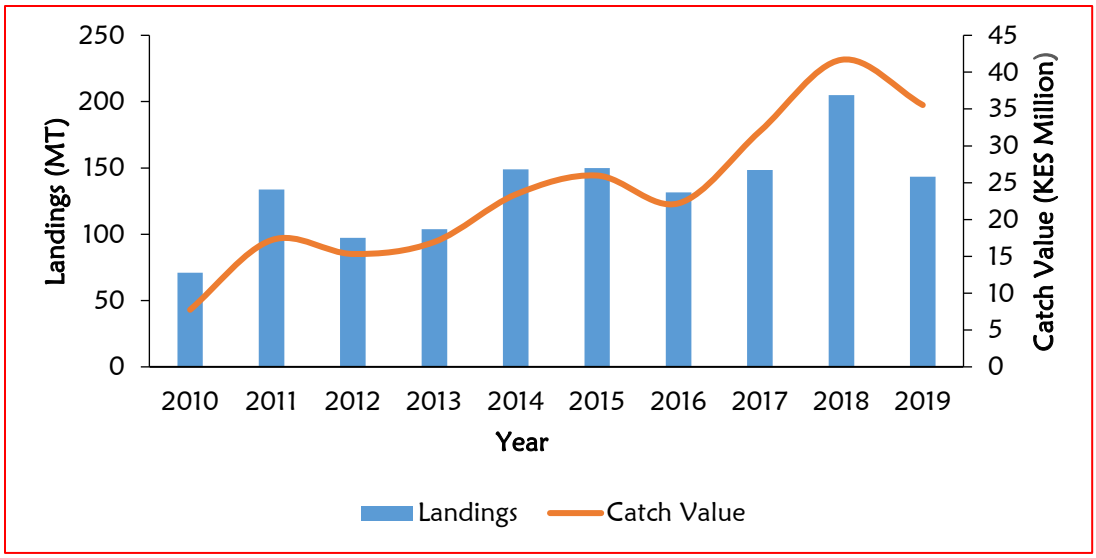


Figure 39: Landings and catch value of fish during SEM from the year 2010-2019 (Source: Fisheries data, 2020).

The consultants undertook a survey in 3 major landing sites within the project area. These include the Shimoni landing site, Bati landing site and Kibuyuni landing site (Figures 40 and 41). Parts of the Bati landing site are nesting ground for turtles. These areas include Mwembeni, Kagera and Funguni (Figure 41).

The Mwazaro BMU Self-help group members voluntarily remove marine debris from the coastline. The wastes are separated into plastics, rubber, glass and other wastes (Figure 42). The plastic bottles are currently repurposed for growing mangroves seedlings. The BMU members are still in search for innovative ways to reuse the remaining ocean debris.

Figure 40: The Shimoni landing site (Source: Site visit, September 2020).

Figure 41: Sections of the Bati landing site. The consultants and the some of the BMU members at Bati landing site (Left) and a section of the turtle nesting grounds in Bati- Mwembeni (Source: Site visit, September 2020).

Figure 42: Marine debris collected around Bati Beach area that are currently heaped as they source for innovative ways of recycling the wastes (Source: Site visit, September 2020).

The communities in Shimoni, Wasini, Mkwiro, Kibuyuni and Majoreni have also adopted the use of locally managed Community Conservation Areas (CCA) to conserve fisheries and marine resources and as a way of securing alternative livelihood activities. They are locally known as "*tengefu*" and are fully protected with no extraction or fishing allowed. *Tengefu* are jointly managed by BMUs and the Fisheries Department and in some cases managed by the Kenya Wildlife Service (KWS).

There are three mapped CCAs including Kibuyuni, Wasini and Mkwiro each occupying an area of 16, 30 and 14 Hectares respectively. These CCAs are likely to be impacted by the proposed project. There is a proposed CCA in Changai located next to Changai landing site (Figure 43).

Figure 43: Location and spatial extent of the CCA in Kibuyuni (A), Wasini (B) and Mkwiro (C) (Source: Field survey, October 2020).

2.11.2 Seaweed farming

Seaweed farming has been identified as a good prospect for social and economic development of coastal areas. It is aimed at diversifying livelihood opportunities for fishing communities whose source of income has been seriously put at risk by diminished capture of fish. The two major seaweed species farmed are *Eucheuma denticulatum* (spinosum) and *Kappaphycus alvarezii* (cottonii). Extracts of dried seaweed are used as food thickeners and in the global pharmaceutical and cosmetic industries. Seaweed has also been used as an additive to soils, mainly in coastal areas due to the high fibre content that acts as a soil conditioner and the mineral content as fertilizer.

In Kibuyuni village, there are 143 seaweed farmers each owning 6-10 blocks of seaweed farms. These farmers have received support on seaweed farming from various stakeholders including the Kenya Marine Fisheries Research Institute (research and technical support and training on seaweed production), KCDP (up-scaling of seaweed farming, construction of drying racks, purchase of boat for seaweed value addition techniques) and County Government of Kwale (construction of seaweed store). Seaweed drying is done over open racks for about three days (Figure 44), then packed and stored in their storage facility. The farmers also practice value addition on their seaweed produce through their processing facility to produce bar soaps, liquid soaps, shampoos, lotions, cakes and other products (Figure 45). The group exports dried seaweed to countries like China, Ireland and Malaysia through the Seaweed East Africa Company. Approximately 15-20 tonnes of seaweeds are sold quarterly to buyers from Tanzania. (Kibuyuni).

There are other seaweed farmers in Shimoni, Wasini Island and Mwazaro areas who also practice seaweed farming as an alternative source of livelihood.

Figure 44: Dried seaweeds over open racks on Kibuyuni and sun drying of seaweeds in Mkwiro (Source: Site visit, September 2020).

Figure 45: (A) Soaps, (B) seaweed flour and (C) shampoo made from seaweeds (Source: Site visit, September 2020).

2.11.3 Coastal tourism

Tourism is one of the biggest and most diverse industries in Kenya, contributing 4.1% of national GDP in 2014 (KNBS, 2016).Coastal tourism is dependent on a range of niches i.e. national parks and reserves (both marine and terrestrial), coastal beaches, conferences and events segment, museums and historical sites, wildlife safari and ecotourism. The tourism industry drives economic activities in other sectors such as hotels, travel agents, airlines and other passenger transportation services. Hence stimulating the development in towns like Shimoni, Wasini, Ukunda, Diani,

Mtwapa and Malindi among others. The number of tourists fluctuates seasonally reducing during the Southeast monsoon season. Additionally, the sector has been negatively impacted by insecurity after the insurgency of terrorism acts.

The proposed project site lies within the Shimoni Channel which connects to the Kisite-Mpunguti Marine Park and Reserve, a Marine Protected Area (MPA). The Marine park and Reserve was established to protect the scenic islands and special habitats of a wide range of endemic marine animals and breeding migratory birds. The marine park lies in the coral gardens south of Wasini Island and encompasses three small coral rag forest islands, each with considerable areas of fringing reef. The project site also neighbors the Shimoni Slave Caves and the Shimoni Slave Museum that is managed by a community-based organization and National Museums of Kenya respectively. The caves were used as places of confinement of slaves before shipment to the slave market. The historical site constitutes a network of caves once reputed to be connected to underground routes extending about five kilometers inland (Figure 46). The caves were a sacred site used by Kaya elders for prayers and to offer sacrifices before the invasion of slave traders. The Shimoni Slave museum has collections of the local Digo people's cultural artifacts and others collected from the East African coastal areas like Pemba and Zanzibar, which were centres of the infamous Arab Slave Trade.

Figure 46: A section of the Shimoni caves (Left) and the remnant shackles that were used to secure slaves prior to shipment (Right) (Source: Zuru Kenya).

Across the Shimoni channel lies Wasini Island where there are various tourism attractions such as the coral garden (Figure 47), mangrove boardwalk (Figure 48), dolphin and whale watching, snorkeling, curio vending among other tourism related activities (Figures 49 and 50). Most of these activities are coordinated and operated by Wasini Beach Management Unit and Kisite Boat Operators. Most of the tourists come for day trips to the Marine Park and Reserve from hotels in and around Diani and Mombasa so as to snorkel, dive and watch dolphins.

Currently, there are approximately 200 tourist operators with 50 boats who operate in and around the Marine Park and Reserve, with the capacity to cater for more than 350 visitors a day (Source: Chaiman-Wasini and Kisite Community Boat Operator, September 2020). Both speed boats and the traditional wooded-sail boats are available to provide transport to tourists to attraction sites.

Figure 47: The coral garden at Wasini Island (Source: Google Images of Wasini Island).

Figure 48: The Wasini Women Group mangrove boardwalk (Source: Google Images of Wasini Island).

Figure 49: Tourism activities taking place within the Shimoni channel (Source: Kisite Boat Operators gallery).

Figure 50: Tour boats as seen along the Shimoni channel (Source: Site visit, September 2020).

2.11.4 Agriculture

Subsistence and cash crop farming is practiced in most of the villages within the project area. Many households that engage in fishing and small scale business as their main occupation also practice agriculture as a supplementary source of livelihood and income. The most common subsistence food crops planted in the area are Maize, Beans, Vegetables (kales, *mabenda*, *mkunde*, green grams and *mchicha*), millet, mangoes and bananas. Cash crops grown by farmers are the Coconuts and Cashew nuts. Livestock rearing is also an important occupation in the project area though practiced by few farmers. The farmers in the project area keep some livestock such as cattle, goats and poultry (Figure 51).

Figure 51: Cattle (Left) and ducks (Right) rearing as observed within the project area (Source: Site visit, September 2020).

2.12 Infrastructure and social amenities

Kwale County has a total of 1,483.1 Kilometers of classified roads of which 187.7 Kilometers are Bitumen surface, 425.2 Kilometers is gravel surface and 871.2 Kilometers of earth surface roads/rural access roads. An international trunk road traverses the county from Mombasa to Lunga Lunga on the Kenya–Tanzania border. On the northern side the Mombasa – Nairobi Highway virtually forms the boundary of Kwale and Kilifi County. The Dongo Kundu by-pass is underway which will connect Kwale County with other counties easing congestion at the Likoni Ferry. The

project site is accessible via a tarmacked road approximately 13Km from the Likoni - Lunga Lunga Highway at Kanana Junction.

There are approximately 60 Kilometers of railway line and four (4) airstrips at Ukunda/Diani, Shimba Hills National Reserve, Msambweni and Kinango although only one is operational. Air transport has contributed to the growth of tourism sector, which significantly contributes to the economic growth of the county. There is a small port at Shimoni and Vanga which is mostly used for water transport by boats controlled by Kenya Wildlife Service. The existing Shimoni Jetty is mainly used for commercial activities such as ferrying goods to and from the islands of Pemba and Zanzibar.

Telephone and postal services are available at Kwale, Msambweni, Kinango, Ukunda, Shimba Hills, Lunga-Lunga, Vanga, Kikoneni, Shimoni, Lukore, Diani and Matuga. Other areas are Mackinnon Road and Samburu. The region is served with manual and automatic exchange facilities. With emergence of mobile phones and courier services, utilization of Telkom Kenya services and those of the Postal Corporation of Kenya has since declined which has led to neglect of these facilities and vandalism of equipment. There are three major mobile telephone providers in the county with network coverage of about 75 per cent. Most of the major towns such as Ukunda, Msambweni and Kinango are well covered. Most of the hinterland is either completely uncovered or experience difficulty in accessing the network. The most affected areas include Kubo Division, Vanga, Samburu, Davanya and parts of Lunga-Lunga. The three network providers have about five (5) base transmission stations each in the county. Securicor courier services are available in Ukunda and Kwale Towns.

The most common source of energy in Kwale County is wood fuel used by 80.2% of households for cooking, and 0.5% for lighting. Paraffin is used by 5.7% and 95.5% for cooking and lighting respectively, whereas 11.5% of household use charcoal for cooking with 10.6% using electricity for lighting. Petroleum is used mainly in transport and households e.g. water pumps and generators. Kerosene is the main source of lighting in rural areas. It is also used for cooking in both urban and rural areas. The county has potential for solar (Shimoni), wind (Samburu and Kinango) and biogas (along the coastal strip) which has not been exploited. There are a total of 68 market centres spread throughout the county. Most of the goods traded in these markets are foodstuffs and livestock. There is a wholesale and fresh produce market at Kombani under Economic Stimulus Programme (ESP). The county has five (5) urban centers which are Ukunda/Diani, Kwale, Msambweni, Kinango and Lunga Lunga.

Kwale County has a total of five (5) government hospitals, ten (10) health centers and ninety (90) dispensaries located in Msambweni, Matuga, Lunga-Lunga and Kinango Sub-Counties. The doctor and nurse population ratio stands at 1:76,741 and 1: 3,133 respectively. In addition, the county has a total of thirty six (36) private health facilities and nine (9) health facilities owned by faith based organizations. The average distance to the nearest health facility within the County is seven (7) kilometers as compared to the required maximum of three (3) kilometers. There is a dispensary next to the project site (Figure 52).

Kwale County has a total of 820 Early Childhood Development (ECD) centers, a total of 519 primary schools, 97 secondary schools and 42 tertiary institutions which includes universities, colleges, vocational training and adult centers. Most of the tertiary institutions offer courses related to hospitality, salon and beauty, computer and IT training, among others.

Figure 52: Shimoni dispensary neighboring the proposed project sites (Source: Site visit, September 2020).

2.13 Baseline environmental data

2.13.1 Baseline water quality results

The objective of the water quality sampling and analysis is to provide a baseline for assessing the effectiveness of environmental and social management plans designed to minimize water contamination. The water sampled within the monitoring stations conformed to the standards prescribed under the Third Schedule of the Environmental Management and Coordination (Water Quality), Regulations, 2006 (Figures 53 and 54, Table 10).

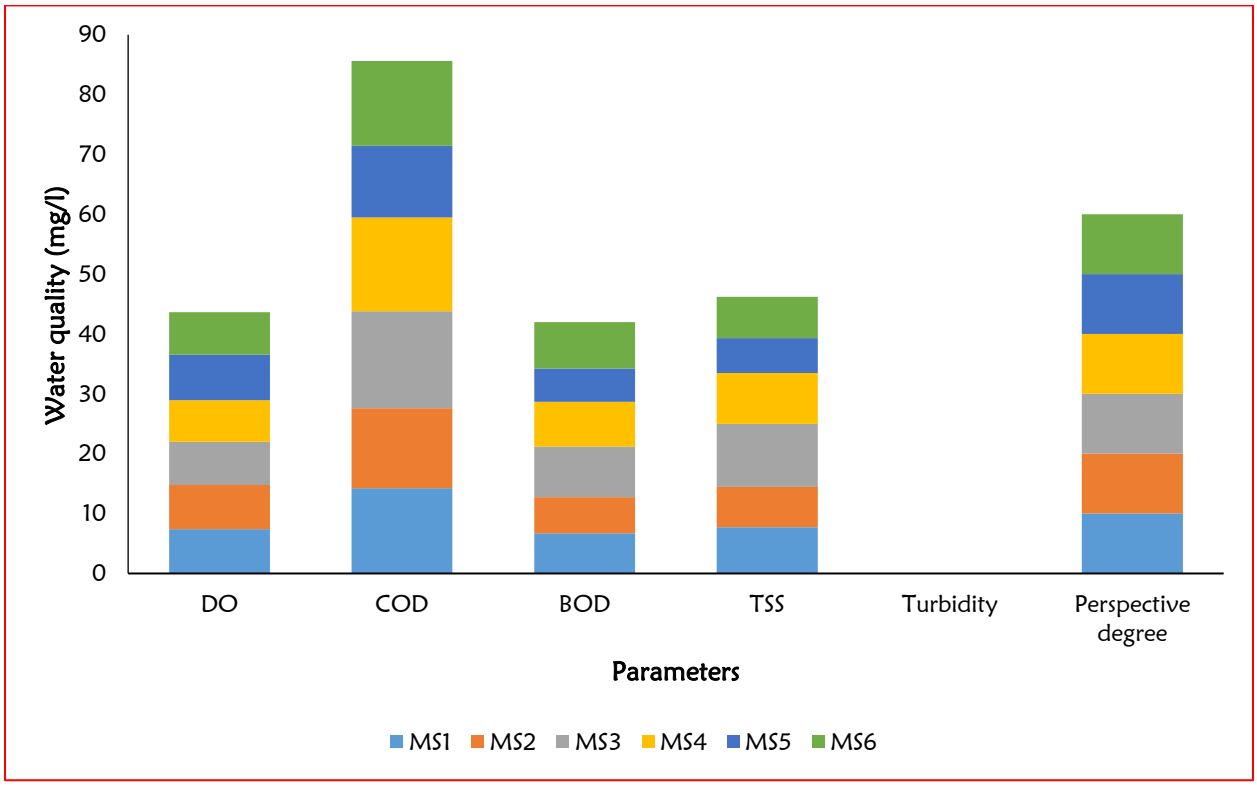


Figure 53: Water quality across six sampling stations identified within the Shimoni Channel (Source: Polucon Services (K) Limited, September 2020).

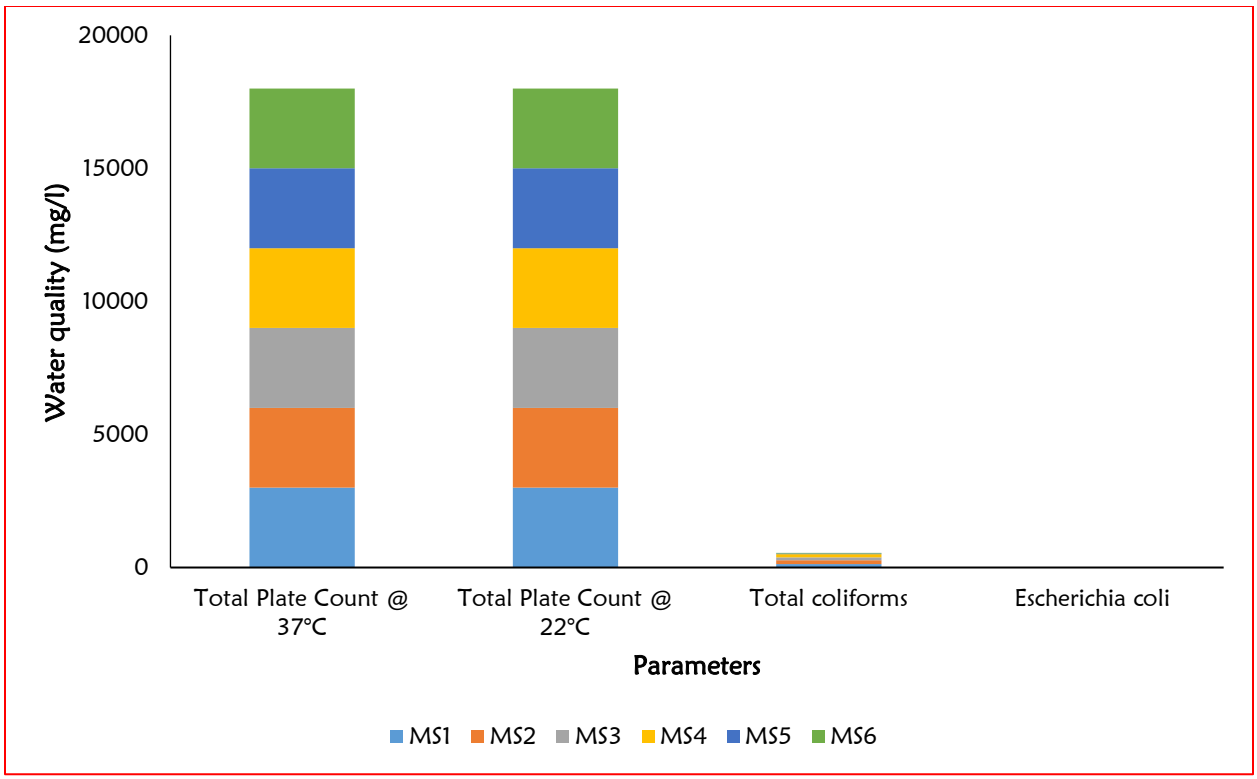


Figure 54: Microbial results across six sampling stations identified within the Shimoni Channel (Source: Polucon Services (K) Limited, September 2020).

Table 10: Detailed summary of the baseline water quality monitoring results for the monitoring stations (Source: Polucon Services (K) Limited, September 2020).

Monitoring Station (MS)	Sampling Depth (M)	Acidity/ Basicity (pH)	COD (mg/l)	BOD (mg/l)	Dissolved Oxygen	Perspective Degree	Total Suspended Solids (mg/l)	Turbidity (NTU)	Total Plate Count @37°C	Total Plate Count @ 22°C	Total coliforms	Escherichia coli/100ml	Ammonia	Oil & grease
MS 1	0.5	7.64	14.50	6.90	7.32	>10	7.30	0.00	>3000	>3000	125	Absent	5.06	Nil
	3m	7.63	13.60	6.30	7.38	>10	8.10	0.00	>3000	>3000	133	Absent	6.13	Nil
	6m	7.63	14.70	7.00	7.58	>10	7.70	0.00	>3000	>3000	130	Absent	4.95	Nil
MS 2	0.5	7.66	12.80	5.80	7.26	>10	6.90	0.00	>3000	>3000	145	Absent	3.54	Nil
	3m	7.64	13.90	6.30	7.36	>10	7.10	0.00	>3000	>3000	151	Absent	3.42	Nil
	6m	7.62	13.30	6.00	7.36	>10	6.30	0.00	>3000	>3000	137	Absent	3.03	Nil
MS 3	0.5	7.71	13.60	7.00	7.05	>10	7.00	0.00	>3000	>3000	19	Absent	3.89	Nil
	3m	7.67	13.90	8.10	7.10	>10	6.40	0.00	>3000	>3000	27	Absent	3.17	Nil
	6m	7.67	15.00	8.30	7.08	>10	7.30	0.00	>3000	>3000	35	Absent	2.91	Nil
MS 4	0.5	7.67	15.20	7.80	6.84	+10	8.60	0.00	>3000	>3000	115	Absent	4.76	Nil
	3m	7.65	16.10	7.50	7.01	+10	9.50	0.00	>3000	>3000	121	Absent	4.04	Nil
	6m	7.63	15.70	7.10	7.02	+10	7.40	0.00	>3000	>3000	110	Absent	4.87	Nil
MS 5	0.5	7.64	11.90	5.50	7.50	>10	5.40	0.00	>3000	>3000	39	Absent	3.09	Nil
	3m	7.62	11.60	5.20	7.71	>10	5.80	0.00	>3000	>3000	25	Absent	3.15	Nil
	6m	7.63	12.40	5.90	7.58	>10	6.30	0.00	>3000	>3000	20	Absent	3.00	Nil
MS 6	0.5	7.64	16.50	9.00	7.23	>10	11.20	0.00	>3000	>3000	99	Absent	5.99	Nil
	3m	7.64	15.80	8.10	7.21	>10	10.50	0.00	>3000	>3000	122	Absent	5.25	Nil
	6m	7.60	16.30	8.30	7.24	>10	9.90	0.00	>3000	>3000	115	Absent	5.88	Nil
EMCA Standards	6.5-8.5	50	30	-	-	30	-	-	-	1000	Nil	100 max	Nil	

2.13.2 Baseline biological monitoring

2.13.2.1 Plankton surveys

Plankton, play a fundamental role in marine ecosystems and especially coastal waters, where nutrients are known to limit primary productivity rates. Furthermore, plankton populations are key indicators of water quality and affect community structure, biomass and productivity rates for the fisheries. Plankton demonstrates water quality through changes in its community composition, and distribution, and proportion of sensitive species. Species rarity is of specific significance in total structure of species diversity.

2.13.2.2 Phytoplankton distribution and diversity

Table 11 shows the genera of Phytoplankton found at the sampling sites, with presence (+) and absence (-) classification for all the monitoring sites (Figures 55 and 56).

Table 11: Presence(+) Absence (-) data for comparison of 67 Phytoplankton genera recorded in the seven (7) monitoring sites and total number of genera at each site.

Class	Genera	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Madyoka	MS-4 Mkwiro	MS-5 Nyuli	Mwazaro
Diatom	Achnathidium	--	--	--	--	+	--
Dinoflagellate	Alexandrium	--	+	+	--	+	+
Dinoflagellate	Amphidinium	--	--	--	--	--	+
Diatom	Amphora	+	+	+	--	--	+
Diatom	Asterionellopsis	+	--	--	+	--	--
Diatom	Asteromphalus	+	--	+	--	--	--
Diatom	Bacteriastrum	+	+	+	+	+	+
Diatom	Biddulphia	--	--	--	--	--	+
Diatom	Bleakeleya	--	--	--	--	+	+
Diatom	Campylodiscus	--	+	+	--	--	--
Diatom	Cerataulina	+	+	+	+	+	+
Dinoflagellate	Ceratium	+	+	+	+	+	+
Diatom	Chaetoceros	+	+	+	+	+	+
Flagellate	Choanoflagellida	+	+	+	+	+	+
Diatom	Corethron	+	+	+	+	+	+
Dinoflagellate	Corythodinium	--	+	+	+	--	--
Diatom	Coscinodiscus	+	+	+	--	+	+
Diatom	Cyclotella	+	--	+	+	--	--
Diatom	Cymatopleura	--	--	--	+	--	--
Diatom	Dactyliosolen	+	--	+	+	+	+
Diatom	Dictyocha	+	+	+	+	+	+
Dinoflagellate	Dinophysis	--	+	+	--	--	--
Diatom	Diploneis	--	--	--	--	+	--
Diatom	Ditylum	+	--	+	+	--	--
Diatom	Entomoneis	+	+	+	--	+	+
Diatom	Eucampia	+	+	+	+	+	+
Flagellate	Eutreptiella	--	+	+	--	--	+
Diatom	Fragilaria	--	--	--	--	+	--
Dinoflagellate	Gambierdiscus	+	--	--	--	+	--
Dinoflagellate	Goniodoma	--	--	+	--	--	--

Class	Genera	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Madyoka	MS-4 Mkwiro	MS-5 Nyuli	Mwazaro
Dinoflagellate	Gonyaulax	--	--	--	--	--	--
Diatom	Guinardia	+	+	+	+	+	+
Dinoflagellate	Gymnodinium	--	+	+	--	--	--
Diatom	Haslea	+	+	+	+	+	+
Diatom	Hemiulus	--	+	+	+	+	+
Diatom	Lauderia	+	+	+	+	+	+
Diatom	Leptocylindrus	+	--	+	+	+	+
Diatom	Licmophora	--	--	+	--	+	+
Diatom	Melosira	+	+	+	+	+	+
Diatom	Meuniera	--	--	+	--	--	--
Diatom	Navicula	+	+	+	+	+	+
Diatom	Nitzschia	+	+	+	+	+	+
Silicoflagellate	Octactis	+	--	+	--	+	--
Diatom	Odontella	--	--	--	--	--	+
Cyanobacteria	Oscillatoria	+	--	+	--	+	+
Dinoflagellate	Ostreopsis	--	--	+	--	--	--
Dinoflagellate	Oxyphysis	--	--	--	--	+	--
Dinoflagellate	Peridinium	--	--	+	--	--	--
Dinoflagellate	Phalacroma	+	--	+	+	--	--
Diatom	Plagiodiscus	--	--	--	--	--	+
Diatom	Pleurosigma	+	+	+	+	+	+
Dinoflagellate	Prorocentrum	+	+	+	+	+	+
Dinoflagellate	Protoperidinium	+	+	+	+	+	+
Diatom	Pseudoguinardia	--	+	+	--	--	--
Diatom	Pseudo-nitzschia	+	+	+	+	+	+
Dinoflagellate	Pyrophacus	--	+	+	--	--	--
Diatom	Rhizosolenia	+	+	+	+	+	+
Diatom	Scenedesmus	+	--	--	--	--	--
Dinoflagellate	Scrippsiella	+	+	+	+	+	+
Diatom	Skeletonema	+	--	+	+	+	+
Diatom	Striatella	--	--	--	--	+	+
Diatom	Surirella	--	--	--	+	+	--
Diatom	Tabellaria	+	--	--	--	--	+
Diatom	Thalassionema	+	+	--	+	+	+
Diatom	Thalassiophysa	--	--	+	--	+	+
Diatom	Thalassiosira	--	+	+	+	+	+
Number of Genera (X/67)		**37**	**34**	**48**	**33**	**41**	**41**

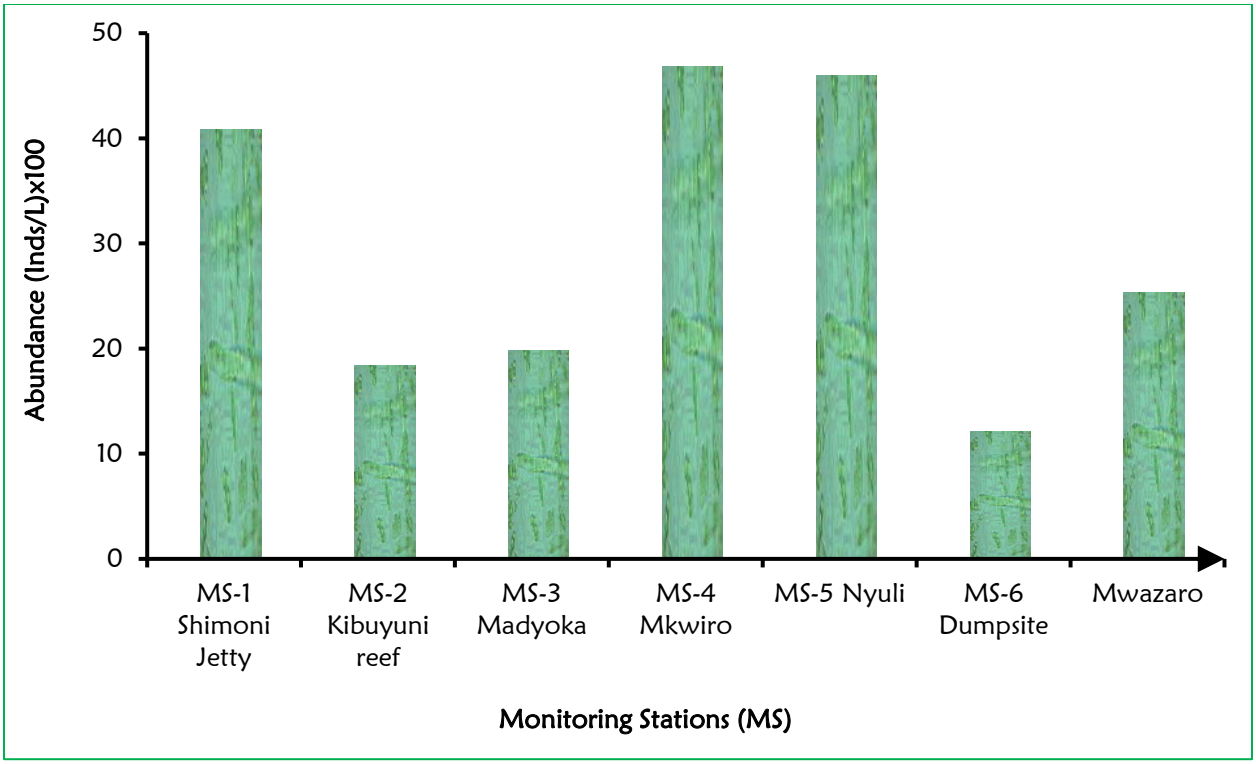


Figure 55: Abundance of Phytoplankton (inds./L) at the selected Baseline monitoring stations, from the current Shimoni Jetty site to the proposed Dumpsite. Mwazaro, an additional site on the Shimoni channel mouth (north of KMMPR) was sampled for comparison.

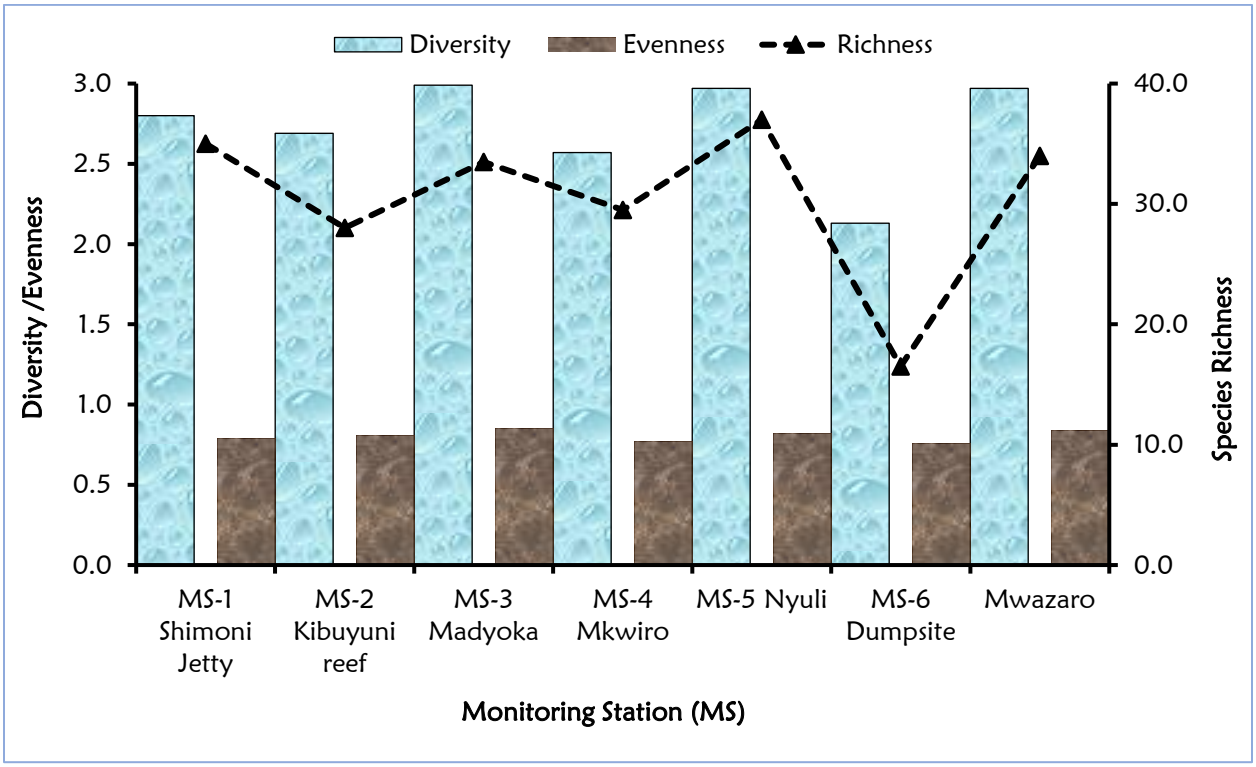


Figure 56: Phytoplankton Diversity, Evenness and Richness at selected Baseline monitoring stations, from the current Shimoni Jetty site to the proposed Dumpsite. Mwazaro, an additional site on the Shimoni channel mouth (north of KMMPR) was sampled for comparison.

2.13.2.3 Zooplankton distribution and diversity

The zooplankton community is an important element of the marine food chain and the zooplankton act serve as intermediary species in the food chain, transferring energy from planktonic algae (primary producers) to the larger invertebrate predators and fish who in turn feed on them. Consequently, the zooplankton community is a key indicator of the health of the fisheries in coastal marine environments.

Analyses indicated that some zooplantkon taxa such Arcatia, Brachyura, Chaetognatha, Corycaeus, Diphyes, Fish eggs, Gastropoda, Labidocera, Neocalanus, Oithona, Oncaea, Caridea, Eucalanus, Lucifer, Oikopleaura, Radiollaria, Stomatopoda, Temora and Turbellaria occurring in at least six (6) out seven (7) survey stations. Consequently, ecological monitoring for any impacts should take cognisance of any changes in these universally occurring taxa. However, some rare taxa such as Atlanta (family Atlantidae); Euchaeta and *Liriope tetraphylla* only recorded at the Nyuli site (within the KMMPR); Calanus, Cumacean and Megalopa at Kibuyuni; Copepodites (Mwazaro), Doliolida and Pontellopsis at the potential dredged materials dumping site; Holothuria, Insecta, Mysida and Pontella (Madyoka); Megalopa (kibuyuni) and Tortanus at the Shimoni Jetty as shown in table 12 below.

Table 12: Presence(+) Absence (-) data for comparison of 57 Zooplankton genera recorded in the Seven (7) monitoring sites and total number of genera at each site.

Taxa	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Madyoka	MS-4 Mkwiro	MS-5 Nyuli	MS-6 Dumpsite	Mwazaro
Acartia	+	+	+	+	+	+	+
Acrocalanus	+	--	--	+	--	--	--
Amphipoda	+	--	+	--	--	--	--
Atlanta	--	--	--	--	+	--	--
Bassia	--	--	--	+	+	--	--
Bivalve	+	+	--	+	--	+	--
Brachyuran zoea	+	+	+	+	+	+	+
Bryzoa	+	--	--	+	+	--	--
Calanopia	--	+	+	+	--	+	+
Calanus	--	+	--	--	--	--	--
Callocalanus	+	--	--	+	+	+	--
Candacia	--	--	--	+	+	--	+
Caridea	+	+	+	+	+	--	+
Centropages	--	+	+	--	+	--	+
Chaetognatha	+	+	+	+	+	+	+
Cladocera	+	+	--	--	+	--	+
Clytemnestra	+	--	--	--	+	--	--
Copepodite	--	--	--	--	--	--	+
Copilia	--	--	--	--	+	+	--
Corycaeus	+	+	+	+	+	+	+
Creseis	--	--	--	--	+	--	+
Cumacean	--	+	--	--	--	--	--
Diphyes	+	+	+	+	+	+	+

Taxa	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Madyoka	MS-4 Mkwiro	MS-5 Nyuli	MS-6 Dumpsite	Mwazaro
Doliolida	--	--	--	--	--	+	--
Eucalanus	Z	+	+	+	+	--	+
Euchaeta	--	--	--	--	+	--	--
Fish eggs	+	+	+	+	+	+	+
Fish larvae	+	+		+	+	--	+
Foraminifera	+	--	--	+	+	+	+
Gastropoda	+	+	+	+	+	+	+
Holothuria	--	--	+	--	--	--	--
Insecta	--	--	+	--	--	--	--
Labidocera	+	+	+	+	+	+	+
Liriope tetraphylla	--	--	--	--	+	--	--
Lucifer	+	+	+	+	+	--	+
Megalopa	--	+	--	--	--	--	--
Mysida	--	--	+	--	--	--	--
Nannocalanua	+	--	--	--	+	--	+
Neocalanus	+	+	+	+	+	+	+
Oikopleaura	+	+	+	+	--	+	+
Oithona	+	+	+	+	+	+	+
Oncaea	+	+	+	+	+	+	+
Pleaurobranchia		--	--	+	--	+	--
Ostracoda	--	+	--	--	--	--	+
Polychaeta larvae	+	+	+	+	--	+	--
Pontella	--	--	+	--	--	--	--
Pontellina	--	--	+	--	+	+	--
Pontellopsis	--	--	--	--	--	+	--
Porcellidium	+	--	--	+	--	--	+
Pseudodiaptomus	--	--	+	--	--	+	--
Radiollaria	+	+	--	+	+	+	+
Sapphirina	--	--	--	--	+	--	+
Stomatopoda	+	+	+	+	+	+	--
Temora	+	+	+	+	+	--	+
Tortanus	+	--	--	--	--	--	--
Turbellaria	--	+	+	+	+	+	+
Undinula	--	--	--	--	+	+	--

Results showed a fairly high species richness and diversity within all the surveyed stations, with Mean±SD at 52±6 taxa, with lowest richness recorded in the offshore dumpsite (45 Taxa) while the Kisite Mpunguti Marine Park and Reserve Site at Nyuli recorded the highest taxa at 63, confirming the importance of the Marine protected area (MPA) as a refugia and bank for species within the wider shimoni ecosystem. The inshore survey stations recorded very similar number of taxa with 48 taxa at Madyoka creek mouth; 49 taxa at the Kibuyuni coral gardens; 52 taxa at the

proposed Shimoni Port site at Jetty; and 52 species each at Mkwiro community conservation area across the channel and the Mwazaro site south of the Ramisi river mouth (Figure 57).

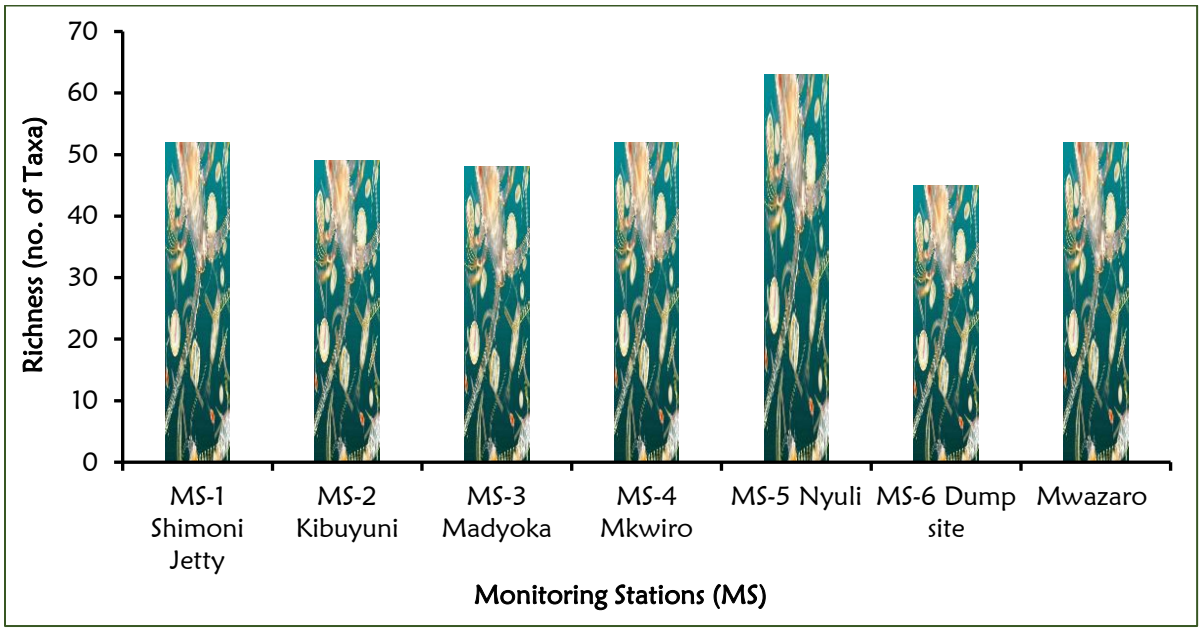


Figure 57: Zooplankton Species Richness at selected Baseline monitoring stations, from the current Shimoni Jetty site to the proposed Dumpsite, and Mwazaro, an additional site on the Shimoni channel mouth (north of KMMPR).

Similarly, species distribution showed higher abundance (inds./litre) at the Kisite Mpunguti Marine Park and Reserve Site at Nyuli with 305 inds./litre followed by Mwazaro south of the Ramisi River mouth with 140 inds./litre; 63, Shimoni Jetty site with 86 inds./litre; Mkwiro community conservation site with 25 inds./litre; the offshore dumpsite with 13 inds./litre and Kibuyuni coral reef site and the inner Madyoka creek site with 5 inds./litre and 6.0/inds/litre, respectively (Figure 58).

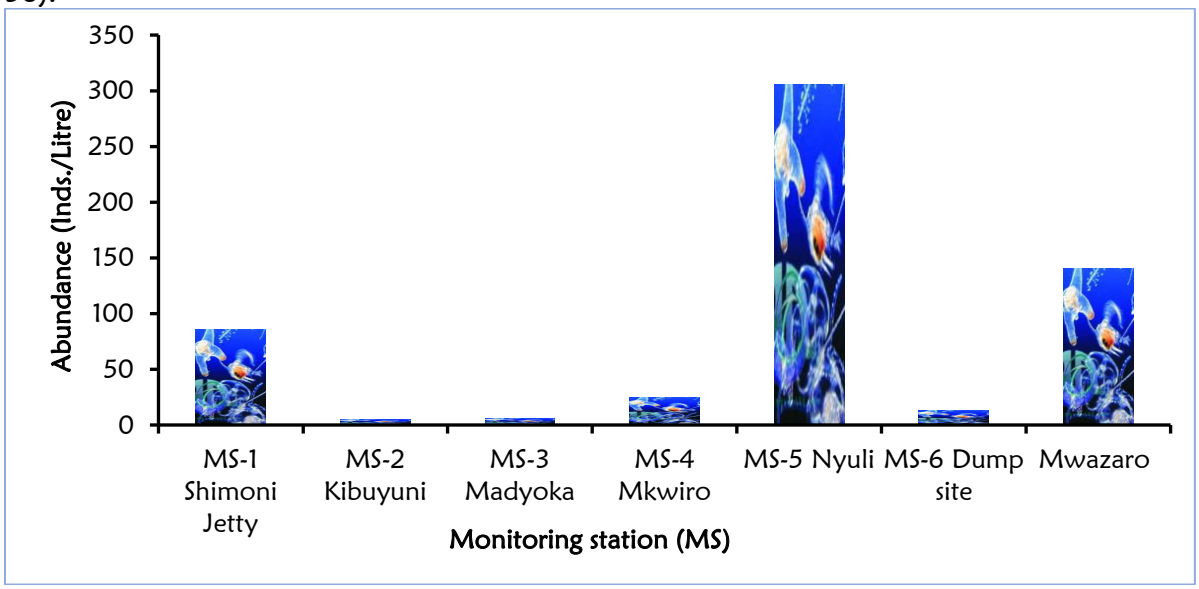


Figure 58: Zooplankton Abundance at selected Baseline monitoring stations, from the current Shimoni Jetty site to the proposed Dumpsite, and Mwazaro, an additional site on the Shimoni channel mouth (north of KMMPR).

2.13.3 Fisheries

A total of 96 fish species from the 25 families were recorded across the three sites in Shimoni during the field survey. The highest species richness was recorded at Mkwiro with 63 species while Nyuli and Kibuyuni recorded 51 and 41 species respectively, the common names are based on Lieske and Myers (2001) (Figure 59a). The total fish density based on the 13 families was varied by sites ranging from highest of 4626.7 ± 451.6 Individuals/ha at Mkwiro to 2333.3 ± 275.5 and 2146.7 ±153.8 at Nyuli and Kibuyuni respectively (Figure 59b). Pairwise test of significant difference using Tukey HSD test revealed significant difference between Mkwiro and Kibuyuni and Mkwiro and Nyuli ($p < 0.05$). The difference was not significant between Nyuli and Kibuyuni ($p = 0.91$).

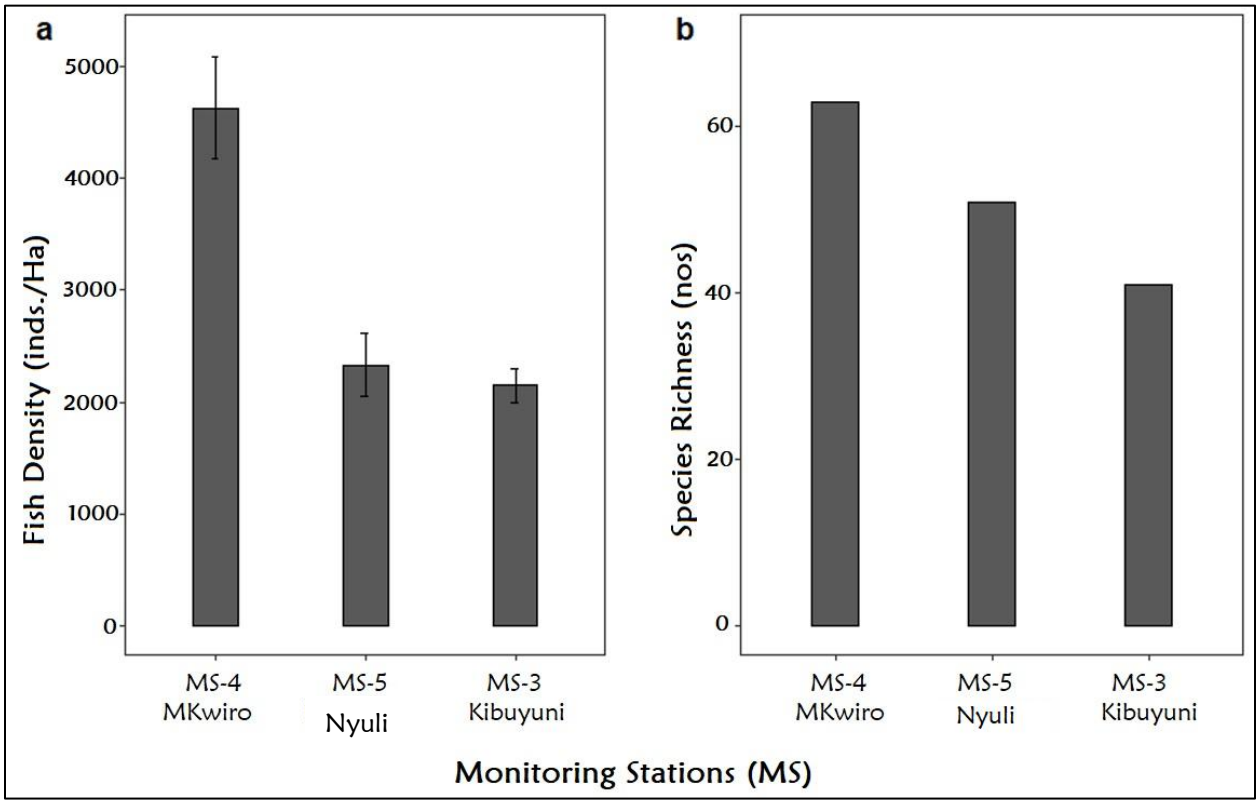


Figure 59: Barplot of Mean (se) of total fish density by sites (a) and Total number of species (absolute number) by sites (b).

Eight of the 13 pre-selected families were recorded in all the three sites. Haemulidae was recorded at Mkwiro and Kibuyuni while Serranidae was recorded at Nyuli and Kibuyuni. Balistidae, Siganidae and Kyphosidae were only recorded in one of the sites. Acanthuridae was the most abundant family in all the sites with mean densities of 1293.3 ± 246.9, 1106.7 ± 314.4 and 693.3 ± 209.5 at Mkwiro, Nyuli and Kibuyuni respectively. Other abundant families (>500 individuals/ha) were Lutjanidae at Mkwiro and Nyuli and Pomacanthidae and Scarinae at Mkwiro (Figure 60). Common names are based on Lieske and Myers (2001) (Table 13).

The difference in density and richness recorded could likely be due to protection and coral reef condition. Mkwiro which recorded highest density is protected through community conserved area hence low fishing pressure compared to Nyuli that is open to fishing hence recorded lower density and richness. Although, the survey at Kibuyuni was within a community conserved area, the extent of coral dominated reef is small and has high sediment load hence lowest density and diversity. Acanthuridae (surgeonfishes) are common taxonomic group in coral reefs and span a range of

trophic groups hence expected to be in higher densities in relatively healthy coral reefs. This suggests the coral reefs in a relatively health state.

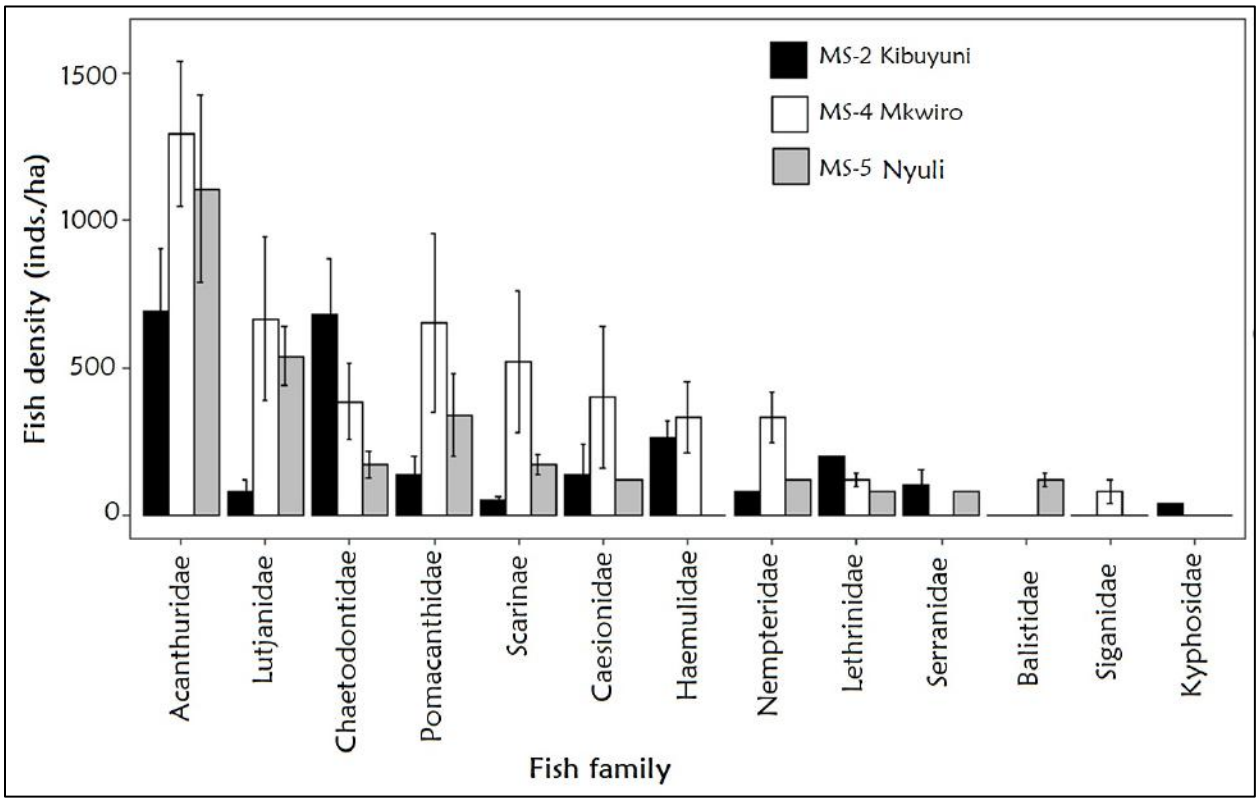


Figure 60: Fish family density at Kibuyuni, Mkwiro and Nyuli (Mean density ± SE) (Source: Field survey, September 2020).

Table 13: Presence (+) and absence (-) of coral reef fish species recorded in the 3 sites and total at each site (Source: Field survey, September 2020).

Family	Scientific name	Species common name	Kibuyuni (41)	Mkwiro (63)	Nyuli (51)
Holocentridae	*Neoniphon sammara*	Bloodspot squirrelfish	-	+	+
Holocentridae	*Sargocentron caudimaculatum*	Tailspot squirrelfish	+	+	+
Aulostomidae	*Aulostomus chinensis*	Trumpetfish	-	+	-
Serranidae	*Aethaloperca rogaa*	Redmouth grouper	+	-	-
Serranidae	*Cephalopholis argus*	Peacock grouper	+	-	+
Serranidae	*Cephalopholis boenack*	Chocolate hind	+	-	-
Serranidae	*Cephalopholis spiloparaea*	Strawberry grouper	-	-	+
Serranidae	*Epinephelus caeruleopunctatus*	White spotted grouper	+	-	-
Serranidae	*Epinephelus malabaricus*	Malabar grouper	+	-	-
Cirrhitidae	*Paracirrhites forsteri*	Freckled hawkfish	-	+	+
Priacanthidae	*Priacanthus hamrur*	Cresent-tail bigeye	+	+	-
Apogonidae	*Apogon cookii*	Blackbanded cardinal fish	+	+	-
Apogonidae	*Apogon aureus*	Ring-tailed cardinalfish	+	+	-
Lutjanidae	*Aprion virescens*	Green jobfish	-	-	+
Lutjanidae	*Lutjanus bohar*	Twinspot snapper	+	-	-
Lutjanidae	*Lutjanus fulviflamma*	Blackspot snapper	+	+	+
Lutjanidae	*Lutjanus lutjanus*	Bigeye snapper	-	-	+
Lutjanidae	*Lutjanus kasmira*	Bluelined snapper	-	-	+
Caesionidae	*Pterocaesio tile*	Bluestreal fusilier	+	+	-
Caesionidae	*Caesio caerulaurea*	Scissor-tail fusilier	-	+	-
Caesionidae	*Caesio lunaris*	Lunar fusilier	-	-	+
Caesionidae	*Caesio spp.*	Caesio spp.	-	+	-
Haemulidae	*Diagramma pictum*	Slatey sweetlips	+	-	-
Haemulidae	*Plectorhinchus flavomaculatus*	Gold-spotted sweetlips	+	-	-
Haemulidae	*Plectorhinchus gaterinus*	Blackspotted sweetlips	+	+	-
Haemulidae	*Plectorhinchus playfairi*	Whitebarred sweetlips	-	+	-
Nempteridae	*Scolopsis ghanam*	Arabian spinecheeck	+	+	+
Lethrinidae	*Lethrinus harak*	Blackspot emperor	-	+	+
Lethrinidae	*Lethrinus lentjan*	Pinkeye	+	-	-
Lethrinidae	*Lethrinus mahsena*	Sky emperor	+	+	-

Family	Scientific name	Species common name	Kibuyuni (41)	Mkwiro (63)	Nyuli (51)
Lethrinidae	*Lethrinus microdon*	Smalltooth emperor	-	-	+
Lethrinidae	*Monotaxis grandoculis*	Bigeye emperor	-	+	-
Mullidae	*Mulloidichthys vanicolensis*	Yellowfin goatfish	-	+	+
Mullidae	*Parupeneus macronema*	Longbarbel goatfish	-	+	+
Mullidae	*Parupneus barberinus*	Dash and dot goatfish	-	+	+
Kyphosidae	*Kyphosid spp.*	Kyphosid	+	-	-
Chaetodontidae	*Chaetodon auriga*	Threadfin butterflyfish	+	+	-
Chaetodontidae	*Chaetodon falcula*	Saddleback butterflyfish	+	-	-
Chaetodontidae	*Chaetodon interuptus*	Teardrop butterflyfish	+	-	-
Chaetodontidae	*Chaetodon kleinii*	Klein's butterflyfish	-	+	+
Chaetodontidae	*Chaetodon lunula*	Racoon butterflyfish	+	+	-
Chaetodontidae	*Chaetodon melannotus*	Blackbacked butterflyfish	+	+	-
Chaetodontidae	*Chaetodon meyeri*	Meyer's butterflyfish	-	+	+
Chaetodontidae	*Chaetodon trifascialis*	Chevroned butterflyfish	+	-	+
Chaetodontidae	*Chaetodon trifasciatus*	Redfin butterlfyfish	+	+	+
Chaetodontidae	*Chaetodon xanthocephalus*	Yellowhead butterflyfish	-	+	-
Chaetodontidae	*Chaetodon guttattisimus*	Spotted butterflyfish	-	-	+
Pomacanthidae	*Apolemichthys trimaculatus*	Three-spot angelfish	-	+	-
Pomacanthidae	*Centropyge multispinis*	Many-spined angelfish	+	+	+
Pomacentridae	*Plectroglyphidodon dicki*	Dick's damsel	-	+	-
Pomacentridae	*Abudefduf sparoides*	False-eye sergeant	-	+	-
Pomacentridae	*Chromis dimidiata*	Two-tone chromis	+	+	+
Pomacentridae	*Amphiprion akallopsis*	Skunk anemonefish	-	+	-
Pomacentridae	*Abudeduf sexfasciatus*	Scissor-tail sergeant	-	-	+
Pomacentridae	*Plectroglyphidodon lacrymatus*	Jewel damsel	+	+	+
Pomacentridae	*Dascyllus trimaculatus*	Three-spot dascyllus	-	+	+
Pomacentridae	*Dascyllus aruanus*	Humbug dascyllus	+	-	+
Labridae	*Labroides bicolor*	Bicolor cleaner wrasse	+	+	-
Labridae	*Bodianus axillaris*	Axilspot hogfish	-	+	+
Labridae	*Thalassoma hebraicum*	Goldbar wrasse	-	+	+
Labridae	*Thalassoma lunare*	Cresent wrasse	+	+	-

Family	Scientific name	Species common name	Kibuyuni (41)	Mkwiro (63)	Nyuli (51)
Labridae	*Gomphosus caeruleus*	Indian ocean bird wrasse	-	+	+
Labridae	*Cheilinus trilobatus*	Tripletail wrasse	-	+	+
Labridae	*Heliochores hortulans*	Checkerboard wrasse	-	+	+
Labridae	*Hemigymnus fasciatus*	Barred thicklip wrasse	-	+	-
Labridae	*Anampses lineatus*	Lined wrasse	-	+	-
Labridae	*Anampses twistii*	Yellowbreasted wrasse	-	+	-
Labridae	*Coris frerei*	Queen coris	-	-	+
Scarinae	*Calotomus carolinus*	Stareye parrotfish	-	-	+
Scarinae	*Chlorurus sordidus*	Bullethead parrotfish	-	+	+
Scarinae	*Scarus atrilunula*	Blackcresent parrotfish	-	+	-
Scarinae	*Scarus ghobban*	Bluebarred parrotfish	+	+	+
Scarinae	*Scarus psittacus*	Palenose parrotfish	-	-	+
Scarinae	*Scarus rubroviolaceus*	Redlip parrotfish	-	+	+
Pinguipedidae	*Parapercis hexophthalma*	Speckled sandperch	-	+	+
Zanclidae	*Zanclus cortunus*	Moorish idol	+	+	-
Acanthuridae	*Acanthurus gahm*	Black surgeonfish	+	+	+
Acanthuridae	*Acanthurus leucosternon*	Powder-blue surgeonfish	-	+	+
Acanthuridae	*Acanthurus lineatus*	Striped surgeonfish	-	-	+
Acanthuridae	*Acanthurus nigrofuscus*	Dusky surgeon fish	-	+	+
Acanthuridae	*Acanthurus thompsonii*	Thompson's surgeonfish	-	+	-
Acanthuridae	*Ctenochaetus binotatus*	Two-spot bristletooth	-	+	-
Acanthuridae	*Ctenochaetus striatus*	Striped bristletooth	+	+	+
Acanthuridae	*Ctenochaetus truncatus*	Goldring bristletooth	-	-	+
Acanthuridae	*Naso brevirostris*	Spotted unicornfish	-	+	-
Acanthuridae	*Naso thynnoides*	Singlespine unicornfish	-	-	+
Acanthuridae	*Zebrasoma desjardinii*	Desjardini's tailfin tang	+	-	-
Acanthuridae	*Zebrasoma scopas*	Sailfin tang	+	+	-
Acanthuridae	*Acanthurus blochii*	Ringtail surgeonfish	+	+	+
Siganidae	*Siganus stellatus*	Stellate rabbitfish	-	+	-
Siganidae	*Siganus sutor*	African whitespotted rabbitfish	-	+	-

Family	Scientific name	Species common name	Kibuyuni (41)	Mkwiro (63)	Nyuli (51)
Balistidae	*Sufflamen chrysopterus*	Halfmoon triggerfish	-	-	+
Balistidae	*Balistuphus undulatus*	Orange-stripped triggerfish	-	+	-
Ostraciidae	*Ostracion meleagris*	Spotted trunkfish	-	-	+
Tetraodontidae	*Canthigaster coronata*	Crown toby	+	-	+
Tetraodontidae	*Arothron hispidus*	White spotted puffer	-	-	+
Total			**41**	**63**	**51**

2.13.4 Benthic substrate

Hard corals dominated the substrate cover at Kibuyuni and Mkwiro with mean cover of 59.3 % ± 1.3 and 29.3 % ± 1.8 respectively. Nyuli was dominated by soft corals with a mean cover of 24.0% ± 3.1. Hard coral cover at Nyuli was 20.7% ± 2.4. The coral cover at Mkwiro and Kibuyuni are higher than the average for the Kenyan coral reefs of about 20% while Nyuli is within the country average. Several recently dead corals were observed at all the sites and this is likely due to the recent bleaching events (April and May, 2020) or other factors such as sedimentation especially at Kibuyuni. Silt and seagrass were only recorded at Kibuyuni with a mean cover of 12.0% ± 1.2 and 7.3% ± 1.3 respectively (Figures 61 and 62). A total of 21 coral genera were recorded in the three sites. Kibuyuni recorded the highest richness with 19 genera while Nyuli recorded 14 and Mkwiro recorded 12 genera. Taxonomic names are based on Corals of the World (2020) (Table 14).

It was also noted that there are ongoing biodiversity conservation programmes in Shimoni, Wasini, Mkwiro and Kibuyuni where the local communities have Community Conservation Areas to conserve fisheries and marine resources. They have established coral nurseries on degraded sites, transplant the corals and create awareness on restoration of marine life.

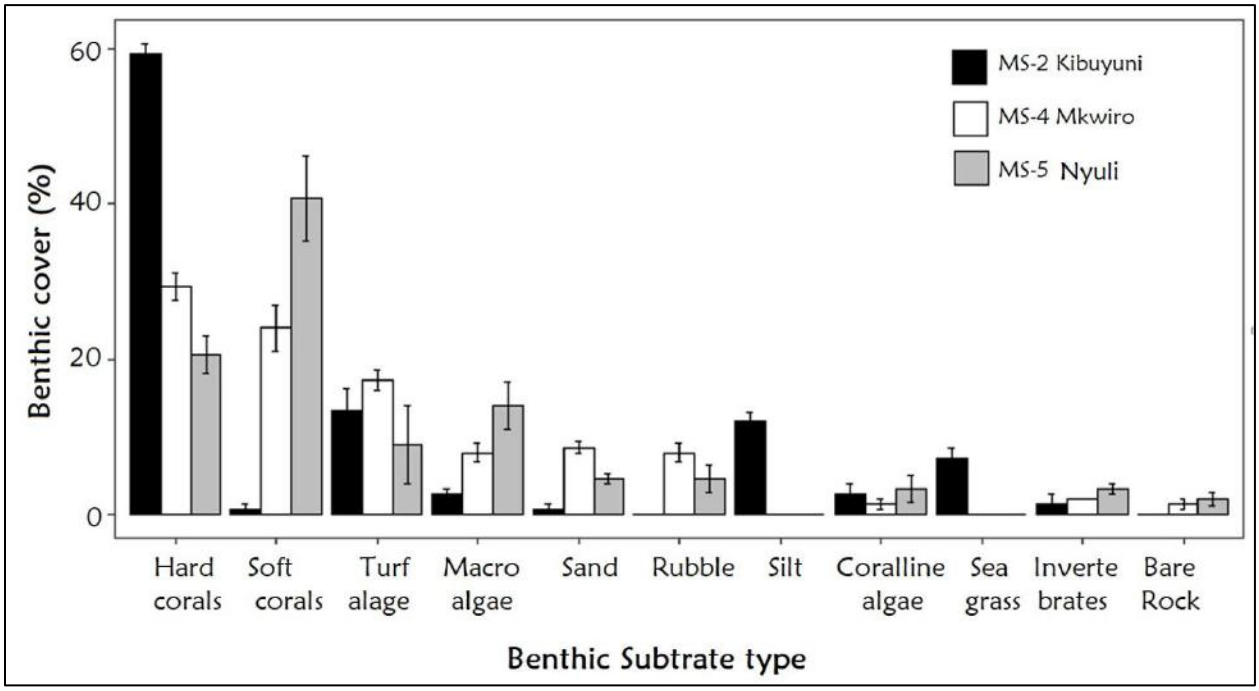


Figure 61: Benthic habitats Characterization for the biological monitoring sites; Kibuyuni, Mkwiro and Nyuli (Mean density ± SE).

Figure 62: Different benthic substrates of coral reefs in the three sites surveyed, Hard coral Acropora, Rubble Sand and Seagrass meadow.

Table 14: Presence (+) Absence (-) data for comparison of 21 coral genera recorded in the three (3) monitoring sites and total at each site.

Family	Genus	Kibuyuni	Mkwiro	Nyuli
Acroporidae	Acropora	+	+	+
Acroporidae	Montipora	+	+	+
Acroporidae	Isopora	-	-	+
Acroporidae	Asteopora	+	+	-
Pocilloridae	Pocillopora	+	+	+
Pocilloridae	Stylophora	+	-	-
Pocilloridae	Seriatopora	+	-	-
Fungiidae	Fungia	+	+	+
Fungiidae	Herpolitha	+	-	+
Faviidae	Favia	+	+	+
Faviidae	Favites	+	+	+
Faviidae	Echinopora	+	+	+
Faviidae	Platygyra	+	+	+
Faviidae	Diploastrea	+	-	-
Mussidae	Symphilia	+	+	+
Mussidae	Lobophylia	+	-	-
Merulidae	Merulina	+	-	-

Family	Genus	Kibuyuni	Mkwiro	Nyuli
Poritidae	Porites	+	+	+
Poritidae	Goniopora	+	+	-
Coscinaraeidae	Coscinaraea	-	-	+
Oculinidae	Galaxea	+	+	+

2.13.5 Benthic invertebrates

A total of 14 benthic invertebrates were recorded across the sites. Mkwiro recorded the highest species richness with 10 taxa observed while 7 taxa were recorded at both Kibuyuni and Nyuli. Only two taxa Asteroidea (seastar) and Sea anemone were recorded across all the sites. Nyuli recorded the highest mean density of 12.3 ± 4.1 individuals/250m^2, Mkwiro and Kibuyuni recorded mean densities of 7.6 ± 2.5 individuals/250m^2 and 6.1 ± 2.1 individuals/250m^2. Overall, the sea urchin species *Echinostrephus molaris* and *Echinothrix diadema* were the most abundant invertebrates with mean densities of 33.7 ± 8.2 individuals/250m^2 and 27.3 ± 8.0 individuals/250m^2 respectively (Table 15).

Table 15: Mean density and standard error of 14 benthic invertebrates taxa recorded by sites. Number in parenthesis indicate number of taxa (Source: Field survey, September 2020).

	Kibuyuni (7)		Mkwiro (10)		Nyuli (7)	
Benthic Invertebrates	Mean	SE	Mean	SE	Mean	SE
Asteroidea	2.7	1.8	8.7	1.8	16.7	2.9
Bivalves	0.0	0.0	2.0	2.0	4.0	2.0
C. tigris	0.0	0.0	1.3	1.3	0.0	0.0
Diadema savignyi	3.3	1.3	0.0	0.0	0.0	0.0
Diadema setossum	14.0	3.1	3.3	1.8	0.0	0.0
E. diadema	19.3	10.7	35.3	17.4	0.0	0.0
E. molaris	0.0	0.0	14.0	6.1	53.3	8.8
Egg shell	0.0	0.0	0.7	0.7	0.0	0.0
Gastropoda	0.0	0.0	4.0	2.0	4.7	1.3
Giant clam	0.0	0.0	0.7	0.7	0.7	0.7
Holothuria	0.7	0.7	0.0	0.0	0.0	0.0
Lobster	2.0	1.2	0.0	0.0	0.0	0.0
Sea anemone	0.7	0.7	6.0	3.5	6.0	1.2
Sea hare	0.0	0.0	0.0	0.0	0.7	0.7

2.13.6 Bathymetric survey of the dumping site

The soundings data was transformed to depth of water at the Lowest Astronomical Tide (LAT). A depth off-set of 0.5m was added to the subsequent values due to the depth of the Transponder unit submerged under the boat. Data was subsequently transferred to the mapping software. The area around the potential dredged material dumping site i.e. MS6 is approximately 400m deep (Figure 63).

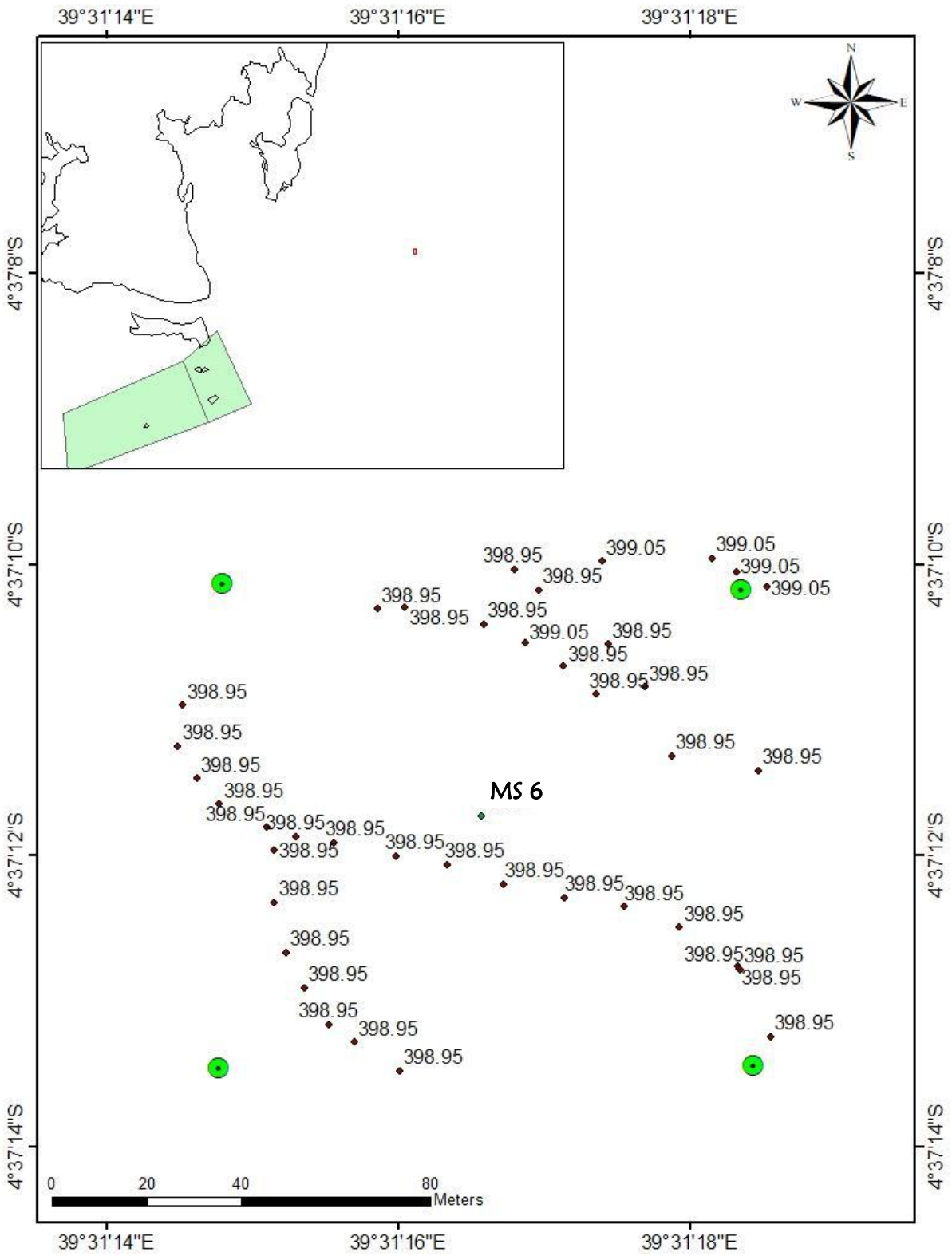


Figure 63: Bathymetry survey results of the soundings within the Shimoni channel (Source: Field survey, September 2020).

2.13.7 Sediment

The results of analysis of sediment samples collected showed that most of the sampled stations were dominated by sandy sediments, with the 39.17% ±31.49 course sand (range: 11.5-62.3%) and 60.83% ±fine sands (range: 29.8-88.5%) confirming textural quality of the sediments as 100% sand in the sites: Madyoka (62.3% & 37.7%), Mwazaro (12.6 % & 87.4%), Mkwiro (70.2% & 29.8%) and Shimoni Jetty (11.5% & 88.5% course & fine sand respectively). The ternary plots for the sediments at the four stations are shown in figure 64. The additional Survey stations off the Coral gardens at Kibuyuni and Nyuli could not be sampled for sediments due to the dominance of hard corals substrate while the potential dredged material dumping site running down to depths beyond 300m couldn't be sampled using the Ekman grab sampler due to depth challenges and under currents.

Analyses of organic matter content of the sediment samples using the ignition methods showed that all the sites were poor in sediment organic matter content with Mean SD of 3.15±1.21% OM. Mkwiro and Madyoka recorded 4.56% and 3.72% respectively, while Shimoni Jetty and Mwazaro recorded lower OM content at 2.37% and 1.93% respectively, indicative of very pristine grounds with minimal pollution input of organic waste. This may also indicate that the Shimoni / Wasini channel is well flashed by the tides, ensuring that the sediments are not chocked with organic matter deposition which would easily result in anoxic conditions especially within the channel. Sediment moisture averaged 49.1±14.4% with Mkwiro recording the highest moisture at 67.96% followed by Madyoka at 52.47%, Mwazaro at 39.92 and the Shimoni Jetty area at 35.95% which all correlated well with the organic matter content in the sampled sites. However, the Kibuyuni, Nyuli and offshore dumpsites which were dominated by hard coral and gravel can be categorised as poor in both sediment organic matter and moisture content, which may also suggest that the flashing rates and strength of currents at the selected sites was also high ensuring little disposition of organic matter.

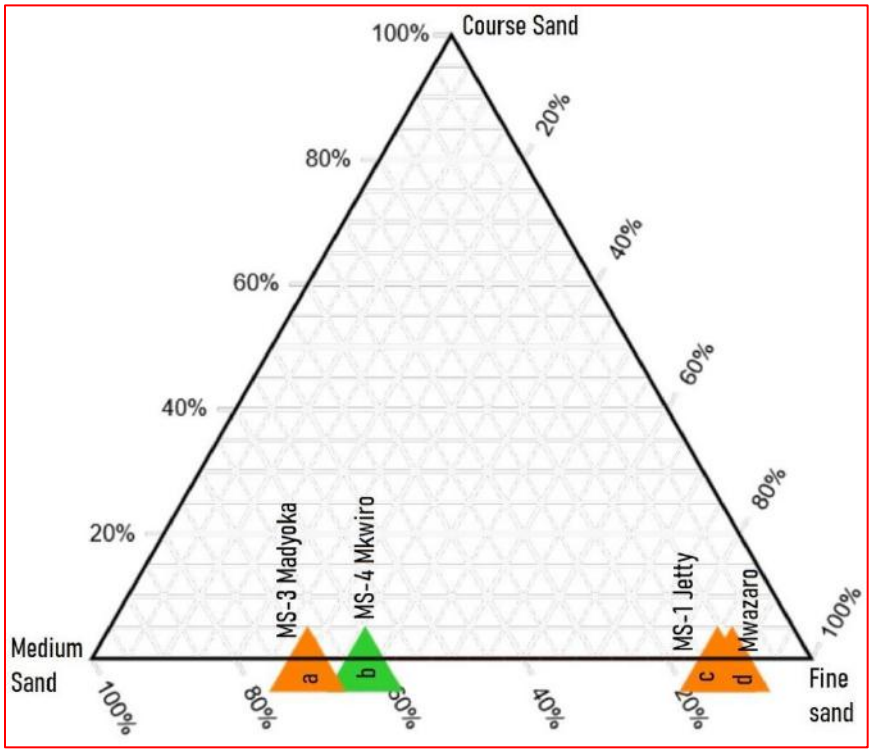


Figure 64: Pooled ternary plot for the sediments classifications for Madyoka creek mouth, Shimoni Jetty, Mwiro conservation areas and the Mwazaro station off the Shimoni Channel

2.13.8 Ambient air quality measurements

The objective of the ambient air quality measurements was to measure concentrations of dust and gaseous emissions so that the results can be assessed in relation to the Environmental Management and Coordination (Air Quality Regulations), 2014. Table 16 summarizes the findings of ambient air quality measurements at the Shimoni Fisheries Jetty. The findings show that the baseline values are within the limits prescribed under the Environmental Management and Coordination (Air Quality) Regulations, 2014.

Table 16: Ambient air quality measurements for the proposed Shimoni Port (Source: Polucon (K) Services Limited, September, 2020).

Monitoring time (hrs)	Weather conditions	Temp °C	Humidity %	CO mg/m³	NO_x ppm	SO_2 µg/m³	O_3	$PM_{2.5}$ µg/m³	PM_{10} µg/m³
1300-1900	Sunny	27	76	0.35	0.04	12.4	0.05	31.8	64.3
1900-0100	Windy	26	82	0.33	0.03	8.6	0.04	28.5	58.6
0100-0700	Windy	24	51	0.3	0.03	7.2	0.04	25.9	57.2
0700-1300	Sunny	24	83	0.36	0.04	10.1	0.05	32.4	60.7
Average	-	**25.25**	**73**	**0.34**	**0.035**	**9.6**	**0.045**	**29.7**	**60.2**
Air Quality Regulations, 2014 limits	-	-	-	**2**	**0.4**	**80**	**1.25**	-	**100**

2.13.9 Noise level measurements

The objective of the noise level measurements was to inform measures to safeguard the health of employees and visitors during construction and operation of the Shimoni Port Jetty and ensure compliance with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. Table 17 summarizes the findings of noise level measurements at the Shimoni Fisheries Jetty. The findings show that the baseline values are within the limits prescribed under the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

Table 17: Baseline noise level measurements obtained from at the Shimoni Fisheries Jetty (Source: Polucon (K) Services Limited, September, 2020).

Monitoring period	Time (hrs)	Leq dBA	LAmax (dBA)	LAmin (dBA)	L5 (dBA)	L50 (dBA)	L95 (dBA)
Diurnal noise level	0600-0610	53.8	62.5	49.3	59.5	53.2	51.2
	0700-0710	53.4	69.3	53.3	62.2	54.3	23.1
	0800-0810	56.1	57.8	51.4	52.3	51.9	50.4
	0900-0910	56.6	58.5	55.3	56.6	55.4	54.4
	1000-1010	58.0	66.5	53.3	62.6	57.3	54.6
	1100-1110	50.3	59.7	40.4	52.2	48.6	43.0
	1200-1210	60.2	75.9	51.4	67.4	56.6	53.8
	1300-1310	55.0	64.3	53.0	57.9	54.3	54.2
	1400-1410	54.5	61.9	50.1	67.8	51.8	50.7
	1500-1510	56.7	71.5	49.5	59.7	55.8	51.4
	1600-1610	56.8	63.5	50.7	61.4	50.8	50.3
	1700-1710	62.6	71.0	58.1	59.7	59.5	60.2
Averages	-	56.2	65.2	51.3	59.9	54.1	52.3
Noise Regulations, 2009 limits		**60.0**					

Monitoring period	Time (hrs)	Leq dBA	LAmax (dBA)	LAmin (dBA)	L5 (dBA)	L50 (dBA)	L95 (dBA)
Nocturnal Noise level	1800-1810	57.6	71.5	53.4	60.6	54.8	54.5
	1900-1910	60.2	67.4	53.2	54.5	53.2	52.7
	2000-2010	60.9	63.4	56.0	57.5	57.0	56.4
	2100-2110	62.3	69.6	57.8	59.4	59.2	58.5
	2200-2210	54.3	61.2	48.4	58.1	49.7	49.3
	2300-2310	59.3	64.5	55.3	56.9	56.6	55.2
	0000-0010	52.9	56.0	43.4	54.8	43.9	43.2
	0100-0110	52.1	56.0	43.3	54.7	44.0	44.2
	0200-0210	49.0	63.1	45.1	48.8	46.1	47.5
	0300-0310	46.9	49.7	45.7	48.7	46.6	46.2
	0400-0410	47.6	55.0	44.9	51.8	47.6	45.9
	0500-0510	52.5	64.2	50.1	55.5	53.1	50.6
Averages	-	54.6	61.8	49.7	55.1	50.9	50.3
Noise Regulations, 2009 limits		**35.0**					

3 IDENTIFICATION OF ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

The proposed Shimoni Port will have both socio-economic benefits and attendant negative environmental and social impacts. One of the key objectives of the ESIA process is to systematically assess the value of the benefits against the environmental and social concerns and provide measures to avoid, prevent or reduce the magnitude of the impacts. The following section identifies, predicts and analyzes these impacts and proposes mitigation measures to address them. The mitigation measures are based several EIA principles such as the entitlement to a clean and healthy environment and duty to enhance and safeguard the environment, polluter pays principle, precautionary approach, regional cooperation and stakeholder involvement in addressing environmental and social challenges of the proposed Shimoni Port.

3.1 Positive impacts of the proposed project

The project's direct benefits include but are not limited to the following;

3.1.1 Economic benefits of Shimoni Port development

According to the feasibility study carried out by the proponent in 2018, the economic benefits from the port are estimated at Kenya Shillings 28.3 billion over a 5-year horizon which will accrue from revenues to the government, fish sales and business opportunities in hinterland transport. A key benefit of the fishing port would be a ready market for local fishermen's landings value addition that would potential translate to better returns and livelihoods for them through exports. Additionally, section 99 of the Fisheries Management and Development Act, 2016 states that the operator shall retain no more than 30% of the total fish catch taken from Kenya's Economic Exclusive Zone annually, or such other amount as maybe prescribed and the remaining portion of the bycatch shall be landed for sale in the local market. The proposed industrial fishing port will tap on the benefit of blue economy.

3.1.2 Contribution of the project towards attainment of Vision 2030 and the Presidential Big Four Agenda

The construction of the Shimoni port will help in attainment of the Economic and Macro Pillar sector of Vision 2030 which is the national long-term development blueprint to create a globally competitive and prosperous nation with a high quality of life. It will also support the presidential Big Four Agenda by enhancing food security.

3.1.3 Provision of employment opportunities and support to other businesses

According to the feasibility study carried out by the proponent in 2018, the construction and operation of the port would create over 1,000 direct employment opportunities in fish processing and trade, ship repairs and handling, trucking, cargo transportation and handling services, administration, security and cleaning services among others.

3.1.4 Growth of Shimoni market

The construction and subsequent operation of Shimoni Port will lead to the economic spin off of Shimoni Village such as the development of real housing estates, hotels and Shimoni Market Centre.

3.1.5 Revenue to the Government

Both the County and National Government will generate revenue from export and import taxes, inspection fees, licences and services rendered by suppliers to the port. The revenue will potentially finance the government's obligations to citizens and overall development of the region.

3.1.6 Transfer of skills

The proposed port will facilitate the transfer of skills and technology to local people. During construction and operation of the proposed project, several people from within and outside the county will be employed to provide different services. As such, the local people will learn new skills and technology from the civil engineers, welders, masons and other experts that will be deployed.

3.2 Negative impacts during the construction phase of the proposed project

The proposed project is expected to have impacts on the marine ecosystem, terrestrial environment and local livelihood. These impacts include impact on Shimoni Slave Caves, impact on of potential dredging and dumping on water quality, generation of sediment plumes, re-suspension of heavy metals by dredging works, impact of dredging and dumping of substrate on marine habitats, oil spills and bioaccumulation of Polycyclic Aromatic Hydrocarbons (PAHs) from dredging activities, impact of dumping of dredged materials, potential impact on the Kisite – Mpunguti Marine National Park and Reserve, impact on fisheries and livelihoods, impact on Community Conserved Areas, impact on seaweed farming, navigational risks, loss of mangroves, loss of terrestrial vegetation cover, environmental risks of obtaining raw materials, impact of construction on the marine environment, potential capsizing of barges and vessels delivering raw materials, water consumption and effluent generation, solid waste generation and management, occupational safety and health, noise pollution, air pollution and labour influx and social concerns and asbestos removal and disposal. The anticipated environmental impacts and social concerns likely to emanate during this phase are discussed in detail below.

3.2.1 Impact on Shimoni Slave Caves

Prior to the construction, it is important to note the proximity of the auxiliary infrastructure for phase 1 such as the proposed warehouses to the Shimoni Slave Caves which was gazetted as a monument in 1992 under the Antiquities and Monuments Act, Cap. 215. The siting of the warehouse on the draft design layout should be ascertained to ensure that it doesn't sit on top of the underground cave leading to the sea and which National Museums intends to rehabilitate.

Recommended mitigation measure

1. Identify an alternative location for the warehouse away from the caves.

3.2.2 Impact of potential dredging and dumping on water quality

Potential dredging activities will upset sediments at the Shimoni channel. This will potentially alter the water quality by increasing turbidity hence affecting the Channel's productivity mainly due to reduced light, temperature changes and reduced availability of Dissolved Oxygen. Notably, baseline water quality sampling and analysis for physical and chemical parameters including pH, Total Dissolved Solids, Total Suspended Solids, Chemical Oxygen Demand, Biological Oxygen Demand, Turbidity, Dissolved Oxygen, Perspective Degree and Temperature indicated that the marine water was within the EMC (Water Quality) Regulations, 2006.

Impact of dredging on water quality has a cascading effect on the phytoplankton population in water. The envisaged increase of turbidity will potentially have an adverse effect on growth of phytoplanktons. Nutrient level is expected to rise when bottom sediment is suspended during dredging activity. This is expected to increase growth of phytoplankton on a thin surface layer of water for a short period. After which the population of phytoplanktons will decrease severely. The presence of zooplanktons is highly correlated with the population of phytoplanktons in water. Therefore, decrease in phytoplankton population would ultimately affect the diversity and population of zooplanktons.

Recommended mitigation measures

1. Dredging should be conducted during high tide in order to allow tidal flushes thereby reducing turbidity levels
2. Procure and deploy silt curtains during dredging to reduce turbidity in adjacent environments
3. Implement the critical limits for water quality during potential dredging and dumping the based on the values for other project which are being carried out by KPA (pH; 6.6-8.8, Dissolved Oxygen; >4mg/l, Turbidity; +60mg/l, Total Suspended Solids; +60mg/l, Chemical Oxygen Demand; 50mg/l and Perspective dregree (-))
4. Develop and implement a water quality monitoring plan for during potential dredging and dumping activities

3.2.3 Generation of sediment plumes and associated impacts

Potential dredging activities will upset sediments at the bottom of the water in Shimoni channel thereby generating sediment plumes that might be transported to the shores by the prevailing currents. The physico-chemical conditions of the waters in the channel and the MPA would be altered temporarily during the dredging period. High levels of total suspended solids can cause increased water temperatures and decreased Dissolved Oxygen. Moreover, dredging activities contribute to underwater noise.

Recommended mitigation measures

1. Dredging should be conducted during high tide in order to allow tidal flushes thereby reducing turbidity levels.
2. Potential dredging and dumping activities should be conducted during the South East Monsoon season when fishing activities are at their lowest

3.2.4 Re-suspension of heavy metals by potential dredging works

Potential dredging may cause re-suspension of already settled heavy metals such as lead, zinc, copper, chromium and nickel among others into the water column which will become available to the marine organisms. Some of these heavy metals are very toxic to the marine organisms at some levels. The concentration of the heavy metals will potentially be high during dredging.

Recommended mitigation measures

1. Dredging should be conducted during high tide in order to allow tidal flushes thereby reducing turbidity levels.
2. Procure and install silt curtains to contain sediments within the dredging areas
3. Develop and implement a sediments quality and biological monitoring plans focusing on heavy metals and health risks
4. Notify NEMA and potentially affected communities if high levels of heavy metal concentrations are reported in the monitoring plan for discussion on suitable intervention measures

3.2.5 Impact of potential dredging and dumping of substrate on marine habitats

Coral reefs, seagrass and mangrove habitats are important in providing habitat and breeding grounds for most local fisheries species and support offshore productivity. Potential dredging will lead to complete loss of seagrass beds, coral reefs and mangroves depending on their occurrence and distribution within the project site. For instance; hard corals dominated the substrate cover at Mkwiro which lies within the proposed dredging area with a mean cover of 59.3 % ± 1.3 followed by Nyuli, a site within the MPA as per the baseline survey. Seagrass dominated the Kibuyuni area with a mean cover of 7.3% ± 1.3. The mangroves forest cover are only limited to two project site

namely Kibuyuni area with an area of ≈1.57ha and next to Shimoni Garden Cottages with an area of ≈0.57ha. Coral, seagrass and mangrove habitats will be threatened by sediment suspension and potential oil spills during dredging and disposal of dredged materials offshore which can be dispersed by currents and cause habitat degradation. This in turn affects the biota they support.

Dolphins of Wasini and the entire Kisite-Mpunguti Marine National Park and Reserve roam freely in their natural habitat and hence dredging may interfere with their movement patterns. Increased suspended sediments can also affect filter feeding organisms, such as shellfish, through clogging and damaging feeding and breathing structures. Similarly, juvenile fish can be damaged if suspended sediments become trapped in their gills and lead to their fatalities.

Recommended mitigation measures

1. Use of silt curtains to localize turbidity to the dredging area
2. The contractor should commence dredging during the off season of the migratory marine megafauna. The frequency of cetacean sightings is highly seasonal, for example humpback whales are frequently sighted between the months of July to October coinciding with the peak breeding and calving periods.
3. Undertake daily monitoring of turbidity levels at the water quality monitoring stations identified by the consultants during dredging
4. Develop and implement a biodiversity monitoring plan for the areas to be dredged and the dumping site

3.2.6 Oil spills and bioaccumulation of Polycyclic Aromatic Hydrocarbons (PAHs) from potential dredging activities

Potential oil spills from the dredger can affect marine organisms by the high toxic concentrations of the unmodified and photo modified Polycyclic Aromatic Hydrocarbons (PAHs). Normally, bioaccumulation of the PAHs by the marine organisms contributes to different levels of toxicity. Normally, bioaccumulation of PAHs by the marine organisms contributes to different levels of toxicity. Bioaccumulation of PAHs from sediments is thought to involve an intermediate step in which the PAHs dissolve or are released into solution from the solid matrix and then partitioned into the lipid-rich tissues of marine organisms. Bioaccumulation of PAHs is a concern to the health of human beings consuming some of the marine fisheries (finfish and shellfish).

Recommended mitigation measures

1. Prevent oil spills from occurring through effective maintenance of the dredger and precautionary measures
2. Ensure that the machinery are serviceable and licensed to operate by International Maritime Organization (IMO) and the Kenya Maritime Authority (KMA)
3. Procure an oil spill response boom, equipment and train personnel on its use in the event of oil spills
4. Use degreasers to dissolve localized oil spills during barge/equipment maintenance
5. Keep records of all pollution incidents and notify NEMA within 24 hours of occurrence
6. Comply with the provisions of the Marpol Convention 73/78, the EMCA Cap. 387 of the Laws of Kenya and the KMA Act, 2012

3.2.7 Impact of potential dumping of dredged materials

The dredged material will need to be disposed off responsibly. Following on the London Convention criteria, the ESIA experts in consultation with the proponent and based on previous experience at Mombasa Port identified a suitable site for the dumping of the dredged material from

the Shimoni Channel. The site is located 17 Km offshore (04.652388°S/ 39.529794°E) from the existing Shimoni jetty/proposed project site and has a depth of -400m.

Recommended mitigation measures

1. Obtain a permit for the dumping site from KMA as will be required from time to time to comply with the London Convention 1972 / 1996 Protocol (ANNEX III).
2. Dumping of dredged materials should be restricted offshore at the identified site (MS6) to prevent potential pollution of the key biodiversity areas such as the Kisite- Mpunguti Marine Park and Reserve and the Community Management Conservation Areas.
3. Dumping of dredged materials should not be dropped at the surface since this will cause long distance dispersal of sediment from the disposal site. This would bring back a lot of sediment to the coastal shore. Dumping should be in deeper areas of the proposed dumping site.

3.2.8 Potential impact on the Kisite – Mpunguti Marine National Park

The proposed project lies within Shimoni Channel which connects to the Kisite - Mpunguti Marine Park and Reserve, a Marine Protected Area (MPA) gazetted under the Wildlife Conservation and Management Act, 2013. The MPA harbours a rich marine ecosystem with species of international importance such as the endangered sea turtles and dolphins. Besides supporting livelihoods, the MPA drives various economic activities including tourism and fisheries among others, which make significant contributions to the local and national economy. The MPA is currently under threat from various causes including pollution, over-exploitation of the reserve, destructive fishing practices and climate change among others. This means that any upstream developments and activities that occur within the Shimoni Channel where the proposed project will be undertaken will exacerbate these threats through pollution from potential dredging and dumping activities, potential oil spills from the dredging ship or potential running aground which which will degrade water quality and can affect affect the biodiversity of the MPA or interfere with their movement patterns of the MPA fauna such as dolphins. Notably, the MPA is approximately 3.5 Km from the mouth of Shimoni Channel.

Recommended mitigation measures

1. The contractor should commence dredging during the off season of the migratory marine megafauna. Existing literature and interviews with Kenya Wildlife Service and the local fishermen indicates that the frequency of cetacean sightings is highly seasonal, for example humpback whales are frequently sighted between the months of July to October coinciding with the peak breeding and calving periods.
2. Undertake daily monitoring of turbidity levels at the water quality monitoring stations identified by the consultants during dredging
3. The proponent and contractor will collaborate with the Kenya Wildlife Service to either establish a hotline or use existing one to report marine fauna sightings and strandings to expedite appropriate action

3.2.9 Impact on fisheries and livelihoods

The Shimoni channel is a key fishing ground for most fishers and during the potential dredging of the channel fishers will lose a source of livelihood. According to records from the State Department of Fisheries, Aquacultue and Blue Economy the total number of fishermen utilizing Shimoni area is estimated at 1000 (Catch Assessment Survey, 2016). Records from the Chairpersons of the Beach Management Units in Shimoni area estimate the number to about 1408 registered fishermen. It is however important to note that these figures are not an actual representation since there is

uncaptured data on the number of unregistered fishermen who are involved in illegal fishing practices.

Potential dredging activities at the channel is anticipated during phase 2 of the project. Three villages of Mkwiro, Wasini and Shimoni are likely to lose their fishing grounds which includes Mkwiro, Nyuli, Kibuyuni, Mwamba mkuu, Mpunguti, Waga and Sii due to possible restriction of movements of small boats. Similarly, some landing sites in the same villages are likely to stop being in use. On average, the annual total estimated catch in Shimoni area during North East Monsoon (NEM) and South East Monsoon (SEM) season is ≈281.3 MT valued at over KES 50 million and ≈118.3 MT valued at over KES 21 million per year respectively (Source: State Department of Fisheries, Aquacultue and Blue Economy Catch Data, 2010 – 2019). This translates to a loss of ≈KES 51,000 and ≈21,000 per year for each fisherman during NEM and SEM season respectively.

Apart from the socioeconomic effects, these impacts may lead to conflicts between the dredging company, the local community, fishermen and the business community.

Recommended mitigation measures

1. Proponent to liaise with the County and National Fisheries to update the number of fishermen within the study area
2. Carrying out potential dredging activities during the South East Monsoon season when there is reduced fishing activities
3. Constitute a committee comprised of State Department of Fisheries, Aquacultue and Blue Economy, the County Fisheries Office and the BMUs for conflict resolution
4. Implementation of the KPA Grievances Redress Mechanism Tool

3.2.10 Impact on Community Conserved Areas

The BMUs within the study area have established three (3) Community Conserved Areas (CCA) also locally known as *Tengefu* in Mkwiro, Wasini and Kibuyuni. These no-take zones are fully protected with no extraction or fishing allowed. In Mkwiro and Wasini CCAs, the communities in collaboration with other stakeholders are carrying out coral reef restoration and establishment projects. Dredging activities during phase 2 will potentially impact on these CCAs through water quality degradation which will in turn affect coral reefs and fisheries resources. The most affected would be the Mkwiro and Wasini CCAs which coincides with the proposed site for the industrial fishing port.

Recommended mitigation measures

1. Implement the recommended measures to prevent water quality degradation
2. Transplanting the corals to a new site identified in consultation with the local fishermen and other stakeholders
3. Implement the KPA Grievance Redress Mechanism

3.2.11 Navigational risks

Other issues that may impact on local fishermen include maritime accidents. For instance, their boats can drift into the construction areas, collide with the dredger or ships or pillars at night thereby causing accidents. Other channel users include Wasini Island residents, tourists travelling to Kisite - Mpunguti Marine Park and Reserve, Wasini Island and diving centers such as Pilli Pipa and Paradise Divers in Mkwiro.

Recommended mitigation measures

1. Create awareness among the local fishermen and other channel users on dredging activities and the construction of the jetty and the area to be covered
2. Map out alternative routes that will be used by the channel users during the implementation of the proposed project
3. Ensure placement of aids to navigation to warn fishermen and other channel users of potential dangers such as bouys and beacons and light houses
4. Ensure the barges and construction areas are well lit at night
5. Comply with the code of safety for special purpose ships, 2008
6. Comply with the Kenya Maritime Authority Act, 2012

3.2.12 Impact on seaweed farming

Seaweed farming has been identified as a good prospect for social and economic development of coastal areas and especially in Kibuyuni. It is aimed at diversifying livelihood opportunities for fishing communities whose livelihoods have been put at risks by diminished capture fisheries. There are 143 seaweed farmers in Kibuyuni with 85% being women. Each of the farmer has 6-10 blocks of farms (measuring 100 m by 25 m each). Approximately Twenty (20) tonnes of seaweeds are harvested quarterly from the farmers (Source: Kibuyuni BMU, September 2020). Each kilogram of seaweed is sold at KES 25 translating to 15million/year. During phase 1 which involves the construction of the jetty, seaweed farming will not be impacted. However, dredging activities at phase 2 will have environmental impacts which include water quality degradation and pollution (oil spills and wastes) from dredger and ships docking in Kibuyuni.

Recommended mitigation measures

1. Use of silt curtains to localize turbidity to the dredging area
2. Prevent oil spills from occurring through effective maintenance of the dredger and precautionary measures
3. If Kibuyuni area (Plot 1) and Shimoni Garden Cottages (Plot 2) are chosen for the development of the fishing port, then form a committee in collaboration with the seaweed farmers and KPA for timely interventions to protect the seaweed farms from pollution
4. Supporting the local women groups to re-establish affected seaweed farms in suitable locations
5. Implement the proposed water quality monitoring plan for timely intervention to protect the sea weed farms
4. Implement the KPA Grievance Redress Mechanism

3.2.13 Loss of mangroves

According to the feasibility study report, there are four proposed project sites for the construction of the industrial fishing port at Kibuyuni (Plot 1), next to Shimoni Garden Cottages (Plot 2), next to the existing Shimoni jetty (Plot 3) and KPA owned land (Plot 4). The mangroves forest cover are only limited to two project site namely Kibuyuni area with an area of ≈1.57ha and next to Shimoni Garden Cottages with an area of ≈0.57ha. According to the National Mangrove Forest Management Plan, the average stocking rates of mangroves in Kwale County is ≈3,327 stems/ha translating to a potential total loss of 5,223 trees and 1,896 trees in Kibuyuni and next to Shimoni Garden Cottages respectively. As noted in the baseline information, mangrove forest provides both important environmental goods and services which include breeding grounds for fish, coastal stabilization, habitats for birds and other biodiversity and support apiculture. They also regulate climate through carbon sequestration. Hence clear felling the mangroves will lead to habitat loss and will affect the other services they provide. According to the National Forest Mangrove Management Plan for Kenya, the Total Economic Value of mangroves is KES 12,600/ha/year

(WWF, 2016) which translates to a gross loss of KES 19,782 /year in Kibuyuni and KES 7,182/year in Shimoni Garden Cottages but compounded by the irreversible nature of the project impact.

Recommended mitigation measures

1. Obtain approval from Kenya Forest Service (KFS) and prior to felling of the mangrove trees
2. Apply and obtain Special Use Licence from the KFS if either Plot 1 or plot 2 is used for port development
3. If either Plot 1 or plot 2 is used for port development, replant approximately of 10,446 trees and 3,792 trees respectively at an alternative site to be determined in consultation with KPA, KFS and the local Community Forest Association (CFA). This is based on twice the loss at each of the two (2) sites.

3.2.14 Loss of terrestrial vegetation cover

The preparatory works for the proposed Shimoni Port will involve clearing of trees, bushes and other vegetation cover which covers 16%, 84%, 74% and 50 % in Kibuyuni (Plot 1), next to Shimoni Garden Cottages (Plot 2), next to the existing Shimoni jetty (Plot 3) and KPA owned land (Plot 4) respectively. The major tree species documented at the four (4) plots include the Indian almond - *Terminalia catappa*, Red Jacaranda, Neem trees- *Azadirachta indica*, Baobab tree- *Adansonia digitata*, pine tree, coconut trees, mango trees, shrubs and grasses among others. Vegetation cover at the sites provides several environmental and socio-economic benefits which include preventing soil erosion which would degrade water quality at Shimoni Channel, carbon sequestration and provision of wood fuel to the local community. Hence clearance of the vegetation would lead to the loss of these benefits during the construction of the Industrial fishing port (Phase 2).

Recommended mitigation measures

1. Obtain authorization from Kenya Forest Service and the County Government of Kwale to fell trees
2. Retain tree cover in areas that will not be constructed
3. The proponent can compensate the loss in vegetation cover by procuring at least 1,000 seedlings of fast maturing tree species for planting within farmlands and homesteads neighboring the proposed project site
4. Landscaping of the port by planting sediment binding grass (preferably Kikuyu grass) and establishing flower gardens in consultation with a qualified landscape architect

3.2.15 Environmental risks of obtaining raw materials for construction of the port

The port construction activities such as piling, building of quay, fish auction market, offices, cargo storage areas and sanitation blocks among others will require raw materials such as building blocks, aggregates, cement, steel, timber and sand. The raw materials will be sourced from the environment and will have negative environmental impacts at their points of origin.

Recommended mitigation measures

1. Procure quantities of construction materials in line with the Bill of Quantities prepared by a Licensed quantity surveyor
2. Source raw materials from sites that are licensed as per the EMCA Cap. 387 of the Laws of Kenya
3. Re-use and recycle construction materials where practical

3.2.16 Potential capsizing of barges and vessels delivering raw materials

Transporting raw materials such as sand, ballast, cement and steel for the construction of the jetty on water poses environmental risks due to the potential of transportation boats running aground during low or rough tides and consequently polluting the sea.

Recommended mitigation measures

1. Use sea worthy vessels certified by Kenya Maritime Authority (KMA) during construction
2. Employ competent and certified coxswains to pilot the vessels during construction of the jetty

3.2.17 Impact of port construction activities on the marine environment

The construction activities including excavation and other civil works will create loose soils that are susceptible to erosion. This will contribute to sedimentation within the adjacent marine waters hence water quality degradation. Other potential sources of water quality degradation is solid waste and poorly managed effluent. Piling works have the potential to impact the marine environment through disturbance of the seabed and accidental spillages and discharges. This will in turn affect the biological communities such as fish, marine mammals and benthic habitats. Notably, a baseline survey on benthic habitat was conducted within the proposed project area and the critical habitats identified lied within Nyuli, Mkwiro and Kibyuni areas.

Recommended mitigation measures

1. Civil works near shore areas should be carried out during the low tide
2. Contract a NEMA licensed contractor to manage both solid waste and effluent
3. Carry out observations on marine mammals prior to the commencement of piling activities
4. Develop and implement a water quality monitoring plan

3.2.18 Water consumption and effluent generation

During the construction phase, water will be required for concrete mixing, casting and curing works, drinking and sanitation purposes which will lead to increased demand for water. Water will be supplied by water vendors and water bowsers. Seventy percent (70%) of the water used for domestic purpose will generate effluent whereas the rest soaks into ground areas within the project site or drain to the channel. Poor disposal of the wastewater will have the potential to pollute underground aquifers and the sea.

Recommended mitigation measures

1. Sensitize workers and contractors on the need for water conservation and implement penalties for wastage such as running pipes when not in use
2. Contractors to procure mobile toilets for the workforce as the existing facilities are inadequate to service both KPA staff and the workers
3. Comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006

3.2.19 Solid waste generation and management

The construction activities will generate solid waste such as biomass, overburden, cuttings and rejected materials among others. Workers at the site will generate domestic waste such as food leftovers, plastics and wrappings among others. These will need to be disposed off appropriately. The dredger will also generate both domestic and commercial wastes which will need to be disposed off responsibly. Poor disposal of solid wastes has negative environmental impacts which would include pollution of the channel, providing habitat for disease causing pathogens and vectors reducing the aesthetic value of the port environment.

Recommended mitigation measures

1. Use the generated overburden in landscaping
2. Sensitize construction workers on the process of solid waste collection, segregation and proper disposal
3. Procure and strategically place adequate solid waste collection bins with a capacity for segregation within the construction sites
4. Procure the services of a NEMA licensed waste handler to dispose solid wastes from the construction sites and the ship
5. The barge should comply with the provisions of the Marpol Convention 73/78, the EMCA Cap. 387 of the Laws of Kenya and the KMA Act, 2012
6. Comply with the provisions of Environmental Management and Coordination (Waste Management) Regulations, 2006

3.2.20 Occupational safety and health

The operations of the dredger and the construction of the port will employ personnel who will be exposed to potential occupational safety and health hazards. These include accidental falls, drowning and high noise levels especially those working in the engine rooms. Additionally, the channel is used as a transport corridor locally thus the dredger may pose navigational safety risks to other maritime traffic including local fishing boats.

Recommended mitigation measures

1. Register the site as a work place with the Directorate of Occupational Safety and Health Services (DOSHS)
2. Employ competent personnel who can swim in the event of falls into the sea
3. Provide life jackets to all workers working within the sea area and train personnel on proper use
4. Provide a well-trained rescue and first aid team as well as a standby boat to act as an ambulance in the event of accidents in the sea
5. Ensure the dredger is licensed by the IMO and KMA
6. Create awareness among the channel users on the presence of the dredger and its activities as well as the required safety precautions
7. Hire qualified and well-trained personnel for the dredging and construction works
8. Contractors to obtain insurance cover for employees and ensure appropriate compensation in the event of accidents
9. Provide Personal Protective Equipment (PPE) for ship crew, workers and visitors to the port
10. Contractors for both the dredging and construction works at the jetty should recruit qualified and experienced Occupational Safety and Health Officers to train and enforce compliance with safety measures
11. Erect safety signage and boards at all construction zones showing the required safety measures and PPE to be used
12. Comply with the Merchant Shipping Act, 2009 (Part VII Section 117-168 on Safety, Health and Welfare of Seafarers)
13. All accidents should be reported, investigated and corrective action taken to prevent reoccurrence
14. Comply with provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009
15. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.2.21 Noise pollution

The construction works, delivery of construction materials by heavy trucks and the use of machinery will lead to high levels of noise and vibration within the construction site and the surrounding area. Noise may lead to hearing impairments which will reduce the workmanship of the employees and also affect their finances due to treatment and medication. Neighbors to the project site will also be exposed to noise during site preparation and construction activities.

Construction sites such as the proposed project which are near residential areas can only emit noise levels of up to 60 dB(A) during the day and 35dB(A) during the night as per the Second Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

Recommended mitigation measures

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

3.2.22 Air pollution

Air pollution will be as a result of dust generated during excavation, concrete mixing activities and exhaust fumes from heavy commercial vehicles accessing the site. The vehicle exhausts are known to contain Sulphur dioxide, carbon monoxide and hydrocarbons and together with dust generated constitute major pollutants which can affect air quality. The most relevant pollutant considered is particulate matter because of its potentially significant increase during the construction phase. Respirable particulate matter may present respiratory diseases, cause eye irritation and visual intrusion to workers, visitors to the project site and the neighbors if it is in excess of 100 $\mu g/Nm^3$ as per the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

Recommended mitigation measures

1. Install appropriate and adequate dust screens around the project site
2. Sprinkle water at the excavation areas to suppress dust
3. Cover stock piles of construction materials (aggregates, sand and fill material) to reduce dust emissions especially during windy conditions
4. Procure, provide and enforce the use of dust masks to workers and visitors to the project site
5. Use of serviceable machinery/equipment and trucks
6. Monitor fugitive emissions to ensure compliance with the limits set under the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014
7. Comply with the provisions of Environmental Management and Coordination (Air quality) Regulations, 2014

3.2.23 Labour influx and social concerns

During the implementation of the proposed project, there will be creation of approximately 100 employment opportunities. It is expected that the contractors will source Labour from the local community and elsewhere in the country when the skills required are not available locally. The influx of workers will potentially lead to increased demand and competition for goods, social and health services, which can lead to price hikes and crowding out of local consumers, increased volume of traffic and higher risk of accidents, increased demands on the ecosystem and natural resources, social conflicts within and between communities, increased risk of spread of communicable diseases, and increased rates of illicit behavior and crime.

Recommended mitigation measures

1. Prior to starting construction, the contractor should prepare a site-specific Labor Influx Management Plan
2. Establish liaison committee for its implementation in collaboration with the Ministry of Interior and Coordination of National Government, County Government of Kwale, BMUs, Community Based Organizations, Kenya Fisheries Service and Hoteliers among other stakeholders

3.2.24 Asbestos removal and disposal

Seven fisheries buildings are roofed using asbestos and hence KPA intends to remove and dispose them to reduce the risks they may pose to their staff and the general public. The total area covered by the asbestos roofing is 600m^2. Asbestos is a naturally occurring fibrous mineral with high tensile strength, the ability to be woven, and resistance to heat and most chemicals. Because of these properties, Asbestos fibers have been used in a wide range of manufactured goods, including asbestos-Cement Corrugated Sheet for roofing, ceiling and floor tiles, paper and cement products, textiles, coatings, and friction products such as automobile clutch, brake and transmission parts. However, when asbestos-containing materials deteriorate or are damaged, asbestos fibers are released into the air. Fibers that are inhaled can lodge and remain in the lungs, or migrate to other locations in the body. Asbestos fibers have been shown to cause asbestosis, lung cancer and mesothelioma. They are hence classified as carcinogenic under UN Class 12 and CODE H16 and hazardous under both the Fourth Schedule of the Environmental Management and Coordination (Waste Management) Regulations, 2006 and the Factories and Other Places of Work (Hazardous Substances) Rules, 2007.

Recommended mitigation measures

1. Remove all the asbestos roofing sheets.
2. Removal and handling of asbestos sheets should be undertaken by a NEMA licensed contractor to comply with the Environmental Management and Coordination (Waste Management) Regulations, 2006 and the National Guidelines on the Safe Management and Disposal of Asbestos, 2011 by NEMA.
3. All personnel involved in the removal and handling of the asbestos should be provided with the following Personnel Protective Equipment (PPE), trained on their use and compliance on use enforced by the supervisors. The PPE will include;
    i. P2 disposable mask or a full-face respirator
    ii. Disposable overalls with a hood suitable to the task, e.g. European Standards Type 5 and Type 6
    iii. Gloves with wrist taped
    iv. Gumboots or non-laced footwear with disposal slippers over
4. The sheets should be wrapped with a High-Density Polyethylene (HDPE), marked as hazardous and secured ready for transportation.

5. Transport vehicles used must have a NEMA licence for transportation of hazardous wastes.
6. Disposal should be at a NEMA licensed site with a capacity to handle hazardous wastes.

3.3 Negative impacts during operational phase of the proposed project

At this phase, the potential environmental and social impacts include climate change adaptation, pollution from fish processing activities, introduction of invasive species, wastewater generation and management, solid waste generation and management, oil and grease spills, potable water and energy demand, occupational safety and health, air pollution, noise pollution, fire risks and emergencies, potential sources of conflicts, potential impacts on visual quality and potential collapse of Port infrastructure. The anticipated environmental impacts and social concerns likely to emanate during this phase are discussed in detail below.

3.3.1 Climate change adaptation

Maritime transport is a contributor to climate change, accounting for approximately 2.7% of annual global CO_2 emissions in 2014, and potentially rising to 10% of total global GHG emissions by 2050 if other sectors make significant reductions (Source: National Climate Change Action Plan 2018-2022). The rate of sea level rise along Africa's Indian Ocean coast is projected to be greater than the global average. This will lead to greater levels of and more frequent coastal flooding. Due to the importance of transport in the development of Kenya and the region, and as recommended in the National Climate Change Action Plan (NCCAP), Kenya aims to address climate change in the transport sector by working to reduce greenhouse gas emissions while encouraging development of transport infrastructure that accounts for the effects of climate change. Among the risks that the port faces are sea level rise caused by climate change. However, port activities can exacerbate this impacts. The proponent should implement measures to ensure low carbon foot at Shimoni Port.

Recommended mitigation measures

1. KPA to develop the Ports' Climate Change Action Plan to address emissions and sea level changes
2. Engineering designs should take into considerations the impact on climate change such as sea level rise
3. Develop and ensure application of air quality management protocols to avoid, minimize, and control combustion emissions, including GHG emissions, related to land-based port activities
4. Implement the air quality monitoring plan
5. Maintain cargo transfer equipment (e.g., cranes, forklifts, and trucks) in good working condition to reduce air emissions
6. Ensure compliance with the Climate change Act 2016 and the National Climate Change Action Plan 2018-2022
7. Comply with the Marpol Convention 73/78 (MARPOL Annex VI)

3.3.2 Pollution from fish processing activities

Fish processing activities can cause pollution of the environment from wastewater discharge, biological decomposition of fish guts and associated organic matter. These can potentially lead to odour due to poor housekeeping, overloaded or improperly run wastewater treatment and disposal facilities and prolonged storage of wastes. The facility should maintain a clean environment to ensure that the activities carried out during processing cause minimal pollution.

Recommended mitigation measures

1. Keep all working and storage areas clean and remove waste products immediately
2. Put in place a drainage channel within the production area to aid in washing off any spillages to avert odour
3. Cover all transfer systems, wastewater canals, and wastewater treatment facilities to reduce the escape of foul odours
4. Avoid processing batches of raw material that are of considerably lower than average quality; this will reduce the odour components
5. Reduce the stock of raw materials, waste, and by-products and store this stock for short periods of time only in a cold environment
6. Seal by-products in covered, leak-proof containers
7. Empty and clean fat traps on a regular basis
8. The fisheries offal's can be sold to fertilizer industry/animal feed farms such as Mamba Village Crocodile Farm and the Nile Crocodile Farm

3.3.3 Introduction of invasive species

The shipping industry has the potential to inadvertently bring invasive species to ports through various means. Organisms become hitchhikers on ships by being carried in ballast water, attaching to vessel hulls and anchor chains on ships. The risk of a given species disrupting an ecosystem is related to the similarity of oceanographic conditions between the origin and destination environments. The new species may not be naturally regulated by predation or other means and can become dominant. Invasive species impose ecological, economic, and health-related damages that can be severe and intensify over time.

In the absence of natural predators and competitors, invasive species can overtake available resources, disrupt the local food web, alter habitat structures and act as secondary vectors of parasites and disease. Competition or extensive population growth can initiate mass mortality of economically important species or damage to fishing gear and among other facilities, potentially causing closures of industrial activities.

Recommended mitigation measures

1. Enforce flushing and refilling ballast tanks with water from the open ocean before the ships arrive at the port
2. Ensure that the resultant water from on-board treatment is not toxic when discharged in the destination port
3. All vessels docking at the Port to comply with the provisions of the Marpol Convention 73/78.

3.3.4 Wastewater generation and management

Wastewater will emanate from the sanitation facilities, cleaning operations and vessels docking at the port which will need to be desludged. Poor effluent management will have the potential to pollute underground aquifers, the marine environment and can harbor disease causing pathogens and vectors such as mosquitoes. Toxic substances that may be included in the cleaning operations may contain oil and grease and heavy metals among other raw materials which will decompose to inorganic form, deplete the dissolved oxygen and lead to eutrophication of Shimoni channel impacting on fisheries, health of the communities and livelihoods.

Recommended mitigation measures

1. Design and construct a bio-digester to manage effluent from sanitation facilities and waste water from cleaning operations
2. Apply and obtain an Effluent Discharge License from NEMA pursuant to the provisions of Environmental Management and Coordination (Water Quality) Regulations, 2006
3. Comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006
4. All vessels docking at the Port to comply with the provisions of the Marpol Convention 73/78, the EMCA Cap 387 of the Laws of Kenya and the KMA Act, 2012

3.3.5 Solid waste generation and management

The operational phase of the project will generate waste in the form of plastics, paper, organic wastes, oil and grease containers used for machinery maintenance, cargo residues among others. Similarly, ships will generate wastes which include plastics, metal, glass, paper, organic wastes, effluent and potential used oil and lubricants. Poor disposal of the wastes will cause pollution and degradation of water quality, harbor pathogens and disease vectors such as mosquitoes and flies among others thus leading to potential health challenges and reduce the aesthetics of the Shimoni port and its environs.

Recommended mitigation measures

1. Sensitize employees, visitors, ship crew and the community neighboring the port on the importance of proper solid waste management through reduction, re-use and recycling. This could be done through regular clean-up days involving the employees and crew.
2. Provide infrastructure for solid waste collection and storage at the port with capacity for segregation to support and enhance recycling initiatives. This should include infrastructure for handling solid wastes from ships
3. Procure the services of a NEMA licensed waste handler to dispose off solid wastes from the port at scheduled intervals
4. Comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006
5. Ships and other vessels should comply with the provisions of the Marpol Convention 73/78, the EMCA Cap 387 of the Laws of Kenya and the KMA Act, 2012

3.3.6 Oil and grease spills

Oil and grease may be introduced within the port during maintenance and servicing of water vessels, illegal discharge of tank washings and oil-contaminated ballast water, tanker accidents, dumping of wastes among others. Leaked oils, oily wastes and mixtures will potentially be transported into the channel through runoff, cleaning activities or direct introduction by ships and maritime crafts leading to water quality degradation. Degraded water quality will in turn impact on fishery resources and the marine ecosystem. Some oils contain carcinogens and their contamination is biomagnified especially in fishery resources. Adverse health effects of consuming contaminated fish include liver damage, skin irritation, reproductive and developmental effects.

Recommended mitigation measures

1. Create awareness on oil spill prevention and training on containment if oil spills do occur
2. Establish a well-equipped pollution control center (with booms, dispersants etc.)
3. Procure a well-equipped pollution control boat and train port personnel on usage
4. Prepare and implement as need arises, an oil spill contingency plan for the port
5. Procure a NEMA licensed contractors to dispose, reuse or recycle waste oil
6. Report and document all oil spills incidents, action taken and the results of the action taken

7. All ships and maritime crafts to Comply with the provisions of the Marpol Convention 73/78, the EMCA Cap 387 of the Laws of Kenya and the KMA Act, 2012

3.3.7 Water and energy demand

During the operation of the Port, approximately 250m^3 of water/day will be required for drinking, general cleaning, cleaning of fish and sanitation purposes among other day to day uses. Shimoni area lacks reliable supply of fresh water thus many locals depend on wells for water, which they pump into storage tanks and use for domestic purpose.

Energy will be required for lighting, operation of equipment and machinery and auxiliary facilities. The area is connected to the national grid. Just like water demand, energy use will increase during the operational phase.

Recommended mitigation measures

1. The proponent will sink 3 boreholes at the project site, connect the port to the reticulated supply by Kwale Water and Sewerage Company or install a sea water desalination plant
2. Enhance water conservation through awareness creation among employees and visitors
3. Kenya Power and Lightning Company is upgrading the power infrastructure to avoid straining the existing community supply once the port development activities and operation commence
4. Install solar panels at the port area for lighting purposes
5. Keep records on power consumption by the port including generators and other equipment to inform energy management and audit interventions

3.3.8 Occupational safety and health

There will be an increase in traffic within the Shimoni channel during the operational phase of the proposed project which may lead to accidents especially with the local fishermen's boats either fishing or conducting tours at the channel. Such accidents could lead to death, are a threat to livelihoods and could lead to conflicts between the proponent and the local community. Within the port, the safety and health of workers and visitors to the facility is of utmost importance. Occupational safety and health issues during this phase will include physical and chemical hazards which could cause adverse human health or loss of life. Physical hazards will include the accidents during boarding and/or disembarking from the boats at the jetty or the boats crashing into the pillars, potential for falls caused by slippery floors and stairs, injuries caused by unprotected machinery or moving parts and movement of Heavy Commercial Vehicles (HCVs). Chemical hazards will occur due to exposure of workers to hazardous substances through inhalation and exposure of eye or skin to toxic chemicals and inhalation of dust.

Recommended mitigation measures

1. Install navigational aids, marker buoys, and early warning signage along the Shimoni channel to the port
2. Sensitize local fishermen and tour operators on the increased traffic at the channel
3. Establish a control tower to guide traffic within the channel
4. Create awareness among employees on the importance of their safety
5. Develop and implement a safety action plan and set goals to ensure zero fatalities
6. Provide adequate PPE to workers and enforce on their use
7. Control access to the port area
8. Ensure regular and proper maintenance of equipment and work tools
9. Place appropriate safety and warning signage at strategic areas within the Port

10. Conduct first aid training among the workers and provide well-stocked first aid kits at different sections of the port area
11. Provide and keep an accident/ incident register
12. Provide insurance cover to all employees
13. Procure and equip an ambulance which should be stationed at the port all the time and fully manned
14. Undertake Occupational Safety and Health audits annually
15. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.3.9 Air pollution

Sources of air pollution at the port will include smoke, vehicular emissions and fumes such as NO_2 and NO_3 which are generated by ships while maneuvering and berthing which may affect air pollution in the hinterland. Accidental leakage of gasses from ships and other Port related activities may cause problems such as toxic material emission, explosions, fumes, odors and hazardous airborne emissions. Air pollution and emissions above the limits set under the Third Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014 can potentially cause health problems which include respiratory diseases, eye irritation and visual intrusion to receptors like the employees and visitors especially in areas neighboring the Port area.

Recommended mitigation measures

1. Sprinkle water in dusty areas during the dry season
2. Improve vegetation cover at the port as a measure to improve air quality and prevent fugitive dust
3. Provide dust masks to workers and enforce on their use
4. Implement the air quality monitoring plan proposed on a quarterly basis
5. Comply with the provisions of the Environmental Management and Coordination (Air Quality) Regulations, 2014

3.3.10 Noise pollution

The main sources of noise pollution during the operation of the Port will emanate from ships, cargo handling equipment and movement of vehicles within the project area. The noise levels produced may be above the stipulated Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 limits and may lead to hearing impairments to workers, visitors to the site and neighbors.

Recommended mitigation measures

1. Provide earmuffs to employees working in peak noise areas
2. Reduce the time of exposure to employees working in peak noise areas
3. Use serviceable machinery and equipment
4. Comply with the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009

3.3.11 Fire risks and emergencies

Fire risks and emergencies at the Port can occur due to operational negligence, electrical faults and spillage/leakage of flammable and ignitable chemicals. Hydrocarbons are volatile under certain conditions and their vapors in specific concentrations are flammable. Fire risks may also arise from facilities neighboring the port. If precautions are not taken to prevent their ignition, fire and subsequent safety risks may arise resulting in injuries, loss of lives and property.

Recommended mitigation measures

1. Develop, clearly display and implement a fire and emergency response action plan
2. Provide a fully equipped fire station, ambulances and firefighting equipment
3. Service the firefighting equipment quarterly by a reputable firm
4. Train employees on the use of fire-fighting equipment
5. Display fire safety and warning signage at all sections of the Port
6. Ensure proper handling and storage of flammable materials
7. Ensure regular inspection and maintenance of electrical appliances
8. Conduct fire drills regularly
9. Conduct annual fire safety audit and implement the recommendations

3.3.12 Potential impacts on visual quality

Lighting for night operations may cause nuisance to the nearby community. Wastes from port related activities, smoke from ships, bulk cargo piles stacked in a port may give an unpleasant impression. Additionally, the landscape of the area may be changed into an artificial scene of industrialization.

Recommended mitigation measure

1. The design of the port should blend with its surroundings so that it helps to improve the scenery.

3.3.13 Potential collapse of Port infrastructure

There is a potential of the port infrastructure to collapse if the construction is not undertaken in conformity with the engineering designs and Kenya's building code. This may lead to loss of lives and potential economic decline.

Recommended mitigation measures

1. The contractor should ensure that the design and construction of the jetty conforms to the building code and implementation is supervised by registered engineers
2. Conduct regular inspections of the jetty to ensure structural integrity

3.4 Possible decommissioning phase

The socio-economic importance of the proposed Shimoni Port to both the County, National and Regional Governments makes decommissioning a remote possibility. Hence the ESIA study does not consider the impacts at this phase as significant even in the long term. However, in the invent that decommissioning becomes imminent possibly as a result of a court order, natural calamities, sedimentation of the channel and people's preference on other means of transportation of goods such as roads and air transport, it is recommended that the proponent will prepare and submit a due diligence decommissioning audit report to NEMA for approval at least three (3) months in advance. For the purposes of prediction and information, the environmental and social concerns which may arise in this scenario are discussed in detail below.

3.4.1 Economic decline

In the event of decommissioning of the Shimoni Port, the proponent will incur huge financial losses and the employees will also lose their livelihoods. In addition, the government will lose revenue earned from the operations of the Port leading to economic decline.

Recommended mitigation measures

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

3.4.2 Occupational safety and health risks

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

Recommended mitigation measures

1. Contract a licensed construction company to carry out demolition activities
2. Install signage to forewarn people on ongoing demolition activities
3. Provide adequate and enforce the use of PPE throughout the demolition works
4. Avail first aid kits on site throughout the entire demolition period
5. Ensure workers are given the correct hand tools and equipment for the jobs assigned
6. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.4.3 Solid waste generation and management

Demolition activities will result in generation of solid waste. The waste generated will include wood cuttings, roofing waste, scrap metals and building rubble among others. If not properly managed, these generated waste will pose safety and health risks and pollution of Shimoni channel.

Recommended mitigation measures

1. Contract NEMA licensed waste handler to dispose the solid waste
2. Recover the reusable and recyclable components
3. All recyclable materials should be collected and sent to NEMA licensed recyclers
4. Comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006

3.4.4 Effluent generation and management

Demolition activities will result in effluent generation which will need to be disposed off appropriately.

Recommended mitigation measures

1. Contract NEMA licensed waste handler to dispose the effluent
2. Comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006

3.4.5 Insecurity

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

Recommended mitigation measure

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

3.5 Impact analysis

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

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

Magnitude describes the actual change that is predicted to occur in the resource or receptor. It takes into account all the various impact characteristics in order to determine whether an impact is negligible or significant. Some impacts can result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes can be regarded as essentially having no impact and are characterized as having a negligible magnitude (Table 18). The levels of impacts are defined using the following terms

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

Table 18: Risk and impact significance matrix for the proposed Shimoni Port.

Environmental Impact	Magnitude of impact		
	Construction phase	Operational phase	Decommissioning phase
Impact on Shimoni Slave Caves	2	0	0
Impact of potential dredging on water quality	3	0	0
Generation of sediment plumes and associated impacts	3	0	0
Re-suspension of heavy metals by potential dredging works	3	0	0
Impact of potential dredging and dumping of substrate on marine habitats	3	0	0
Oil spills and bioaccumulation of PAHs from potential dredging activities	2	0	0

Environmental Impact	Magnitude of impact		
	Construction phase	Operational phase	Decommissioning phase
Impact of potential dumping of the dredged materials	3	0	0
Potential impact on Kisite–Mpunguti Marine National Park and Reserve	3	3	1
Impacts on fisheries and livelihood	3	3	1
Impact on CCAs	3	0	0
Navigational risks	3	3	1
Impact on seaweed farming	3	2	0
Loss of mangroves	3	0	0
Loss of terrestrial vegetation cover	3	0	0
Increased energy demand	1	3	1
Sourcing of raw materials	2	0	0
Potential capsizing of barges and vessels delivering raw materials	2	0	0
Impact of port construction activities on marine environment	3	3	2
Water consumption and energy demand	2	3	1
Effluent generation	1	2	1
Solid waste generation	2	3	2
Occupational safety and health	3	3	3
Noise pollution	2	2	2
Air pollution	2	1	2
Fire risks and emergencies	1	3	1
Asbestos removal and disposal	3	0	0
Climate change adaptation	0	3	0
Pollution from fish processing activities	0	3	0
Introduction of invasive species	0	2	0
Oil and grease spills	3	3	0
Potential impacts on visual quality	2	2	2
Potential collapse of the jetty	1	2	0
Labour influx and social concerns	2	3	2
Economic decline	0	0	3
Insecurity	0	0	2

Legend

Magnitude	Impact score
Negligible	0
Low	1
Moderate	2
High	3

3.6 Public participation

Public and stakeholder participation in the ESIA process is a legislative requirement under Regulation 17 of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. Prior to the preparation of the ESIA study report, the proponent organized a

kick-off meeting to hand over the project site to the consultants. During the preparation of the ESIA, the consultants organized and held;

- Five community consultative meetings in Shimoni, Kibuyuni, Majoreni, Mkwiro and Wasini villages
- Two stakeholder consultative meetings to review the draft ESIA report
- A stakeholders' meeting to validate the ESIA study report.

Brief details of the consultative meetings are discussed below and the proceedings of all the meetings are annexed to this report.

3.6.1 Kick-off meeting with the key project stakeholders

The proponent organized a kick-off meeting/ site handover with the consultants and the key stakeholders on 27th August, 2020 (Figure 65). The aim of the meeting was to handover the project site to the consultants so as to facilitate the commencement of the ESIA process, give an overview of the proposed project and obtain remarks from the key project stakeholders. The proceedings of the kick-off meeting are annexed to the report.

Figure 65: The kick-off meeting held at the project site with the proponent, key stakeholders and consultants (Source: Consultative meeting, August 2020).

3.6.2 Community consultative meetings

The community consultative meetings were held on 10th September 2020 in Shimoni and Kibuyuni villages, on 14th September 2020 in Majoreni village and on 15th September in Mkwiro Village (Figure 66). Notably, Wasini village residents declined to be addressed during the community consultative meeting. The community demanded the presence of senior KPA management before they could agree to participate in the ESIA study meetings. However, the Area Chief informed them that the community consultative meeting was only preliminary profiling of the potential environmental and social impacts of the proposed Shimoni Port and that all the other villagers within the Location had successively held their meetings. Following the demand of the Wasini residents, another meeting was scheduled and held with the key representatives of Wasini village at the County Fisheries offices in Shimoni on 2nd October 2020.

Table 19 summarizes the impacts identified by the local communities and their recommended mitigation measures.

Figure 66: The participants during the community consultative meetings (Source: Community consultative meeting, September 2020).

Table 19: Impacts identified by the local community and their recommended mitigation measures.

Impact identified by the local communities	Recommended mitigation measures proposed by the community
Impact on fishing activity and other fisheries resources	- Developing a Memorandum of Understanding between the proponent and the affected local community and implement it to the latter - Compensation to any affected persons during the potential dredging in Phase 2 and construction activities - Provision of fishing vessels to the fishermen so as to venture offshore as a CSR
Impact on seaweed farming	- Compensation to any affected persons during the potential dredging in Phase 2 and construction activities - Trainings to the seaweed farmers on alternative livelihoods prior to the commencement of the proposed project
Impact on CCAs	- Compensation to any affected persons during the potential dredging in Phase 2 and construction activities
Impact on coral and other marine habitats	- Compensation to any affected persons during the potential dredging in Phase 2 and construction activities
Air and noise pollution	- Implement measures to prevent air and noise pollution
Employment opportunities to the locals	- Prioritizing employment opportunities to the locals - Capacity building by offering trainings and scholarships to the local youths - Equipping learning facilities as part of CSR to support education

3.6.3 Stakeholders consultative meetings to review the draft ESIA study report

The experts in collaboration with the proponent and the local administration organized and held two major stakeholders consultative meetings on 2nd and 6th October 2020 to review the draft ESIA report (Figure 67). The meetings were held at Shimoni County Fisheries Offices' ground. Table 20 summarizes the impacts identified by the stakeholders and their recommended mitigation measures.

Figure 67: A section of the stakeholders during the meeting to review the draft ESIA report (Source: stakeholders meeting, October 2020).

Table 20: Impacts identified by the local community and their recommended mitigation measures.

Impact identified by the local community	Recommended mitigation measures by the community
Impact on fishing activity and other fisheries resources	- Developing a Memorandum of Understanding between the proponent and the affected local community and implement it to the latter - Compensation to any affected persons during the potential dredging in Phase 2 and construction activities - Provision of fishing vessels to the fishermen so as to venture offshore as part of CSR - The trade mechanism should ensure small scale retailers such as fish mongers can access the fish offloaded from the vessels at competitive prices
Impact on CCAs, coral and other marine habitats	- Valuation of community conserved natural capital - Estimation of cummulative funding to community projects at least for the last 10years - Identification of alternative conservation areas at least bigger than the current sizes - Estimation of fisher earnings and valuation of affected fishery - Transplanting of corals found within the proposed project site prior to commencement of the project - A well laid out short and long term community support system
Impact on tourism activities	- Compensation to any affected persons during the potential dredging in Phase 2 and construction activities - Build a research center for the Wasini Women Group as part of CSR to help support Ecotourism

Employment opportunities to the locals	- Prioritizing employment opportunities to the locals - Capacity building by offering trainings and scholarships to the local youths - Equipping learning facilities as part of CSR to support education

3.6.4 Stakeholders meeting to validate the ESIA study report

Following incorporation of comments from the two meetings to review the draft ESIA study report, a validation meeting with the stakeholders was held on 14th October 2020 at the County Fisheries Offices' ground in Shimoni (Figure 68). During the meeting, the stakeholders confirmed that all the issues they had raised during the review meetings had been addresse by the consultants except for Ms. Asha Mohammed who said her concern on a trade mechanism that will ensure small scale retailers such as fish mongers have access to the fish offloaded from the fishing vessels at competitive prices were not captured. The consultants added her concern into the proceedings and the ESIA study report after which the stakeholders endorsed the ESIA study report for submission to the proponent and NEMA.

Figure 68: A section of the participants during the stakeholders'meeting to validate the ESIA study report (Source: stakeholders meeting, October 2020).

3.7 Analysis of project alternatives

3.7.1 Introduction

Analyzing project alternatives is important as it allows the proponent to evaluate possible project options that could mitigate the environmental risks identified during the ESIA process through prevention, elimination of the risks all together and reduction of the severity of an impact. The analysis could also assist the project in assessing the economic viability of a particular development proposal. The analysis can also assist NEMA and other government agencies in decision making by either approving the project proposal or advising the proponent on the need to change the project for instance in terms of location, design and technology among other alternatives. For the proposed Shimoni Port, the analysis of alternatives is based on the findings of the ESIA study, the contribution from stakeholders, the KPA Master Plan, 2019 and the Feasibility Study for Shimoni Port Development conducted in 2018. These alternatives include the no project alternative, the yes project alternative, location alternatives and dredging/dumping alternatives.

3.7.2 The No project alternative

The No Project alternative means that the status quo will be retained where the Shimoni Port Development will not happen. This would be the best-case scenario in mitigating the environmental and social impacts that are likely to emanate from the development of the port. For instance, there would be no potential dredging or dumping that would lead to water quality degradation and impacts on habitats and fisheries. The alternative is however challenged by Kenya's development needs and planning aimed at improving the livelihoods of its citizens by achieving sustainable economic growth. Retaining the status quo denies the government a chance to contribute towards the realization of the Kenya Vision 2030 – Economic and Macro Pillar and tapping on the benefits of the Blue Economy such as employment creation, food security and revenue to the government. Hence, the No project alternative is not considered viable in the light of the benefits of the proposed project which would be lost in the event that Shimoni Port is not implemented.

3.7.3 The Yes project alternative

The yes project alternative means the implementation of the Shimoni Port Development in its entirety where the predicted environmental and social impacts will occur. From the economic point of view, this is the most feasible alternative considering the benefits that will accrue from the implementation of the Shimoni Port Development. According to the feasibility study of 2018, the total net economic effect and the Net Present Value (NPV) of the project is estimated at Kenya Shillings 28.3Billion and 10.4 Billion respectively with an Internal Rate of Return of ≈30%. These economic benefits will accrue from revenues to the government, fish sales and business opportunities in hinterland transport. A key benefit of the fishing port would be a ready market for local fishermen's landings value addition that would potential translate to better returns and livelihoods for them through exports. According to the study, the construction and operation of the port would create over 1,000 direct employment opportunities in fish processing and trade, ship repairs and handling, trucking, cargo transportation and handling services, administration, security and cleaning services among others. The cost benefit analysis as per the feasibility study takes into consideration the environmental and social concerns among other economic costs which are estimated at Kenya Shillings 0.5 Billion. This figure may however be an underestimate considering the value of environmental goods and services provided by critical habitats such as mangroves and coral reefs which will potentially be impact by dredging and port construction activities. These values are therefore reconsidered during quantification of the impacts of the port project.

3.7.4 Location alternatives

The feasibility study identified four potential locations for the development of the Shimoni Port (Figure 69). These sites are;

1. The KPA owned land and surrounding area;
2. The location of the existing jetty and surrounding area;
3. The location west of the existing jetty; and,
4. The far most west location of the Shimoni coastline.

Figure 69: Potential areas identified for the Development of Shimoni Port Project (Shimoni Port Development Feasibility Study, 2018).

To determine the most suitable locations, the feasibility study employed a scored criterion based on bathymetry (15%), natural shelter provided by the Shimoni Channel (5%), land accessibility (5%), topography and coastal geomorphology (40%), land availability and tenure (15%), ease of implementation (5%) and environmental impact (15%). Based on the criteria and a weighting strategy of 0-10, the area marked as 2 (Delineated using Blue color) was identified as the most suitable for the development of the industrial fishing port (Table 21).

Table 21: Multi-criteria analysis location choice-industrial fishing (Source: Shimoni Port Development Feasibility Study, 2018).

Criteria	Industrial Fishing Weight	Rationale	KPA Owned Land + Surrounding Area	Existing Pier + Surrounding Area	**Location West of the Pier**	Far most Western location	Total
Nautical Access	15.00%	A fish port needs sufficient depth to handle purse seiners. It is estimated about CD -8.0 to CD – 10.0 will be sufficient.	4.0	2.0	**3.0**	1.0	10.0
Natural Shelter	5.00%	Although fishing vessels are best handled in relatively calm waters, there is no need for fully calm waters.	2.0	2.5	**2.5**	3.0	10.0
Land Accessibility	5.00%	Considering the high value of the goods to be transported (fish) there should be a road connection but the area does not need to be directly adjacent to the village centre.	3.0	4.0	**2.0**	1.0	10.0
Structure of the Land	40.00%	Considering that the industrial fish port will need quite some buildings to be constructed, a flat an reliable soil is required. Also, the port land needs to be at almost the same level as the sea.	2.0	3.5	**3.5**	1.0	10.0
Available Space	15.00%	The industrial fish port would require approximately 7,000 m2.	3.0	1.0	**3.0**	3.0	10.0
Ease of Implementation	5.00%	Since the activities will most likely be carried out by a private party, there is no need for KPA land to be involved.	4.0	1.0	**2.5**	2.5	10.0
Environmental Impact	15.00%	The sensitive environment in Shimoni will impact every commercial activity.	4.0	3.0	**2.0**	1.0	10.0
Total	**100.00%**		**2.9**	**2.7**	**3.0**	**1.5**	**10.0**

During data collection for the ESIA study, several other factors came up which were not considered in the criteria used by the feasibility study as follows. The basis for the scoring and weighting seems arbitrary and has no justification and hence it might be difficult to accurately choose the most suitable location for the port.

1. The criteria did not take into consideration the impact of the port development activities on community livelihoods such as potential loss of traditional fishing grounds, impact on sea weed farming and disruption of tourism activities
2. The environmental impact criteria identifies mangrove loss as the only environmental impact of the project which undervalues the total value of the environmental goods and services provided by the marine and terrestrial ecosystem. Apart from mangroves, the marine ecosystem includes other critical habitats such as seagrass, coral reefs, sandy beaches which support the artisanal fishery and offshore productivity. The terrestrial areas include vegetation cover that would be lost to the construction of port infrastructure including fish processing plant, offices, warehouses, roads and other infrastructure.
3. The criteria does not take into consideration the locally managed community conservation areas in Mkwiro, Wasini and a proposed one to be located at site No. 2 which is identified for the development.
4. The value of the existing jetty was not considered whose use during port development could reduce the costs of transportation of raw materials and hence synergize the construction of phase 1 of the Shimoni Port which is a more robust Jetty to handle larger vessels.
5. There were no consultations with stakeholders on the best site for the construction of the port which would have probably contributed to a difference in the study criteria scoring and weighting.

Based on these omissions and the contributions by stakeholders during the community consultative meetings and the meeting to review the draft ESIA Study report, the key factors to consider in location analysis are;

1. Community livelihoods and social issues
2. Environmental risks
3. Proximity of the port development to conservation areas
4. Availability of suitable land
5. Bathymetry

An analysis of each of the proposed sites based on these factors is presented in Table 22 below.

Table 22. An analysis of the proposed sites based on the factors to be considered in the choice of location for the Shimoni Port Development.

Site No.	Community livelihoods	Environmental risks	Proximity to conservation areas	Land suitability	Bathymetry
1	Port will impact on seaweed farming and fishing	Destruction of mangroves and seagrass habitats	Mangrove forests	Land is privately owned and KPA will need to purchase it	Site would require dredging
2	Impact on seaweed farming and fishing	Mangroves will be cleared, water quality degradation at dredging	Proposed community conservation area	Land is privately owned and KPA will need to purchase it	Site would require dredging

Site No.	Community livelihoods	Environmental risks	Proximity to conservation areas	Land suitability	Bathymetry
3	Existing Jetty, minimal dredging may be required	No significant risks	No community conservation area	Land belongs to Fisheries and can partner with KPA	Site may or may not require dredging
4	Will enhance livelihoods as fish landing and tourism site	There are mangrove patches which may be cleared	Lies opposite Mkwiro community conservation area	Land belongs to KPA	Site may or may not require dredging

Following the analysis, the consultants adopted an ordinal risk classification to score and rank the sites based on low risk (L), medium risk (M) and high risk (H). This process was subjected to stakeholder input during the review of the draft ESIA report on 2nd October 2020 to validate the findings and minimize the potential environmental and social impacts of the proposed port development. The results are summarized in Table 23 below.

Table 23. Ordinal score analysis of the proposed locations for the Shimoni Port Development.

	Site 1			Site 2			Site 3			Site 4		
Criteria	L	M	H	L	M	H	L	M	H	L	M	H
Community livelihoods, social issues												
Environmental sensitivity, habitat loss												
Proximity to community conservation areas												
Suitable land availability												
Bathymetry												
Overall score												
Rank			3			3	1				2	

The results of the location analysis demonstrate that the Site 3 which is located next to the existing Shimoni Jetty is the most suitable as it has the least negative environmental and social impacts. The reasons include the fact that it is located in an area that will not pose significant environmental impacts, the land/sea use is consistent with the existing scenario, KPA will not need to purchase the land and it will enhance community livelihoods by providing fish landing area and support tourism activities. To address the limitations on availability of land, the proponent will complement Site 3 by developing site 4 which can be used for construction of warehouses and storage areas among other port infrastructure.

3.7.5 Potential dumping location alternatives

The choice of the potential dumping site was selected based on the provisions of the London Convention 1972 / 1996 Protocol (ANNEX III). The potential dredged material dumping site is at a depth range of 398 – 399 metres. The site is located 17 Km offshore (04.652388°S/ 39.529794°E) from the existing Shimoni jetty; North East of the Kisite Mpunguti Marine Park and Reserve. Additionally, the site is located away from the main fishing grounds and Community Conservation Areas. The consultants undertook baseline water quality sampling at the proposed dumping site at depths of -0.5m, -3m and at -6m depths. The test parameters included pH, Temperature, Turbidity, Dissolved Oxygen, Perspective Degree, Total Suspended Solids, Chemical Oxygen Demand, Biological Oxygen Demand, Total Plate Count, Total Coliforms and *Escherichia coli*, Ammonia and Oil and grease. The results were within the Environmental Management and Coordination (Water Quality) Regulations, 2006. The ESIA report has recommended obtaining a permit for the dumping site in compliance with the London Convention 1972 / 1996 Protocol (ANNEX III).

The proponent may consider dumping the dredged material on land which may not be environmentally, socially and economically viable. This is because there will be need to acquire additional land for disposal of the dredged material which will have an implication on the cost. In addition, the dredged materials may be contaminated hence affecting terrestrial environment if not well managed. Thus this option is not considered viable.

4 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

4.1 Introduction

The preceding section identified and analyzed the potential environmental and social impacts of the proposed Shimoni Port and proposed mitigation measures to address the impacts. Under this section, three Environmental and Social Management Plans (ESMPs) are proposed to guide the proponent in implementing the mitigation measures. These are ESMPs for the construction, operational and possible decommissioning phases of Shimoni Port. Each of the ESMP is organized into five sections comprising of the environmental impact, the recommended mitigation measures, responsibility, timeframe and budget. The strategies for mitigation include preventing the impact from occurring in the first place, minimizing the impact, taking corrective action where impact occurs among others.

4.2 Environmental and Social Management Plan for the construction phase

At the construction phase, the focus on the ESMP is on addressing the impact on Shimoni Slave Caves, impact of potential dredging and dumping on water quality, generation of sediment plumes, re-suspension of heavy metals by dredging works, impact of dredging and dumping of substrate on marine habitats, oil spills and bioaccumulation of Polycyclic Aromatic Hydrocarbons (PAHs) from dredging activities, impact of dumping of dredged materials, potential impact on the Kisite – Mpunguti Marine National Park and Reserve, impact on fisheries and livelihoods, impact on Community Conserved Areas, impact on seaweed farming, navigational risks, loss of mangroves, loss of terrestrial vegetation cover, environmental risks of obtaining raw materials, impact of construction on the marine environment, potential capsizing of barges and vessels delivering raw materials, water consumption and effluent generation, solid waste generation and management, occupational safety and health, noise pollution, air pollution and labour influx and social concerns and asbestos removal and disposal (Table 24). The timeframe for implementation is considered to be the time it will take for the proponent to complete the construction of the port.

4.3 Environmental and Social Management Plan for the operational phase

The main issues of concern at operational phase of the project are climate change adaptation, pollution from fish processing activities, introduction of invasive species, wastewater generation and management, solid waste generation and management, oil and grease spills, potable water and energy demand, occupational safety and health, air pollution, noise pollution, fire risks and emergencies, potential sources of conflicts, potential impacts on visual quality and potential collapse of Port infrastructure (Table 25). The timeframe for implementation is considered to be the time the port will be operational.

4.4 Environmental and Social Management Plan for the possible decommissioning phase

The focus of the decommissioning ESMP (Table 26) is on addressing the issues identified by the ESIA study. The main issues of concern at this phase of the project are economic decline, occupational safety and health risks, solid waste generation, effluent generation and insecurity.

Table 24: Environmental and Social Management Plan for the construction phase of the Shimoni Port.

Impact	Recommended mitigation measures	Responsibility	Timeframe	Costs (KES)
Impact on Shimoni Slave Caves	Identify an alternative location for the warehouse away from the caves	Contractor/KPA	Prior to construction	Nil
Impact of potential dredging and dumping on water quality	Conduct dredging during high tide in order to allow tidal flushes thereby reducing turbidity levels	Contractor/KPA	During high tide	Nil
	Procure and deploy silt curtains to contain sediments within the dredging areas	Contractor/KPA	During dredging	Tender
	Implement the critical limits for water quality based on the values for other project which are being carried out by KPA	Contractor/KPA/KWS/ KeFS	During dredging and dumping	Nil
	Develop and implement a water quality monitoring plan	Contractor/KPA	Prior and during dredging and dumping	500,000/ Month
Generation of sediment plumes and associated impacts	Conduct dredging during high tide in order to allow tidal flushes thereby reducing turbidity levels	Contractor/KPA	During high tide	Nil
	Conduct potential dredging and dumping during the SEM season when fishing activities are at their lowest	Contractor/KPA	During SEM season	Nil
Re-suspension of heavy metals by potential dredging works	Conduct dredging during high tide in order to allow tidal flushes thereby reducing turbidity levels	Contractor/KPA	During high tide	Nil
	Procure and install silt curtains to contain sediments within the dredging areas	Contractor/KPA	During dredging	Tender
	Develop and implement a sediments quality and biological monitoring plans	Contractor/KPA/KWS	Prior and during dredging and dumping	1,000,000/ Month
	Notify NEMA and potentially affected communities if high levels of heavy metal concentrations are reported in the monitoring plan for discussion on suitable intervention measures	Contractor/KPA/KWS	During dredging and dumping	Nil
Impact of potential dredging and dumping of substrate on marine habitats	Use of silt curtains to localize turbidity to the dredging area	Contractor/KPA	During dredging	Tender
	Commence dredging during the off season of the migratory marine megafauna	Contractor/KPA	During the off season of the migratory marine megafauna	Nil
	Undertake daily monitoring of turbidity levels at the water quality monitoring stations identified by the consultants	Contractor/KPA/KWS	Daily during dredging	500,000/ Month

	Develop and implement a biodiversity monitoring plan	Contractor/KPA/KWS	During dredging and dumping	500,000/ month
Oil spills and bioaccumulation of polycyclic aromatic hydrocarbons (PAHs) from dredging activities	Prevent oil spills from occurring through effective maintenance of the dredger and precautionary measures	Contractor/KPA	During dredging and dumping	Internal costs
	Ensure that the machinery are serviceable and licensed to operate by IMO and KMA	Contractor/KMA/KPA	Prior and during dredging and dumping	Nil
	Procure an oil spill response boom, equipment and train personnel on its use in the event of oil spills	Contractor/KPA/KMA	Prior to dredging and dumping	Tender
	Use degreasers to dissolve localized oil spills during barge/equipment maintenance	Contractor/KPA	During dredging and dumping	1,000,000
	Keep records of all pollution incidents and notify NEMA within 24 hours of occurrence	Contractor/KPA	During dredging and dumping	Nil
	Comply with the provisions of the Marpol Convention 73/78, The EMCA Cap. 387 of the Laws of Kenya and The KMA Act, 2012	Contractor/KPA	During dredging and dumping	Nil
Impact of potential dumping of the dredged materials	Obtain a permit for the dumping site from KMA as will be required from time to time to comply with the London Convention 1972 / 1996 Protocol (ANNEX III)	KPA/KMA	Before dredging and dumping	TBD
	Dumping of dredged materials should be restricted at MS6	Contractor/KPA	During dumping	Nil
	Dumping of dredged materials should not be dropped at the surface	Contractor/KPA	During dumping	Nil
Potential impact on Kisite – Mpunguti Marine National Park	Commence dredging during the off season of the migratory marine megafauna	Contractor/KPA	During the off season of the migratory marine megafauna	Nil
	Undertake daily monitoring of turbidity levels at the water quality monitoring stations identified by the consultants	Contractor/KPA/KWS	Daily during dredging	500,000/ Month
	Establish a hotline or use existing one to report marine fauna sightings and strandings to expedite appropriate action	Contractor/KPA/KWS	Prior to dredging	20,000
Impacts on Fisheries and livelihood	Update the number of fishermen within the study area	KPA/ KeFS/ BMUs	Immediate	Nil
	Carry out potential dredging activities during the SEM season when there is reduced fishing activities	Contractor/KPA	During dredging	Nil
	Constitute a committee for conflict resolution	Contractor/KPA/State Department of Fisheries,	Before dredging	Nil

		Aquacultue and Blue Economy / KeFS / the BMUs		
	Implement the KPA Grievance Redress Mechanism Tool	Contractor/KPA/GRM committee	Immediate	TBD
Impact on Community Conserved Areas	Implement the recommended measures to prevent water quality degradation	Contractor/KPA	During dredging	TBD
	Transplant the corals to a new site identified in consultation with the local fishermen and other stakeholders	Contractor/KPA/County Government/BMUs/ NGOs	Before dredging	TBD
	Implement the KPA Grievance Redress Mechanism	Contractor/KPA/GRM committee	Immediate	TBD
Impact on seaweed farming	Prevent oil spills from occurring through effective maintenance of the dredger and precautionary measures	Contractor/KPA/County Government/BMUs	During dredging and dumping	Internal costs
	Use silt curtains to localize turbidity to the dredging area	Contractor/KPA	During dredging	Tender
	If Plots 1 and 2 are chosen for the development of the fishing port, then form a committee in collaboration with the seaweed farmers and KPA for timely interventions to protect the seaweed farms from pollution	Contractor/KPA/County Government/BMUs	Before dredging	Nil
	Support local women groups to re-establish affected seaweed farms in suitable locations	KPA/BMUs	After dredging	TBD
	Implement the proposed water quality monitoring plan for timely intervention to protect the sea weed farms	Contractor/KPA	During dredging and port operations	500,000/ month
	Implement the KPA Grievance Redress Mechanism	Contractor/KPA/GRM committee	Immediately	TBD
Navigational risks	Create awareness among the channel users on dredging activities and the construction works	Contractor/KPA	Before dredging and dumping	500,000
	Map out alternative routes for maritime traffic	Contractor/KPA	Before dredging and dumping	100,000
	Installation of navigational aids along Shimoni Channle	Contractor/KPA	During dredging, dumping and construction	Tender
	Ensure the barges and construction areas are well lit at night	Contractor/KPA	During dredging, dumping and construction	Nil

	Comply with the code of safety for special purpose ships, 2008 and KMA Act, 2012	Contractor/KPA	During dredging, dumping and construction	Nil
Loss of mangroves	Obtain approval from KFS prior to felling of the mangroves	Contractor/KPA/KFS	Before felling of mangroves	20,000
	Apply and obtain Special Use Licence from the KFS if either Plot 1 or plot 2 is used for port development	Contractor/ KPA/KFS	Prior to port development	5,000 application
	If either Plot 1 or plot 2 is used for port development, replant approximately of 10,446 trees and 3,792 trees respectively at an alternative site	KPA/KFS/CFA	During and post dredging	10,000,000
Loss of terrestrial vegetation cover	Obtain authorization to fell trees	Contractor/KPA/KFS	Before felling of trees	10,000
	Retain tree cover in areas that will not be constructed	Contractor/KPA	During construction	Nil
	Procure at least 1,000 seedlings of fast maturing tree species for planting within farmlands and homesteads neighboring the proposed project site	Contractor/KPA	Continuous	200,000
	Landscape the port	Contractor/KPA	After construction	2,000,000
Sourcing of raw materials	Procure materials in line with the Bill of Quantities	Contractor/KPA	During construction	Nil
	Source raw materials from sites that are EMCA Compliant	Contractor/KPA	During construction	Nil
	Re-use and recycle construction materials where practical	Contractor	During construction	Nil
Potential capsizing of barges and vessels delivering raw materials	Use sea worthy vessels certified by KMA	Contractor/KPA/KMA	During construction	Nil
	Employ competent and certified coxswains to pilot the vessels during construction of the jetty	Contractor/KPA/KMA	During construction	Nil
Impact of port construction activities on marine environment	Civil works near shore areas should be carried out during the low tide	Contractor/KPA	During construction	Nil
	Contract a NEMA licensed contractor to manage both solid waste and effluent	Contractor/KPA	Before construction	Tender
	Carry out observations on marine mammals prior to the commencement of piling activities	Contractor/KPA/KWS	Prior to commencement of pilling activities	Nil
	Develop and implement a water quality monitoring plan	Contractor/KPA	During construction	500,000
Water consumption	Sensitize workers and contractors on the need for water conservation and implement penalties for wastage	Contractor/KPA	During construction	100,000

and effluent generation	Contractors to procure mobile toilets for the workforce	Contractor/KPA	During construction	500,000
	Comply with the Water Quality Regulations, 2006	Contractor/KPA	During construction	Nil
Solid waste generation and management	Use of overburden in backfilling and landscaping	Contractor/KPA	During construction	Nil
	Sensitize construction workers on the process of solid waste collection, segregation and proper disposal	Contractor/KPA	During construction	20,000
	Procure adequate solid waste collection bins with capacity for segregation	Contractor/KPA	During construction	500,000
	Procure the services of a NEMA licensed waste handler to manage waste	Contractor/KPA	During construction	Tender
	Comply with the Marpol Convention 73/78, The EMCA Cap. 387 of the Laws of Kenya and The KMA Act, 2012	Contractor/KPA/KMA	During dredging	Nil
	Comply with the Waste Management Regulations, 2006	Contractor/KPA	During construction	Nil
Occupational safety and health	Register the site as a work place with the DOSHS	Contractor/KPA	Before commencement	5,000
	Employ competent personnel who can swim in the event of falls into the sea	Contractor/KPA	During dredging and jetty construction	Nil
	Provide life jackets to all workers working within the sea area and train personnel on proper use	Contractor/KPA	During dredging and jetty construction	2,000,000
	Provide a well-trained rescue and first aid team as well as a standby boat to act as an ambulance in the event of accidents in the sea	Contractor/KPA	During dredging and jetty construction	TBD
	Ensure the dredger is licensed by the IMO and KMA	Contractor/KPA/KMA	Before dredging and dumping	Nil
	Create awareness among the channel users on the presence of the dredger and its activities as well as the required safety precautions	Contractor/KPA/KMA	Prior and during dredging and dumping	100,000
	Hire qualified and well-trained personnel for the dredging and construction works	Contractor/KPA	During dredging, dumping and construction	TBD
	Obtain insurance cover for employees and ensure appropriate compensation in the event of accidents	Contractor/KPA	During dredging, dumping and construction	1,000,000/year
	Provide PPE for ship crew, workers and visitors to the port	Contractor/KPA	During dredging, dumping and construction	1,000,000

	Recruit qualified and experienced Occupational Safety and Health Officers	Contractor/KPA	During dredging, dumping and construction	TBD
	Erect safety signage and boards at all construction zones	Contractor/KPA	During construction	100,000
	Comply with the Merchant Shipping Act, 2009 (Part VII Section 117-168 on Safety, Health and Welfare of Seafarers	Contractor/KPA	Throughout	Nil
	All accidents should be reported, investigated and corrective action taken to prevent reoccurrence	Contractor/KPA	During dredging and construction	Nil
	Comply with Noise and Excessive Vibration Pollution (Control) Regulations, 2009	Contractor/KPA	Throughout	Nil
	Comply with the OSHA, 2007	Contractor/KPA	Throughout	Nil
Noise Pollution	Limit construction works to day time hours only	Contractor/KPA	During construction	Nil
	Locate machinery that are likely to produce noise as far as practical from neighboring properties	Contractor/KPA	During construction	Nil
	Procure and provide adequate earmuffs to workers and visitors to the site and enforce their use	Contractor/KPA	During construction	200,000
	Use serviceable machinery	Contractor/KPA	During construction	Nil
	Sensitize truck drivers to avoid unnecessary hooting and running of vehicle engines	Contractor/KPA	During construction	50,000
	Comply with Noise and Excessive Vibration Pollution (Control) Regulations, 2009	Contractor/KPA	During construction	Nil
Air pollution	Install appropriate and adequate dust screens around the construction areas	Contractor/KPA	During construction	2,000,000
	Sprinkle water at the excavation areas to suppress dust	Contractor/KPA	Daily	100,000
	Cover stock piles of construction materials to reduce dust emissions especially during windy conditions	Contractor/KPA	During construction	Nil
	Procure, provide and enforce the use of dust masks	Contractor/KPA	During construction	200,000
	Use serviceable machinery/equipment and trucks	Contractor/KPA	During construction	Nil
	Monitor fugitive emissions to ensure compliance	Contractor/KPA	Quarterly	500,000
	Comply with Air quality Regulations, 2014	Contractor/KPA	During construction	Nil
Labour influx	Prepare a site-specific Labor Influx Management Plan	KPA	Prior to construction	TBD
	Establish a liaison committee	Contractor/KPA/ Ministry of Interior and Coordination of National Government/ County	Immediately	Nil

		Government of Kwale/ BMUs etc		
	Implement the KPA Grievance Redress Mechanism Tool	Contractor/KPA/GRM committee	Immediately	5,000,000
Asbestos removal and disposal	Remove all the asbestos roofing sheets	Contractor/KPA	Immediately	Tender
	Removal and handling of asbestos sheets should be undertaken by a NEMA licensed contractor	Contractor/KPA/ NEMA licensed contractor	During asbestos removal	Tender
	All personnel involved in the removal and handling of the asbestos should be provided with PPE, trained on their use and compliance on use enforced by the supervisors	Contractor/KPA/ NEMA licensed contractor	During asbestos removal	TBD

Table 25: Environmental and Social Management Plan for the operational phase of the Shimoni Port.

Impact	Recommended mitigation measures	Responsibility	Timeframe	Costs (KES)
Climate change adaptation	Develop the Ports' Climate Change Action Plan to address emissions and sea level changes	KPA	Immediately	100,000
	Engineering designs should take into considerations the impact on climate change such as sea level rise	KPA	During construction	Nil
	Develop and ensure application of air quality management protocols	KPA	Throughout operations	Nil
	Implement the air quality monitoring plan	KPA	Quarterly	500,000
	Maintain cargo transfer equipment in a good working condition to reduce air emissions	KPA	Throughout operations	Internal costs
	Comply with the Climate change Act, 2016 and the National Climate Change Action Plan 2018-2022	KPA	Throughout operations	Nil
	Comply with the Marpol Convention 73/78 (MARPOL Annex VI)	KPA/KMA	Throughout operations	Nil
Pollution from fish processing activities	Keep all working and storage areas clean and remove waste products immediately	KPA	Throughout operations	Nil
	Put in place a drainage channel within the production area to aid in washing off any spillages to avert odour	KPA	During construction	In project costs
	Cover all transfer systems, wastewater canals, and wastewater treatment facilities	KPA	Throughout operations	Nil
	Avoid processing batches of raw material that are of considerably lower than average quality	KPA	Throughout operations	Nil
	Reduce the stock of raw materials, waste, and by-products and store this stock for short periods of time only in a cold environment	KPA	Throughout operations	Nil
	Seal by-products in covered, leak-proof containers	KPA	Throughout operations	Nil
	Empty and clean fat traps on a regular basis	KPA	Throughout operations	Nil
	The fisheries offal's can be sold to fertilizer industry/animal feed farms	KPA	Throughout operations	TBD
Introduction of invasive species	Enforce flushing and refilling ballast tanks with water from the open ocean before the ships arrive at the port	KPA/KMA	Throughout operations	Nil

	Ensure that the resultant water from on-board treatment is not toxic when discharged in the destination port	KPA/KMA	Throughout operations	Nil
	Comply with the provisions of the Marpol Convention 73/78	KPA/KMA	Throughout operations	Nil
Wastewater generation and management	Design and construct a bio-digester to manage effluent	KPA	During construction	Tender
	Apply and obtain an Effluent Discharge License from NEMA	KPA	Yearly	TBD
	Comply with the Water Quality Regulations, 2006	KPA	Throughout operations	Nil
	Comply with the Marpol Convention 73/78, The EMCA Cap 387 of the Laws of Kenya and The KMA Act, 2012	KPA	Throughout operations	Nil
Solid waste generation and management	Sensitization on the importance of good solid waste management	KPA	Throughout operations	100,000
	Provide infrastructure for solid waste collection with a capacity for segregation	KPA	Throughout operations	500,000
	Procure the services of a NEMA licensed waste handler to dispose off solid wastes	KPA	Throughout operations	Tender
	Comply with the Waste Management Regulations, 2006	KPA	Throughout operations	Nil
	Comply with Marpol Convention 73/78, The EMCA Cap 387 of the Laws of Kenya and The KMA Act, 2012	KPA	Throughout operations	Nil
Oil and grease spills	Create awareness on oil spill prevention and training on containment if oil spills do occur	KPA	Throughout operations	100,000
	Establish a well-equipped pollution control center (with booms, dispersants etc.)	KPA	6 Months	Tender
	Procure a well-equipped pollution control boat and train port personnel on usage	KPA	6 Months	Tender
	Prepare and implement an oil spill contingency plan	KPA	Throughout operations	200,000
	Procure a NEMA licensed contractor to dispose, reuse or recycle waste oil	KPA	Throughout operations	Tender
	Report and document all oil spills incidents, action taken and the results of the action taken	KPA	Throughout operations	Nil
	Comply with the Marpol Convention 73/78, The EMCA Cap 387 of the Laws of Kenya and The KMA Act, 2012	KPA	Throughout operations	Nil

Water and energy demand	Sink 3 boreholes at the project site, connect the port to the reticulated supply by KWAWASCO or install a sea water desalination plant	KPA/KWAWASCO	Immediately	TBD
	Enhance water conservation through awareness creation among employees and visitors	KPA	Throughout operations	50,000
	Upgrading the power infrastructure to avoid straining the existing community supply	KPA/Kenya Power	Immediately	TBD
	Install solar panels at the port area for lighting purposes	KPA	Immediately	Tender
	Keep records on power consumption by the port to inform energy management and audit interventions	KPA	Monthly	Nil
Occupational safety and health	Install navigational aids, marker buoys, and early warning signage along the Shimoni channel to the port	KPA/KMA	Throughout operations	Tender
	Sensitize local fishermen and tour operators on the increased traffic at the channel	KPA/County Government/ Kenya Fisheries Service	Throughout operations	500,000
	Establish a control tower to guide traffic within the channel	KPA	Immediately	Tender
	Create awareness among employees on the importance of their safety	KPA	Throughout operations	100,000
	Develop and implement a safety action plan and set goals to ensure zero fatalities	KPA	Throughout operations	200,000
	Provide adequate PPE to workers and enforce on their use	KPA	Throughout operations	2,000,000
	Control access to the port area	KPA	Throughout operations	Tender
	Ensure regular and proper maintenance of equipment and work tools	KPA	Throughout operations	Internal costs
	Place appropriate safety and warning signage at strategic areas within the Port	KPA	Throughout operations	500,000
	Conduct first aid training and provide well-stocked first aid kits at different sections of the port	KPA	Throughout operations	2,000,000
	Provide and keep an accident/ incident register	KPA	Throughout operations	Nil
	Provide insurance cover to all employees	KPA	Throughout operations	10,000,000
	Procure and equip an ambulance which should be stationed at the port all the time and fully manned	KPA	Throughout operations	10,000,000

	Undertake Occupational Safety and Health audits	KPA	Annually	Tender
	Comply with the provisions of the OSHA, 2007	KPA	Throughout operations	Nil
Air pollution	Sprinkle water in dusty areas during the dry season	KPA	Dry season	100,000
	Improve vegetation cover at the port to prevent fugitive dust	KPA	Throughout operations	TBD
	Provide dust masks to workers and enforce on their use	KPA	Throughout operations	100,000
	Implement the air quality monitoring plan	KPA	Quarterly	500,000
	Comply with the Air Quality Regulations, 2014	KPA	Throughout operations	Nil
Noise pollution	Provide earmuffs to employees working in peak noise areas	KPA	Throughout operations	200,000
	Reduce the time of exposure to employees working in peak noise areas	KPA	Throughout operations	Nil
	Use serviceable machinery and equipment	KPA	Throughout operations	Nil
	Comply with the Noise and Excessive Vibration Pollution (Control) Regulations 2009	KPA	Throughout operations	Nil
Fire risks and emergencies	Develop, clearly display and implement a fire and emergency response action plan	KPA	Throughout operations	100,000
	Provide a fully equipped fire station, ambulances and firefighting equipment	KPA	Throughout operations	Tender
	Service the firefighting equipment	KPA	Quarterly	Tender
	Train employees on the use of fire-fighting equipment	KPA	Quarterly	2,000,000
	Display fire safety and warning signage at all sections of the Port	KPA	Throughout operations	Nil
	Ensure proper handling and storage of flammable materials	KPA	Throughout operations	Nil
	Ensure regular inspection and maintenance of electrical appliances	KPA	Throughout operations	Internal costs
	Conduct fire drills regularly	KPA	Quarterly	Cost factored
	Conduct fire safety audit	KPA	Annually	Tender

Potential impacts on visual quality	The design of the port should blend with its surroundings so that it helps to improve the scenery	KPA	During construction	Nil
Potential collapse of Port infrastructure	Ensure that the design and construction of the jetty conforms to the building code	Contractor/KPA	During construction	Nil
	Conduct regular inspections of jetty to ensure structural integrity	Contractor/KPA	Throughout operations	Nil

Table 26: Environmental and Social Management Plan for the possible decommissioning phase of the Shimoni Port.

Environmental impact	Recommended mitigation measures	Responsibility	Timeframe	Costs (KES)
Economic decline	Train employees on alternative livelihoods	KPA	Prior to decommissioning	TBD
	Prepare and issue recommendation letters to employees to seek alternative employment opportunities	KPA	During decommissioning	Nil
	Review potential job opportunities in other ongoing contracts and recommend the employees who qualify	KPA	Prior to decommissioning	Nil
	Comply with the labor laws by paying the employees their terminal dues	KPA	Before decommissioning	Nil
Occupational safety and health risks	Contract a licensed construction company to carry out demolition	KPA/ licensed construction company	During decommissioning	Tender
	Install signage to forewarn people on ongoing demolition activities	KPA	During decommissioning	200,000
	Provide adequate and enforce the use of PPE	KPA	During decommissioning	500,000
	Avail first aid kits on site throughout the entire period	KPA	During decommissioning	1,000,000
	Ensure workers are given the correct hand tools and equipment for the jobs assigned	KPA	During decommissioning	Nil
	Comply with the OSHA, 2007	KPA	During decommissioning	Nil
Solid waste generation and management	Contract NEMA licensed waste handler to dispose the solid waste	KPA/ NEMA licensed waste contractor	During decommissioning	Tender
	Recover the reusable and recyclable components	KPA	During decommissioning	Nil
	All recyclable materials should be collected and sent to NEMA licensed recyclers	KPA/ NEMA licensed recyclers	During decommissioning	Nil
	Comply with the Waste Management Regulations, 2006	KPA	During decommissioning	Nil
Effluent generation and management	Contract NEMA licensed waste handler to dispose the solid waste	KPA	During decommissioning	Tender
	Comply with the Water Quality Regulations, 2006	KPA	During decommissioning	Nil

Environmental impact	Recommended mitigation measures	Responsibility	Timeframe	Costs (KES)
Insecurity	Extend the tenure of the contracted security firm	KPA	During decommissioning	Cost factored

5 ENVIRONMENTAL AND SOCIAL MONITORING PLANS

5.1 Introduction

Effective implementation of the Environmental and Social Management Plan requires the development and implementation of a suite of monitoring plans for the environmental media and socio-economic issues identified during the baseline survey. The objective of the monitoring plans is to enhance the environmental performance of the proposed project by providing data and information on compliance with legislative standards, conservation and preservation of the environment and determining the levels of deviation from the values obtained during the baseline monitoring. This is in turn informs the corrective measures if any that need to be implemented to comply with the legislative standards and environmental restoration. For the proposed project, seven monitoring plans are proposed. These are;

1. Water quality monitoring plan
2. Sediment monitoring plan
3. Fisheries monitoring plan
4. Biodiversity monitoring plan
5. Air quality monitoring plan
6. Noise monitoring plan
7. Grievances Redress Mechanism

5.1.1 Water quality monitoring plan

5.1.1.1 Introduction

The potential sources of water quality degradation will be excavations, piling activities, dumping of construction wastes from the port area into the ocean, dredging and dumping, leakage of oils, lubricants and chemicals from construction equipment and poor disposal of effluent from the dredger and construction works among others. Poor water quality will affect both the groundwater aquifers and freshwater habitats and fauna including the benthic communities due to reduced light and dissolved oxygen. The objective of the water quality sampling and analysis is to assess the variation in water turbidity and chemical properties due to dredging and dumping and expansion activities, which could alter the physical or chemical characteristics of the water in the ocean and to provide a baseline for assessing the effectiveness of environmental and social management plans designed to minimize water contamination.

In addition, the proponent should have in place a water quality monitoring plan targeting portable water to the port

5.1.1.2 Monitoring location

Water quality monitoring will be carried out at the discharge point of the proposed biodigester and at the six stations within the ocean based on the baseline sampling points (Monitoring Station 1, 2, 3, 4, 5, 6, referred to as MS 1, MS 2, MS 3, MS 4, MS 5 and MS 6 respectively). These stations are MS 1: Shimoni Jetty, MS 2: Kibuyuni, MS 3: Madyoka Island, MS 4: Mkwiro, MS 5: Nyuli and MS 6: Potential Dumping site. The GPS coordinates for these monitoring points are provided. In addition, water samples at MS 1 – MS 6 will be obtained at depths of -0.5m, -3m and -6m.

5.1.1.3 Monitoring parameters

The water monitoring parameters and the specified target values to be monitored during construction and subsequent operations of the port will be the same as the ones provided during the baseline monitoring which are based on the Environmental Management and Coordination (Water Quality) Regulations, 2006 (Table 27).

The standards for monitoring drinking water will be the Kenya Standards KS EAS 153:2014 for drinking water

Table 27. Water quality monitoring parameters and the standards prescribed under the Third Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006.

Parameter	Standards
pH Value	6.5-8.5
Biological Oxygen Demand mg/L	30max
Chemical Oxygen Demand mg/L	50 max
Total Suspended Solids mg/L	30 max
Ammonia-NH+;mg/L	100 Max
Total Dissolved Solids mg/L	1200 Max
E. Coli Colonies count/100ml	Nil
Total coliform count/100ml	30mg/L

5.1.1.4 Monitoring methods

Water samples will be obtained at the proposed biodigetser and depths of -0.5m, -3m and -6m for the ocean based sampling points. Each sample obtained from these locations and depths should be analyzed as per the parameters specified above and in accordance with the methods tabulated in table 28 below and the Environmental Management and Coordination (Water Quality) Regulations, 2006.

Table 28: Water Quality Monitoring Methods and Equipment.

Tests	Test Methods	Equipment
pH Value	APHA Method 4500-H*B	pH Meter-pH 520
Biological Oxygen Demand, mg/l	AOAC Method 973.44	Model EZ-BOD
Chemical Oxygen Demand, mg/l	PQA/LIM/064	PF-12
Total Suspended Solids, mg/l	APHA Method 2540D	LSS-200
Total Dissolved Solids, mg/l	APHA Method 5220B	TDS Meter
Dissolved Oxygen	APHA Method 4500G	DO 610 meters
Turbidity	APHA Method 2130B	Turbidity meter LTURB-3B
Oil and Grease	APHA Method 5520B	-

5.1.1.5 Monitoring frequency

Water quality sampling and analysis will be undertaken monthly within the ocean and quarterly for the effluent in collaboration with a NEMA designated laboratory. Analysis for potable drinking water should be conducted monthly.

5.1.2 Sediment monitoring plan

5.1.2.1 Introduction

Sediments reflect processes in the water column. They act as sinks for trace pollutants such as heavy metals and persistent organics when environmental conditions change and directly influence the quality of the overlying water. In addition, they are natural habitats for aquatic organisms, like snails, mussels and aquatic flora. The Port's activities will potentially impact the water quality from oil spills, waste water and solid waste among others if not well managed. Some of these pollutants will settle on the benthic zone causing pollution. In addition, the dredging activities will upset sediments at the Shimoni channel hence re-suspension of already settled heavy metals and hydrocarbon, if any. For this reason, sediment monitoring assesses the ecological status of the ocean to detect toxic constituents and to control their effect.

5.1.2.2 Monitoring location

Sediment monitoring should be conducted in the five (5) monitoring locations which will coincide with MS 1, MS 2, MS 3, MS 4 and MS 5 under the water quality monitoring plan.

5.1.2.3 Monitoring parameters

The monitoring parameters for sediments will include testing for the presence of hydro carbons and heavy metals such as lead, zinc, copper, chromium and nickel. In addition, the monitoring team should undertake physical observations of any potential sediment plume along the Shimoni Channel from the dredger when sailing out and back to the project site.

5.1.2.4 Monitoring methods

The monitoring method will involve using the Auger Sampler to scoop sediments from the channel and analyze the samples for heavy metals and hydro carbon.

5.1.2.5 Monitoring frequency

Sediment sampling and analysis will be carried out in collaboration with a NEMA designated laboratory on an annual basis.

5.1.3 Fisheries monitoring plan

5.1.3.1 Introduction

Dredging activities are likely to deteriorate the water quality of the Shimoni Channel. Water quality degradation may directly impact negatively on fisheries due to reduced Dissolved Oxygen and destruction of their breeding and nursery habitats. The objective of the fisheries monitoring plan is to track changes in fisheries so as to inform mitigation measures and environmental management decisions by the proponent.

5.1.3.2 Monitoring location

There will be four (4) monitoring locations which will coincide with MS 2, MS 4 and MS 5 under the water quality monitoring plan and Mwazaro and Funzi Island.

5.1.3.3 Monitoring parameters

The monitoring parameters will include percentage cover for critical habitats, fisheries species diversity, abundance, catch per unit effort and landings.

5.1.3.4 Monitoring methods

Fisheries monitoring will be carried out using two approaches i.e. 50m transects dives within MS 2, MS 4, MS 5 and Funzi Island to survey fish, crustacean and marine fauna and interviews with local fishermen using structured questionnaires.

5.1.3.5 Monitoring frequency

The monitoring frequency will be twice monthly during the construction phase and there after annually or bi-annually depending on the status of the marine environment or in the event of significant environmental risks such as oil spills which could impact on the fisheries.

5.1.4 Biodiversity monitoring plan

5.1.4.1 Introduction

Water quality degradation impacts negatively on biological communities such as benthos, fisheries and mangroves. The objectives of the biological monitoring plan will therefore be to determine the impact of water quality degradation on the biological communities compared to their status

and condition reported in the baseline chapter and determine recovery of habitats and fauna populations' post dredging and dumping.

5.1.4.2 Monitoring location

There will be six (6) monitoring locations which will coincide with MS 2, MS 3, MS 4, MS 5, MS6 and Funzi Island under the water quality monitoring plan. These are hotspots and sensitive areas for biodiversity conservation. MS 2, MS 4 and MS 5 are coral growing areas, MS 6 is the potential dredged material dumping site and MS 3 and Funzi Island are dominated by mangrove strands.

5.1.4.3 Monitoring parameters

Biological monitoring will focus on critical habitats i.e. coral reefs and benthic communities, seagrass beds, seaweeds, mangroves and fauna including fish, crustacean and endangered species The monitoring parameters will include fisheries species diversity, abundance, catch per unit effort and landings, and sightings of endangered species. The mangrove forest will be monitored on the basis of potential diebacks of mangroves from smothering by sediments or changes in tidal regime.

5.1.4.4 Monitoring methods

The biological monitoring methods will replicate the baseline methodology as follows;

- 50m transects dives within the MS 2, MS 4, MS 5 and Funzi Island to survey major substrate categories (coral, seagrass etc.) and biodiversity (fish, crustacean, marine fauna).
- Visual observations and documentation through underwater photography of the condition of the major benthic communities during the dives and marine fauna abundance. Photographic samples should be collected and later analyzed for qualitative and quantitative parameters including benthic fauna and flora (e.g. corals, sea urchins, star fishes, crustaceans and mollusks) as well as common substrate profiling (sand, sea grass/weeds, and corals).
- A Remotely Operated Vehicle (ROV) should be used to survey areas where diving is not possible i.e. potential dredged material dumping site (MS 6). The ROV observes benthic habitats and fauna as well as levels of sedimentation in the water column.
- Setting up of permanent transects at MS 2, MS 4, MS 5 and Funzi Island to improve quality of monitoring by reporting real time changes in biological communities.
- Interviews with local fishermen using structured questionnaires at the landing sites.
- Mangrove forest monitoring methods at MS3 through transect walks and recording observations and documenting the number of die backs if any and the condition of the forest.

5.1.4.5 Monitoring frequency

The monitoring frequency will be twice monthly during the construction phase and there after annually or bi-annually depending on the status of the marine environment or in the event of significant environmental risks such as oil spills which could impact on the biodiversity of the marine environment

5.1.5 Air quality monitoring plan

5.1.5.1 Introduction

Potential sources of air pollution at the project site are dust during construction activities, emissions from machinery/ equipment and vehicular traffic, emissions from ships while maneuvering and berthing, accidental leakage of gasses from ships and other Port related activities. Air pollution and emissions above the acceptable level can potentially cause health problems which include respiratory diseases and visual irritants. The purpose of the air quality monitoring plan is to therefore measure the concentrations of dust and gaseous emissions emanating from the project

activities and compare with the results obtained during the baseline survey. In addition, the results will be used to evaluate if the adopted air pollution controls and management are effective.

5.1.5.2 Monitoring location

Air quality monitoring will be conducted at the port area and in areas in close proximity to the neighborhood. These locations are sensitive receptors of air pollution above the prescribed limits.

5.1.5.3 Monitoring parameters

Port activities are a source of fugitive emissions. Therefore, the proponent should monitor fugitive emissions during the construction and operational phases as per the First Schedule of the Environmental Management and coordination (Air Quality) Regulations, 2014 (Table 29).

Table 29: Air quality parameters and ambient air quality tolerance limits as per the First Schedule of the Environmental Management and coordination (Air Quality) Regulations, 2014

Pollutant	Limits as per EMC (Air Quality) Regulations, 2014
Sulphur Oxides (SO_X)	80 $\mu g/m^3$
Nitrogen Dioxide	150 $\mu g/m^3$
Suspended Particulate Matter (SPM)	360 $\mu g/m^3$
Respirable Particulate matter (< 10μm) (RPM)	70 $\mu g/m^3$
$PM_{2.5}$	35 $\mu g/m^3$
Non methane hydrocarbons	700ppb
Total VOC	600 $\mu g/m^3$
Oxides of Nitrogen	80 $\mu g/m^3$
Carbon monoxide/ carbon dioxide	10 mg/m^3

5.1.5.4 Monitoring methods

Air quality measurements should be carried out at the port area for a 24-hour period by employing Aeroqual portable air monitors which uses a mix of sensor technologies and dust samplers using the laser particles sensors for monitoring particulate suspended matter. The results interpretation and analysis as well as sampling duration information should be used to calculate the gases concentrations.

5.1.5.5 Monitoring frequency

Air qulaity monitoring will be done on a quarterly basis in collaboration with a NEMA designated laboratory.

5.1.6 Noise monitoring plan

5.1.6.1 Introduction

Potential sources of noise pollution will emanate mainly from the actual construction activities, machinery and equipment operations, vehicular movements, from ships and cargo handling. Noise may lead to hearing impairments which will reduce the workmanship of the employees and also affect their finances due to treatment and medication. The objectives of the noise level measurements is to inform measures to safeguard the health of employees and visitors during construction and operation of the Shimoni Port, and ensure compliance with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 (Tables 30 and 31).

Table 30: Maximum permissible intrusive noise levels for construction sites as per the Second Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

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

Table 31: The maximum permissible intrusive noise levels as per the First Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

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

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

5.1.6.2 Monitoring location

Noise level measurements will be conducted within the peak noise producing sections of the Port.

5.1.6.3 Monitoring methods

Noise measurements will be conducted at the port area for 24 hours. Prior to recording the noise measurements, an inspection of the monitoring points and implicated activities of the area should be undertaken. Noise levels will be determined by the noise level meter, with an inbuilt, ῶoctave/octave band filter which does real time and octave analysis. The noise level meter will be raised 2 meters above the ground and fitted with a ½" electrets condenser microphone with a measurement range of between 30 - 130dB and a frequency range and weighting of 25Hz – 10KHz and A, C & Z respectively. For all measurements taken to establish the ambient noise levels, the equivalent noise level (LAeq), the sound pressure level at 5%, 50% & 95% (L5), (L50), (L95) respectively during that measurement period at 1-hour interval. The noise level will be measured in terms of the A-weighted equivalent continuous sound pressure level Leq. Each individual measurement will be taken simultaneously with the nature of the noise climate of the area. This will involve an auditory observation and identification of noise incidents influencing the noise level meter readings by the surveyor.

5.1.6.4 Monitoring frequency

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

5.1.7 Grievances Redress Mechanism

5.1.7.1 Introduction

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

5.1.7.2 Grievances prevention

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

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

5.1.7.3 Grievances Redress Mechanism Tool

KPA has developed a Grievances Redress Mechanism (GRM) tool for conflicts prevention and resolution. The objective of the GRM tool is to ensure that grievances by stakeholders are addressed and resolved in a fair and transparent manner and ensure careful documentation and reporting of grievances and corrective actions. The flow chart below shows the steps followed during the implementation of the GRM tool by the proponent (Figure 70). A complete copy of the GRM tool is appended to the report.

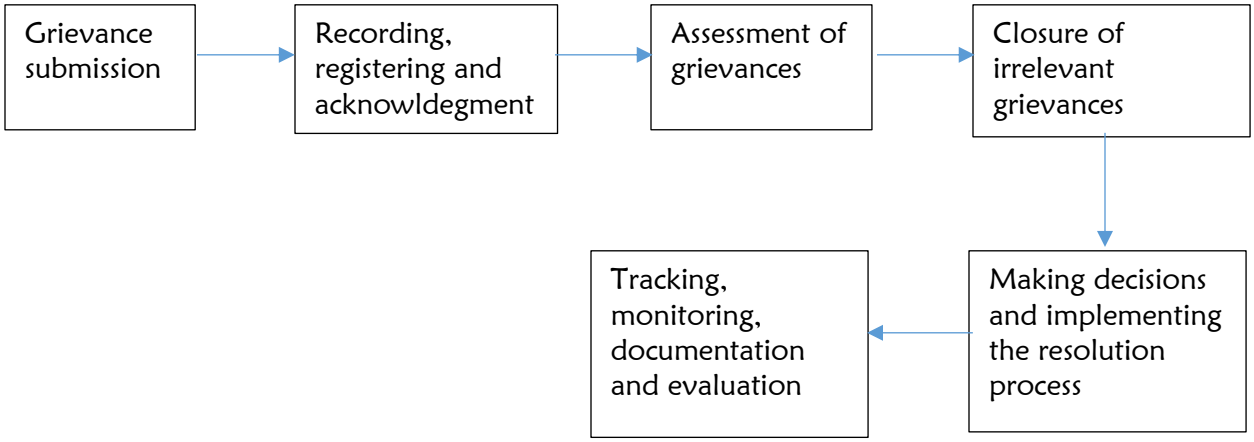


Figure 70. Grievances Redress Mechanism Tool flow chart (Source: KPA, 2020)

6 GOVERNANCE FRAMEWORKS

6.1 Introduction

The Third Schedule of EIA/EA Regulations requires that environmental guidelines and standards which include Kenya government policies and strategies, national legislation, multi-lateral environmental agreements and the institutional arrangements to render them should be incorporated in an ESIA report. The legal and institutional frameworks provide important safeguards for protection and conservation of fragile environments and vulnerable communities and enhance the implementation of the ESMPs. Under this section, the ESIA will therefore review the applicable sets of laws, international agreements and institutions which environmental compliance requirements for the proposed Shimoni Port Infrastructure.

6.2 Policy Framework

6.2.1 National Environment Policy, 2013

Kenya has a National Environment Policy prepared and approved in 2013 by the Ministry of Environment, Water and Natural Resources. Its overall goal is to provide better quality of life in Kenya for present and future generations through sustainable management and use of freshwater resources and wetlands. This policy elaborates the use of environmentally- friendly development strategy that integrates and promotes cohesion of development and environmental policies and enhances transfer of environmentally sound technologies. Chapter 5 of the policy elaborates on environmental stewardship and specifically part 5.6 states that environment impacts of Infrastructural development like ports are distinct and unique such as effects on flora and fauna, social and psychological disruption and vegetation clearance among others. Chapter 6 of the policy elaborates on environmental quality and health and the need to ensure a clean and health environment for all. The relevant policy statements for the proposed Shimoni Port include; 1) Sustainable use of marine resources and the conservation of vulnerable coastal ecosystems, 2) Ensure the development and implementation of a harmonized Integrated Coastal Zone Management (ICZM) Policy and Integrated Ocean Management Policy, Strategy and Action Plan, 3) Undertake and support research and training in the conservation and management of coastal and marine ecosystems and resources, 4) Promote closer regional and international cooperation in the conservation and management of marine migratory species and 5) Involve and empower communities in the management of coastal and marine ecosystems.

6.2.2 Integrated Coastal Zone Management Policy, 2017

The National Environment Policy statements tasks NEMA to develop and implement a harmonised ICZM Policy and Integrated Ocean Management Policy, Strategy and Action Plan. This policy statement has since been developed and is the process of being implemented in line with Sec. 55 of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya. Considerable progress in ICZM implementation in Kenya have been made recently with the release of the second 2009 State of the Coast report in 2017, highlighting the status, trends, threats and impacts to Kenya's coastal and marine environment; and the formulation of the ICZM Policy which addresses the conservation and protection the various coastal ecosystems and outlines institutional arrangements for the management of coastal and marine resources. The overall objective of the ICZM Policy is to guide the management and utilisation of the coastal and marine environment and its resources to ensure sustainable livelihoods and development through seven strategic areas which have been identified and prioritised for action in the ICZM Policy. These strategic areas include conservation of the Coastal and Marine Environment – conserve the coastal and marine resources and environment for sustainable development.

Based on the strategic areas identified and prioritised for action in the ICZM Policy, a National Plan of Action for the coastal and marine environment of Kenya, 2019-2023 has also been developed

to promote sustainable development in the coastal zone. Its main objectives include cconservation and restoration of critical habitats and biodiversity, sustainable utilization of coastal and marine resources, prevention and control of pollution in the coastal and marine environment, protection and mitigation of shoreline change and conservation and restoration of cultural and heritage sites. A strategy for the shoreline management planning process has also already been developed (GOK, 2010).

6.2.3 The Shoreline Management Strategy for Kenya, 2010

NEMA developed a shoreline management plan consistent with the Environment and ICZM policies. The Strategy firstly identifies the key shoreline management issues in Kenya on a systematic basis using sediment cells, recommends shoreline management policies and objectives in response to these observed issues and finally outlines strategies to achieve these policies and objectives. A total of 29 sediment cells have been identified in the strategy. The project area is listed under sediment cell 28 (Shimoni to Vanga) (Table 32).

Table 32: An extract of Sediment Cell 28 where the project site is listed under the Shoreline Management Strategy for Kenya including the conservation objectives and strategies (Source: Shoreline Management Strategy for Kenya, 2010).

Cell	Objectives	Strategies
Cell 28 Shimoni to Vanga	Promote fisheries	• Maintain fish landing sites within the cell. • Planning and enforcement to ensure against encroachment or illegal allocation of fish landing sites • Empower BMU
	Conserve mangroves, coral reefs, seagrass habitats	• Enforce laws related to use of destructive fishing gear • Control/reduce water pollution. • Appropriate development planning on adjacent shorelines (i.e. no highly polluting industries) • Develop harvesting plans for mangroves and rehabilitate degraded areas • Promote nature-based tourism
	Protect against flooding in Umba River	• Catchment / river basin management plan

6.2.4 Kenya Vision 2030

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

6.2.5 Kwale County Integrated Development Plan 2018-2022

The overall aim of the County Integrated Development Plan (CIDP) is to increase and expand sustainable development opportunities and build people's capacities to enable them create wealth and transform their lives for growth and prosperity in line with the Kenya's Vision 2030, Big Four Agenda and the Sustainable Development Goals. The development of the Shimoni Port is part of the CIDP 2018-2022 agenda.

6.2.6 United Nations Sustainable Development Goals

The Sustainable Development Goals (SDGs) were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. SDG 8 focuses on promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all by 2030, through supporting development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encouraging the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services. SDG 13 focuses on climate action in line with the infrastructure and transport sector and SDG 14 focuses on protection of life below water. The proposed Shimoni port will support the strategic development of the Kenyan Ports thus facilitating growth of the local, national and regional economies through increased capacity to handle exports and imports to and from Kenya and protecting the environment.

6.2.7 KPA Environment Policy

The proponent, Kenya Ports Authority has an environmental policy statement in place. It strives to improve and attain the highest standards of environmental performance for the benefit of the port communities under its stewardship. Some of the policy statements to achieve this goal include; adoption of green port initiatives, providing and maintaining a clean, safe and healthy working environment and compliance with the current national and international standards among others.

6.2.8 National Oceans and Fisheries Policy, 2008

The Policy aims at enhancing the fisheries sector's contribution to wealth creation, increased employment for youth and women, food security, and revenue generation through effective private, public and community partnerships. The policy also explores challenges and opportunities ranging from the unsustainable utilization of fisheries resource, the inadequacy of fisheries management, conflict on resource use, gender rights issues and equity, stagnated aquaculture development, inadequate capacity to do quality assurance and inadequate infrastructure

6.3 Other relevant policies

Other than the National Environment Policy, the KPA Environment Policy and the National Oceans and Fisheries Policy, there are other policies which are relevant to the proposed Shimoni Port as shown in Table 33.

Table 33. Summary of the National Policy Frameworks and their relevance to Shimoni Port.

Policy Framework	Relevance to Shimoni Port
National Climate Change Framework Policy	To enhance adaptive capacity and resilience to climate change, and promote low carbon development for the sustainable development of Kenya
National Forest Policy, 2014	Ensure sustainable development, management, utilization and conservation of forest resources and equitable sharing of accrued benefits for the present and future generations of the people of Kenya
The National Water Policy, 1999	Enhances water resources management and pollution control through abstraction permits and standards for effluent discharge
National Wildlife Conservation and Management Policy, 2017	Provides a framework for conserving Kenya's rich diversity of species, habitats and ecosystems for the benefit of its people and the global community
National Health Policy, 2014-2030	It ensures that the country attains the highest possible standards of health, in a manner responsive to the needs of the population

National Land Policy, 2009	Sets guidelines for sustainable land use and management practices

6.4 Legal framework

6.4.1 The Constitution of Kenya, 2010

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

Relevance to the proposed project

- The proponent should ensure that port operations do not infringe on the right to a clean and healthy environment for all.
- The proponent must ensure that the operations are 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.

6.4.2 Kenya Ports Authority Act, 2014

It is an Act of Parliament that creates the Kenya Ports Authority (KPA). The Authority is responsible for all the port infrastructure in Kenya. Kenya Ports Authority maintains, operates, improves and regulates all scheduled ports on the coastline and hinterland of Kenya, including principally Kilindini Harbour at Mombasa, as well as other ports include Lamu, Malindi, Kilifi, Mtwapa, Kiunga, Shimoni, Funzi, Vanga and Kisumu.

Relevance to the proposed project

The proponent is mandated to maintain, operate, improve and regulate the Shimoni port and other ports set out in the Second Schedule of the Act.

6.4.3 The Kenya Maritime Authority Act, 2012

The Government of Kenya established Kenya Maritime Authority (KMA) in 2004, for the purpose of transferring areas of responsibility over shipping concerns from the Merchant Shipping Department of Kenya Ports Authority to an independent Governmental Authority. Thus, KMA under the Incorporation Order is responsible for Port and Flag State implementation of various international instruments relating to maritime transport. The Regulatory role of KMA therefore aims to broaden and modernize the institutional and legal framework for the implementation of maritime safety, security and the preservation of the aquatic environment.

Relevance to the proposed project

The proposed project will involve dredging of the access channel and associated civil works within the port area. These works have safety implications on navigation at the water body as well as potential pollution which KMA has a direct oversight obligation as follows;

- National maritime legislation i.e. the KMA and the Merchant Shipping Acts remain the primary tools for attaining international standards in safety and security and the preservation of the marine environment. Only through such regulations can the Government enforce international maritime conventions, especially those emanating from the International Maritime Organization (IMO). Such rules and regulations are also relevant for the implementation of national maritime safety, security and marine environment conventions/programmes.

- KMA is the designated national competent oil spill authority responsible for the development and provision of guidelines for the management of oil spills in the maritime environment. Under Section 5 (i) of the Act, KMA is required to enforce safety of shipping, including compliance with construction regulations, maintenance of safety standards and safety navigation rules.

6.4.4 The Merchant Shipping Act, 2009

The Merchant Shipping Act is administered by the Kenya Maritime Authority. It is an Act of Parliament to make provision for the registration and licensing of Kenyan ships, to regulate proprietary interests in ships, the training and the terms of engagement of masters and seafarers and matters ancillary thereto; to provide for the prevention of collisions, the safety of navigation, the safety of cargoes, carriage of bulk and dangerous cargoes, the prevention of pollution, maritime security, the liability of ship-owners and others, inquiries and investigations into marine casualties; to make provision for the control, regulation and orderly development of merchant shipping and related services; generally to consolidate the law relating to shipping and for connected purposes.

Relevance to the proposed project

The proponent will collaborate with KMA in implementation of the Merchant Shipping Act in terms of ensuring ships and other maritime crafts accessing the port are licensed, prevention of pollution and in improving port and navigational safety.

6.4.5 The Environmental Management and Co-ordination Act Cap. 387 of the Laws of Kenya

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

Relevance to the proposed project

Section 58 of the Act requires proponents of a development likely to have deleterious effects on the environment to prepare and submit an ESIA report to NEMA for consideration for decision making. This study report is prepared to comply with the provisions of this section. In addition, several Regulations have been enacted by the line Ministry to operationalize the Act as discussed below.

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

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

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

Water Quality Regulations are meant to address the challenges of pollution of water resources as well as their conservation. They consist of VI parts and Eleven Schedules dealing with protection of sources of water to miscellaneous provisions. Part II, 6, (a) specifies the need for an effluent discharge licence. It states in part that "No person shall discharge any effluent from sewage treatment works, industry or other point sources without a valid effluent discharge license issued in accordance with the provisions of the Act. Part III, 12 (1 & 2), 13 and 14 sets out the need for adherence to the discharge standards specified in the Third, Fifth and Sixth Schedules. The port

should construct a bio-digester to manage effluent from sanitation facilities and waste water from cleaning operations.

3. Environmental Management and Coordination (Waste Management) Regulations, 2006

The Regulations focus on management of solid wastes, industrial wastes, hazardous wastes, pesticides and toxic substances and radioactive substances. The regulations are aimed at addressing the impact of pollution from wastes on the environment which become important sources of disease-causing pathogens. In compliance with these Regulations, the proponent will ensure proper waste disposal throughout the project cycle and procure the services of a NEMA licensed contractor for solid waste management.

4. Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009

These Regulations were enacted pursuant to the provisions of Section 42 (3) of EMCA. One of the key objectives of the Regulations is to facilitate the sustainable utilization and conservation of resources on river banks, lake shores, and on the seashore by and for the benefit of the people and community living in the area. The proponent should comply with the provisions of this Act.

5. Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

These Regulations were gazetted to manage noise levels to levels that do not cause a disturbance to the public. The operations at the port are likely to generate noise above the acceptable limits within the neighborhood. Noise level measurements were obtained on 11th September, 2020 to provide a benchmark for continued monitoring. Appropriate PPE should be provided for employees engaged in activities that may produce noise above the acceptable limits within the facility.

6. Environmental Management and Coordination (Air Quality) Regulations, 2014

These regulations were aimed at controlling, preventing and abating air pollution to ensure clean and healthy ambient air. Potential sources of emissions during the operation of the Shimoni Port would include emissions from ships and locomotives as well as vehicular traffic. Air Quality measurements were obtained on 11th September, 2020 to provide a benchmark for continued monitoring. The proponent should therefore undertake quarterly air quality monitoring.

6.4.6 The Fisheries Management and Development Act, 2016

The Fisheries Management and Development Act provides the framework for the development, management, exploitation, utilization and conservation of fisheries and for connected purposes. The overall objective of this Act is to provide for the conservation, management and development of fisheries and other aquatic resources to enhance the livelihood of communities dependent on fishing. It also regulates the landing of fish and provides for the management of fishing ports, including fish landing stations. As part of the implementation of the Act and improve community participation in the conservation and management of fisheries, the Kenya Government gazetted the Beach Management Units (BMUs) Regulations in 2007. Moreover, section 99 of the Act states that the operator shall retain no more than 30% of the total fish catch taken from Kenya's Economic Exclusive Zone annually, or such other amount as maybe prescribed and the remaining portion of the bycatch shall be landed for sale in the local market.

Relevance to the proposed project

The proposed project site is a designated fishing port area as specified in the Second Schedule of the Act. The proponent should comply with the provisions of the Act and specifically;

- Unless otherwise provided by the Cabinet Secretary, the proponent shall not engage in fishing for, catch, possess, transport, process, buy or sell any species of fish declared endangered or threatened with extinction pursuant to subsection 45 (1)
- Comply with Section 49 (1) of the Act which has provisions for the prevention of pollution and protection of fish and their habitats.
- Adhere to Section 60 (1) of the Act, 2016 which states thus "Any person who sells or exports fish or fish products intended for human consumption shall comply with all applicable food quality, health and sanitation requirements and shall not sell or export such fish or fish products which — (a)are adulterated; (b)are contaminated with or contains a poisonous or harmful substance or pathogenic micro-organisms; (c)have not met applicable inspection standards; or (d)are otherwise injurious to human health.
- Adhere to Section 158 (1) of the Act which prohibit any foreign fishing vessel without Authorization from the Director General
- Obtain statutory licenses in accordance with the Act

The proponent should collaborate with the BMUs to ensure that the local fisher community has information on project scope to avoid conflicts which are likely to arise from interference with the landing sites and support the sustainable development of the fisheries sector. Additionally, the proposed industrial fishing port will comply with the provision of this Act.

6.4.7 The Wildlife Conservation and Management Act, 2013

It is the law charged with the responsibility of providing for the protection, conservation, sustainable use and management of wildlife in Kenya and for connected purposes. It designates protected areas, lists and provides for the protection of endangered, vulnerable and protected species as well as invasive species. It is critical in the study of biodiversity as it is the most comprehensive database alongside the IUCN red list of endangered species.

Relevance to the proposed project

The proposed project sites lies along the Shimoni Channel which connects to the Kisite-Mpunguti Marine Park and Reserve, a Marine Protected Area (MPA) gazetted under the Wildlife Conservation and Management Act, 2013. The MPA harbours a rich marine ecosystem that includes marine species of international importance such as the endangered sea turtles and dolphins and open sea marine resources among others. The proponent should implement measures to prevent pollution from the port operations which would degrade water quality and affect the wildlife.

6.4.8 The Forest Conservation and Management Act, 2016

It is an Act of parliament that gives effect to Article 69 of the constitution with regard to forest resources, to provide for the development and sustainable management and rational utilization of all forest resources for the socio-economic development of the country and for connected purposes.

Relevance to the proposed project

The proponent should obtain a permit from the Kenya Forest Service to cut down trees or mangroves to pave way for the development. In addition, he should plant trees in areas within the facilities that will not be developed to compensate for loss during construction and identify and area for mangrove replanting.

6.4.9 The Water Act, 2016

The Constitution acknowledges access to clean and safe water as a basic human right and assigns the responsibility for water supply and sanitation service provision to the 47 established counties.

The purpose of the 2016 Water Act is to align the water sector with the Constitution's primary objective of devolution. The Act establishes several organs to ensure development and sustainable use of water resources. These include the Water Resources Authority (WRA), the Water Sector Trust Fund (WSTF), Water Resources Users Associations (WRUAs), Water Services Providers (WSPs) and Water Works Development Agencies among others.

Relevance to the proposed project

The Water Act provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water, to provide for the regulation and management of water supply and sewerage services.

6.4.10 The Climate Change Act, 2016

The Climate Change Act provides a regulatory framework for the development, management, implementation and regulation of mechanisms to enhance climate change resilience and low carbon development for the sustainable development of Kenya. It provides for mainstreaming of climate change responses into development planning, decision making and implementation as well as resilience and adaptation in all governance sectors.

Relevance to the proposed project

The proponent should implement measures to ensure low carbon foot at Shimoni Port. This could be through developing the Ports' Climate Change Action Plan to address emissions and sea level changes, installation of renewable energy infrastructure for lighting and energy efficient machines, ensure application of air quality management procedures (including for GHG emissions) for ship operations while in port area, maintain cargo transfer equipment (e.g., cranes, forklifts, and trucks) in good working condition to reduce air emissions among others. Additionally, the proponent should support local communities in climate change adaptation measures through investments in capacity building e.g. in agriculture, forestry, conservation and fisheries as part of KPAs Corporate Social Responsibility (CSR).

6.4.11 The Kenya Coast Guard Service Act, 2018

The Kenya Coast Guard Service was established by The Coast Guard Service Act 2018, and was operationalized on 22nd October 2018. The Coast Guard Service is responsible for protecting the country's waters against dumping of harmful wastes and pollutants, search and rescue services, and the arrest of illegal fishermen.

Relevance to the proposed project

The proponent should collaborate with the Kenya Coast Guard by reporting illegal activities and in prevention of pollution of the ocean and trafficking.

6.4.12 Physical and Land Use Planning Act, 2019

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

Relevance to the proposed project

The proponent should obtain applicable planning approvals from the County Government of Kwale for construction activities. Future port development should be aligned to the completed physical plans.

6.4.13 The Public Health Act, 2012

The Act aims at prohibiting activities that may be injurious to the general public. It outlines the responsibilities for the County Government to maintain a safe and clean environment by controlling the operation activities of any facility.

Relevance to the proposed project

The proponent should ensure compliance with Act by providing clean, healthy and safe environment during construction and subsequent operation of Shimoni Port.

6.4.14 Occupational Safety and Health Act, 2007

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

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

Relevance to the proposed project

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

6.4.15 The County Government Act, 2012

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

Relevance to the proposed project

The Act gives the right to access all property at all times by the County Government officers and servants for inspection purposes. The Port Management will be under obligation to allow County officers and inspectors at the premises and comply with the by-laws of the County.

6.5 Institutional arrangements to implement the legal framework

To implement the above legal framework the government has established a number of institutions with varying mandates of implementation as shown in Table 34.

Table 34: Institutions and their legislative mandate as it applies to the Shimoni Port.

Institution	Legislative mandate
Kenya Ports Authority	To implement the KPA Act
Kenya Maritime Authority	To implement the KMA Act and the Merchant Shipping Act
National Environment Management Authority	To implement the Environmental Management and Coordination Act and Associated Regulations
State Department of Fisheries, Aquacultue and Blue Economy	To implement the Fisheries Management and Development Act and subsidiary regulations
Kenya Wildlife Service	To implement the Wildlife Conservation and Management Act, 2013
Water Resources Authority	To implement the Water Act, 2016
Kenya Forest Service	To implement the Forest Conservation and Management Act, 2016
Kenya Coast Guard	To implement the Kenya Coast Guard Service Act, 2018
County Government of Kwale	To implement the County Government Act, 2012, its by-laws and the Physical Planning and Land Use Planning Act, 2019
Kenya Revenue Authority	Responsible for the assessment, collection and accounting for all revenues that are due to government, in accordance with the laws of Kenya
Kenya Bureau Standards	Provision of the country's Quality Infrastructure for facilitation of trade. It will ensure that goods to and from the Port are compliant to international standards through an internationally recognized Standards Measurement Systems.
Department of Immigration	Responsible for population registration and maintenance of an inclusive population register, migration management, border control and refugees welfare supervision
Department of Public Health	To implement the Public Health Act
Directorate of Occupational Safety and Health Services	To implement the Occupational Safety and Health Act alongside the subsidiary legislation
Civil society and conservation organization	Non-state, not for profit voluntary entities who play a various role in the implementation of a project including advocacy, conservation, safeguarding the environment and funding among others
Community and Faith Based Organizations	Nonprofit groups that work at a local level to improve life for residents; some may be directly affected by the proposed project

6.6 Multilateral Environmental Agreements

Kenya is a signatory to several international conventions, protocols and treaties and is therefore bound by the requirements of these conventions and protocols. The relevant ones in respect of the proposed project are aimed at ensuring a sustainable environment. They include;

1. United Nation Convention on the Law of the Sea (UNCLOS)
2. Convention for the Protection, Management and Development of the Coastal Environment of the Eastern African Region (The Nairobi Convention) of 1985
3. Convention on Biological Diversity, 1992
4. The Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1963
5. Bonn Convention on the Conservation of Migratory Species

6. Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, 1989 (Basel Convention)
7. International Convention for the Prevention of Pollution from Ships (MARPOL) 1973/78
8. The London Convention 1972/Protocol 1996
9. United Nations Framework Convention on Climate Change (UNFCC)
10. The World Bank and IFC Safeguard and Sustainability Policies

6.6.1 United Nation Convention on the Law of the Sea (UNCLOS)

The convention is an international agreement that resulted from the third United Nations Conference on the Law of the Sea (UNCLOS III), which took place between 1973 and 1982. It was opened for signature on 10th December 1982 and entered into force on 16th November 1994. Kenya signed the convention 10th December 1982 and ratified it on 02nd March, 1989. The Law of the Sea Convention defines the rights and responsibilities of nations with respect to their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. Under the Convention, responsibility for ensuring the long-term sustainability of living marine resources within the 200 nautical mile exclusive economic zone rests with coastal States such as Kenya. On the high seas, States have a duty to cooperate with other States in adopting measures to manage and conserve living resources. The Kenya's National Focal Points for the Convention is the Kenya International Boundaries Office.

Relevance to the proposed project

The Convention requires all States to protect and preserve the marine environment, including rare or fragile ecosystems and the habitat of endangered species. They are also required to take all measures consistent with the Convention to prevent, reduce and control pollution of the oceans. The proponent should ensure prevention of maritime pollution to protect the marine habitat.

6.6.2 Convention for the Protection, Management and Development of the Coastal Environment of the Eastern African Region (The Nairobi Convention) of 1985

The Nairobi Convention, which was first signed in 1985 and entered into force in 1996, is part of UN Environment's Regional Seas Programme. The convention is a partnership between governments, civil society and the private sector, working towards a prosperous Western Indian Ocean Region with healthy rivers, coasts and oceans. The programme aims to address the accelerating degradation of the world's oceans and coastal areas through the sustainable management and use of the marine and coastal environment. It does this by engaging countries that share the western Indian Ocean in actions to protect their shared marine environment. The Kenya's National Focal Points for the Convention is the Ministry of Environment and Forestry.

Relevance to the proposed project

Kenya being a signatory to the convention, has a responsibility of ensuring sustainable management and use of the marine and coastal environment. For the proposed development, the proponent should implement the ESIA recommendations to ensure conservation of the vulnerable coastal ecosystem.

6.6.3 Convention on Biological Diversity, 1992

The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5th June 1992 and entered into force on 29th December 1993. Kenya ratified the Convention in 1994. The objectives of this Convention are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of

relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

The Convention on Biological Diversity gives the responsibility of conservation and protection of biodiversity to the signatories. As such, it is imperative for developments within the Kenyan jurisdiction to be cognizant of the objectives of the Convention. The Kenya's National Focal Points for the Convention are Ministry of Environment and Forestry, National Environment Management Authority, Kenya Wildlife Service and National Museums of Kenya.

Relevance to the proposed project

The Shimoni Channel and open waters are renowned for the attractiveness of its coastal zones, high marine biodiversity and rich marine and coastal resources. The fulfillment of human needs for food, goods, and services involves the disruption and often degradation of the marine natural habitats. These habitats are threatened by a number of factors mainly including destructive fishing, recreational activities and water quality degradation. The proponent should ensure that the Port's activities do not pollute the ocean ecosystem thus maintaining biological diversity.

6.6.4 The Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1963

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a multilateral treaty to protect endangered plants and animals. It was drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). The convention was opened for signature in 1973 and CITES entered into force on 1st July 1975. Kenya ratified the Convention on 13th December 1978 and it entered into force on 13th March 1979. Therefore, the country is obliged to protect endangered plants and animals. The Kenya's Focal Points are Kenya Wildlife Service and National Museums of Kenya.

Relevance to the proposed project

The project area harbors a rich marine ecosystem that includes fringing mangroves, seagrass beds, coral reefs, marine species of international importance such as the dolphins and the endangered sea turtles (Hawksbill and green turtles) and dugongs. The proponent should implement measures to prevent the degradation of habitats and threats to the biodiversity within the marine environment.

6.6.5 Bonn Convention on the Conservation of Migratory Species

As a result of international concern over the threats to migratory species, the Conservation of Migratory Species of Wild Animals (Bonn Convention) was adopted in 1979 and entered into force on 1st November 1983. It is an environmental treaty under the aegis of the United Nations Environment Programme that provides a global platform for the conservation and management of terrestrial, aquatic and avian migratory species throughout their range. Kenya ratified the Convention in 1999, hence the country is obliged to protect migratory species that live within or pass through the Kenya's jurisdictions. Kenya Wildlife Service is the focal point and implementing agency for the Bonn Convention.

Relevance to the proposed project

The Wasini Shimoni channel as well as the Kisite Mpunguti Marine Park and Reserve is a major migratory destination for several large fauna species such as the Humpback whales, whale sharks and other breeding migratory birds (roseate and sooty terns) which are vulnerable to a wide range of threats, including habitat shrinkage in breeding areas and degradation of their feeding grounds. The proponent should ensure that the Port's activities do not pollute the ocean.

6.6.6 Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, 1989

The Basel Convention was adopted in March 1989 in Basel, Switzerland, and entered into force in 1992. It was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries. It does not, however, address the movement of radioactive waste. The Convention is also intended to minimize the amount and toxicity of wastes generated to ensure their environmentally sound management as closely as possible to the source of generation, and to assist less developed countries in environmentally sound management of hazardous and other wastes they generate.

Kenya ratified the convention on 30th August, 2000. Therefore, the country is obliged to comply with the import and export bans of hazardous waste and ensure wastes generated are kept within the country's boundary and as close as possible to the source of generation and provide incentives for waste reduction and pollution prevention. The National Focal Point for the Convention is the Ministry of environment and Mineral Resources.

Relevance to the proposed project

The proponent should ensure that hazardous wastes are not exported from or into the port and waste generated within the facility and from the ships are properly managed.

6.6.7 International Convention for the Prevention of Pollution from Ships (MARPOL) 1973/78

The MARPOL Convention is the main international convention covering prevention of pollution by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and also includes the Protocol of 1997 (Annex VI). MARPOL has been updated by amendments through the years. The Convention covers pollution by oil & oily water, noxious liquid substances in bulk, harmful substances in packaged form, sewage and garbage and air pollution from ships. The Convention includes regulations aimed at preventing and minimizing pollution, both accidental pollution and that from routine operations.

Kenya became a signatory to the convention in 1973. Therefore, the country is obliged to comply with the provisions of the Convention in preventing pollution of the environment by ships from the discharge of harmful substances or effluents containing substances in contravention of the convention. The designated national competency authority responsible for prevention of ship pollution is the Kenya Maritime Authority.

Relevance to the proposed project

Pollution originating from ships, including oily sludge, food packaging and food waste will need to be managed as per the requirements of the convention during the operation of port.

6.6.8 London Convention 1972 / Protocol 1996

The London Convention is one of the first global conventions to protect the marine environment from human activities and has been in force since 1975. Its objective is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter. Currently, 87 States are Parties to this Convention. Additionally, in 1996, the "London Protocol" was agreed to further modernize the Convention and, eventually, replace it. Under the Protocol all dumping is prohibited, except for possibly acceptable wastes on the so-called "reverse list". The Protocol entered into force on 24 March 2006 and there are currently 53 Parties to the Protocol. The purpose of the Protocol is similar to that of the Convention, but the Protocol is more restrictive: application of a "precautionary approach" is included as a general obligation; a "reverse list" approach is adopted, which implies that all dumping

is prohibited unless explicitly permitted; incineration of wastes at sea is prohibited; export of wastes for the purpose of dumping or incineration at sea is prohibited. Kenya ratified the Convention on 1976. The National Focal Point for the Convention is the Kenya Maritime Authority.

Relevance to the proposed project

The choice of the potential dumping site was selected based on the provisions of the Convention/Protocol. The proponent will apply and obtain a permit for the dumping site from KMA as will be required from time to time to comply with the London Convetion, 1972/Protocol 1996.

6.6.9 United Nations Framework Convention on Climate Change (UNFCC)

The ultimate objective of this convention is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. It should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, so as to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Kenya is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), its Kyoto Protocol and its Paris Agreement and therefore decisions taken under the UNFCCC are binding to the country. Kenya ratified the UNFCCC on 30th August, 1994 and subsequently it entered into force on 28th November, 1994. The country accented to The Kyoto Protocol on 25th February 2005, leading to its entry into force on 26th May 2005 and ratified The Paris Agreement on 28th December, 2016 which entered into force on 27th January 2017. Climate change has the potential to compromise infrastructure design, function and performance across a range of settings. Reliable water transport infrastructure in Kenya facilitates smooth and faster movement of goods and services and national and regional integration. This, boosts trade within and across Kenyan borders, promotes economic development, and contributes to poverty reduction and wealth creation.

The National Climate Change Secretariat is the National Focal Point for the United Nations Framework Convention on Climate Change. It also works with climate change coordination units in different ministries, departments and agencies to ensure that climate change is mainstreamed in the different sectors of the economy

Relevance to the proposed project

Maritime transport is a contributor to climate change, accounting for approximately 2.7% of annual global CO_2 emissions in 2014, and potentially rising to 10% of total global GHG emissions by 2050 if other sectors make significant reductions (Source: National Climate Change Action Plan 2018-2022). Due to the importance of transport in the development of Kenya and the region, and as recommended in the National Climate Change Action Plan (NCCAP), Kenya aims to address climate change in the transport sector by working to reduce greenhouse gas emissions while encouraging development of transport infrastructure that accounts for the effects of climate change. The proponent should implement measures to ensure low carbon footprint at Shimoni Port.

6.6.10 The World Bank and IFC Safeguard and Sustainability Policies

The financing institutions (The World Bank through its IFC branch) have also developed a policy on social and environmental sustainability that calls for positive development outcomes in the public and private sector. In order to achieve this, the World Bank has set up performance standards on environmental and social sustainability as well as general and industry specific environmental, health and safety guidelines against which projects are reviewed. The thrust of the standards is to

ensure that projects financed by the bank are developed in a manner that is socially responsible and reflect sound environmental management practices.

Relevance to the proposed project

The World Bank Safeguard Policies to be considered include; OP/BP 4.01 Environmental Assessment, OP/BP 4.04 Natural Habitats, OP/BP 4.10 Indigenous Peoples, OP/BP 4.11 Physical Cultural Resources, OP/BP 4.12 Involuntary Resettlement and OP/BP 4.36 Forests (Table 35). On the IFC Policy and Performance Standards the project will need to comply with performance standards 1, 2,3,4,6 and 7 (Table 36).

Table 35: Summary of World Bank Environmental and Social Safeguard policies.

Safeguard and sustainability policy	Focus
OP/BP 4.01 Environmental Assessment	The Bank requires environmental assessment of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable and thus improve decision making
OP/BP 4.04 Natural Habitats	To promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions
OP/BP 4.10 Indigenous Peoples	To design and implement projects in a way that fosters full respect for indigenous peoples' dignity, human rights, and cultural uniqueness, so that they: ● Receive culturally compatible social and economic benefits; and ● Do not suffer adverse effects during the development process
OP/BP 4.11 Physical Cultural Resources	To assist in preserving physical cultural resources and avoiding their destruction or damage. Physical cultural resources include resources of archaeological, paleontological, historical, architectural, and religious, aesthetic, or other cultural significance.
OP/BP 4.12 Involuntary Resettlement	To address and mitigate economic, social, and environmental risks the community, institutions and social networks faces when they are weakened or lost
OP/BP 4.36 Forests	To harness the potential of forests, reduce poverty in a sustainable manner, integrate forests into sustainable economic development and protect the vital local and global environmental services and values of forests.

Table 36: Summary of IFC sustainability and performance safeguards.

Performance Standard	Focus
No. 1	Social and Environmental Assessment and Management System
No. 2	Labor and Working Conditions: Focus is on forced and child labor as well as occupational health and safety
No. 3	Pollution prevention and abatement
No. 4	Community health, safety and security
No. 6	Biodiversity conservation and sustainable natural resource management

7 CONCLUSION AND RECOMMENDATIONS

The proposed project is considered important and beneficial as it will contribute towards socio-economic growth of the area through employment creation, increased revenues from fishing activities and trade and ensuring utilization of the country's Exclusive Economic Zone (EEZ) and growth of the Blue Economy Sector. Despite these benefits, there will be negative environmental and social impacts which will accompany the development of Shimoni Port. The key concerns include the impact of dredging and dumping on the marine ecosystem, oil spills and their management, loss of livelihoods and pollution.

The ESIA has recommended mitigation measures and monitoring plans to address the negative impacts which include use of silt curtains during dredging, aligning dredging activities to coincide with low risk annual periods for migration of mega fauna such as whales and during the South East Monsoon period when fishing activities are at their lowest. It is important to note that these key impacts will not manifest during phase1 of the Shimoni Port Development as dredging is not expected unless otherwise advised by the on-going bathymetric survey. Further during phase 2 where dredging and dumping is expected, potential conflicts may arise in respect to access to traditional fishing grounds and impact on Community Conservation Areas. To mitigate these conflicts, the proponent will avail resources to implement the Environmental Management and Monitoring Plans recommended by the ESIA and the KPA Grievance Redress Mechanism Tool. It is on this basis that we recommend that the ESIA recommends that the project be allowed to proceed alongside conditions which will ensure compliance with the provisions of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya.

8 ANNEXTURES

1. Copy of approval of the scoping report and Terms of Reference for the study
2. Copy of KPA Environment Policy Statement
3. Copies of reports of baseline environmental monitoring results (Water quality, air quality and noise level measurements)
4. Proceedings of the ESIA Study Kick-off meeting held with the proponent and key stakeholders held on 27th August 2020
5. Letters of Invitation and Evidence of Receipt by the community for the Consultative Meetings
6. Proceedings of the Community Consultative Meetings held in Shimoni (10th September 2020), Kibuyuni (10th September 2020), Majoreni (14th September 2020), Mkwiro (15th September 2020) and Wasini (2nd October 2020)
7. Letters of Invitation and Evidence of Receipt by the stakeholders for the Meetings to review the Draft ESIA Report
8. Proceedings of the first stakeholder meeting to review the Draft ESIA Report held on 2nd October 2020
9. Proceedings of the second stakeholder meeting to review the Draft ESIA Report held on 6th October 2020
10. Letters of Invitation and Evidence of Receipt by the stakeholders to validate the ESIA study report
11. Proceedings of the stakeholders' meeting to validate the ESIA study report held on 14th October 2020
12. Copy of KPA Grievances Redress Mechanism Tool
13. Copy of NEMA practicing license for the firm, Envasses Environmental Consultants Limited
14. Copies of NEMA practicing licenses for the key Lead Experts, Mr. Simon Nzuki, Ms. Jane Gitau and Dr. Bernerd Fulanda.

9 REFERENCES

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