KENYA PORTS AUTHORITY
P.0. BOX 95009- 80104
MOMBASA

PROPOSED CONSTRUCTION OF BERTH 19B AND ASSOCIATED INFRASTRUCTURE AT THE PORT OF MOMBASA

GPS Coordinates Latitude: $04^0$2' 42.92"S; Longitude $039^0$37'27.5"E

ENVIRONMENTAL IMPACT ASSESSMENT STUDY

PREPARED BY

HEZTECH ENGINEERING SERVICES
EIA/EA LICENSED FIRM OF EXPERTS REG No. 5194
P.O. BOX 42269 – 80100
MOMBASA

November 2024

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Submitted By

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KENYA PORTS AUTHORITY
MOMBASA

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EXECUTIVE SUMMARY

This is an Environmental and Social Impact Assessment (ESIA) Study Report for proposed construction of a Container Berth 19B (B19B) and associated infrastructure to be developed by Kenya Ports Authority (KPA) at the port of Mombasa. The proposed berth will be located to the west of the existing Berth 19 the GPS coordinates of the site are 4° 02'50"S 39° 37'20"E. The proposed Berth 19B development will be an extension of the existing Container Terminal 1 (CT1) facility. The ESIA study and report compilation was carried out as provided for in the Environmental Management and Coordination Act, 1999 (Amended) 2015.

Project Objective

The objective of the proposed project is to construct a new berth and a container yard with additional storage space to increase the container handling capacity at the Port of Mombasa for the current and projected container volumes.

Project Scope

The scope of the proposed project is as follows:

- ✓ Dredging works at the berth pockets and the turning basin (ESIA for dredging works being undertaken as a separate project);
- ✓ Quay structures and associated quay furniture e.g., fender systems and bollards;
- ✓ Revetments under the quay deck and at the return edges;
- ✓ Land reclamation and ground improvement;
- ✓ Stacking yards and port roads;
- ✓ Electrical power supply and distribution systems;
- ✓ Lighting and earthing systems;
- ✓ Drainage and utility systems;
- ✓ Navigational aids, if required;
- ✓ Security, ICT, LAN systems alarm detection systems and dedicated data communication;
- ✓ Water supply, both portable and for firefighting.

Design of proposed project

The proposed Berth 19B will be an extension of the existing Container Terminal (CT1), hence the arrangement, form of structures and general operational philosophy of Berth 19B will be consistent with those of the existing CT1. Berth 19B will be designed to serve container ships of 45,000DWT and to have a design depth of C.D.L –13.5m. The quay structure will accommodate the Ship to Shore (STS) Crane rails, which are expected to be a continuation of the existing crane rails on the existing CT1 quay structure. An inclined revetment will be installed along the western boundary and connected to the revetment below the quay structure. Dredging at the berth pockets will be done if required, to secure the required water depth in front of the quay wall and excavation of soil that forms a soft stratum to ensure the stability of the revetment section. Soil improvement will be achieved by perforated vertical drains (PVD) consolidated by a surcharge material. Yard pavement shall be determined in consideration of the traffic volume, design wheel load, durability

and maintenance. Utilities and services that will be provided as part of the Berth 19B development include water supply, drainage, electrical power supply and communication.

Proposed project cost

Direct construction cost of the proposed project covering civil works, utilities, building works, mobilization and demobilization is estimated to be USD 122.030, 000.00

Environmental and socioeconomic baseline

Baseline studies indicate that marine habitats (coral reefs, seagrass beds, mangroves) very close to the project area are in moderate to bad condition, largely due to maritime and port operations that has degraded them, particularly the long term resource extraction for food and scheduled dredging and pollution from multiple sources have degraded the marine habitats and communities. Key fishing grounds near the port of Mombasa were noted to be mainly at Likoni, Shelly beach, Mweza, Mtongwe, Dongo Kundu, Mwangala, Tunza, Old Town, Ndugani, an Mkupe, which are spread across the two creeks close the port. Exploitation of fishery resources was noted to be mainly traditional, utilizing rudimentary gears and vessels that mainly operate within the reef. This limitation prevents the exploitation of the vast fisheries outside the reef, which are essential for supporting food security.

Alternatives considered

During the project design, alternatives for implementation of the project were considered and reviewed for their economic and environmental suitability. The alternatives considered were the no project alternative, the yes project alternative, alternative project location and alternative designs.

Stakeholder consultation and public participation

Stakeholders consulted included those drawn from national and county government institutions and departments, civil society organizations, beach management units, private companies, academia and political leadership. Public participation drew participants from the general public. Key issues that were discussed included; distance from the dredging site to dumping site, source of reclamation materials, distance from the dumping site to the nearest landing site, dredging method to be used, piling technology to be used, involvement of BMU throughout the project cycle, project alternatives, sources of water, proposal for use of renewable energy, impacts of dumping of dredged materials, impacts of sand harvesting, impacts on marine cables, traffic management measures, impacts on marine habitats, fishermen compensation, employment for local people, potential benefits of the project to Mombasa County, youth training opportunities, facilitation of BMUs with modern fishing equipment to venture into deep sea fishing, and marine habitats restoration.

Potential positive impacts

- ✓ Employment opportunities
- ✓ Support to existing local businesses
- ✓ Technology transfer
- ✓ Enhancement of container handling capacity of the port.

- ✓ Optimisation of Container Terminal 1 (CT1) into a four-berth terminal hence improving the operational efficiency of the terminal.
- ✓ Sustainability of business growth.

Potential negative impacts

- ✓ Potential release of contaminants
- ✓ Increased turbidity
- ✓ Changes in water flow and circulation
- ✓ Habitat disturbance
- ✓ Nutrient release
- ✓ Underwater piling noise
- ✓ Turbidity and sedimentation
- ✓ Construction waste pollution
- ✓ Fugitive dust pollution
- ✓ Occupational accidents and injuries
- ✓ Oil and lubricants spills
- ✓ Storm water runoff

Proposed mitigation measures of potential negative impacts

Issue/ Concern	**Proposed mitigation measures**
Seabed disturbance during piling as a result of noise and vibtation	- Minimise seabed disturbance during foundation piling by restricting the pilling to actual point only. - Acoustically improve the piling process by vibratory pile driving and or drilled foundations - Intrinsic underwater noise measurements be carried out during piling
Turbidity and sedimentation	- Secure the working site with silt curtains - Onsite turbidity measurements be carried out during construction period
Increase in total suspended solids in marine water	- Secure marine construction site with silt curtains - Secure adjacent offshore construction site with silt traps - Construct catch basins at offshore site adjacent to marine construction site - Monitor suspended solids in marine water during construction period
Construction Waste	- Prepare and implement an elaborate waste management plan - Eliminate and or minimize waste generation by proper planning. - Contractor to provide waste receptacles for site generated construction waste - Contractor to designate a temporary area for holding waste as it is generated before collection for disposal

Issue/ Concern	Proposed mitigation measures
	- Waste to be segregated on site to separate paper waste, plant matter, plastics, timber, steel to determine what can be reused and the appropriate method of disposal for waste that is to be disposed. - Waste collectors to be provided with appropriate PPEs when handling waste. - Waste to be disposed at County designated waste disposal site only - Vehicles used to collect waste from site for disposal to be licensed by NEMA for waste collection - Waste collection and disposal tracking documents to be completed and copies maintained on site.
Accidents and injuries	- Provide for breaks to rest and refresh within an eight hour shift period to avoid situations where workers operate under strenuous conditions. - Appropriately secure and anchor floating platforms to deter their continuous movement in the water while working. - Properly insulate and secure electrical outlets from coming into contact with water to avoid risks of fire, explosions, burns, and electrical shocks. - Put non-skid coating where workers are doing construction on barges or float platforms to prevent workers from falling due to the slippery surface and get injured. - Secure a tag line when using a crane to haul materials to prevent workers getting hit. - Ensure mooring gear are of adequate strength to hold the vessel in place at the berth. - Appropriate training of workers on work safety procedures. - Provision of appropriate personal protective equipment (PPE) to workers including life jackets to those working at the water front to enable floatation in the event of drowning - Timely servicing and maintenance of equipment to prevent accidents that may arise due to equipment malfunction.
Oil and lubricants spills	- Immediately fix all noticeable leaks that can result in oil and lubricant spills. - Promptly collect any spills from all working areas my means of appropriate oil and lubricants absorption materials. - Ensure all equipment and machinery are timely serviced as per manufacturer's recommendations to avoid leakages. - Activate the oil spill response contingency plan in the event of major spills
Noise	- Equipment to be well maintained and serviced. - Proponent to provide ear protector/ ear plugs/ ear mufflers for ear protection

Issue/ Concern	Proposed mitigation measures
	- Monitor noise levels to ensure they are within the prescribed limit as provided for in the Environmental Management and Coordination (Noise and Excessive Vibration) (Control) Regulations, 2009.

ABBREVIATIONS AND ACRONYMS

AFS	Anti-fouling Systems
AGOL	Africa Gas and Oil Limited
AIDS	Acquired Immune Disease Syndrome
AQM	Air Quality Meter
BMU	Beach Management Unit
CBA	Cost-Benefit Analysis
CBD	Central Business District
CBP	Concrete Block pavers
CCC	China Road Construction Company
CESMP	Construction -Environmental & Social Management Plan
CITES	Convention on International Trade in Endangered Species
CLO	Community Liaison Officer
CO	Carbon monoxide
COD	Chemical Oxygen Demand
COMRED	Coastal and Marine Resource Development
CSR	Corporate Social Responsibility
CT I	Container Terminal I
DO	Dissolved Oxygen
DOSH	Directorate of Occupational Safety and Health
DSR	Diani Sea Resort
EA	Environmental Audit
EIA	Environmental Impact Assessment
EMC	Environmental Management Coordination
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
ESAI	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management Monitoring Plan
FOC	Fibber Optic Cable
GBV	Gender Based Violence
GHGs	Green House Gasses
GoK	Government of Kenya
GPS	Geographical Positioning Systsem
GRM	Grievance Redress Mechanism

HIV	Human Immune Virus
HSE	Health Safety and Environment
ICT	Information Communication Technology
ICZM	Integrated Coastal Zone Management
ISO	International Standards Organization
IUCN	International Union for Conservation of Nature
JICA	Japan International Corporation Agency
KATO	Kenya Association of Tour Operators
KFS	Kenya Forest Service
KM	Kilometer
KMA	Kenya Maritime Authority
KOT	Kipevu Oil Terminal
KPA	Kenya Ports Authority
KPC	Kenya Pipeline Corporation
KTA	Kenya Transporters Association
LPC	laser particle counter
Mg/L	Milligram per Liter
MMPNR	Mombasa Marine Park and National Reserve
MPDP	Mombasa Port Development Project
NEM	North East Monsoon
NEMA	National Environment Management Authority
NEPA	National Environment Protection Agency
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NOSRCP	National Oil Spill Response Contingency Plan
NOx	Oxides of Nitrogen
NTSA	National Transport Safety Authority
OSHA	Occupational Safety and Health Audit
PAPs	Project Affected Persons
PM	Particulate Matter
PPEs	Personal Protective Equipment
PVD	Perforated Vertical Drains
PWD	People with Disabilities
RTG	Rubber Tired Gantry

RVR	Rift Valley Railway
SEM	South East Monsoon
SEZ	Special Economic Zone
SGR	Standard Gauge Railway
SOx	Oxides of Sulphur
Spp	Species
SSG	Ship-to-Shore Gantry
STDs	Sexually Transmitted Diseases
STS	Ship to Shore
STS	Shore to Shore
SWA	Swahili Beach Area
TEUs	Twenty Foot Equivalent Units
ToR	Terms of reference
TSS	Total Suspended Solids
TUM	Technical University of Mombasa
UFPs	Ultrafine Particles
UNEP	United Nations Environmental Programme
USD	United States Dollars
WB OP	World Bank Operational
WHO	World Health Organization
WIBA	Work Injuries Benefits Act

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1. INTRODUCTION

1.1 Project definition

This is an Environmental Impact Assessment (EIA) Study for the proposed Container Berth 19B (B19B) and associated infrastructure to be developed by Kenya Ports Authority (KPA) at the port of Mombasa. The proposed project is part of KPA's wider strategic plan of increasing its container handling capacity to address current and projected container volumes. Container volumes at the Port of Mombasa has increased more than threefold in the last decade, with container throughput exceeding 1 million Twenty Foot Equivalent Units (TEUs) per year. As a result, heavy cargo congestion has become chronic, with old berths and narrow yards still in use due to lack of sufficient facilities. The proposed development of Berth 19B is envisaged to facilitate the transformation of the existing Container Terminal I (CTI) into a four-berth terminal with additional yard storage area, with increased operational flexibility to greatly aid in meeting the shortfall between forecast future demand and existing capacity at the Port.

The proposed project is a port related development within a marine environment to handle containers. Such a project is categorized as high risk project in the second schedule of EMCA, 1999 specifically section 3 (4) (d) and (e) i.e. and therefore must be subjected to a full Environmental Impact Assessment Study.

1.2 Location

The proposed Berth 19B will be located in Mombasa County within Mombasa Port to the west of the existing Berth 19 as shown in Figure 1. 4° 02'50"S 39° 37'20"E

Figure 1: Location of proposed Berth 19B

1.3 Project Proponent

The project proponent is Kenya Ports Authority (KPA), a state corporation established by an Act of Parliament and mandated to construct, maintain, operate and improve all sea and inland waterways in Kenya.

1.4 Project Objective and Scope

1.4.1 Project objective

The objective of the proposed project is to construct a new berth and a container yard with additional storage space thereby increasing container handling capacity to address current and projected increase in container volumes.

1.4.2 Scope

The proposed project will cover the following:

- ✓ Dredging works at the berth pockets and the turning basin (ESIA for dredging works being undertaken as a separate project),
- ✓ Quay structures and associated quay furniture e.g., fender systems and bollards
- ✓ Revetments under the quay deck and at the return edges
- ✓ Land reclamation and ground improvement
- ✓ Stacking yards and port roads
- ✓ Electrical power supply and distribution systems.
- ✓ Lighting and earthing system
- ✓ Drainage and utility systems
- ✓ Navigational aids, if required
- ✓ Security, ICT, LAN system alarm detection system and dedicated data communication
- ✓ Water supply, both portable and for fire fighting

1.5 Terms of Reference

Terms of reference (ToR) for the EIA study for the proposed project were prepared and submitted to the National Environment Management Authority (NEMA) for review and approval. A copy of the approved ToR is attached as Appendix 1.

2. BACKGROUND TO ENVIRONMENTAL IMPACT ASSESSMENT

2.1 Definition of Environmental Impact Assessment

Broadly environmental impact assessment (EIA) refers to the need 'to identify and predict the impact on the environment and on man's health and wellbeing of legislative proposals, policies, programmes, projects and operational procedures, and to interpret and communicate information about the impacts' (Munn 1979). Glasson *et.al* (2012) defines EIA as 'a systematic process that examines the environmental consequences of development actions in advance'. EIA is thus a vital tool that aid formulation of development actions, decision making, an instrument for sustainable development and vehicle for stakeholder consultation and participation (Glasson *et.al* 2012).

2.2 The purposes of EIA

2.2.1 An aid to decision making

For the decision maker, for example, a local authority, it provides a systematic examination of the environmental implications of a proposed action, and sometimes alternatives, before a decision is taken. The EIA can be considered by the decision-maker along with other documentation related to the planned activity. EIA is normally wider in scope and less quantitative than other techniques, such as cost-benefit analysis (CBA). The EIA process has a potential, not always taken up, to be a basis for negotiation between the developer, public interest groups and the planning regulator. This can lead to outcome that balances well the interests of the development action and the environment.

2.2.2 An aid to the formulation of development actions

EIA provides a framework for considering location and design options as well as addressing environmental concerns. It can be an aid to the formulation of development actions, indicating areas where a project can be modified to minimize or eliminate all together its adverse impacts on the environment. The consideration of environmental impacts early in the planning life of a development can lead to more environmentally sensitive development; to improved relations between the developer, the planning authority and the local communities; to a smoother development consent process, and sometimes to a worthwhile financial return on the extra expenditure incurred. O'Riordan and Sewell (1981) links such concepts of negotiation and redesign to the important environmental themes of 'green consumerism' and 'green capitalism'. The growing demand by consumers to goods that do no environmental damage, plus a growing market for clean technologies, is generating a response from developers. EIA can be the signal to the developer of potential conflict; wise developers may use the process to negotiate 'environmental gain' solutions, which may eliminate or offset negative environmental impacts, reduce local

opposition and avoid costly public inquiries. This can be seen in the wider and contemporary context of corporate social responsibility (CSR) being increasingly practiced by major businesses (Crane et al.2008).

2.2.3 A vehicle for stakeholder consultation and participation

Development actions may have wide-ranging impacts on the environment, affecting many different groups in society. There is increasing emphasis by government at many levels on the importance of consultation and participation by key stakeholders in the planning and development of projects. EIA can be a very useful vehicle for engaging with communities and stakeholders, helping those potentially affected by a proposed development to be much better informed and to be more fully involved in the planning

2.2.4 An instrument for sustainable Development

Existing environmentally harmful developments have to be managed as best as they can. In extreme cases, they may be closed down, but they can still leave residual environmental problems for decades to come. It would be much better to mitigate the harmful effects in advance, at the planning stage, or in some cases avoid the particular development together. This of course leads on to the fundamental role of EIA as an instrument for sustainable development-a role some writers have drawn attention to as one often more hidden than it should be when EIA effectiveness is being assessed (Jay et al.2007)and development process.

2.3 Origins and development of EIA

The first EIA legislation was formerly established in the United States of America in 1969 (NEPA 1970), in Europe the 1985 European Community directive on EIA (Directive 85/337) introduced broadly uniform requirements for EIA for all member states (CEC, 1985). In Australia, the Commonwealth EIA system was established in 1974 under the Environmental Protection (Impact of Proposal) Act (Wood 2003, Ellott and Thomas, 2009). The United Kingdom enacted a formal legislation on EIA in 1988 (Glasson et.al 2012). China formerly enacted its first EIA legislation in 1979 (Moorman and Ge 2007). In Africa and the Middle East, Israel and Algeria pioneered in enactment and implementation of EIA legislations in 1982, 2003 and 1983, 1990 respectively (Economic Commission for Africa, (2005) Almagi et.al (2007). In East Africa Uganda pioneered in enacting EIA legislation in 1998, Kenya EIA legislation was enacted in 2000, and implemented in 2003 (Morara et.al 2011).

2.4 Key elements in the EIA process

The environmental impact assessment process comprises of various interactive steps such as screening, scoping, consideration of alternatives, action design, preparation of the EIA report,

reviewing or evaluating the report, decision making, and post decision activities such as monitoring and auditing (Glasson et al., 1994; Wood, 1995). According to UNEP (2002) key elements in the EIA process are screening, scoping, impact analysis, mitigation, reporting, review, decision-making, follow up and public involvement. Figure 2 is the schematic presentation of general EIA process.

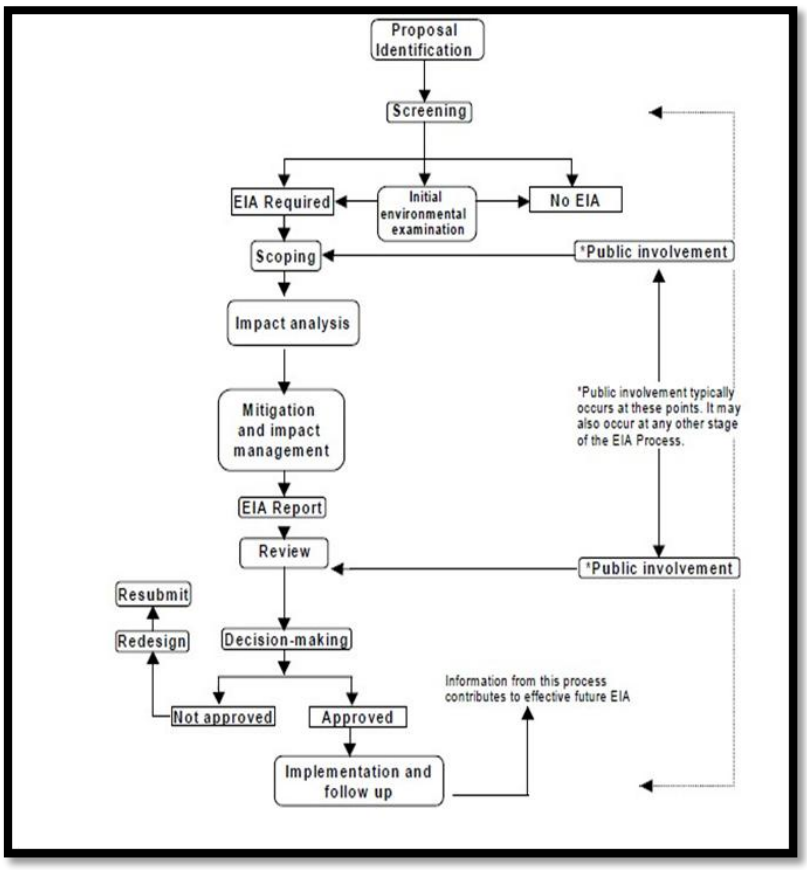

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Figure 2 Generalized EIA process flowchart

2.4.1 Screening

Screening determines whether or not a proposal requires an EIA and, if so, what level of analysis is necessary. This process brings clarity and certainty to the implementation of EIA, ensuring that it neither entails excessive review nor overlooks proposals that warrant examination. Legal Notice No. 31 of 30th April 2019, that amended the second schedule of the Environmental Management and Coordination Act, 1999 categorizes port development projects under high-risk projects in section category 3 (10) (a) of the amended second schedule of the Act. Based on this, it is required that an environmental impact assessment study report be submitted for the proposed project. Regulation 11 (1) of the Environmental (Impact Assessment and Audit) Regulations, 2003 require that an environmental impact assessment study be conducted in accordance with the terms of reference developed during the scoping exercise by the proponent and approved by the Authority.

2.4.2 Scoping

Scoping identifies the important issues in readiness for preparation of terms of reference; it is a critical, early step in the preparation of an EIA (UNEP. 2002). The scoping process identified the issues that are likely to be of most importance during the EIA and eliminated those that are of little concern. In this way, the EIA study was focused on the significant effects and time and money are not wasted on unnecessary investigations (Glasson et al., 2012). The following were the key issues identified to be focused on during the EIA study.

- Impacts on marine water quality
- Impacts on marine flora
- Impacts on marine fauna
- Impacts of macro benthos
- Impacts on fisheries resources
- Impacts on local air quality
- Noise and vibration impacts
- Traffic related impacts
- Waste related impacts
- Occupational injuries and accidents

2.4.3 Impact analysis

Impact analysis is carried out in the detailed phase of the EIA; it involved identifying the impacts more specifically, predicting the characteristics of the main impacts and evaluating the significance of the residual impacts (UNEP, 2002).

2.4.4 Impact Mitigation

Mitigation is the stage of the EIA process when measures are identified to avoid, minimize or remedy impacts. These measures are implemented as part of the process of impact management, together with any necessary adjustments to respond to unforeseen impacts. Both elements are integral to ensuring that the EIA process leads to practical action to offset the adverse environmental impacts of proposed developments (UNEP, 2002). Mitigation recommends feasible and cost–effective measures to prevent or reduce significant negative impacts to acceptable levels.

2.4.5 Reporting

Reporting involves compiling all the information obtained into an EIA report which is a keystone document. It assembles the information that assists the proponent in managing the impacts of the proposal, the responsible authority in decision-making and condition

setting; and the public in understanding the likely impacts of the proposal (UNEP, 2002).

2.4.6 Report review

The review stage of the EIA report is one of the main 'checks and balances' built into the EIA process to establish the quality of an EIA. It helps to ensure the information submitted is credible and sufficient for decision-making purposes (UNEP, 2002) by verifying the accuracy and comprehensiveness of the report (Glasson et al., 2012). The decision-making element of the EIA process involves approving or rejecting the proposal and setting conditions. Decision making stage provides for incorporation of environmental considerations into proposed development (Glasson et al., 2012). Once the proposed project is approved, implementation and follow up complete the EIA process (UNEP, 2002).

2.4.7 Monitoring and auditing

Monitoring, auditing and other tools are used to 'close the loop' of impact prediction and condition setting (Sadler, 1996). Monitoring and auditing is vital as it is used to identify the impacts that occur; to check that these are within the levels predicted and required by legislation; determine that mitigation measures are properly implemented and work effectively; ensure the environmental benefits expected are being achieved; and provide feedback to improve future applications of the EIA process (Arts, 1998).

3. APPROACH AND METHODOLOGY

3.1 Approach

At the beginning of the assignment an inception meeting was held between the proponent, KPA, the project consultant Yooshin Engineering Corporation and the environmental consultancy team Heztech Engineering Services at the KPA boardroom. The team later visited the proposed project site. The meetings served as formal introduction for clarification of Terms of Reference (ToR) for the study team and physically show the team the proposed project site. The EIA study team developed the ToR and submitted the same to NEMA for approval.

3.2 Methodology

The following methodology was used in undertaking the Environmental Impact Assessment:

- Scoping and development of Terms of Reference
- Desk review of relevant project documents including project design documents, relevant policy and legislative documents including relevant international conventions, agreements and protocols ratified by Kenya.
- Field visits for detailed documentation of site conditions and actual site assessment.
- Baseline studies
- Public participation
- Impact prediction and mitigation measures determination
- Reporting

3.2.1 Scoping

Scoping identified the important issues in readiness for preparation of terms of reference; it was a critical, early step in the preparation of an EIA study report. The scoping process identified the issues that are likely to be of most importance during the EIA and eliminated those that were of no concern.

3.2.2 Desk review

Desktop review included review of National Policies applicable to the proposed project including; Kenya's Vision 2030, Integrated National Transport Policy 2024, National Sustainable Waste Management Policy 2021, National Environment Policy 2013, National Wildlife Conservation and Management Policy 2017, Kenya Youth Development Policy 2019, National Energy Policy 2018, Sessional Paper no. 4 of 2013 on the Employment

Policy and Strategy for Kenya, Sessional Paper No. 01 of 2017 on National Land Use Policy, Sessional Paper 01 of 2021 on National Water Policy and Draft National Maritime Transport policy 2022 and National Climate Change Framework Policy 2018. National laws reviewed included, Constitution of Kenya 2010, Environmental Management and Co-ordination Act (EMCA) 1999, Sustainable Waste Management Act, 2022, Land Act 2012, Fisheries Management and Development Act No 35, 2016, Forest Conservation and Management Act 2016, Water Act, 2016, Physical and Land Use Planning Act Cap 303, Merchant Shipping Act No. 4 of 2009, Energy Act 2019, Wildlife (Conservation and Management) Act Cap 376, National Museums and Heritage Act Cap 216, Kenya Maritime Authority Act (Cap. 370), Tourism Act, 2011, Occupational Safety and Health Act 2007, Employment Act 2007, HIV and AIDS Prevention and Control Act 2006 and Kenya Ports Authority Act. The review also covered national legislations including; Environmental (Impact, Audit and Strategic Assessment) Regulations, 2009 Legal Notice No.101, Environmental Impact Assessment Guidelines and Administrative Procedures, 2002, Environmental Management & Coordination (Air Quality) Regulations, 2014 (Legal Notice No.34), Environmental Management & Coordination (Water Quality) Regulations, 2006 (Legal Notice No.120), Environmental Management and Coordination (Noise And Excessive Vibration Pollution) (Control) Regulation, 2009 Legal Notice No.61, Environmental Management & Coordination (Waste Management) Regulations, 2006 Legal Notice No.121, The Environmental (Preservation of Pollution in Coastal Zone and Other Segments of The Environment) Regulation, 2003, Fisheries (Beach Management Unit) Regulations, 2007 and Building Operations and Works of Engineering Construction Rules, 1984.

3.2.3 Field assessment

Field assessment involved visiting the proposed project site and documenting the current conditions at the site such as the existing structures and neighboring facilities. Also the location where the proposed project will be constructed was assessed in relation to the existing structures. The assessment also included the existing access road to the proposed project site and available space to meet needs of the proposed project. The site was assessed for any flora and fauna and observations recorded. GPS coordinates for the site were taken by a handheld GPS and photographs of site observation were taken. Site office meetings were held between the Lead Consultant and team, KPA Engineers, KPA Environmental and Safety Officers who collectively responded to questions and clarified emerging issues during site assessment.

3.2.3 Stakeholder consultation and public participation

Stakeholder consultation and public participation involved first mapping of stakeholders to identify stakeholders who were likely to be affected by the proposed project, and those who were interested in the project. The stakeholders were then reached out to, and consulted using a methodology that best suited each cluster of stakeholders.

3.2.4 Baseline Studies

Various baseline studies were carried out to document and understand the current environmental situation before any changes occur. The baseline studies were vital as they provided variable data and information that aided in potential impact identification and proposal of feasible mitigation measures. The following baseline studies were carried out:

- Marine water quality
- Noise and vibration
- Ambient air quality
- Marine flora and fauna
- Macro benthos
- Socioeconomic
- Fisheries

3.2.5 Reporting

All the information and data collected from scoping exercise, the desk top document review, field assessments, baseline studies and stakeholder consultation and public participation was compiled into two reports namely:-

- Terms of Reference Report; and
- Environmental Impact assessment (EIA) Study Report.

Terms of Reference Report was submitted to NEMA as specified in Regulation 11 (1) and 11(2) of the Environmental (Impact Assessment and Audit) Regulations, 2003. The Environmental Impact assessment (EIA) Study Report was prepared as specified in Regulation 18 of the Environmental (Impact Assessment and Audit) Regulations, 2003 and submitted to NEMA as specified in Regulation 19 of the Environmental (Impact Assessment and Audit) Regulations, 2003.

3.3 Study team

Heztech Engineering Services a Firm of Experts registered and licensed by NEMA (EIA/EA registration number 5194) was contracted to carry out the environmental and

social impact assessment study for the project and prepare the ESIA study report. Engineering design was carried out by Yooshin Engineering Corporation while all laboratory analysis works were carried out by Polucon Services Kenya Limited an accredited laboratory. Appendix 2 is copy of practicing licenses of the firm of experts and Lead Expert.

4. RELEVANT POLICIES LAWS AND REGULATIONS

4.1 National policies

The following National Policies are relevant to the project.

- ⇒ Kenya's Vision 2030
- ⇒ National Environment Policy 2013
- ⇒ National Sustainable Waste Management Policy 2021
- ⇒ National Energy Policy 2018
- ⇒ Sessional Paper 01 of 2021 on National Water Policy
- ⇒ Integrated National Transport Policy 2024
- ⇒ The Kenya Youth Development Policy 2019
- ⇒ Sessional Paper no. 4 of 2013 on the Employment Policy and Strategy for Kenya
- ⇒ Sessional Paper No. 01 of 2017 on National Land Use Policy
- ⇒ National Climate Change Framework Policy Sessional Paper No. 5 of 2016
- ⇒ Sessional Paper No.13 of 2014 on Integrated Coastal Zone Management (ICZM) Policy

4.1.1 Kenya's Vision 2030

Kenya's Vision 2030 is the Country's development blueprint that aims to transform Kenya into a newly- industrializing, middle income country providing a high quality of life to all its citizens in a clean and secure environment by the year 2030.

4.1.2 National Environment Policy 2013

The National Environment Policy 2013 aims to provide a framework for an integrated approach to sustainable management of Kenya's environment and natural resources.

4.1.3 National Sustainable Waste Management Policy 2021

The National Sustainable Waste Management Policy of 2021 aims to establish an enabling regulatory environment that prioritizes waste minimization and contributes to a circular economy. It also supports County Governments' mandate to provide sustainable waste management services and provides a framework for coordinated action at the national level. The policy proposes a waste hierarchy that includes reducing waste generation, reusing materials, effective and affordable waste collection, and proper treatment and disposal of residual waste in well-engineered and regulated landfills.

4.1.4 National Energy Policy 2018

The National Energy Policy of 2018's overall objective is to ensure sustainable, adequate, affordable, competitive, secure and reliable supply of energy at the least cost geared to meet national and county needs while protecting and conserving the environment.

4.1.5 Sessional Paper 01 of 2021 on National Water Policy

Sessional Paper 01 of 2021 on National Water Policy aim is to guide the achievement of sustainable management, development and use of water resources in Kenya. It provides a framework for sustainable management and financing of water resources; water harvesting and storage; and for equitable, efficient, and universal access to water supply and reasonable standards of sanitation, for domestic, economic use and ecosystem sustenance.

4.1.6 Integrated National Transport Policy 2024

Integrated National Transport Policy 2024 aims to provide an enabling road; rail; maritime; air; and pipeline transport environment for the stimulation of rapid development and efficient management of a safe, widely accessible transport system that responds to modern technological advancement in a rapidly changing and globalized environment.

4.1.7 The Kenya Youth Development Policy 2019

The Kenya Youth Development Policy 2019 promotes holistic empowerment and participation of the youth in socio-economic and political development for themselves, the country and the future. It aims to ensure adequate youth development and empowerment while harnessing their potential for productive engagement at local, County, National and International levels.

4.1.8 Sessional Paper no. 4 of 2013 on the Employment Policy and Strategy for Kenya

Sessional Paper no. 4 of 2013 on the Employment Policy and Strategy for Kenya aims to promote full employment as a priority in national, economic and social policy and to enable the economically active population to attain and secure sustainable livelihood through productive and freely chosen employment by the year 2030.

4.1.9 Sessional Paper No. 01 of 2017 on National Land Use Policy

Sessional Paper No. 01 of 2017 on National Land Use Policy whose overall goal is to provide legal, administrative, institutional and technological framework for optimal utilization and productivity of land and land related resources in a sustainable and desirable manner at National, County and local level.

4.1.10 National Climate Change Framework Policy Sessional Paper No. 5 of 2016

The Policy aims to enhance adaptive capacity and build resilience to climate variability and change, while promoting a low carbon development pathway. The response to climate change in Kenya must adhere to the constitutional governance framework and commitment to sustainable development, while addressing the goal of attaining low carbon climate resilient development. To attain the latter, the policy focuses on appropriate mechanisms to enhance climate resilience and adaptive capacity, and the transition to low carbon growth.

4.1.11 Sessional Paper No.13 of 2014 on Integrated Coastal Zone Management Policy

The vision of the Integrated Coastal Zone Management (ICZM) Policy is "A coastal zone with healthy ecosystem and resources that sustain the socio-economic development and well-being of the current and future generations". It seeks to promote sustainable development in the coastal zone in line with the principles of the constitution and objectives of Vision 2030.

4.2 Legal framework

The following national laws are relevant to the proposed project;

- Constitution of Kenya, 2010
- Environmental Management and Coordination Act (EMCA), 1999
- The Sustainable Waste Management Act 2022
- Land Act 2012
- Water Act, 2016
- Physical and Land Use Planning Act Cap 303
- The Energy Act 2019
- Occupational Safety and Health Act, 2007
- Employment Act, 2007
- HIV and AIDS Prevention and Control Act 2006
- The Public Health Act Cap 242
- Work Injuries Benefits Act 2007
- Fisheries Management and Development Act No 35 2016
- Forest Conservation and Management Act 2016
- Merchant Shipping Act No. 4 of 2009
- Wildlife (Conservation and Management) Act Cap 376
- National Museums and Heritage Act Cap 216
- Kenya Maritime Authority Act (Cap. 370)
- Tourism Act, 2011
- Kenya Ports Authority Act

4.2.1 Constitution of Kenya 2010

The Constitution of Kenya 2010 established a system of devolved government based on counties. The key constitutional provisions relevant to the project are:

- ✓ Article 10 on national values and principles of governance including 10 (2a) on democracy and participation of people.
- ✓ Fourth Schedule Article 10 on implementation of specific national government policies on natural resources and environmental conservation.
- ✓ Fourth Schedule Article22 under national government on the protection of the environment and natural resources with a view to establishing a durable and sustainable system of development.
- ✓ Bill of rights Article 42 which states that every person has the right to a clean and healthy environment.
- ✓ Article 196 on public participation. The Constitution of Kenya is the first to recognise the need for cultural heritage conservation. It commits the citizens to respect and recognize citizens to respect and recognize environment as a national heritage and asks them to promise to sustain it for the benefit of posterity. In Section 69(2) the Constitution assigns everyone the duty to cooperate with state organs and other persons to protect and conserve environment and ensure sustainability in development and use of natural resources.

4.2.2 Environmental Management and Coordination Act (EMCA), 1999

This is an Act of Parliament to provide for the establishment of an appropriate legal and institutional frameworkfor the management of the environment. The Act established theNational Environment Management Authority (NEMA) as the regulatory authority in charge of environmental matters.

Relevant Provisions include mandates given to NEMA such as:

- ✓ Section 2(a): Coordination of environmental management activities and promotion and integration of environmental considerations into development projects.
- ✓ Section 2(d): Examination of land use patterns to determine their impact on the quality and quantity of natural resources.
- ✓ 2(e): Carry out surveys to assist in the proper management and conservation of the environment.
- ✓ 2(I): Monitor and assess activities carried out by proponents in order to ensure tnat

the environment is not degraded by such activities, that environmental management objectives are adhered to, and adequate early warning on impending environmental emergencies is given.

EMCA 1999, as amended in 2015 is the main national statute that governs environmental protection in Kenya, including waste management. The following are some of the important requirements for waste generators stipulated under the EMCA:

- ✓ No person shall transport any waste other than in accordance with a valid license to transport wastes issued by the Authority (Section 87 (2))
- ✓ No person shall transport any waste other than to a waste disposal site established in accordance with a license issue by the Authority (Article 87 (2)).
- ✓ Every person whose activities generate wastes shall employ measures essential to minimize wastes through treatment, reclamation and recycling (Article 87 (5)).
- ✓ No hazardous waste shall be exported to any country from Kenya without a valid permit granted by the Authority and written consent given by a competent authority of the receiving country (Article 91 (4)).
- ✓ No hazardous waste shall be transported within or through Kenya without a valid permit granted by the Authority (Article 91 (5)).

4.2.3 The Sustainable Waste Management Act 2022

The Sustainable Waste Management Act, 2022 provides for the sustainable management of waste by creation of extended producer responsibility schemes as well as a circular economy for the reduction of waste. The Act provides for take back schemes and the labelling of products that may cause pollution. It provides for the creation of material recovery facilities in every County as well as the creation of incentives to encourage recycling. The purpose of the Act is thus to establish the legal and institutional framework for sustainable waste management and the realization of the constitutional provision on the right to a clean and healthy environment.

4.2.4 Land Act 2012

This is an Act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and ra1ionalize land laws; to provide for the sustainable administration and management of land and land-based resources. It has repealed the Way leaves Act, Cap 292 and the Land Acquisition Act, Cap 295 and therefore provides for land acquisition for various purposes. Section 5 (1) of this Act provides the following forms of land tenure:

- ✓ Freehold
- ✓ Leasehold

- ✓ Such forms of partial interest as may be defined under this Act and other law, including but not limited to easements.
- ✓ Customary land rights, where consistent with the Constitution.

The Act specifies that there shall be equal recognition and enforcement of land rights arising under all tenure systems and non-discrimination in ownership of, and access to land under all tenure systems.

4.2.5 Water Act, 2016

The Water Act 2016 makes provision for the conservation, control and use of water resources in Kenya and for incidental and connected purposes. This Act aims at providing for harmonized and streamlined management of water resources, water supply and sewerage services. The Water Resource Authority was established under this Act to regulate and protect resources from adverse impacts. The Water Act provides for the conservation and controlled use of water resources in Kenya. Under the Ministry of Water the Act prohibits pollution of water resources and controls the discharge of industrial and municipal effluents into the ocean and other water bodies.

4.2.6 Physical and Land Use Planning Act Cap 303

The Physical and Land Use Planning Act Cap 303 is an Act of Parliament that makes provision for the planning, use, regulation and development of land and for connected purposes. The Act provides the principles, procedures and standards for the preparation and implementation of physical and land use development plans at the national, county, urban, and rural and cities level. It provides the administration and management of physical and land use planning in country with clear procedures and standards for development control and the regulation of physical planning and land use. It also provides a framework for the co-ordination of physical and land use planning by County Governments, a mechanism for dispute resolution with respect to physical and land use planning, a framework for equitable and sustainable use, planning and management of land.

4.2.7 The Energy Act 2019

An Act of Parliament to consolidate the laws relating to energy, to provide for National and County Government functions in relation to energy, to provide for the establishment, powers and functions of the energy sector entities; promotion of renewable energy; exploration, recovery and commercial utilization of geothermal energy; regulation of midstream and downstream petroleum and coal activities; regulation, production, supply and use of electricity and other energy forms; and for connected purposes.

4.2.8 Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of workers and all

persons lawfully present at workplaces. The provisions of the Act relevant to engineering construction works are contained in the Abstract of the Act for Building Operations and Works of Engineering Construction Rules. These rules specify the minimum safety and health measures to be taken during construction works which include that the proponent should:

- Give notice of particular operations or works;
- Such notice should be sent in writing to the Occupational Health and Safety Officer, not later than seven days after commencement of construction;
- Post printed copies or prescribed abstracts of the Occupational Safety and Health Act at the site of operations or works;
- Provide sufficient and suitable sanitary conveniences for persons employed. These must be kept clean and well lit.

The purpose of the Act is to secure the safety, health and welfare of persons at work; and protect persons other than persons at work against risks to safety and health arising out of activities of persons at work.

4.2.9 Employment Act, 2007

This is an Act of Parliament to declare and define the fundamental rights of employees, to provide basic conditions of employment of employees, to regulate employment of children, and to provide for connected matters. In accordance with the Act it shall be the duty of the Minister, labour officers and the Industrial Court to promote equality of opportunity in employment in order to eliminate discrimination in employment; and to promote and guarantee equality of opportunity for a person who, is a migrant worker or a member of the family of the migrant worker, lawfully within Kenya. The Act states that no employer shall discriminate directly or indirectly, against an employee or prospective employee or harass an employee or prospective employee on grounds of race, colour, sex, language, religion, political or other opinion, nationality, ethnic or social origin, disability, pregnancy, mental status or HIV status.

4.2.10 HIV and AIDS Prevention and Control Act 2006

The object and purpose of this Act is to (a) Promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS; (b) Extend to every person suspected or known to be infected with HIV and AIDS full protection of his human rights and civil liberties by - (i) Prohibiting compulsory HIV testing save as provided in this Act; (ii) Guaranteeing the right to privacy of the individual; (iii) Outlawing discrimination in all its forms and subtleties against persons with or persons perceived or suspected of having HIV and AIDS; (iv) Ensuring the provision of basic health care and social services for persons infected with HIV

and AIDS; (c) Promote utmost safety and universal precautions in practices and procedures that carry the risk of HIV transmission; and (d) Positively address and seek to eradicate conditions that aggravate the spread of HIV infection.

4.2.11 Public Health Act Cap 242

An Act of Parliament to make provision for securing and maintaining health. The Public Health Act regulates the maintenance, repair and inspection of drains, latrines, cesspool or septic tanks. It spells out requirements for the construction of drains in connection with buildings and prohibits nuisances that may cause injury or health hazards.

4.2.12 Work Injuries Benefits Act 2007

Work Injuries Benefits Act is an Act of Parliament that provides for compensation to employees for work related injuries and diseases contracted in the course of their employment and for connected purposes. The Act stipulates that every employer shall obtain and maintain an insurance policy with an insurance company approved by the Minister in respect of any liability that the employer may incur under this Act to any of his employees. An employee who is involved in an accident resulting in the employees' disability or death is subject to the provisions of the Act, and entitled to benefits provided for under the Act. The Act however states that no employee shall be entitled to compensation if an accident, not resulting to serious disability or death, is caused by the deliberate and wilful misconduct of the employee.

4.2.13 Fisheries Management and Development Act No 35, 2016

This is an Act of Parliament is to provide for the conservation, management and development of fisheries and other aquatic resources to enhance the livelihood of communities dependent on fishing, and to establish the Kenya Fisheries Services; and for connected purposes.

Relevant provisions include:

- Section 5(1): protect, manage, use and develop aquatic resources in a manner that is consistent with ecologically sustainable development and to uplift the living standards of fishing communities;
- Section 7 which provides for the establishment of Kenya Fisheries Service as the state agency responsible for conservation, management and development of Kenya's fisheries resources.

4.2.14 Forest Conservation and Management Act, 2016

This Act established the Kenya Forest Service (KFS) and supportive institutions for management and conservation of all types of forests. This Act mandates the KFS to conserve and manage all

forests and sets out the roles and responsibilities of communities in managing forests. In line with Section 23 of the Act KFS would take keen interest in forest lands where:

- land is an important catchment area, a source of water springs, or is a fragile environment;
- land is rich in biodiversity or contains rare, threatened or endangered species;
- forest is of cultural or scientific significance; or
- the forest supports an important industry and is a major source of livelihood for the local community.

4.2.15 The Merchant Shipping Act No. 4 of 2009

This is an Act of Parliament to make provision for the control, regulation and orderly development of merchant shipping and related services; and to consolidate the law relating to shipping and for connected purposes. It aims 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.

4.2.16 Wildlife (Conservation and Management) Act Cap 376

An Act of Parliament to consolidate and amend the law relating to the protection, conservation and management of wildlife in Kenya; and for purposes connected therewith and incidental thereto. Wildlife Conservation and Management Act (2013) governs wildlife conservation and management in Kenya. This law is enforced primarily by the Kenya Wildlife Service with support from other government agencies. The Act provides for protection, conservation and management of wildlife in Kenya and restricts entry into a protected area without proper permission, prohibits wilful or negligent course of bushfire, felling of trees, hunting, digging, laying, or constructing any pitfall, net, trap, snare, or other device whatsoever capable of killing, capturing or wounding any animal.

4.2.17 National Museums and Heritage Act Cap 216

An Act of Parliament to consolidate the law relating to national museums and heritage; to provide for the establishment, control, management and development of national museums and the identification, protection, conservation and transmission of the cultural and natural heritage of Kenya; to repeal the Antiquities and Monuments Act (Cap. 215) and the National Museums Act; and for connected purposes.

4.2.18 Kenya Maritime Authority Act (Cap. 370)

Kenya Maritime Authority (KMA) is charged with the responsibility of regulating, coordinating and overseeing maritime affairs in the country. In fulfilling this mandate KMA is expected to advise the government on the development of international maritime conventions, treaties and agreements as well as their codification into the laws of Kenya. In addition, KMA is expected to:

- ✓ Conduct and liaise with other stakeholders in doing research, investigations and surveys relating to maritime affairs;
- ✓ Develop and maintain the national oil spill response plan in coastal and inland waterways in liaison with players in the oil industry;
- ✓ Serve as coordinators of search and rescue operations in liaison with KPA, Kenya Navy and other relevant bodies; and
- ✓ Ensure sustainable exploitation of marine resources and rapid response to marine calamities

4.2.19 Tourism Act, 2011

This Act provides for the development and management of stainable tourism and tourism-related activities and services, and for connected purposes. Mombasa County is a popular tourist destination and plans developed have to comply with the Act. Under Section (5) of the Act the Authority responsible for regulation of tourism activities shall, in considering license applications, have regard to:

a) the protection of fragile environmental resources, ecosystems and habitats as provided for by the ministry for the time being responsible for matters relating to the environment;
b) an environmental impact assessment license issued under Part VI of the Environmental Management and Co-ordination Act, 1999 (No. 8 of 1999);
c) any representations received from members of the public.

The Act prohibits discharge of any dangerous materials, substances or oil into a designated tourism development area and pollution of wildlife habitats and ecosystems, or discharge of any pollutant detrimental to the environment contrary to the provisions of this Act or any other law.

4.2.20 Kenya Ports Authority Act Cap 391

This Act empowers Kenya Ports Authority to undertake operation of all scheduled ports in Kenya. Section 17 of the Act empowers KPA to take any water from any natural watercourse. This effectively puts all territorial navigable marine waters in the jurisdiction of the Authority. In addition, the Authority is charged with the powers to

erect and maintain navigational beacons to assist in the safe navigation operation of ships and for accident prevention purposes.

4.3 Regulatory framework

Relevant National Regulations

- ✓ The Environmental (Impact Assessment and Audit) Regulations, 2003 Legal Notice No.101
- ✓ Environmental Impact Assessment Guidelines and Administrative Procedures, 2002
- ✓ Environmental Management & Coordination (Air Quality) Regulations, 2014 (Legal Notice No.34)
- ✓ Environmental Management & Coordination (Water Quality) Regulations, 2006 (Legal Notice No.120)
- ✓ The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulation, 2009 Legal Notice No.61
- ✓ Environmental Management & Coordination (Waste Management) Regulations, 2006 Legal Notice No.121
- ✓ Building Operations and Works of Engineering Construction Rules, 1984

4.3.1 The Environmental (Impact Assessment and Audit) Regulations

These Regulations give effect to EMCA, 1999 by providing guidance on the procedure for conducting EIA studies and detailing the issues to be addressed during the study, as well as the parameters to be evaluated and guidelines for development of environmental management and monitoring plans. In addition the regulations provide guidelines for conducting annual environmental audits.

4.3.2 Environmental Impact Assessment Guidelines and Administrative Procedures, 2002

These guidelines support the Environmental Impact Assessment (EIA) and Environmental Audit (EA) processes and assist in the integration of environmental and social concerns in economic development to foster sustainable development in Kenya.

4.3.3 Environmental Management & Coordination (Air Quality) Regulations, 2014

These regulations provide for prevention, control and abatement of air pollution from premises, processes, operations or works, and prescribe exposure limits of air pollutants and emission levels of hazardous substances.

4.3.4 Environmental Management & Coordination (Water Quality) Regulations, 2006

These regulations provide for protection of ground and surface water from pollution, quality standards for sources of domestic water and the limits and parameters of pollutants in treated waste water which can be discharged into the aquatic environment.

4.3.5 The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulation, 2009

These regulations apply to operation of equipment or machinery and engagement in commercial or industrial activity that is likely to emit noise or excessive vibrations. The regulations specify the limits or levels within which these shall be undertaken. The Regulations also stipulate in the second schedule that construction activities undertaken during the night should not emit excessive noise beyond the permissible levels.

4.3.6 Environmental Management & Coordination (Waste Management) Regulations 2006

These regulations outline the responsibility of the waste generator and prescribe proper mechanisms for handling all waste through segregation, recycling and reuse.

4.3.7 Building Operations and Works of Engineering Construction Rules, 1984

The provisions of the Factories Act relevant to building operations and engineering construction works are contained in the Abstract of the Act for Building Operations and Works of Engineering Construction Rules. These rules specify the minimum safety and health measures to be taken during construction works which include that the proponent should:

- ✓ Give notice of particular operations or works;
- ✓ Such notice should be sent in writing to the Occupational Health and Safety Officer, not later than seven days after commencement of construction;
- ✓ Post printed copies or prescribed abstracts of the Occupational Safety and Health Act at the site of operations or works (Section 61 of the Act);
- ✓ Provide sufficient and suitable sanitary conveniences for persons employed. These must be kept clean and well lit.

4.3.8 The Environmental (Preservation of Pollution in Coastal Zone and Other Segments of the Environment) Regulation, 2003

These Regulations control wastewater and ballast water discharge from ships and waterfront installations.

4.3.9 Fisheries (Beach Management Unit) Regulations, 2007

These regulations aim to support the Fisheries Act by: (a) strengthening the management of fish-landing stations, fishery resources and the aquatic environment; (b) ensuring achievement of high

quality standards with regard so fish and fishery products; (c) building capacity of the members for the effective management of fisheries in collaboration with other stakeholders; and (d) preventing or reducing conflicts in the fisheries sector. The regulations recognize the roles played by different sections of the community, including women, in the fisheries sector. The overall aim is to combine elements from all management levels in a common, participatory approach thereby creating a link and partnership between the government level and artisanal fishermen.

4.4 Applicable World Bank Safeguards and International Conventions

International treaties, Conventions, and World Bank Policies relevant to the project (Table 1) will be complied with.

Table 1 WB Safeguard Policies and International Conventions Applicable to the Project

Sector	Convention/policy
EIA	World Bank Operational Policy 4.01 (Environmental Assessment)
Ship ballast water	International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004
Disposal of dredged material and other waste	1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972
Pollution from ships	International Convention for the Prevention of Pollution from Ships, 1978. (Marpol 73/78)
Anti-fouling paints of ships	International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), 2001
Wetlands	Convention on Wetland of International Importance (Ramsar, 1971)
Biodiversity	Convention on Biological Diversity (1992) WB OP 4.04: Natural Habitats
Wildlife	▪ Bonn Convention on the Conservation of Migratory Species of Wild Animals ▪ Washington Convention on International Trade in Endangered Species (CITES,1973)
Hazardous waste	Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes (1989)
Oil spill	International Convention on Oil Pollution Preparedness, Response and Cooperation (1990)

5. BASELINE INFORMATION

Assessing the baseline condition of the receiving environment is a crucial step in the Environmental Impact Assessment (EIA) process. It offers a comprehensive overview of the current state and evolving trends in environmental parameters relevant to a proposed activity or development. This baseline serves as a benchmark against which anticipated alterations can be assessed and measured. Moreover, it furnishes essential data for monitoring potential impacts.

5.1 Infrastructural (built) environment

The geographic position of the port is approximately 4' 00' S, 39" 40' E. The Port of Mombasa as a facility is one the most important pieces of infrastructure and a critical transport hub for the region (so called the "gateway seaport") for East Africa's trading route (KPA Handbook, 2015). The June-2017 launched Standard Gauge Railway (SGR) line from Mombasa to Nairobi is currently under operation and is expected to tremendously improve cargo off-take at the port which according to Rift Valley Railway (RVR) figures at 2015 was estimated at 5.4%. There is also concurrently on-going roads up-grade around the Port which includes the Dongo-Kundu bypass and the realignment of the port exit route. Moi International Airport, the main airport for the coast region, is very close to Project area, and is served by national airlines as well as other local and international airlines bringing in passengers and cargo.

5.2 Natural environment

The environment around the Project area is surrounded by areas of natural beauty and high natural resource value. The western end of Port Reitz creek is a relatively shallow water bay associated with tidal flats, mud banks, river mouth or creeks, mangroves, and further ashore pockets of indigenous coastal forests. The extensive mangroves in the western end of Port Reitz creek are a bird sanctuary, and provide essential habitat for fish, crustaceans and molluscans breeding grounds (Little et al. 1988, Wakwabi and Jaccarini 1993, Seys et al. 1995, Zimmerman et al. 1995, Wakwabi and Mees 1999, Fulanda 2002, Fisheries Dept 2015). Three perennial rivers – Mwache, Mambone, and Chasimba (Pembe) – feed into Port Reitz creek. In addition, Hodi-hodi and Nzovuni rivers, which drain into Port Tudor, are from arid and semi-arid catchments. The waters of the port areas are widely used for various maritime and shipping activities (KPA 2015, JICA 2016). The significance of these rivers is the supply of freshwater (important for supporting estuarine ecological dynamics). However, during the rains, heavy flooding periods ensue and sediments are transported from the highland areas and deposited within the delta contributing to detritus which form the food items in the diet of prawns, crabs and fish. Significant flooding periods however also provide the cues that trigger upstream fish migrations for spawning and feeding. Mangroves and intertidal mudflats and shallow brackish water creeks are well known feeding and nursery areas

for fish but also for crustaceans (crabs and prawns) on which many fish species in the coastal area depend. In addition, flooding also contributes to siltation challenges for maritime operations and the need for frequent dredging.

5.3 Marine habitats and Biodiversity

Marine habitats very close to the Project area are in moderate to bad condition, largely due to maritime and port operations that has seriously degraded them, particularly the long term resource extraction for food and scheduled dredging and pollution from multiple sources have degraded the marine habitats and communities. Legal and management protection within the Mombasa Marine National Reserve and local hydrodynamic processes protect MPAs from adverse effects of dredging and pollution activities, but they are still, nonetheless, subject to natural pressures (climate change, coral bleaching, ocean acidification) as well as anthropogenic pressures related to land-based sources of pollution, shipping pollution, heavy resource extraction by fishermen and a host of cumulative impacts associated with activities occurring elsewhere. Offshore and deep water marine habitats include soft-substrate sandy slopes, mostly occurring at depths from 25 m down the continental slope. Near the almost continuous fringing coral reef line, a continuous rocky reef edge habitat occurs at depths from about 30 to 10 m. this is the continuous white line associated with the fringing reef crest of the north Coast (Nyali-Bamburi-Shanzu) and South Coast (Shelly beach – Tiwi – Waa – Diani) up to Diani-Challe marine reserve. On the outer reef, the main habitat is sandy / rocky lagoons where coral growth occurs at depths of 8-15 m (for corals) or of 0 to 5 m (for rocky patch reefs). The lagoon is dominated by seagrass beds from 6 m deep to the surface, interspersed with extensive sand. Even though most of the habitats close to the project area and within the Reserve areas are less pristine, they support highly dependent socio- economic sectors, including fisheries, tourism, and urban and community recreation sites.

5.3.1 Coral reefs

Near shore locations around the port of Mombasa feature fringing coral reef lines extending from approximately 30 to 10 meters deep, forming a continuous white line along the fringing reef crest from the north Coast (Nyali-Bamburi-Shanzu) to the South Coast (Shelly Beach – Tiwi – Waa – Diani), reaching the Diani-Challe marine reserve. Moving to the outer reef, sandy/rocky lagoons dominate, with coral growth observed at depths of 8-15 meters (for corals) and 0 to 5 meters (for rocky patch reefs). Dredging operations often disrupt sediment, heightening turbidity and sediment build-up. These effects can contribute to the decline of coral reef ecosystems, either by directly displacing or covering reefs, or indirectly by subjecting corals to heightened stress due to reduced sunlight caused by increased turbidity and sedimentation, which can smother polyps.

5.3.2 Coral reefs baseline

Baseline assessments for coral reefs serve as crucial starting points for understanding the current state of these ecosystems. They involve comprehensive evaluations of various aspects of coral reefs, including their biodiversity, health, and surrounding environmental conditions. Baseline assessments provide a snapshot of the reef's condition at a particular time, creating a reference point against which future changes can be measured. This helps in monitoring and understanding any alterations or degradation over time. Baseline studies were conducted to assess coral reef health and conditions including the identification of coral species with IUCN red list categories, and evaluation of coral community health and risks to sea water temperature rise and other factors. The assessment covered the pre-identified sites along the Mombasa to Diani reef stretch which includes key conservation areas hosting National Marine Protected Areas (MPAs). The geographical scope of the survey area covered about 50 kilometres from the northern border of Mombasa Marine Park and National Reserve (MMPNR) going southwards to Shelly, Waa, Tiwi and the Diani-Chale Marine Reserve. Underwater surveys were conducted at 22 study locations along this coral reef stretch. A total of 9 locations were sampled within the MMPNR, 2 sites within unprotected area between Shelly beach and Tiwi, and 11 locations down-south in the Diani-Chale Marine Reserve (Figure 83). Locations that represent different reef habitats such as:

1. Inner sheltered reefs and outer exposed reefs,
2. Deep (more than 7m depth) and shallow reefs (less than 6m depth) were selected.

Underwater surveys were conducted by scuba diving at deep reef locations and by snorkelling on shallow reef locations mostly on reef lagoons. A team of four divers and one GIS and remote sensing expert conducted underwater surveys at the 22 locations for 6 days and recorded information at each of the surveyed sites that covered benthic cover including live hard coral cover, coral community composition and coral colony health condition. Observed and documented results were as follows:

- ⇒ The benthic cover at the 22 studied reefs showed composition and abundance of various organisms and substrates that characterized the seafloor at these sites.
- ⇒ The levels of hard coral cover, which is the foundational functional group in the reefs, was similar to previous and recent studies that have been done in this area.
- ⇒ Highest hard coral cover was 27% but some sites had as low as 3 % cover.
- ⇒ Some sites in the south had high microalgae abundance with the highest being 32% at Mvureni.
- ⇒ Coral gardens in MMPNR recorded the highest cover of recently dead coral (12 %) even though it is a protected area.

⇒ The surveyed sites had a considerable amount of sand patches or sand cover, the highest being at Mekka with 20 % sand cover. Magandiya and Makonde had high levels of silt cover of 36 % and 20%, respectively.

⇒ Almost all fore-reef sites had a high cover of soft corals with highest cover of 25% at Leven and Mekka.

⇒ Most sites had high percentage cover of resistant corals and low cover of sensitive corals.

⇒ Most of the coral colonies showed healthy condition exhibiting vibrant coloration, intact tissue and polyps, and well-structured growth forms. However, there are some coral colonies that displayed diseases, predation and sediment load on top of the colony.

5.3.3 Cumulative impact of port development activities on coral levels

Past Environmental and Social Impact Assessment reports (ESIAs) done at the Port of Mombasa were reviewed to understand the cumulative impact of dredging, dumping and construction activities at the port of Mombasa on coral reefs in the area. This was necessary due to the anticipated impacts of the proposed dredging and dumping during the construction of the proposed Berth 19B. The cumulative effects of dredging, dumping and construction activities on coral reefs near the port of Mombasa was determined by comparing percent hard coral cover from three ESIA studies (2007 MPDP1) (2009 KOT II) and (2023 and MPDPIII) as well as the Environmental Audit (EA) for the Disposal site of Dredged Material (April 2021). Two sites (Mombasa Marine Park and Shelly Beach) were selected for hard coral cover comparison because of consistently being surveyed by the ESIA and environmental audit studies. Hard coral cover was higher in Mombasa Marine Park (MMP) as compared to the nearby open access Shelly Beach reef (Fig 3).

⇒ Temporarily, hard coral cover varied minimally between 2009 and 2023, with the highest hard coral cover in MMP recorded during 2020-KOTII ESIA study (37%), while the lowest was recorded during 2021 disposal site audit (25).

⇒ Similarly, in Shelly Beach the variations in hard coral cover over the years was minimal with the highest being recorded during the 2020-KOTII survey (21%), while the lowest was during the MPDP III ESIA study of 2023 (4%)

Based on the cumulative impact assessment of the effect dredging, dumping and construction activities on coral reefs at the sites near the Port, the proposed dredging, dumping and construction at Berth 19 is not expected to significantly harm the coral reef habitats in sites near the port.

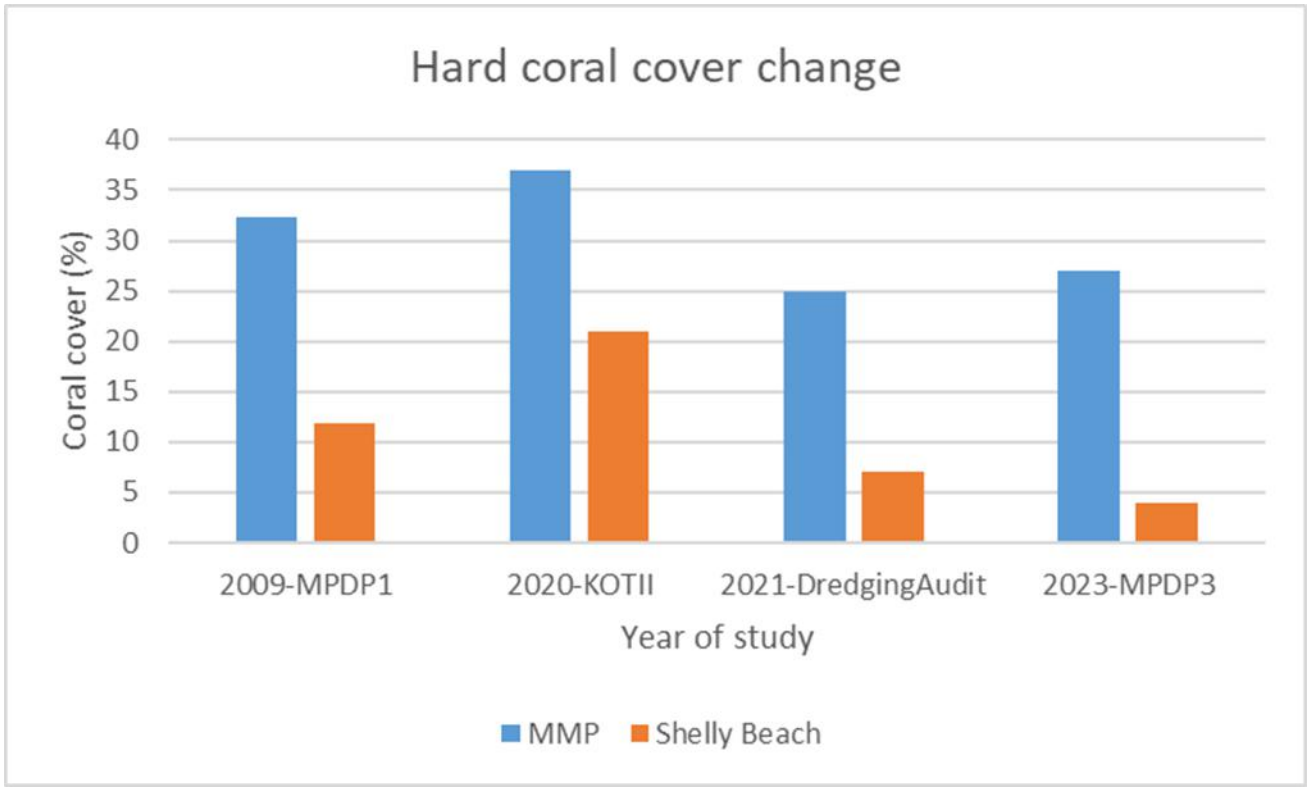


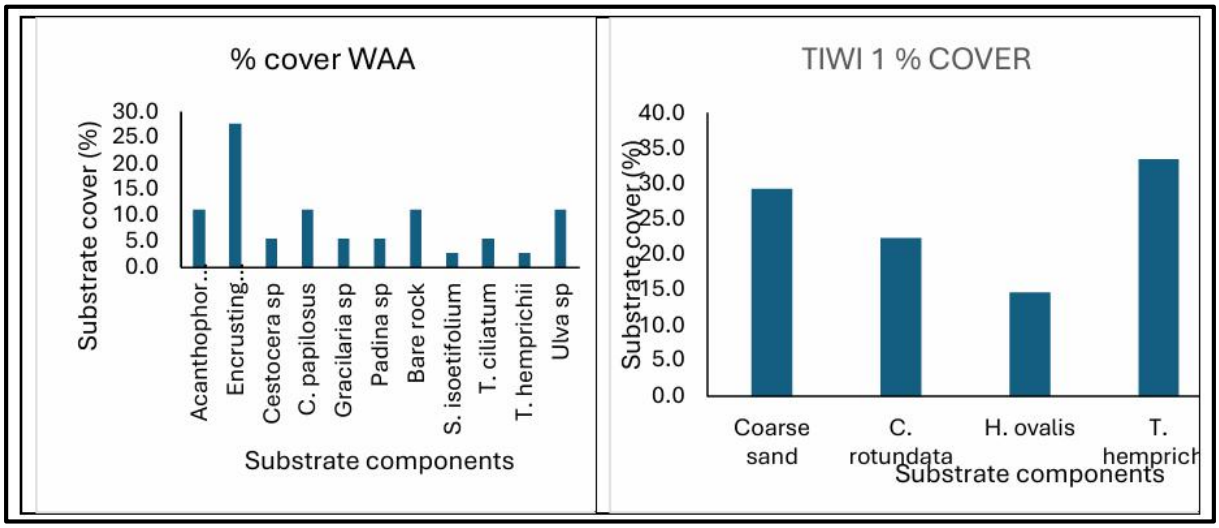
Figure 3 Coral cover change over a period of 10 years

5.3.4 Seagrass

Seagrass plays a crucial role in supporting food security, mitigating climate change, enhancing biodiversity, purifying water, protecting coastlines, and controlling diseases. The effectiveness and service provision of seagrass meadows are bolstered by their proximity and connectivity to other coastal ecosystems such as coral reefs and mangroves. Maintaining and regulating these services is essential for sustaining human well-being and promoting future development. However, seagrass and their associated ecosystem services are under direct threat from a host of anthropogenic influences. For examples, changes in sediment levels that can occur during sea bottom dredging have been found to be harmful to seagrass. Sedimentation can weaken the plants anchoring capacity, making them more vulnerable to detachment from the substrate. The extent of sedimentation effects is species-specific and depends on the magnitude and on the frequency of disturbance. Near the port of Mombasa seagrass species are present along Shelly Beach and Nyali Beach, but Port Reitz lacks significant seagrass populations. The species found at Shelly and Nyali Beaches include Cymodocea serrulata, Cymodocea rotundata, Halodule uninervis, Syringodium isoetifolium, Thalassia hemprichii, Thalassodendron ciliatum, Halophila ovalis, and various Halodule species.

5.3.5 Seagrass baseline

At representative of nine sites between Kikambala – Mtwapa – Mombasa - Shelly Beach, Waa, Tiwi, and Diani were studied. Belt transect running shore to reef were set for the Diani Challe belt. 10m^2 quadrats were set out for detailed seagrass community analysis. The following seagrass parameters were measured; Seagrass community structure: species types, abundance, and percentage cover structure; health status of seagrass beds and threats; associated fauna including species listed as protected/ threatened under Kenyan law and /or IUCN Red List, at the respective sampling locations. Observations made showed that the seagrass cover varied across sites as shown in Figure 4. Macro-fauna associated with seagrass were as presented in Figure 5 and. Figure 6. None of the species observed are listed under IUCN categories.



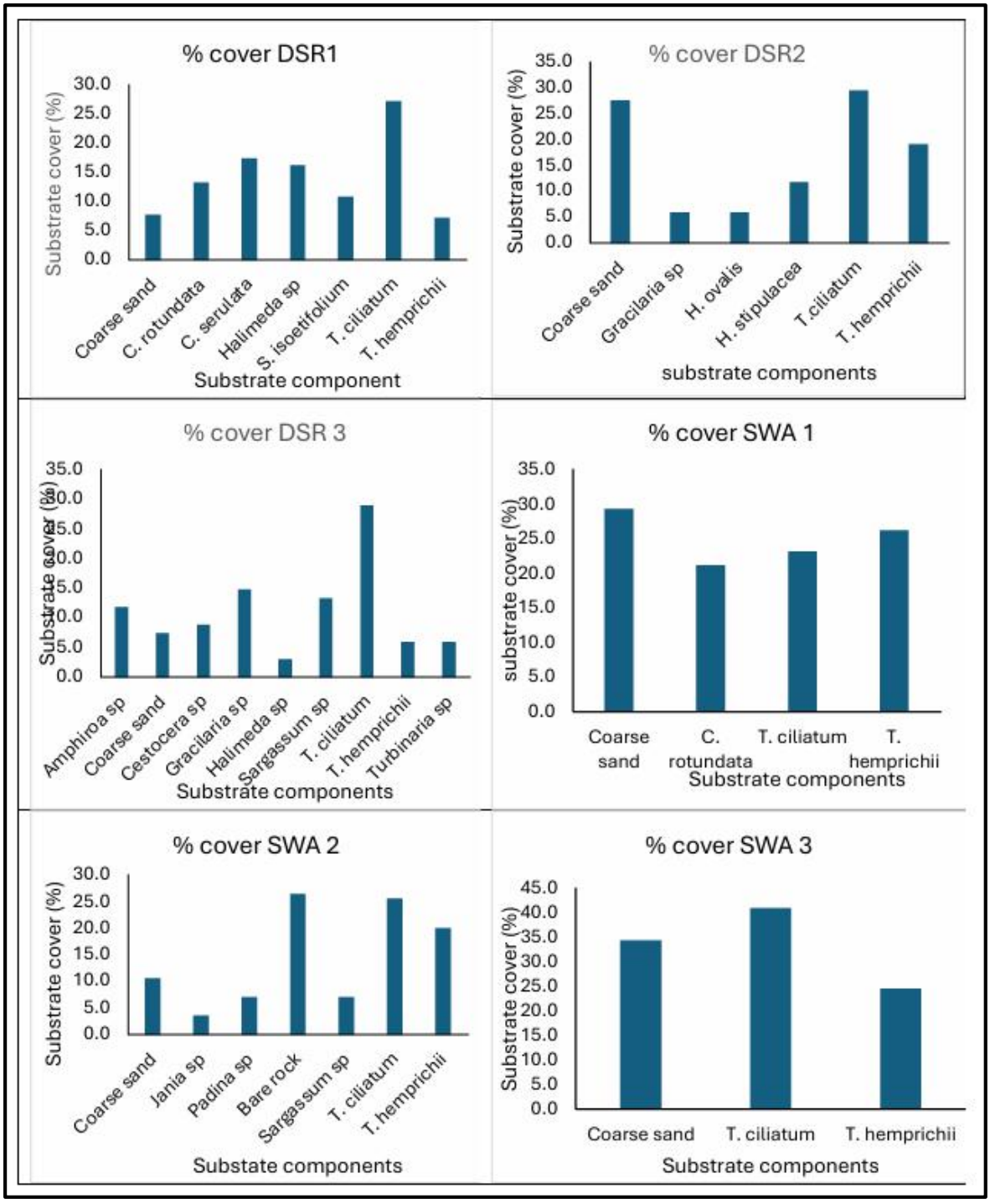


Figure 4 Percent Seagrass Cover at Sampled sites showing seagrass species and cover values alongside other benthic substrates. KEY: TIWI – Coconut Crab Hotel, Tiwi Beach; WAA – Waa Area. Area, DSR – Diani Sea Resort; SWA – Swahili Beach

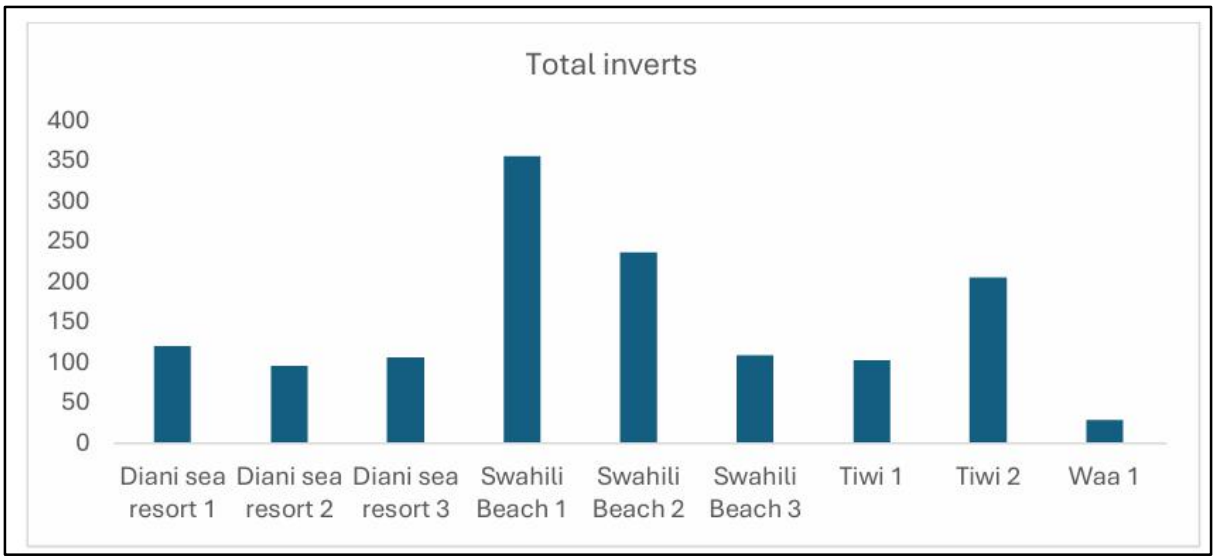


Figure 5 Seagrass associated faunal cover at sampled sites based on total counts of macro-invertebrates

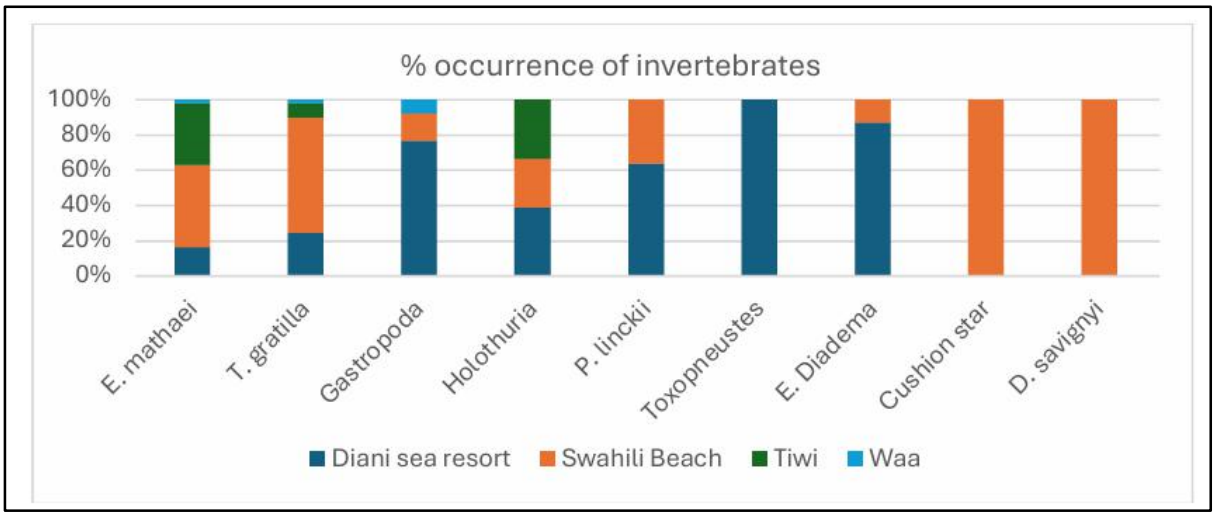


Figure 6 Seagrass associated faunal cover at sampled sites based on dominant macro-invertebrates' taxa

5.3.6 Cumulative impact of port development activities on seagrass

A review was done of previous Environmental Impact Assessments (EIAs) conducted at the Port of Mombasa to understand the cumulative impact of dredging, dumping, and construction activities on the seagrass near the port. This review was necessary to anticipate the potential effects of the proposed dredging and dumping activities during the construction of Berth 19B. To determine the cumulative impacts, we compared the percentage of seagrass cover from three reports the 2021 Mombasa Port Development Project II done February 2021 (MPDP II), the 2021 Environmental Audit of Dredged Material Disposal Site as well as Mombasa Port Development Project Phase III (MPDP III 2023). We also selected two sites, Mombasa Marine Park and Shelly Beach, for seagrass cover comparison because they have been consistently surveyed in the previous ESIAs and environmental audit studies. The analysis showed that:-

⇒ Seagrass cover is higher in Shelly Beach as compared to the nearby Mombasa Marine Park (MMP) (Fig 7).

⇒ Temporarily, seagrass cover varied minimally between 2021 and 2023, when the surveys of the three reports were done.

⇒ Seagrass cover in MMP II seems to have increased by five fold in MPDP III between the two survey periods.

⇒ On the other hand, the variations in seagrass cover in Shelly Beach over the 8 months' period was minimal with the highest being recorded during the 2021-MDP2 survey (74%), while the lowest was during the dredging audit of 2021 (71%).

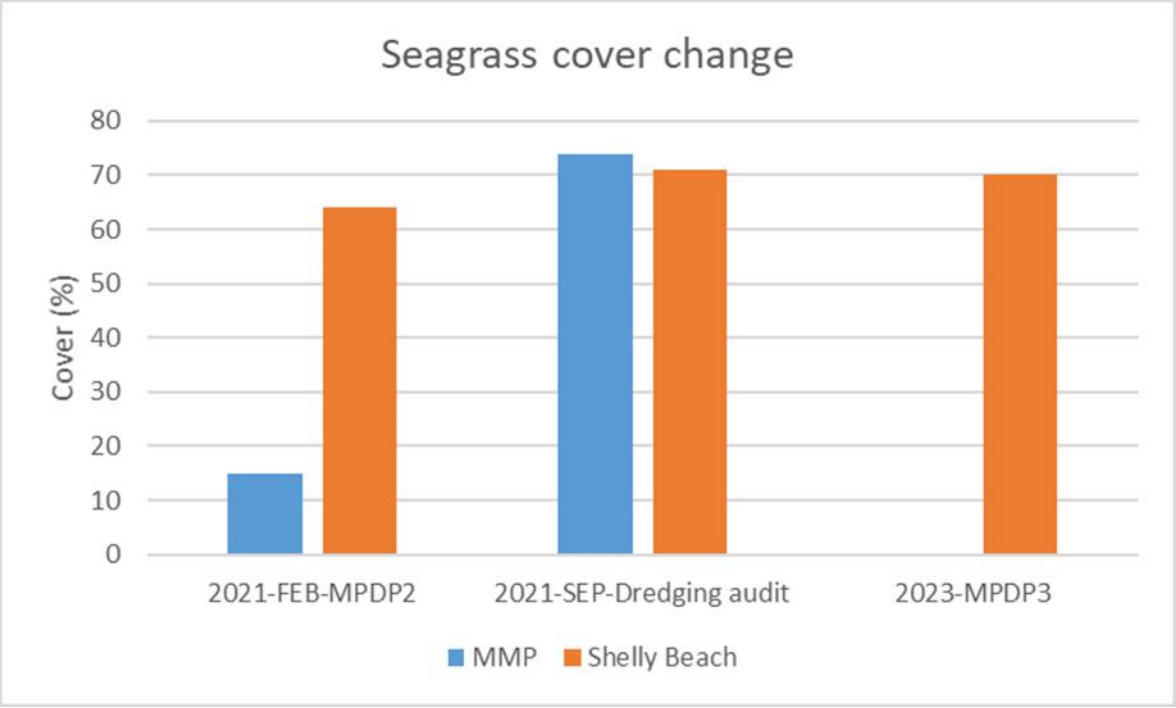


Figure 7 Seagrass cover change at Mombasa Marine Park and Shelly Beach over a period of 9 months

The cumulative impact assessment of dredging, dumping, and construction activities on coral reefs near the port, the proposed activities at Berth 19 are not expected to significantly harm the seagrass habitats nearby.

5.3.3 Mangroves

Mangrove forests serve as crucial habitats for various fish species and invertebrates, providing essential feeding and nursery grounds. They also support diverse bird life, act as carbon sinks, and offer protection against shoreline erosion. Artisanal fishers heavily rely on mangrove ecosystems for a significant portion of their catch. Additionally, mangrove forests serve non-consumptive purposes such as spiritual and cultural functions, aesthetic enjoyment through ecotourism, and beekeeping. However, they are also subject to extractive uses, including timber and construction poles, wood fuel, and herbal medicines. Threats to mangrove forests encompass overexploitation of both wood and non-wood products, conversion of mangrove areas for other land uses like solar salt works and infrastructure development, as well as pollution effects (GOK, 2017). Encroachment by human settlements, siltation, and clearance for aquaculture activities further exacerbate these threats. In Mombasa County, mangroves cover approximately 3,771 hectares, primarily located along Port Reitz and Tudor Creeks. This peri-urban forest is mainly composed

of *Ceriops tagal* and mixed stands of *Rhizophora* species. The forest is severely degraded due to illegal harvesting, land encroachment, and pollution. Approximately 1,850 hectares of mangroves in Mombasa County are degraded and urgently require rehabilitation. Near the Port of Mombasa, the most extensive mangrove forests are located in the typical estuarine environment along major river channels. Notably, at the confluence of the Mwache and Cha Shimba rivers on the Kipevu Channel, where an island of mangroves has formed at the centre of the channel. Between 2012 (MPDP1) and 2018 (MPDP2), approximately 7.5 hectares of mangroves in the Mwache Creek were cleared for port expansion and related activities. Additionally, 14 hectares of mangroves are scheduled to be cleared in 2024 to make way for the Mombasa SEZ project at Dongo-Kundu. Although dredging during the construction of Berth 19B could increase sedimentation levels that can be unfavourable to mangrove development in Port Reitz, mangrove trees to be affected here are an insignificant population (few numbers, scattered, stunted growth) due to location of the construction activities. The proponent proposes to undertake reforestation to ensure restoration of the mangroves set to be cleared.

5.3.4 Benthos

Benthic organisms are usually abundant in surface sediments on the continental shelf and in deeper waters, showcasing significant diversity within and on these sediments. In shallow waters, seagrass beds can create a thriving habitat for Polychaeta worms, crustaceans such as amphipods, and various fish species. In intertidal sediments, most animal activities are heavily influenced by the tides. The dispersal of fluid mud dredged material is anticipated to have a significant short-term impact on benthic organisms within open-water disposal areas. The open-water disposal of fine-grained dredged material may substantially reduce the average abundance of organisms and decrease community diversity in the areas affected by fluid mud. To understand the influence of port operation on benthic community around the port area. We synthesized information and data from secondary sources, in particular the Dredging Environmental Audit of 2021 and ESIA of 2009 (MDP2). A comparison of the benthic community at the current designated disposal sites indicated that:

- ⇒ Diversity of benthos reduced but abundance of some deep-sea benthos increased.
- ⇒ Of importance was the dramatic increase of Oligochaetes which are often largely responsible for the bioturbation of marine sediments and can affect nutrient dynamics of the system (Table 2).

Table 2 Benthos abundance at the designated dumping site of materials to be dredged

Benthos	2009-MDP1	2021-dredging
Nassarius coronatus	20	0
Nereidae	5	0
Oligochaeta	2	800
Baseodiscus unistriatus	13	0
Botridae sp	2	0
Paratanaidae	8	29
Terebra nebulosa	10	0
Platorchestia platensis	9	0
Ceratonereis erythraensis	8	0
Ostracoda	2	29

Disposal of dredged material at the disposal site seems to have a relatively minimum impact on the benthic organisms.

5.3.5 Fisheries assessment

Fisheries play a crucial role in the livelihoods of the local community (GOK, 2018) in Mombasa. However, the exploitation of fishery resources remains traditional, utilizing rudimentary gears and vessels that mainly operate within the reef. This limitation prevents the exploitation of the vast fisheries outside the reef, which are essential for supporting food security. Offshore fisheries are increasingly targeted by both licensed and unlicensed vessels from distant fishing nations in Asia and Europe. The primary species of fish harvested include Scavengers (Lethrinidae, Lutjanidae, and Haemulidae), parrotfish (Scaridae), rabbitfish (Siganidae), grunters (Terapon spp.), and pouters (Gerres spp.). Additionally, pelagic species such as Barracuda (Sphyraena spp.), Kingfish (Scomberomorus spp.), and Mullets (Mugil spp.) are exploited. The crustacean fisheries are dominated by mangrove crabs (Portunidae) found in shallow waters and mangrove areas. Spiny lobsters (Palinuridae) are also caught in shallow water fishing grounds, though in small quantities. Cephalopod fisheries primarily target squids (Loliginidae) and octopuses (Octopodidae) (Figure 8).

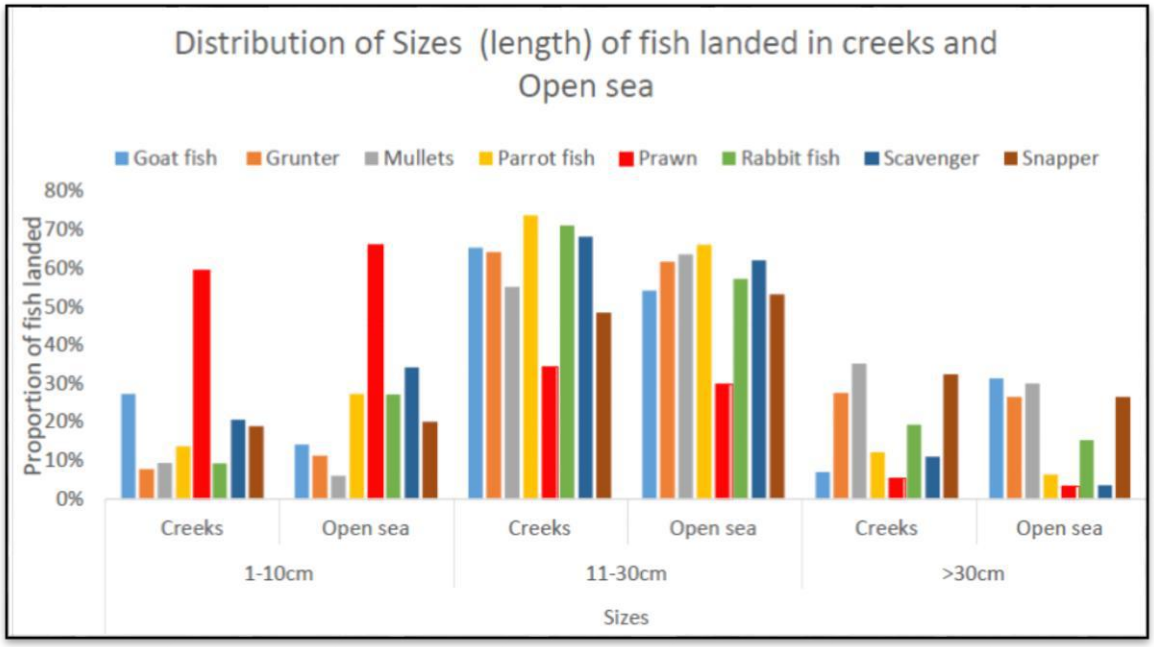


Figure 8 Distribution of catch landings in the creeks and deep sea site near the port (Source MPDP III – 2023 baseline report)

Key fishing grounds near the port of Mombasa include Likoni, Shelly beach, Mweza, Mtongwe, Dongo Kundu, Mwangala, Tunza, Old Town, Ndugani, an Mkupe, which are spread across the two creeks close the port. According to the State Department of Fisheries, Aquaculture, and Blue Economy, the total number of fishermen in Mombasa is estimated at 3,438 (Frame Survey, 2022). It's important to note that these figures may not accurately reflect the actual number of fishermen, as there is un-captured data on unregistered fishermen involved in illegal fishing practices.

To understand the fishery and the fishers likely to be impacted by the dredging and dumping associated with the construction of Berth 19B we performed a desktop analysis, utilizing fisheries data and information from the Department of Fisheries and ESIA reports of 2017 (for repair of Berth 1-14) and 2019 (Mombasa special economic zone) and MPDP III baseline data of 2023. The review showed that:-

- ⇒ Fishing practices utilized within the two creeks near the port predominantly involve traditional artisanal methods, characterized by small-scale operations such as hand lines, traps, and nets.
- ⇒ The fishing vessels are non-mechanized and typically manned by one or two fishermen per boat. While most fishing activities occur in the shallow sea creek vicinity, some ventures into the deep sea are undertaken, particularly from the Mtongwe and Kitanga Juu areas.
- ⇒ Seasonal migrations to the open sea are common among the Mtongwe BMU fishers during calm weather, and this movement may be disrupted during construction due to dredging operations.
- ⇒ Fishing activities in the creeks are year-round, primarily in shallow waters, with only a small fraction of fishers venturing into the open sea.
- ⇒ Fish production is influenced by the northeast monsoons (NEM) from November to March and southeast monsoons (SEM) from April to September, contributing to noticeable seasonality in small-scale fisheries.

⇒ High fishing catches are typically observed during the NEM season. Seasonal variations also affect fishing effort distribution, leading to adaptations such as gear modifications, changes, and migrations between creek and open waters.

⇒ Based on ESIA report for repair of Berth 1-14 (2017), comparative monthly landings between 2013, 2014, and 2015 indicated seasonal fluctuations in catches within the creek, with peaks in 2013 and 2015 from October to March (Fig 9).

⇒ The comparative monthly landings also show a similar trend over the three year, suggesting minimum impact of port operation fisheries productions for landing sites in the two creeks.

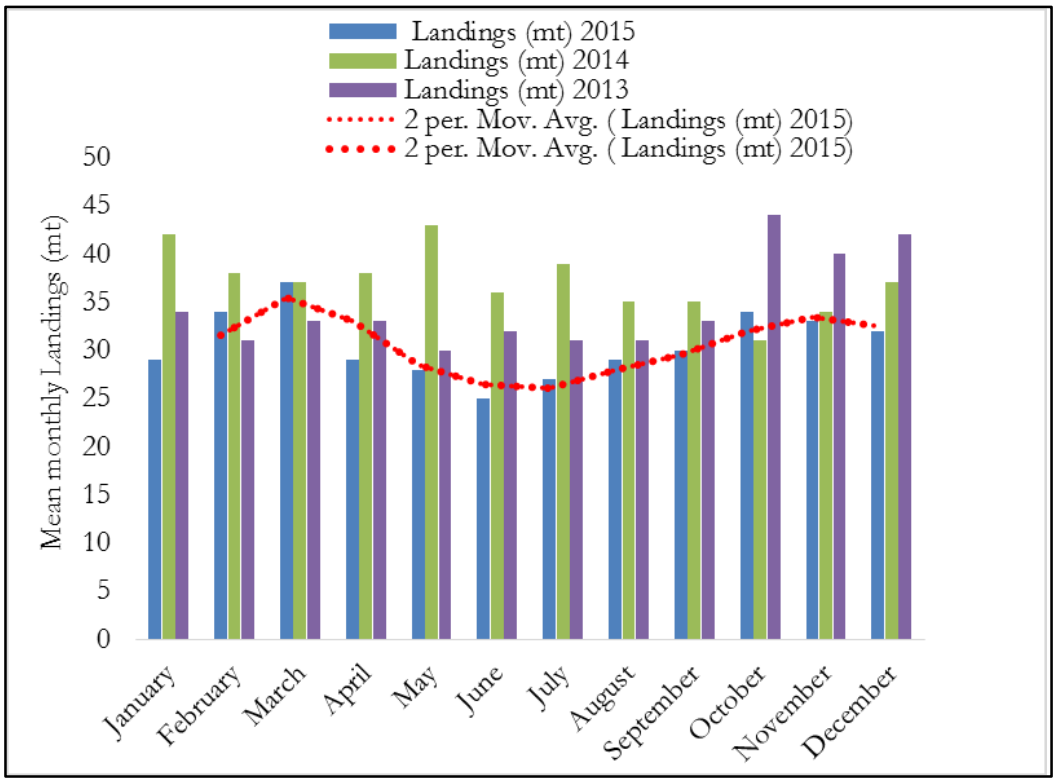


Figure 9 Comparing catch landings in creeks sites near the Port of Mombasa

⇒ Based on gear selectivity, basket traps primarily catch fish in the 11-30 cm size class for both open sea and creek landings. In contrast, fish in the 1-10 cm and >30 cm size classes are only represented in creek landings. Cast nets mostly lands fish in the 1-10 cm size class in both the creeks and open sea, with minimal landings of fish larger than 30 cm in total length in both areas. Gillnets primarily catches fish in the 11-30 cm and 1-10 cm size ranges, catching more fish in the creeks as compared to the open sea. Monofilament nets are effective at landing fish in the 11-30 cm size range in the open sea. Prawn seines successfully catch fish in the 1-10 cm size range in both the open sea and creek areas (Figure 10).

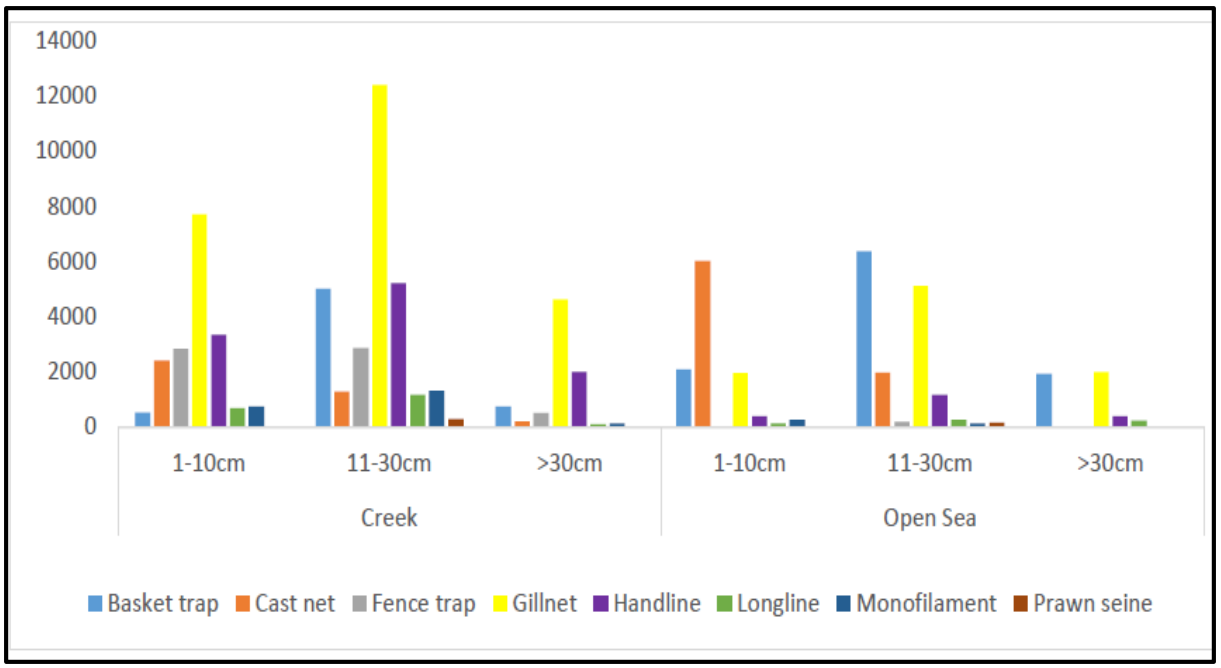


Figure 10 Fish gear selectivity based size in landing sites near the port (Source MPDP III 2023 baseline report)

5.4 Physical oceanographic driving forces

5.4.1 Climate

The Port of Mombasa lies in the hot tropical region where the weather is influenced by the great monsoon winds of the Indian Ocean, which also influences the climate and weather systems that are dominated by the large scale pressure system of the western Indian Ocean and the two distinct monsoon periods. Comparatively dry weather conditions are experienced in the area from November/December to early March, when the North-East Monsoon predominates. Climate is influenced by monsoon winds with the rainfall pattern being characterized into long rains (April-June with an average of 1040mm) and short rains (end of October to December with an average of 240mm). The average annual rainfall for the county is 640mm. The annual mean temperature in the county is 27.9^{0}C with a minimum of 22.7^{0}C and a maximum of 33.1^{0}C. The hottest month is February with a maximum average of 33.1^{0}C while the lowest temperature is in July with a minimum average of 22.7^{0}C. On average, the temperatures are always high in Mombasa. Most rainfall (rainy season) is seen in April, May, October and November. On average, the warmest month is March and on average, the coolest month is September. May is the wettest month and February is the driest month.

5.4.2 Temperature

On average, the temperatures in Mombasa are always high (Figure 11). The warmest month is March and the coolest month is July. The average annual maximum temperature is: 87.8° Fahrenheit (31.0° Celsius) and the average annual minimum temperature is 69.8° Fahrenheit (21.0° Celsius).

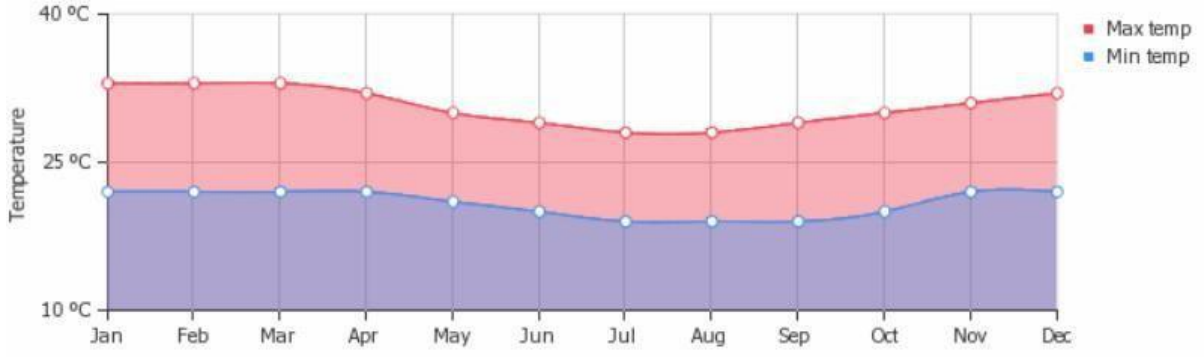


Figure 11 Average minimum and maximum temperatures of Mombasa over the year

Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (0.0 KM).

5.4.3 Sunshine

On average, January, March and October are the sunniest months while May has the lowest amount of sunshine. Figure 12 below is the monthly total of sun hours over the year in Mombasa.

Figure 12 Monthly total of sunshine hours over the year in Mombasa

Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (0.0 KM).

5.4.4 Water Temperature

On average, March has the hottest water temperature while September has the coldest water temperature. Figure 13 below is the mean water temperature in Mombasa over the year.

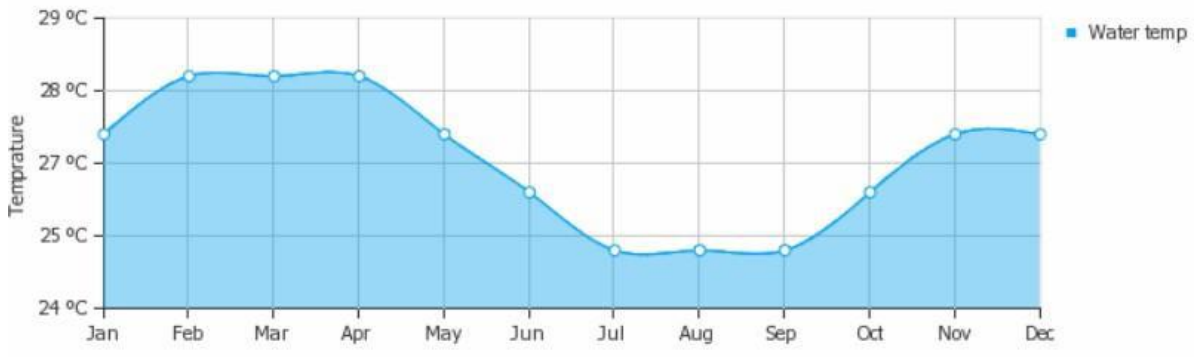


Figure 13Average mean water temperature in Mombasa over the year

Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (0.0 KM).

5.4.5 Precipitation

A lot of rain (rainy season) in Mombasa, falls in the months of April, May, October and November. On average, May is the wettest month while February is the driest month. The average amount of annual precipitation is: 39.37 in (999.9 mm) as shown in Figure 14 below.

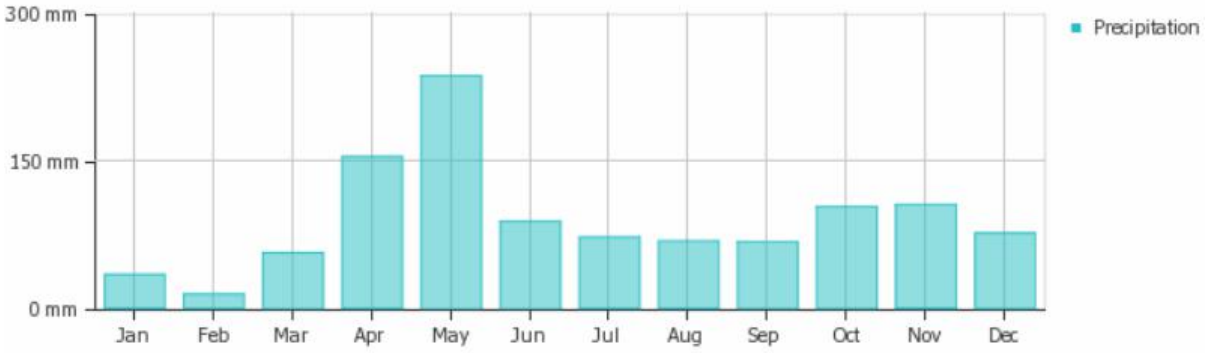


Figure 14 Average precipitation in Mombasa over the Year

Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (0.0 KM).

5.4.6 Monthly Rainy Days

Most rainy days are in the months of April, May, October and November with May having the highest number of rainy days. February has the least number of rainy days. Figure 15 below shows the average monthly rainy days in Mombasa over the year.

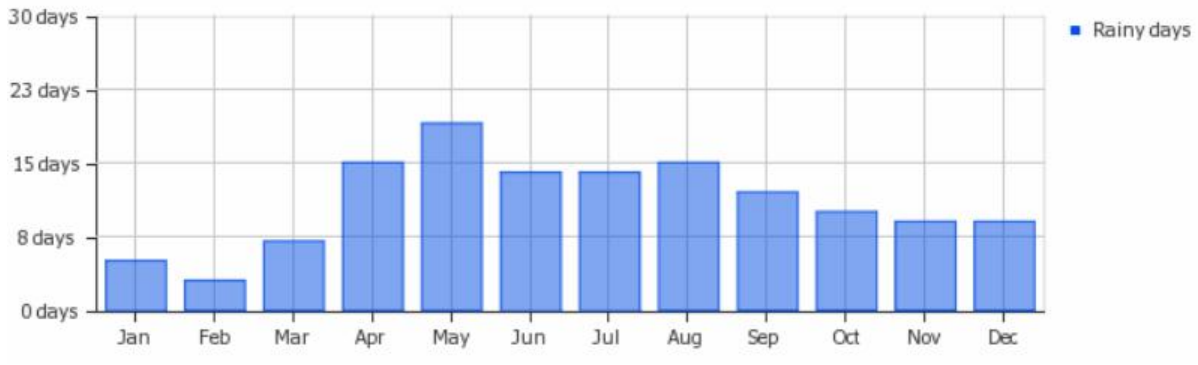


Figure 15 Average Monthly Rainy Days in Mombasa over the year

Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (0.0 KM).

5.4.7 Humidity

On average, May is the most humid month in Mombasa while February is the least humid. Figure 16 is the mean monthly relative humidity over the year in Mombasa.

Figure 16 Mean monthly relative humidity over the year in Mombasa

Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (0.0 KM).

5.4.8 Wind Speed

On average, the windiest months in Mombasa are May and June while the least wind is seen in November. Figure 17 below is the mean monthly wind speed (meters per second).

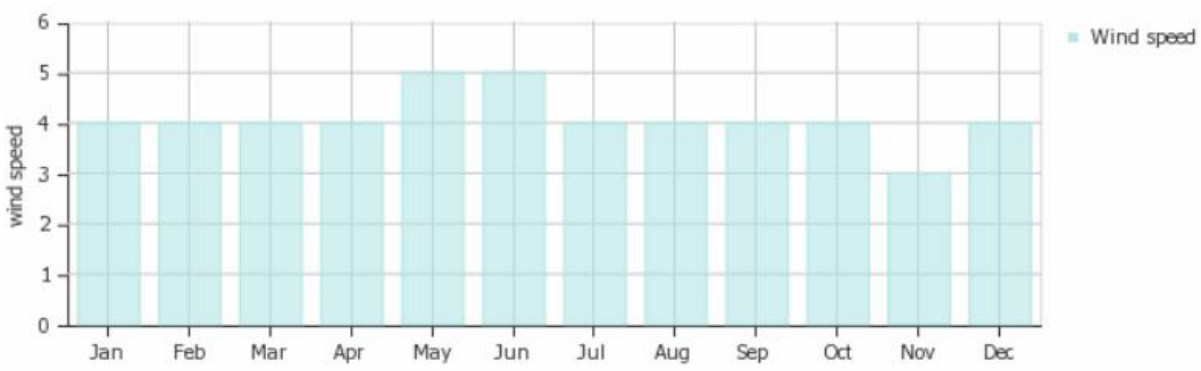


Figure 17 Mean monthly wind speed over the year in Mombasa in meters per second

Source: www.weather-and-climate.com; Data from nearest weather station: Mombasa, Kenya (0.0 KM).

5.5 Marine water quality

5.5.1 Methodology

The methodology employed to establish the baseline marine water quality within Kilindini channel and surrounding creeks involved sampling of marine water samples and submission to the laboratory for analysis of recommended parameters. A vertical water sampling technique was employed where the sampler was lowered into water column and used to draw marine water at depths of 0.5, 3.0 and 6.0 meters. The sampler employs the air pressure difference principle where when the valve at the top of the sampler is opened, water pressure forces water into the sampler through the bottom valve. Once the sampler is full to the capacity, the top valve is released hence sealing the sample for any possible contamination. Samples were kept in a cooler box with ice packs to maintain the water chemistry and submitted to laboratory for analysis. A copy of chain of custody form that details sample descriptions accompanied the sample to the laboratory where sample information was registered before being relinquished to the laboratory analyst for analysis.

5.5.2 Laboratory Testing Protocols

Samples submitted to the laboratory were analyzed as per the test methods detailed in Table 3.

Table 3 Parameters and their respective Test methods

Parameter	Test Method	Specification
Total Suspended Solids	Standard method for examination of water & wastewater method No. 2540-D	NEMA specification, Legal Notice I20 of 2006, Third Schedule
PH	Standard method for examination of water & wastewater method No. 4500-H	NEMA specification, Legal Notice I20 of 2006, Third Schedule
Chemical Oxygen Demand	Standard method for examination of water & wastewater method No. 5220-B	NEMA specification, Legal Notice I20 of 2006, Third Schedule

Dissolved Oxygen	Standard method for examination of water & wastewater method No. 4500-G	NEMA specification, Legal Notice I20 of 2006, Third Schedule
Turbidity	Standard method for examination of water & wastewater method No. 2130-B	NEMA specification, Legal Notice I20 of 2006, Third Schedule

5.5.3 Materials, tools and equipment

- Sampler
- Geographic Positioning System (GPS)
- Digital camera
- Oven
- Desiccator
- pH meter
- Turbidity meter
- DO meter
- Filtration system

5.5.4 Description of the Measurement Location

Baseline marine water quality testing was conducted at 8 selected monitoring locations. Table 4 details the measurement locations and the rationale for point selection.

Table 4 Measurement locations and rationale for their selection

Measurement location	Rationale for measurement Location
Mwache creek	Testing results were to form the benchmark for monitoring impacts of port operations to water quality within the creek.
Mteza creek	Measurement location was to provide the current conditions within the creek which shall form the benchmark for subsequent monitoring during project implementation phase.
Tudor creek	Results from the location were to provide benchmark upon which subsequent marine water management and pollution control strategies shall be based.
Dongo Kundu	The point was located about 50 meters from the site for the proposed construction of the Mombasa Special Economic Zone. Baseline results will assist in implementation of measures for managing cumulative effects of pollution.
Berth 22	The point was located about 15 meters from Berth 22. Baseline results would form benchmark for monitoring water quality around the area.
Berth 17	The point was located next to berth 18 where demolition and construction of Berth 19B will take place.

Berth 16	Monitoring location was located about 30 meters from berth 16 and would be critical in monitoring pollution contributed by tidal currents during construction phase.
KPA headquarter	This location was to provide benchmark for monitoring pollution from Kilindini channel towards Tudor creek.

Table 5 Description of Monitoring locations

No.	SITE NAME	GPS CO-ORDINATES	DESCRIPTION	ONGOING ACTIVITIES
1.	Mwache creek	4° 3'4.08"S 39°35'1.40"E	Measurement location situated within Mwache creek	• Fishing activities by locals
2.	Mteza creek	4° 4'1.49"S 39°35'5.43"E	Measurement point located within Mteza creek.	• Fishing activities by locals
3.	Tudor creek	4° 1'42.19"S 39°39'40.59"E	Measurement location situated about 100 meters from Tudor water sport	• Fishing activities by locals
4.	Dongo Kundu	4° 3'33.24"S 39°36'10.31"E	Located about 50meters from AGOL LPG terminal	• Occasional speedboat movement
5.	Berth 22	4° 3'13.50"S 39°36'54.85"E	Located about 15 meters from berth 15.	• Offloading of cargo from ships
6.	Berth 17	4° 2'46.70"S 39°37'44.20"E	Located about 30 meters from old KOT	• Offloading of containers at berth 18.
7.	Berth 16	4° 2'43.30"S 39°38'10.90"E	Located about 30 meters from berth 16.	• Offloading of cargo from ships
18.	KPA Headquarter	4° 2'30.62"S 39°38'26.26"E	Located between KPA headquarter offices and CCC offices	• No activities

5.5.5 Rationale for parameter selection

5.5.5.1 pH

The pH value of a water source is a measure of its acidity or alkalinity. The pH level is a measurement of the activity of the hydrogen atom, because the hydrogen activity is a good representation of the acidity or alkalinity of the water. It's expressed on an algorithmic with pH of less than 7 being acidic while that of more than 7 being basic. Changes in marine water pH have ripple effect on a number of water quality parameters that are directly affected by it. In a construction sector such changes can result from activities such as release of wastewater into marine water.

5.5.5.2 Dissolved Oxygen

Dissolved oxygen refers to the level of free, non-compound oxygen present in water or other liquids. It is an important parameter in assessing water quality because of its influence on the organisms living within a body of water. A dissolved oxygen level that is too high or too low can harm aquatic life and affect water quality. Dissolved oxygen is necessary to many forms of life including fish, invertebrates, bacteria and plants. These organisms use oxygen in respiration, similar to organisms on land. Fish and crustaceans obtain oxygen for respiration through their gills, while plant life and phytoplankton require dissolved oxygen for respiration when there is no light for photosynthesis [4]. The amount of dissolved oxygen needed varies from creature to creature. Bottom feeders, crabs, oysters and worms need minimal amounts of oxygen, while shallow water fish need higher levels.

5.5.5.3 Chemical Oxygen Demand

Chemical oxygen demand (COD) is the amount of dissolved oxygen that must be present in water to oxidize chemical organic materials. COD measurement determines the ability of water to chemically breakdown chemical compounds therein. High chemical oxygen demand in water indicates greater levels of oxidizable organic matter and consequently, a lower amount of Dissolved Oxygen (DO). Critical DO depletion due to organic contamination can kill off aquatic life forms. A COD test indirectly measures the concentration of organic compounds in a sample of water by measuring the amount of oxygen required for oxidation of all the organic compounds present.

5.5.5.4 Turbidity

Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is a measurement of the amount of light that is scattered by material in the water when a light is shined through the water sample. The higher the intensity of scattered light, the higher the turbidity. Material that causes water to be turbid include clay, silt, very tiny inorganic and organic matter, algae, dissolved colored organic compounds, and plankton and other microscopic organisms. High concentrations of particulate matter affect light penetration and ecological productivity, recreational values, and habitat quality, and cause lakes to fill in faster. Particles also provide attachment places for other pollutants, notably metals and bacteria. For this reason, turbidity readings can be used as an indicator of potential pollution in a water body.

5.5.5.5 Total Suspended Solids

Total Suspended Solids refers to all the particles/sediments that found within a water column in a suspension form. Suspended solids in water determine water clarity, therefore, TSS can be used to establish suitability of water for varying purposes. Suspended solids in water absorb heat energy from the environment making the water warm. When water is warm, the ability of oxygen to dissolve declines, hence impacting life. Human activities such as dredging can disturb the seabed resulting in resuspension of sediments hence high levels of TSS.

5.5.6 Results of marine water quality baseline

Marine water sampling was conducted at locations within Kilindini channel and surrounding creeks of Mwache, Mteza and Tudor and sample submitted to the laboratory for analysis. Parameters tested during the exercise included: Turbidity, Dissolved Oxygen (D.O), pH, Temperature, Total Suspended Solids (TSS) and Chemical Oxygen Demand (C.O.D). Test results for all the monitoring locations show that marine water quality within Kilindini channel is relatively the same. The results do not show any potential pollution hotspots, hence demonstrating the effectiveness of tidal currents in pollutant dilution and dispersion within Kilindini channel and surrounding creeks. Results of the water quality baseline at each of the sampled location are presented in Table 6 which detailed baseline marine water quality report is in Appendix 3 while plate 1 captures marine water sampling in the field.

Table 6 Marine water quality baseline results

Location	Ph @25.50^{0}C	Dissolved oxygen Mg/l	Chemical Oxygen Demand Mg/l	Total suspended solid Mg/l	Turbidity NTU	Water Temperature ^{O}C
CCC/KPA HQ	8.10	6.52	8.33	3.53	27.60	25.57
Berth 16	8.19	6.50	8.23	2.64	34.27	25.43
Berth 18	8.15	6.52	7.47	3.32	34.40	25.5
Berth 21	8.07	6.50	7.93	2.69	34.80	25.5
Dongo Kundu	8.07	6.52	7.37	3.41	35.20	25.57
Mteza Creek	8.01	5.77	10.37	7.75	62.67	25.47
Mwache creek	7.93	6.39	11.33	11.55	72.00	25.47
Tudor Creek	8.16	6.43	8.83	6.25	52.67	25.53

Plate 1 Marine water sampling in progress

5.5.7 Graphical presentation of Marine water quality beeline

5.5.7.1 pH, DO, COD

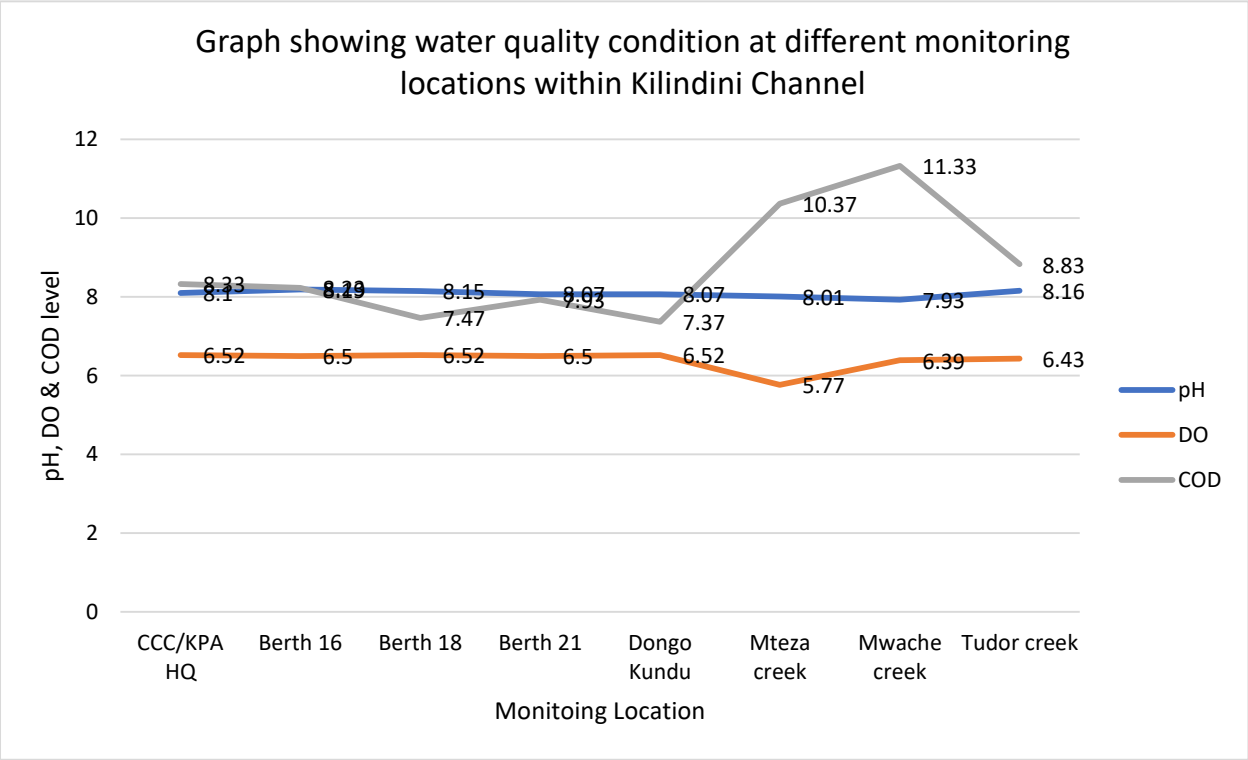


Figure 18 Average results of pH, Dissolved Oxygen and Chemical Oxygen Demand

Results for pH, DO and COD were compared against each monitoring location within Kilindini channel and the surrounding creeks. The levels of pH were relative the same for all the locations within the port of Mombasa and surrounding creeks. Slightly lower pH levels were recorded at Mwache as compared to Mteza and Tudor creeks. Dissolved oxygen concentrations within Kilindini channel monitoring location is relatively unchanged. The levels of DO recorded in all monitoring locations within the creeks of Tudor, Mwache and Mteza were lower than the levels recorded at locations within Kilindini channel. This means that dissolved oxygen depleting processes within the creeks are higher than those within Kilindini channel. Slightly higher levels of COD were recorded at locations within Tudor, Mwache and Mteza as compared to the average

results for locations within Kilindini channel. Higher COD levels recorded within the creeks of Tudor, Mwache and Mteza creeks could be as a result of influx of organic and inorganic compounds from operations therein such as the construction of Mombasa southern bypass.

5.5.7.2 Turbidity, Suspended Solids and Water temperature

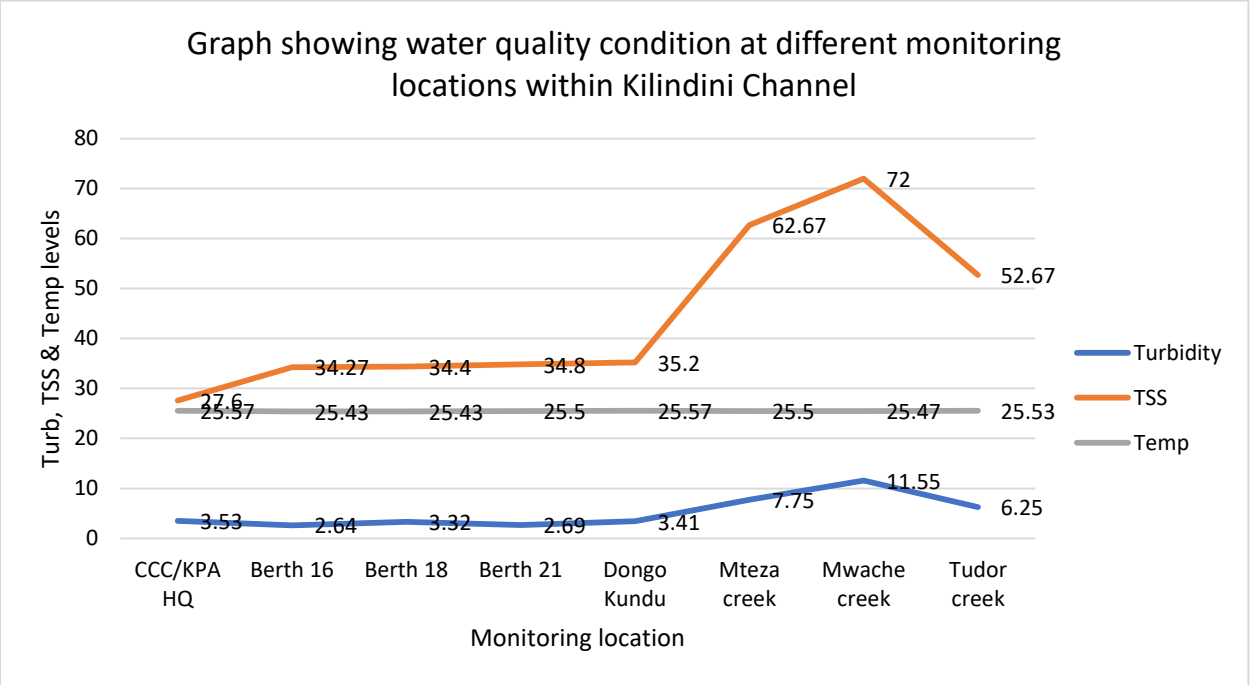


Figure 19 Average of Turbidity, Suspended Solids and Water temperature

The levels of Total Suspended Solids at locations within the creeks of Tudor, Mwache and Mteza were relatively higher than the levels recorded at locations within Kilindini channel. Similarly, the average results for turbidity for locations within Tudor, Mwache and Mteza creeks were higher than the levels recorded in Kilindini channel. High turbidity and TSS levels recorded could be as a result of increased sedimentation within the creeks due to tidal currents and inundation along the riparian zones. Results for water temperature were relatively similar for all the monitoring locations.

5.5.7.3 Relationship Between Chemical Oxygen demand and Dissolved Oxygen

Dissolved Oxygen (DO) and Chemical Oxygen Demand (COD) are two important parameters indicating the general conditions of the water. Dissolved Oxygen indicates the total amount of oxygen dissolved in the water. Most marine organisms need oxygen for respiration and maintenance of life. Chemical Oxygen Demand measures the amount of oxygen consumed by microorganisms in decomposing organic matters in water. It is generally used to reflect the level of organic pollution of environmental water. Therefore, an increase in COD levels results in a decrease in available Dissolved Oxygen.

5.5.7.4 Relationship Between Total Suspended Solids (TSS) and Turbidity

TSS measures the weight of particles suspended in the water while Turbidity is a visual description of how the water looks. The presence of suspended solids in water can result in reduced clarity, hence limiting its quality. Turbidity results can be used as a surrogate measure of TSS in statistical studies where a range of values of both parameters are used to draw a correlation.

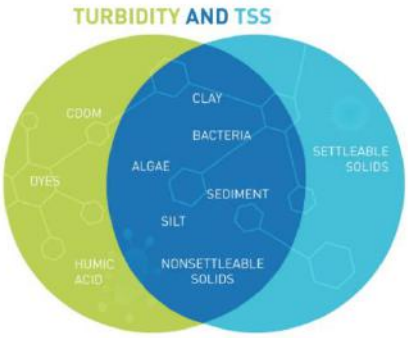


Figure 20 Pictorial illustration of the relationship between Turbidity and TSS

5.6 Ambient Air Quality

5.6.1 Active and Continuous Sampling for Gaseous and Particulate Parameters

Measurement of ambient air quality was conducted using AQM 09 Air Quality Monitor system. Based on advanced sensor technology, the AQM 09 integrates the main ambient gases and meteorological parameters. Measurements for Nitrogen Oxides, Carbon monoxide and Sulphur dioxide were done using the gas sensitive electrochemical methods of active and continuous sampling. The gas sensitive electrochemical sensors generate nano-amp currents proportional to the gas concentration. AQM uses low noise electronics to capture these signals resulting in low detection levels. Ozone, Hydrocarbons and Carbon Monoxide were measured using a gas sensitive semiconductor sensor. The sensor uses proprietary sensing material, built-in automatic baseline correction and interference rejection. This combination results in ppb resolution and a highly linear response. The AQM 09 has a laser particle counter (LPC) for Particulate Matter (PM) measurements. It uses optimized signal processing using low noise electronics, it has algorithms that are added to correct for interferences, e.g., humidity. The equipment was mounted at about 1 – 2 M above the ground surface.

5.6.2 Meteorological Parameters Measurement techniques

As part of the ambient air quality measurement, meteorological parameters were measured. Temperature and humidity were measured on site while wind speed and direction were obtained from online from the Meteorological department. The following techniques were employed: Temperature & humidity were measured using the AQM 09 Air quality Monitor station series which houses temperature and humidity sensors. Temperature was measured by way of a highly accurate Air Chip 3000 while humidity was measured using a capacitive humidity sensor (accuracy < 0.8 % / 0.1 K). To keep the effects of external influences (e.g., solar radiation) as low as possible, the sensors were in a ventilated housing with radiation protection.

5.6.3 Measurement Tools, Equipment and Materials

- AQM 09 Air Quality Monitoring Station

- Geographic Positioning System (GPS)
- Digital camera
- Calibration certificates

5.6.4 Description of the Measurement Location

Measurement points were selected at locations within and surrounding port operations areas (Table 7). Point selection was based on the size of the area, ongoing operations and proximity to nearby receptors.

Table 7 Measurement locations

NO.	SITE NAME	GPS CO-ORDINATES	DESCRIPTION	ONGOING ACTIVITIES
1	Kipevu Clinic	4°2'34.85"S 39°37'5.78"E	Measurement point was located at entrance of Kipevu clinic.	• Truck and personal service vehicle movement along the road
2	CT2 Area	4°2'40.38"S 39°36'59.67"E	Measurement location was positioned a few meters from CT2 offices, next to the parking lot.	• Occasional truck movement of trucks around the loading bay.
3	KPC Oil Tanks	4°2'41.53"S 39°37'18.83"E	The location was situated about 10 meters from the gate of KPC tanks.	• Activities at this location majorly included movement of port operation vehicles.
4	Engineering Department	4°2'45.67"S 39°37'22.37"E	Measurement location was situated behind the Engineering canteen.	• Major activities included movement of locomotive and port operation vehicles into and out of the engineering department.
5	Berth No. 17	4°2'36.18"S 39°37'48.52"E	The location was situated in Breth 17 next to the offices within KPA High level residential areas. Next to the measurement location was the conveyor belt shed for Grain Bulk Handlers limited.	• Major activities included movement of locomotive and port operation vehicles. • Occasional movement private motor vehicles • truck movement of trucks around the loading bay

5.6.5 Rationale for measurement selection

5.6.5.1 Carbon Monoxide

Carbon monoxide is a product of incomplete combustion of carbon containing fuel in limited oxygen supply. In construction sector, emission of CO can result from gasoline and petrol-powered machinery movement or general operations. CO results in limited absorption of oxygen within the respiratory system, when inhaled by humans, hence can cause death.

5.6.5.2 Oxides of Nitrogen

The oxides of nitrogen (NO_X) comprise nitric oxide (NO) and Nitrogen Dioxide (NO_2).
Oxides of Nitrogen are generated from combustion systems due to high pressures and temperatures, leading to oxidation of nitrogen with oxygen, both present in the air.

5.6.5.3 Particulate Matter

Particulate matter refers to is small particles that are classified as PM_{10}, $PM_{2.5}$ or $PM_{0.1}$ depending on their size. These particles have a diameter of less than 10 μm, 2.5 μm and 0.1 μm respectively; particles smaller than 0.1 μm are also called ultrafine particles (UFPs). The combustion of diesel and heavy fuel oil leads to a high amount of PM emissions. PM also develops when certain pollutants meet other substances. The smaller the particles, the worse the effect on human health. Inhalation of inhalable particulate matter pose a great health risk. These tiny particles get into the lungs and are small enough to pass through tissues and enter the blood stream. They can then trigger inflammations which eventually cause heart and lung failures. The World Health Organization estimates that long term exposure to PM2.5 is associated with an increase in the risk of cardiopulmonary mortality by 6–13% per 10 μg/m3 of PM2.5. (Aeroqual, 2022).

5.6.5.4 Sulphur Dioxide

Sulphur dioxide is a colorless gas with a strong choking odor. It is produced from burning of fossil fuels and smelting of mineral ores such as copper, aluminum, zinc and lead. SOx (Oxides of Sulphur) comprehend a family of different chemical compounds characterized by the presence of Sulphur and Oxygen. In nature, these emissions are typically produced by volcanoes. They have harmful effects on the human body, as they stimulate nasal and throat nerves causing respiratory problems especially in asthmatic individuals.

5.6.5.5 Ozone

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

5.6.5.6 Wind Speed & Direction

The wind direction at a given time determines the general area into which a mass of gas or a cloud of particles will move. The wind speed closely specifies how rapidly the contaminant will advance into that area. Other things being equal, the concentration at a point downwind from the source

will be inversely proportional to the wind speed. In rough terrain it cannot be assumed that the wind direction and speed near the source govern the subsequent motion of the contaminant. Hills may deflect the air flow either horizontally or vertically or both, the amount of deflection depending on the vertical stability of the atmosphere. In valleys the wind carrying a pollutant tends to flow either up or down valley, following its meanderings. The deeper the valley the more pronounced this channeling effect is. (Hewson, 1956).

5.6.5.7 Temperature

Temperature and sunlight (solar radiation) play an important role in the chemical reactions that occur in the atmosphere to form photochemical smog from other pollutants. Favorable conditions can lead to increased concentrations of smog.

5.6.5.8 Humidity

Like temperature and solar radiation, water vapor plays an important role in many thermal and photochemical reactions in the atmosphere. As water molecules are small and highly polar, they can bind strongly to many substances. If attached to particles suspended in the air, they can significantly increase the amount of light scattered by the particles. If the water molecules attach to corrosive gases, such as sulfur dioxide, the gas will dissolve in the water and form an acid solution that can damage health and property.

5.6.5.9 Rainfall

Rainfall normally washes particulate matter out of the atmosphere and dissolves gaseous pollutants. Removing particles improves visibility. Where there is frequent high rainfall, air quality is generally better. If the rain dissolves gaseous pollutants, such as sulfur dioxide, it can form acid rain resulting in potential damage to materials or vegetation.

5.6.6 Results of ambient air quality measurement

Measurement of ambient air quality was conducted at five locations within the Port area for a period of 24 hours each. Results obtained show that both gaseous and particulate matter measured was with the air quality guidelines set by the World Health Organization (WHO) and the limits established by the EMC (Air Quality) Regulation of 2014. Results of ambient baseline air quality at each of the sampled location are presented in Table 8 while detailed baseline ambient air quality report is in Appendix 4 while plate 2 captures air quality measurements in the field.

Table 8 Ambient air quality baseline results

Location	Temp (^{0}C)	Humidity (%)	Wind direction	Wind speed	$PM_{2.5}$ µg/m^3	PM_{10} µg/m^3	CO mg/m^3	SO_2 (ug/m^3)	NO_2 Ug/m^3	NO (ug/m^3)	O_3 (ug/m^3)
Kipevu	28.92	74.36	SE	1.97	11.74	14.59	0.216	10.28	24.89	9.35	162.3
CT2 area	27.59	70.76	SE	2.14	9.46	11.32	0.191	9.67	21.04	8.38	142.7
KPC tanks area	27.38	70.08	SE	2.21	15.24	17.43	0.207	15.64	26.33	12.16	126.8

Engineering Dpt.	28.77	72.47	SE	2.09	12.18	14.66	0.258	15.08	25.49	11.28	159.1
Berth No. 17	27.64	71.29	SE	2.11	13.76	15.20	0.287	14.93	26.37	12.37	150.9
WHO guideline	-	-	-	-	25	50	-	20	-	-	
EMC Air quality	-	-	-	-	75	150	5	125	100	80	120

Plate 2 Baseline Air quality field data collection

5.6.7 Graphical presentation of results

Particulate Matter (PM_{10})

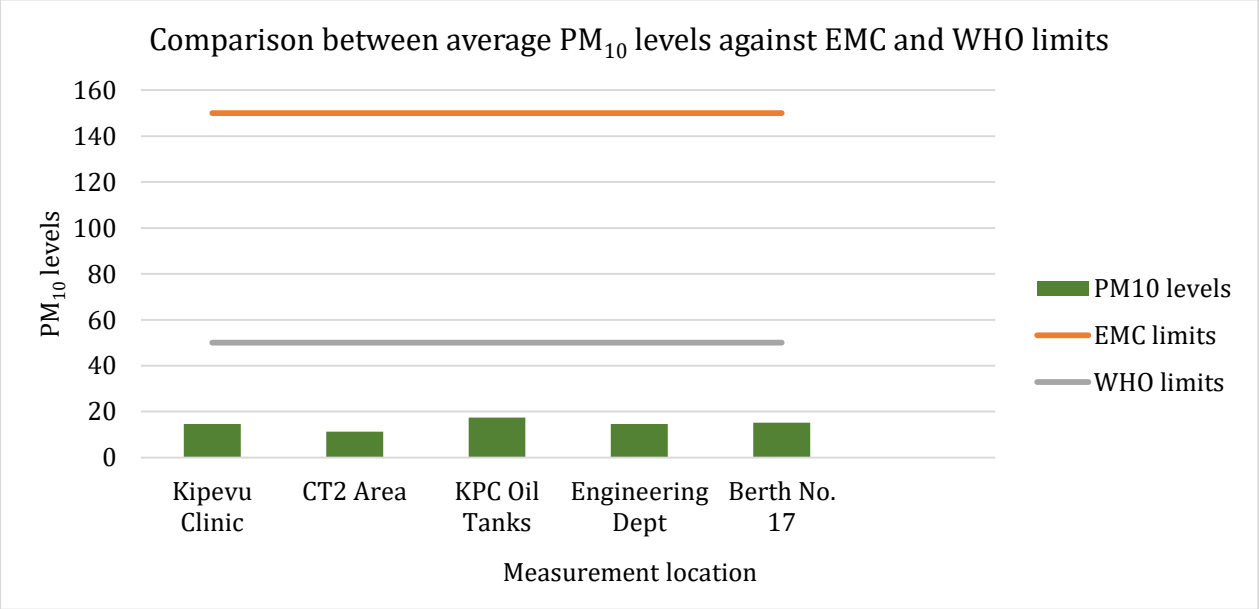


Figure 21 Average PM_{10} results against WHO air quality guidelines and EMC (Air Quality), Regulations, 2014

Particulate matter ($PM_{2.5}$)

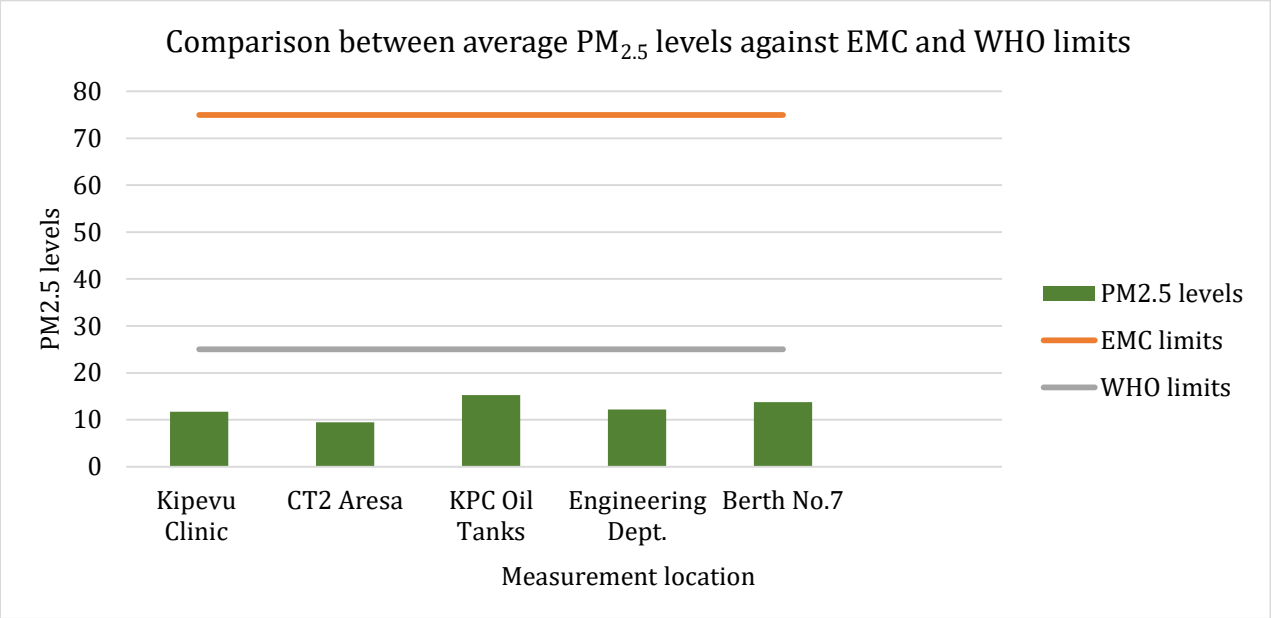


Figure 22 Average $PM_{2.5}$ results against the EMC (Air quality) regulation 2014 limits

Sulphur Dioxides

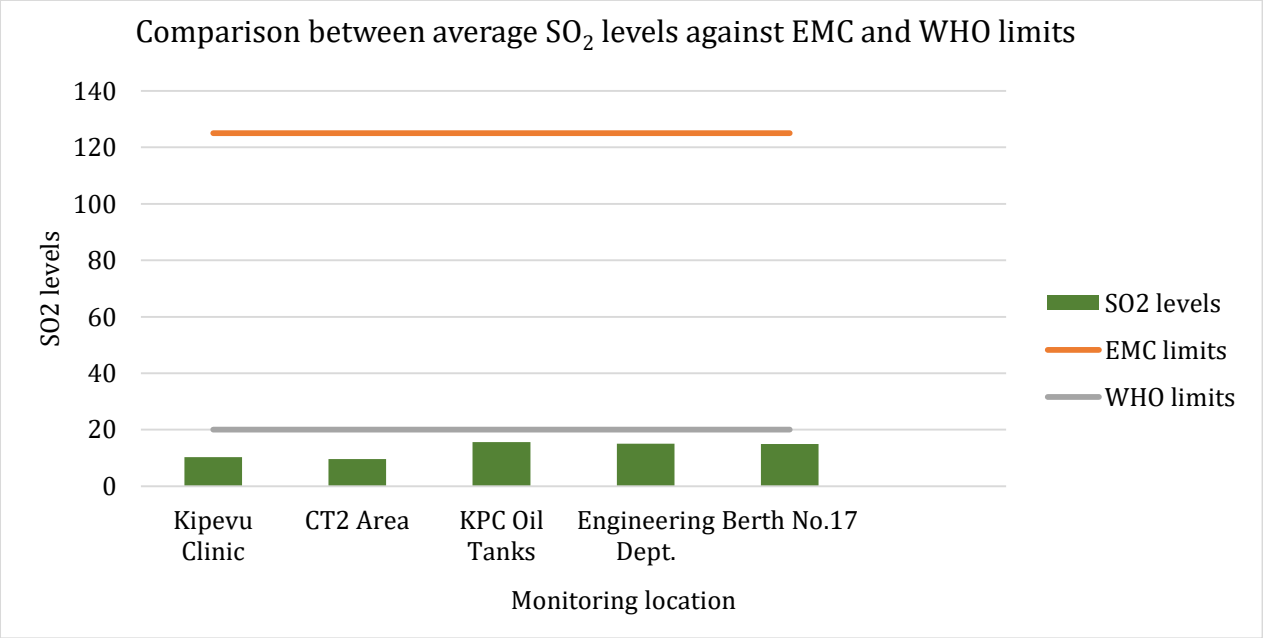
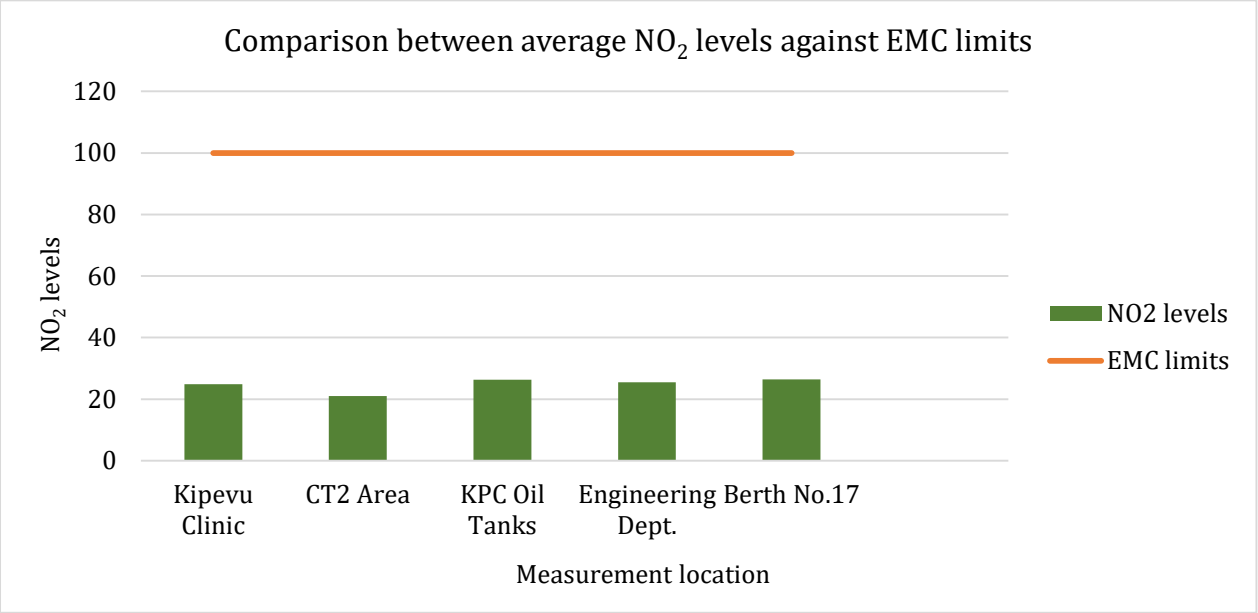


Figure 23Average SO_2 against EMC (Air Quality) Regulations, 2014

Nitrogen Dioxide



F**Figure 24 Average NO_2 against EMC (Air Quality) Regulations, 2014**

Nitrogen Oxide

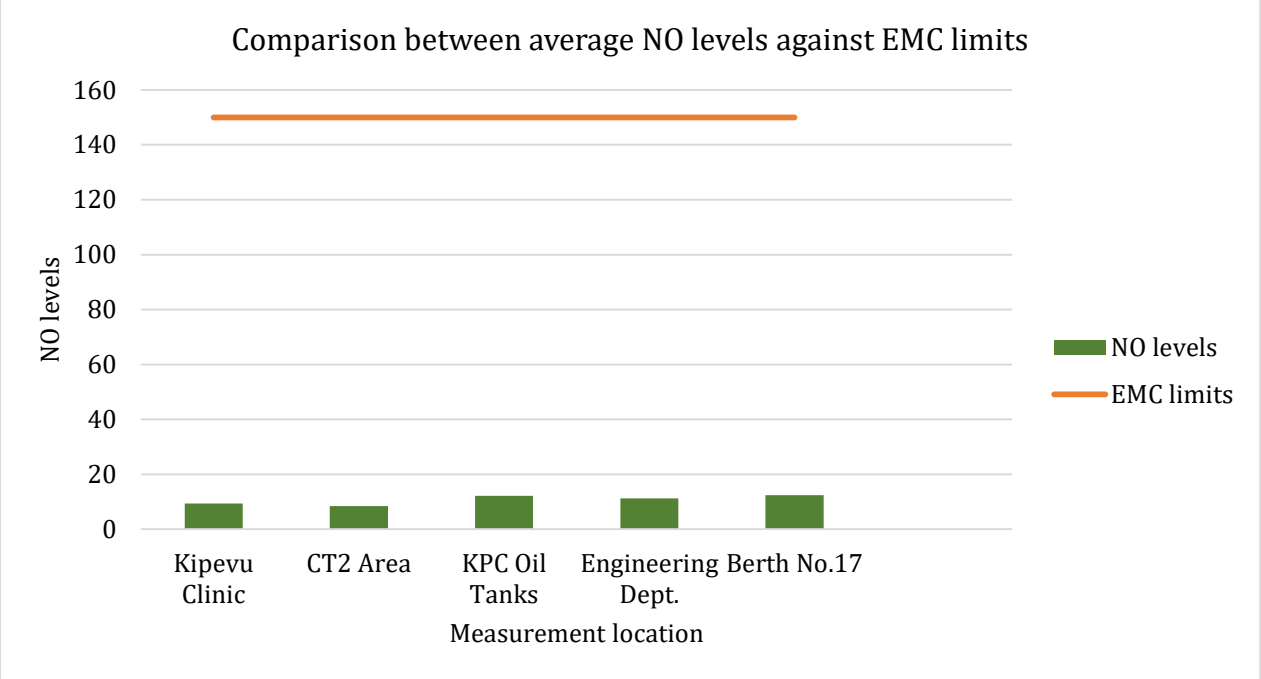


Figure 25 Average Nitrogen Oxide against WHO air quality guidelines

5.7 Noise level baseline

5.7.1 Methodology

The Noise measurements were carried as per the ISO 1996 Parts 1, 2 and 3 standards, entailing the following:

- Inspection of the vicinity and the implicated activities

- Verification/Calibration of the sound level meter before and after the measurements.

Meteorological conditions during the measurement- Measurements of temperature, wind speed and relative humidity were taken before the noise level measurements. The ISO 1996 does not define the length of the measuring period and only advises on the measuring time that covers the changes in operation of the noise source. A series of short-term measurements were conducted at representative measurement locations. These allowed the nature, character and dominant noise sources surrounding and within the Study Area to be identified. Measurements were in duration of 10 to 20 minutes and recorded the following parameters - LAeq, LAmax, and LAmin, L90 and L10. Noise levels are expressed in decibels, A-weighted sound pressure level (dBA). The measurement results are expressed as follows:

5.7.2 Instrumentation

The following instruments were used during the measurement:

Noise Meter: A Type 1, Data logging, precision impulse, integrating sound level meter, with a microphone (and windshield) mounted on a tripod at 1.5m above the ground level and >3m from any façade. Noise level measurement was conducted approximately 2 meters from any sound-reflecting objects, including walls and trees.

5.7.3 Noise level baseline results

Noise level measurement was conducted at 5 locations, similar to those for ambient air quality measurement. Measurements were conducted at an interval of 10 minutes each hour for 24-hour duration at each location. Average results of LAeq were compared against EMC (Noise and Excessive Vibration) (Control) Regulations, 2009 diurnal and nocturnal limits and WHO guidelines for community noise. All study locations had their average diurnal noise levels surpassing EMC limits apart from CT2 area and complied with WHO limits apart from Engineering Department location. Nocturnal average noise levels on the other hand surpassed EMC limits but complied with WHO limits for all the measurement locations. Results of baseline noise level at each of the sampled location are presented in Table 9 while detailed baseline noise level report is in appendix 9.

Table 9 Noise level baseline results

Location	Diurnal noise levels LAeq (dB)	Nocturnal noise levels LAeq (dB)
Kipevu clinic	62.3	58.7
CT2 area	51.2	49.5
KPC tanks area	60.7	59.9
Engineering Dpt.	71.2	66.7
Berth No.17	68.7	66.8
EMC diurnal limits	55.0	-
WHO limits	70	-
EMC nocturnal limits	-	35.0
WHO limits	-	70

5.7.4 Graphical presentation of noise level baseline results

Diurnal average Noise results

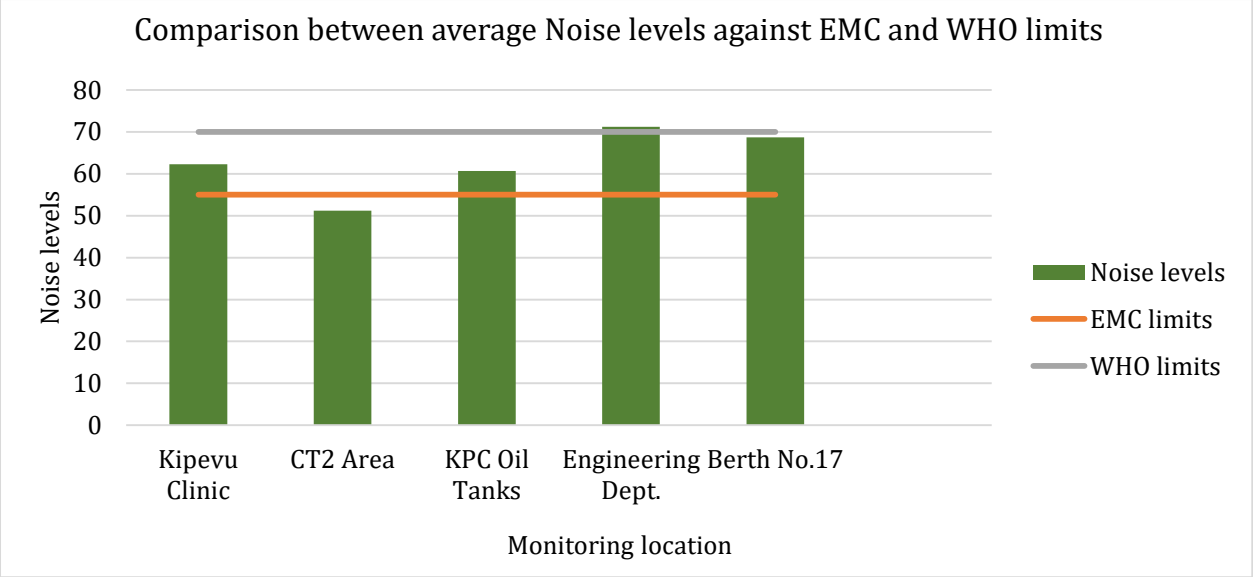


Figure 26 Average Diurnal LAeq against EMC (Noise & Excessive Vibrations) Regulations, 2009 and WHO Noise Guidelines.

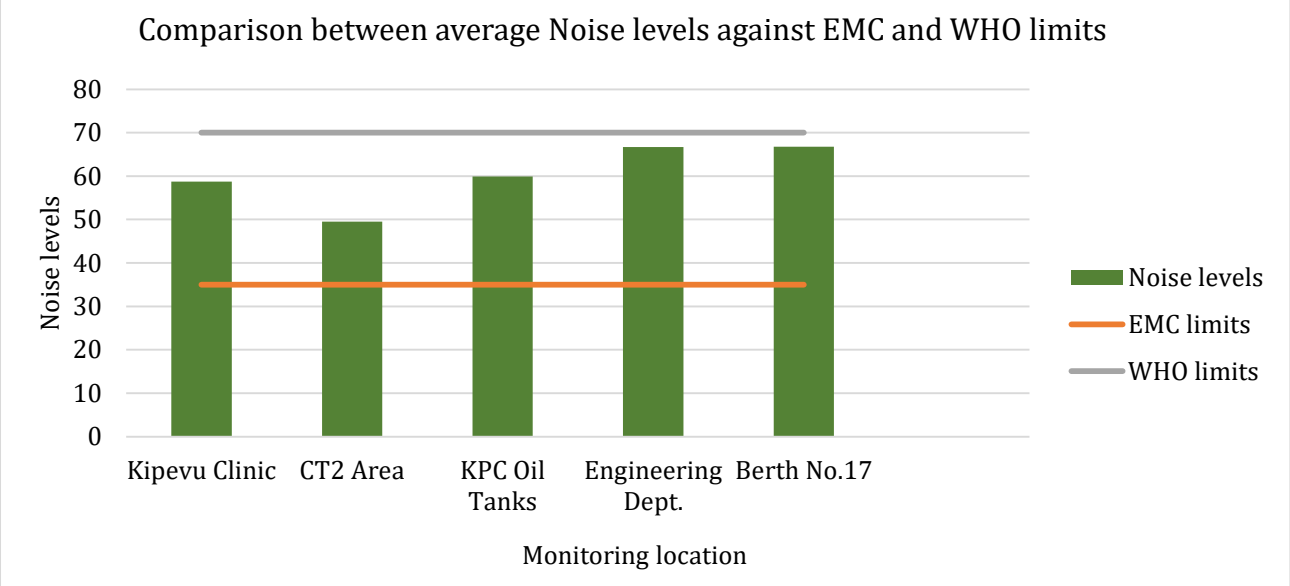


Figure 27 Average Nocturnal LAeq against EMC (Noise & Excessive Vibrations) Regulations, 2009 and WHO Noise Guidelines.

5.8 Vibration levels

5.8.1 Measurement methodology

Vibration levels were assessed using a Vibration Meter connected to a sensor, which was carefully spiked into the ground to measure acceleration, velocity, and displacement ranges. Measurements were recorded at an interval of 10 minutes each hour for a 24-hour duration. Additionally, the surveyor evaluated and documented the characteristics of the surrounding area that could have influenced the measurement results hence accounting for all fluctuations recorded during the exercise.

5.8.2 Tools and equipment

- Vibration meter

- GPS
- Digital camera

5.8.3 Vibration measurement baseline results

Determination of vibration levels was conducted using a vibration meter at locations similar to those of noise level measurement. The exercise involved determination of acceleration, velocity and displacement. Average results for each location were compared to limits set in the EMC (Noise and Excessive Vibration) (Control) Regulation, 2009 and found to within the limits. Results of baseline vibration at each of the sampled location are presented in Table 10 while detailed baseline vibration level report is in Appendix 6.

Table 10 Vibration level baseline

Location	Acceleration (mm/s2)	Velocity (mm/s)	Displacement (mm)
Kipevu clinic	0.03	0.3	0.004
CT2 area	0.02	0.3	0,003
KPC tanks area	0.03	0.4	0.005
Engineering Dpt.	O,05	0.7	0.003
Berth No.17	0.07	0.8	0,005
EMC limits	-	5mm/s	-

5.8.4 Graphical presentation of vibration baseline results

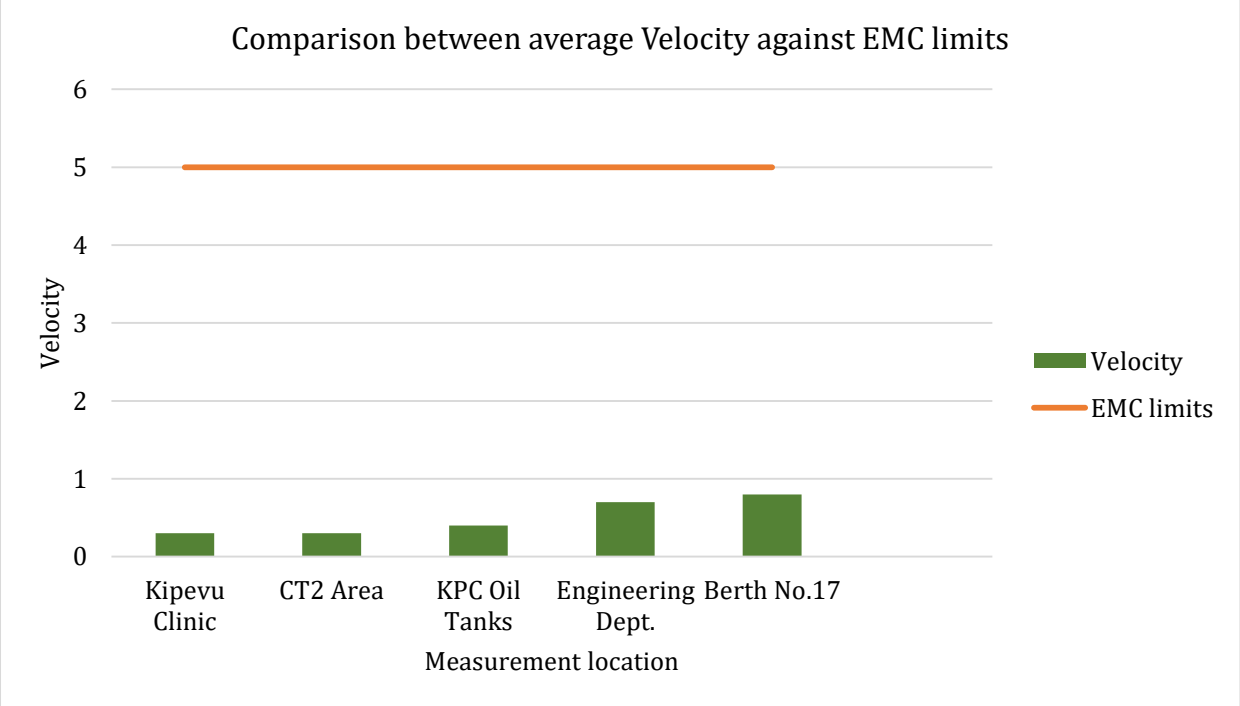


Figure 28 Measured velocity against EMC (Noise and Excessive Vibrations) Regulations, 2009

6. PROJECT DESIGN

The proposed Berth 19B development is an extension of the existing Container Terminal 1 (CT1) facility, therefore the arrangement, form of structures and general operational philosophy of Berth 19B will be consistent with those of the existing CT1. This consistency will apply to the following:

⇒ As the new berth formed by the Berth 19B extension (termed 'Berth 19') extends partially over the existing Berth 19/19A, the dredged depth alongside the new Berth 19 will be the same as the existing Berth 19/19A.

⇒ Similarly, the form of the new quay structure constructed as part of the Berth 19B is expected to be in keeping with the existing Berth 19/19A quay structure.

⇒ STS cranes e.g. span and capacity.

⇒ Pavement type.

An outline of the project design is illustrated in Figure 29

Figure 29 Outline of proposed project design

The design of berth 19B and associated infrastructure (Appendix 7) comprises the following main elements;

- ✓ Dredging works at the berth pockets and the turning basin
- ✓ Quay structures and associated quay furniture e.g., fender systems and bollards
- ✓ Revetments under the quay deck and at the return edges
- ✓ Land reclamation and ground improvement
- ✓ Stacking yards and port roads
- ✓ Electrical power supply and distribution systems

- ✓ Lighting and earthing system
- ✓ Drainage and utility systems
- ✓ Navigational aids, if required
- ✓ Security, ICT, LAN system alarm detection system and dedicated data communication
- ✓ Water supply portable and fire fighting
- ✓ Fire pumping station
- ✓ Welfare Building
- ✓ Alternative maritime power if required

6.1 Infrastructure

6.1.1 Quay Structure

Berth 19B will be designed to serve container ships of 45,000DWT and to have a design depth of C.D.L –13.5m. The purpose of Berth 19B's quay facility specifications is to integrate with Berth 19A to operate the terminal efficiently. The quay structure will accommodate the STS Crane rails, which are expected to be a continuation of the existing crane rails on the existing CT1 quay structure. Considering these operating conditions, the quay structure of Berth 19B will be consistent with the form of construction of the existing CT1 quay structures, comprising a suspended deck supported on piles. Figure 30 is a typical cross of quay.

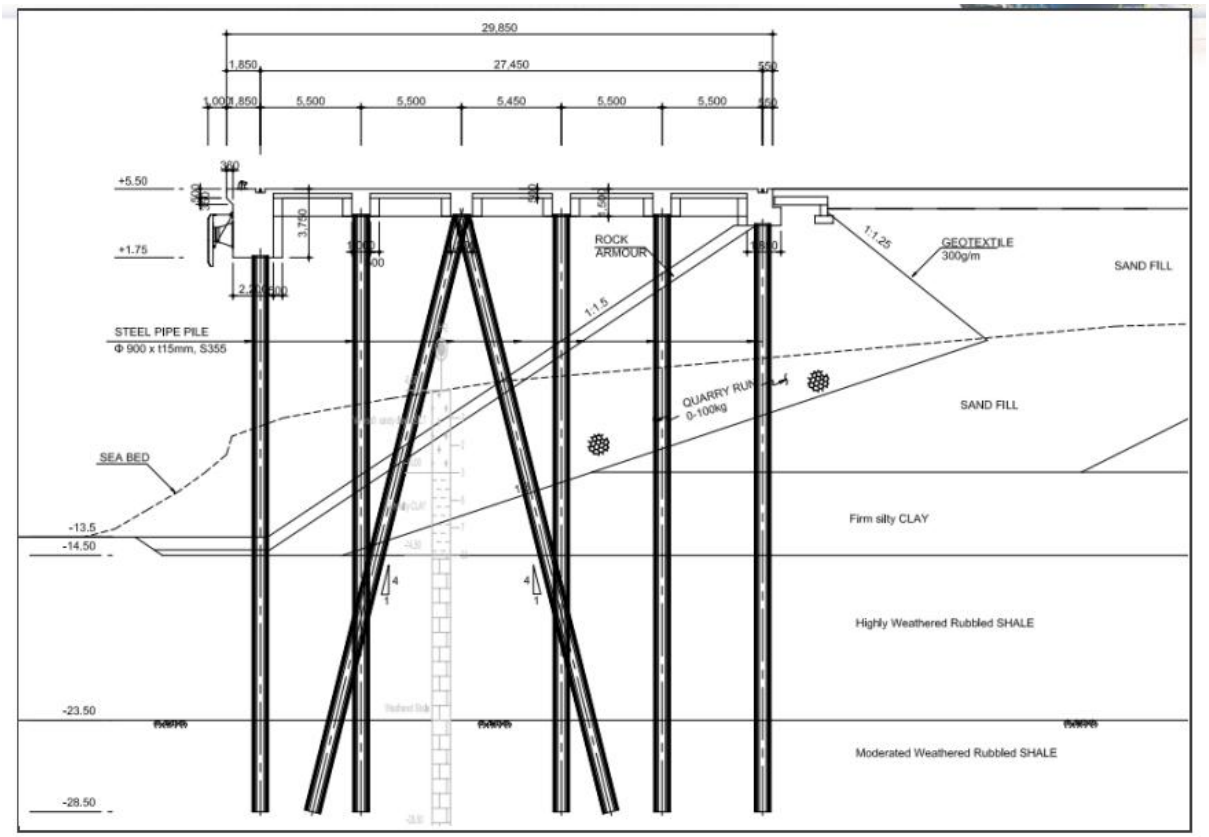


Figure 30 Typical cross-section of quay

6.1.2 Revetment

As part of the development of Berth 19B Terminal, an inclined revetment is planned to be installed along the western boundary and connected to the revetment below the quay structure. Therefore,

the structural form of the lower revetment of the quay structure and the western revetment are similar. The revetment under the quay wall structure is planned to minimize the impact of the quay structure due to differential settlement of the foundation ground, and the western revetment sets the removal range of the soft silt layer above the hardened clay layer in consideration of the safety of the revetment according to site construction. Figure 31 & 32 is a Standard Cross Section of Revetment A & B respectively.

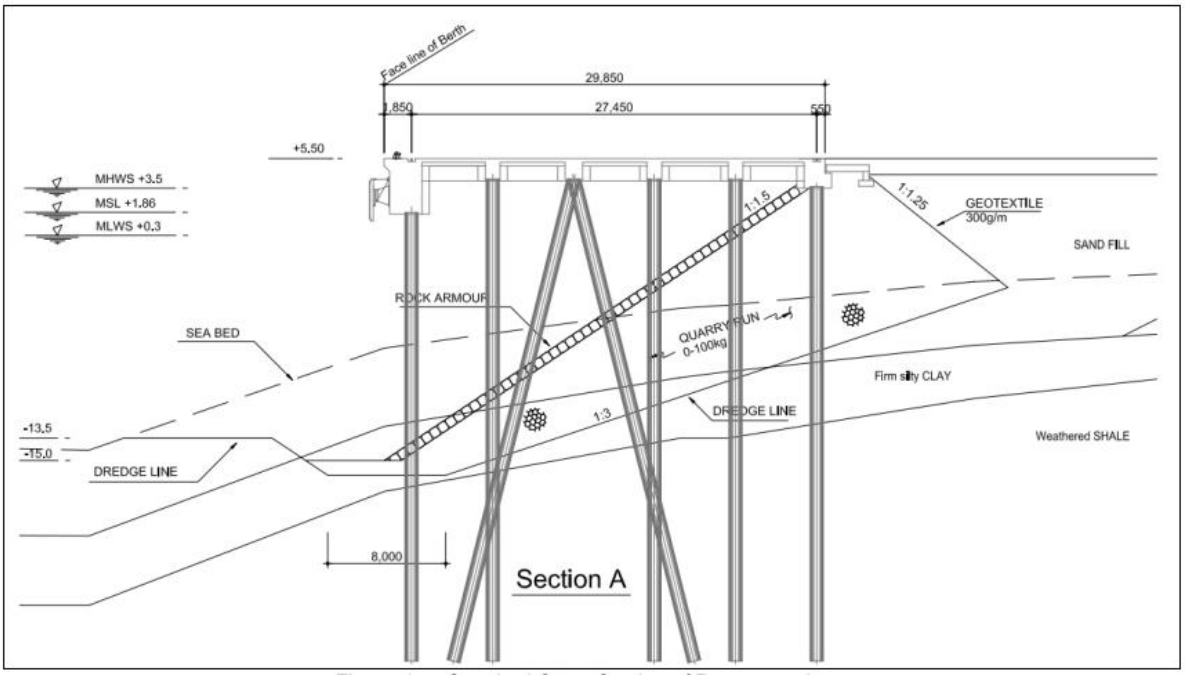


Figure 31 Standard Cross Section of Revetment A

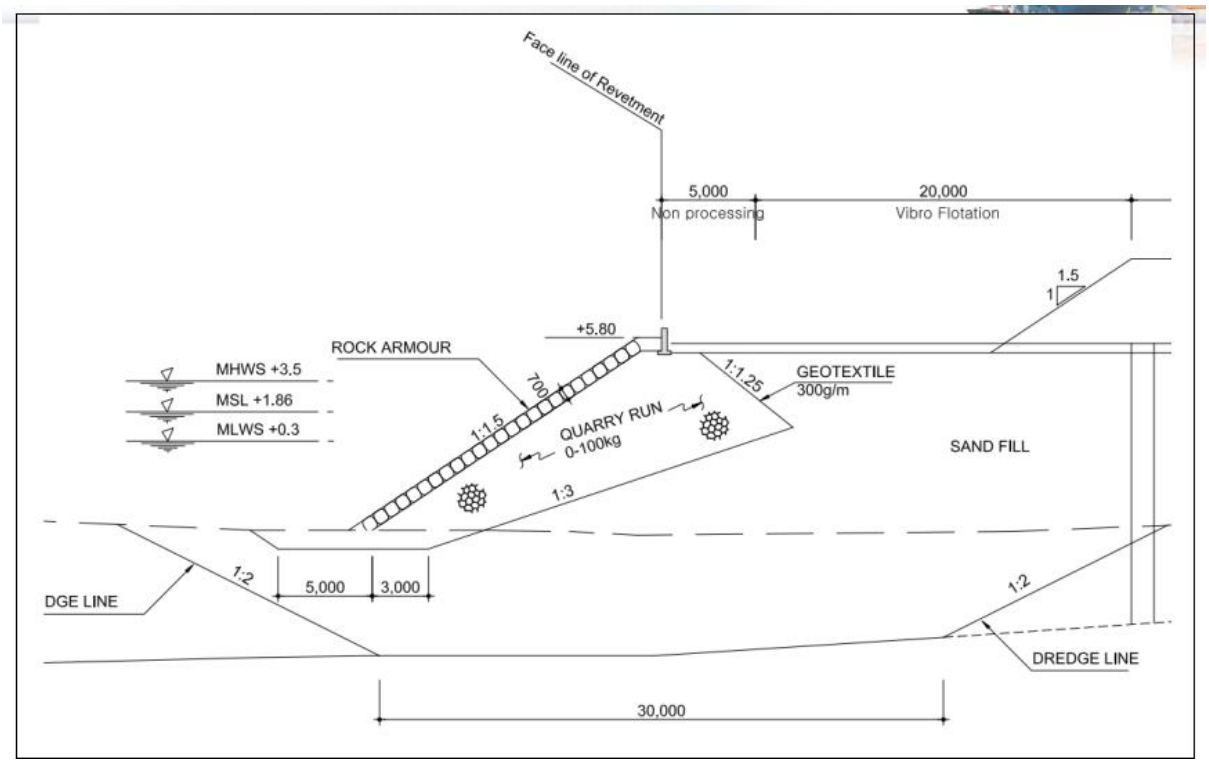


Figure 32 Typical Cross-section of Revetment B

6.1.3 Dredging and reclamation

Berth 19B development will require dredging to secure the required water depth in front of the quay wall and excavation of soil that forms a soft stratum to ensure the stability of the revetment section. The soil generated from dredging and excavation is predicted to be unsuitable for use as landfill material for site preparation, so it is planned to be disposed of at an approved offshore disposal site. In order to excavate the foundation and build a container yard at a certain height behind the revetment, landfill materials brought in from outside would be needed. Materials needed for landfill are selected from economically available materials nearby. There is a track record of using sea sand and river sand as landfill materials in the construction of Berth 19A and 20~21 terminals. In this review, KPA plans to use sea sand as landfill material. The stratum created by sand reclamation must secure the required bearing capacity through appropriate ground treatment methods. In addition, the soft silt layer remaining at the bottom of the buried sand layer is prevent for consolidation settlement by applying a vertical drainage method. Sand replacement and reclamation works will be executed in the following sequences (Figure 33); excavation under revetment, sand filling after excavation, sand filling of behind area of Berth 19B, reclamation from deeper area up to specified elevation, final filling of revetment. It is estimated that dredging will generate about 210,000 ㎥ of dredged material that will be disposed and that sand volumes to be harvested will be about 400, 000 ㎥ for reclamation, 130,000 ㎥ for surcharge and 135,000 ㎥ for revetment quarry run.

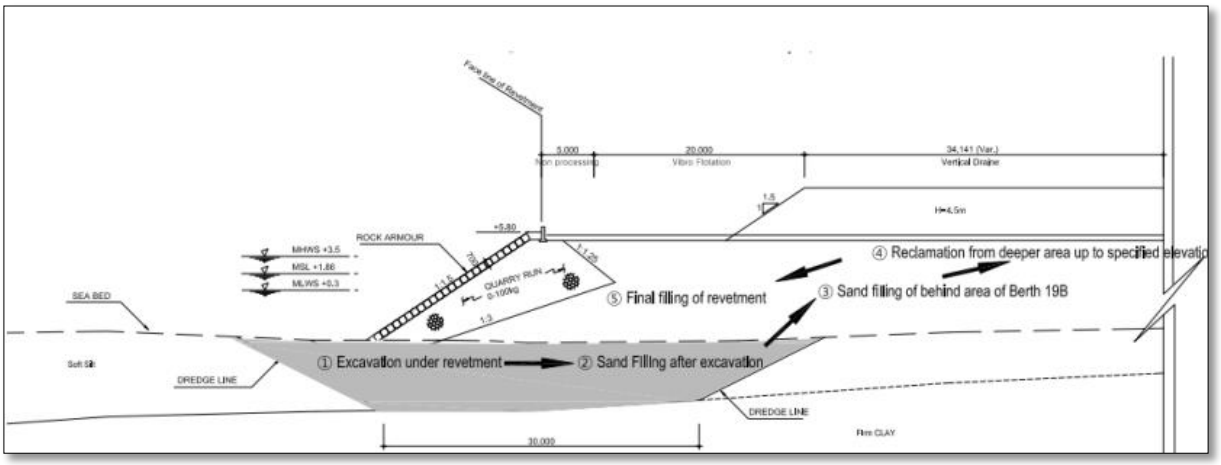


Figure 33 Sequence of reclamation works

6.1.4 Soil Improvement

In the Berth 19B development site, excluding the existing landfill including the existing KOT facility, the seafloor is distributed from the coastline to a depth of 0.0m to 14.0m. The stratum that affects the operation of the container terminal due to ground subsidence among the seafloor is a 3m to 6m thick soft silt layer distributed at the top. In addition, the ground formed by sand reclamation has a loose density, so there is a possibility that it may cause settlement due to the impact load of operating equipment. According to the result of the soil investigation at the site, the clay layer to be improved shows a uniform nature from the existing ground surface to the

bottom of layer. The thickness of clay layer will be improved by perforated vertical drains (PVD) and consolidated by a surcharge material varies 2.0m to 3.0m at the Container yard. The soil improvement plant is presented in Figure 34.

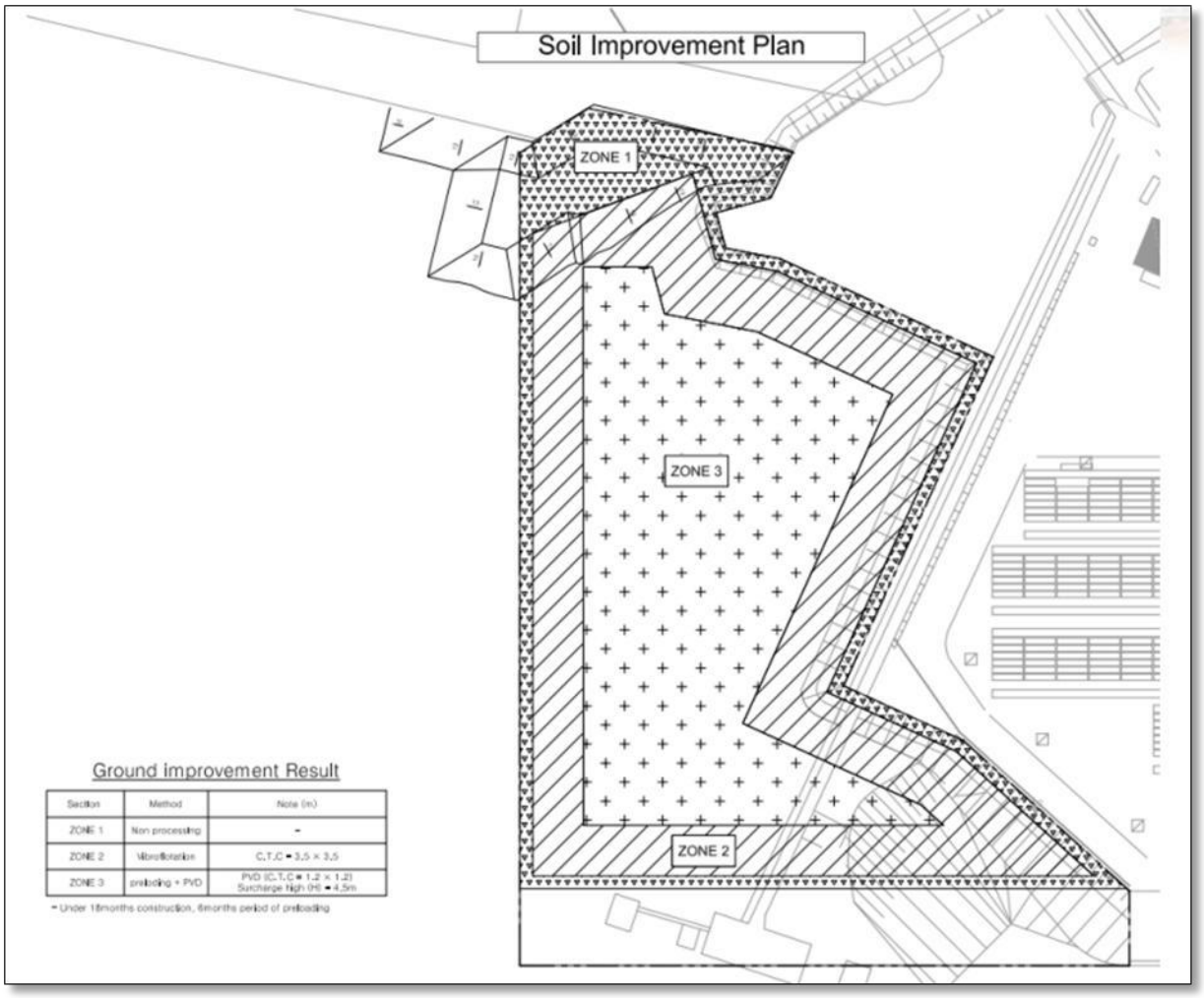


Figure 34 Zoning of soil improvement

6.1.5 Pavement

The yard pavement area is planned to be on reclaimed land. For pavement design, it is assumed that the reclaimed material is fine sand and that it will undergo a soil improvement by perforated vertical drains and consolidated by a surcharge material. It is also assumed that the reclaimed material (sand) is a fine sand with a unified classification SP-SM and an AASHTO Classification A-3(0). The yard pavement shall be determined in consideration of the traffic volume, design wheel load, durability, maintenance. The type of yard pavement preferred is basically the flexible type of Concrete Block pavers (CBP) pavement terminal area in consideration of long-term continuation of the settlement of existing ground even after soil improvement. Concrete Block Pavers has become popular recently for pavement of port terminals on reclaimed area because of ease of repairing without any special equipment. Some specific areas such as RTG (Rubber Tired Gantry Crane) maintenance area requires specific pavement according to the purpose of use. Figure 35 shows paved type per zone of the yard.

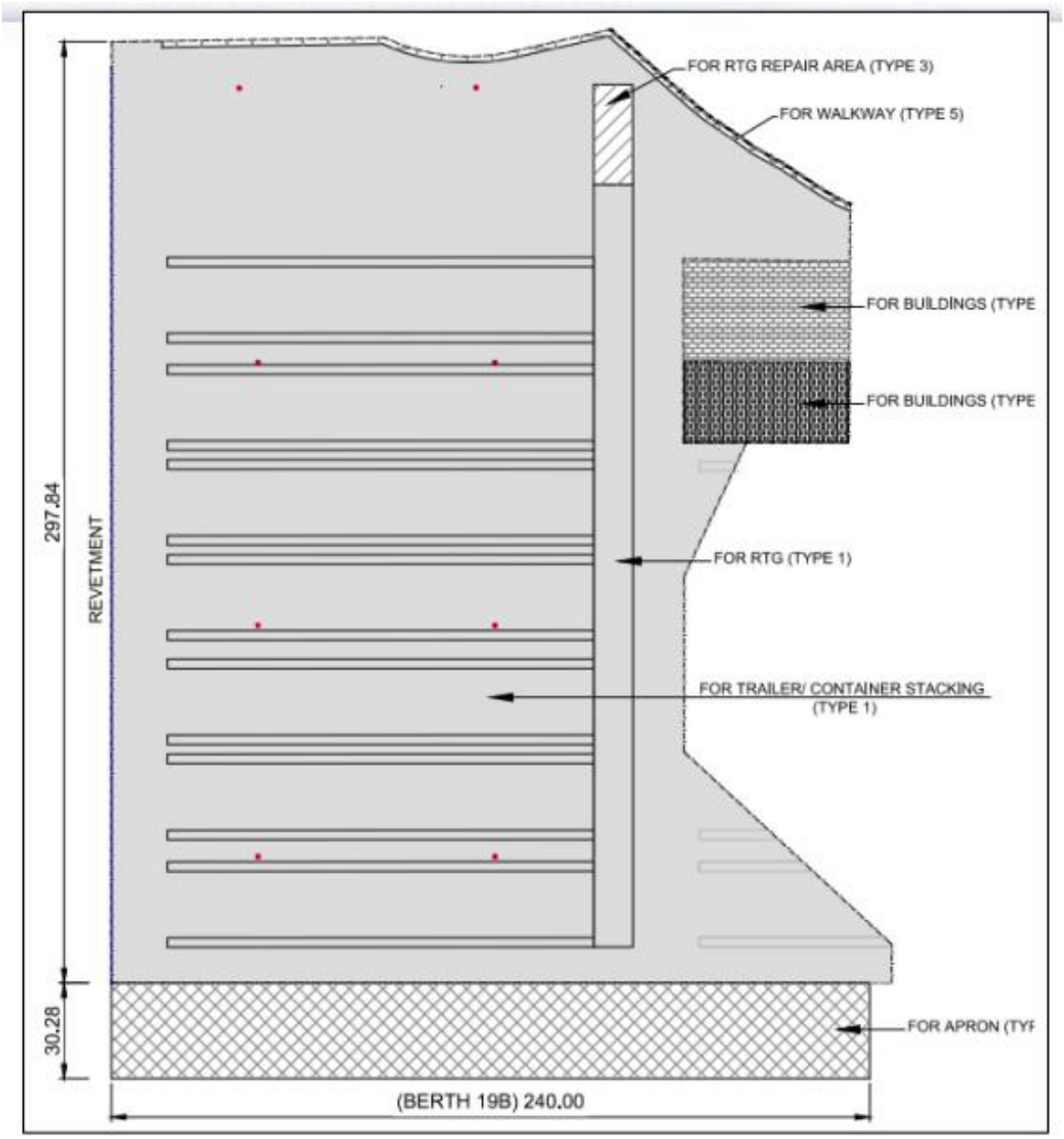


Figure 35 : Pavement type and zone

6.2 Utilities and Services

Utilities and services to be provided as part of the Berth 19B development include:

- ⇒ Water supply
- ⇒ Drainage
- ⇒ Electricity power supply and communication

6.2.1 Water supply

The water supply will be to buildings, vessels, for washing and for fire fighting. Projected total daily water demand to all stated utility point is 280m^3. Water supply to buildings is estimated to be at unit rate of 50~60 l/personnel/day. It is estimated that water supply to vessels will be 120m^3/day per vessel will be sufficient to meet the demand for the vessels. Washing water will be

used at the washing container. It is estimated that 20 m^3/day will be needed for this purpose. Fire fighting water (using water from vessel as fire fighting water in case of fire) is estimated to be 120m^3. Portable and non- portable water will be supplied to the identified utility point of which 80% of the supply will be portable water while 20% will be non-portable water. Portable water will be supplied from the extension of the existing line from rest of the port area, while non-portable water will come from Treated Water Recycling Facility. Portable water will be reticulated for safe water use (Kitchen, lavatory, fire fighting and Vessel water) while non-portable water will be reticulated for flashing or water closet and urinal.

6.2.2 Drainage

The pavements shall have a slope of approximately 0.5 to a maximum of 1.5 % to ensure smooth container handling and adequate rainwater runoff management. The general plan of the catchment area, main route of storm water drainage and outlets is presented in Figure 36.

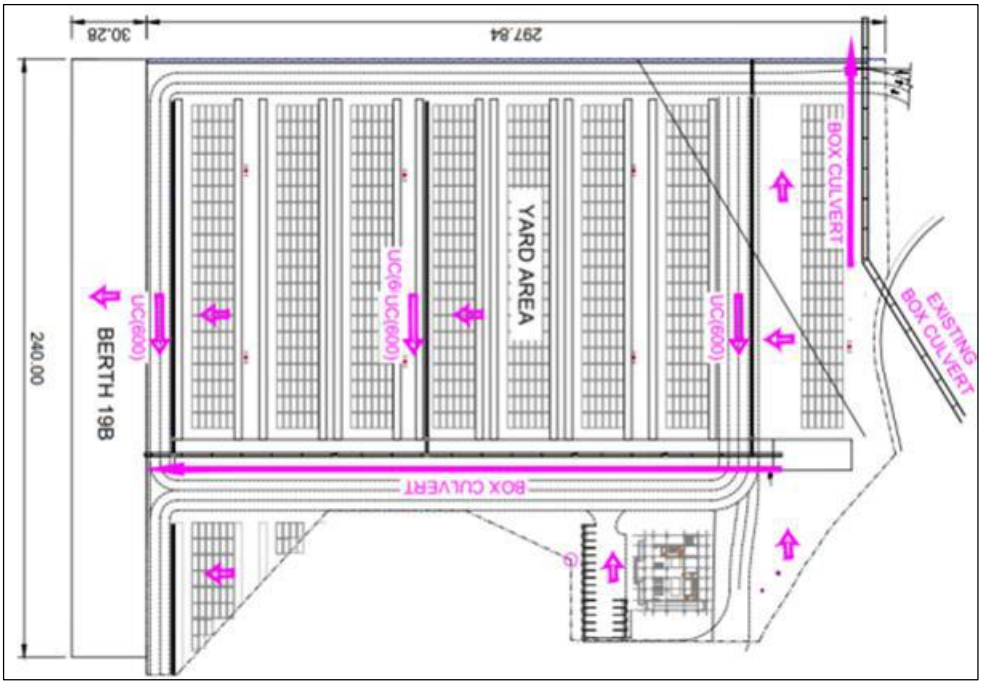


Figure 36 General Layout Plan of Storm Water Drainage for Container Terminal

The drainage system designed for storm water on the container terminal is considered to discharge water into the sea via a main drainage route.

6.2.3 Electricity power supply and communication

The electrical power supply to Berth 19B shall be obtained through breaking the ring at the new Substation R through suitably sized 11kV air circuit breakers to feed a common bus-bar at the designated substation. At the substation, the bus-bar shall feed the main step-down transformer (11kV to 415V ac) via another Air Circuit Breaker at 11kV, 4no. Step-down transformers (11kV to 3.3kV) each supply one of the four proposed ship-to-shore gantry (SSG) cranes and on yet to be determined number of reefer points, also via a 11kv to 415V transformers per reefer point. To continue the ring, an outgoing circuit shall be provided through a suitably sized 11kV circuit

breaker to run in the direction of substation to the main low voltage distribution board supplied from the low voltage side of the main substation transformer, through an appropriate low voltage circuit breaker shall be the main source of the low voltage for high masts yard lighting, road lighting, office utility power supply and other low voltage loads. For this reason, it will be necessary to generate clean power for supply and control of sensitive equipment. A suitably sized standby diesel driven electric generator shall be designed to supply essential services in the yard, welfare building and other essential facilities inside the project. The electrics shall be appropriately connected to the low voltage bus-bar of the utility system and provision made for Automatic Transfer Switching during utility power outages.

To develop a supporting fundamental ICT infrastructure that will enable KPA to introduce computer applications and services that will be integrated into the existing system, a high-speed Fibber Optic Cable (FOC) data transmission backbone will be built to support port operations in Berth 19B.

6.3 Buildings

Building that will be constructed will include welfare facilities building providing additional welfare facilities for the labour force of the terminal. Inside the building will feature changing rooms, toilets, showers and associated facilities.

6.4 Cost Estimates

The capital expenditure for the implementation of Berth 19B includes the construction of quay and terminal structures, service utilities, buildings, security and ICT infrastructure, and port operating equipment. Breakdown of project cost estimates is presented in Table 11 and in Appendix 8.

Table 11 proposed project cost estimates

Item of work	Cost (USD)	Remarks
General Requirement	14,040,000.00	Mobilization, Temporary works, Survey Works, Soil Investigation, Security and insurance, Environmental management, HIV/Aids Management, Engineer Requirement, Engineer Expense, Demobilization
Civil Works (Container Terminal)	97,230,000.00	Dredging & Reclamation, Revetment & Retaining wall, Container berth no.19B, Soil improvement works, Pavement Works & Storm water Drainage
Utility Works	7,520,000.00	Water supply system, Sewerage system, electrical works, LAN system, ISS camera system, dedicated data communication
Building Works	3,240,000.00	Welfare facilities & firewater pumping station
Total	**122, 030,000.00**	Direct construction cost

At the current conversion rate of 1 USD = KES 130 this comes to **KES 15,863,900,000**. The ESIA Review Fees payable to NEMA is 0.1% of this value, hence **KES 15,863,900.00**

7. ANALYSIS OF ALTERNATIVES

During the project design alternatives for implementation of the project are being considered and reviewed for their economic and environmental suitability. The alternatives considered were as follows:

7.1 The 'No Project' Alternative

Under this option the project would not be implemented and the positive gains expected to accrue from implementation of the project would not be realised. This alternative appears unfavourable to the proponent as it will negate efforts being put in place by KPA to decongest the Port of Mombasa by providing additional berthing facilities and container storage yards.

7.2 The 'Yes' Alternative

The Yes Alternative gives a go ahead for the project implying that the Construction of Berth 19B and associated infrastructure would be implemented as currently proposed. The implication of this alternative is that the envisaged benefits of overall improvement of port efficiency by construction of an additional berth and container storage yard will be realised. This is the option preferred by the proponent.

7.3 Alternative Project Locations / Designs

Three locations and designs were considered within the project area as follows:

7.3.1 Option A

This involves extending the existing the existing Container Terminal (CT 1) westwards towards Container Terminal 2 (CT 2) to create a 240m quay line and 5.6ha additional yard area as illustrated below. After cost and operational considerations this was the option chosen by the proponent.

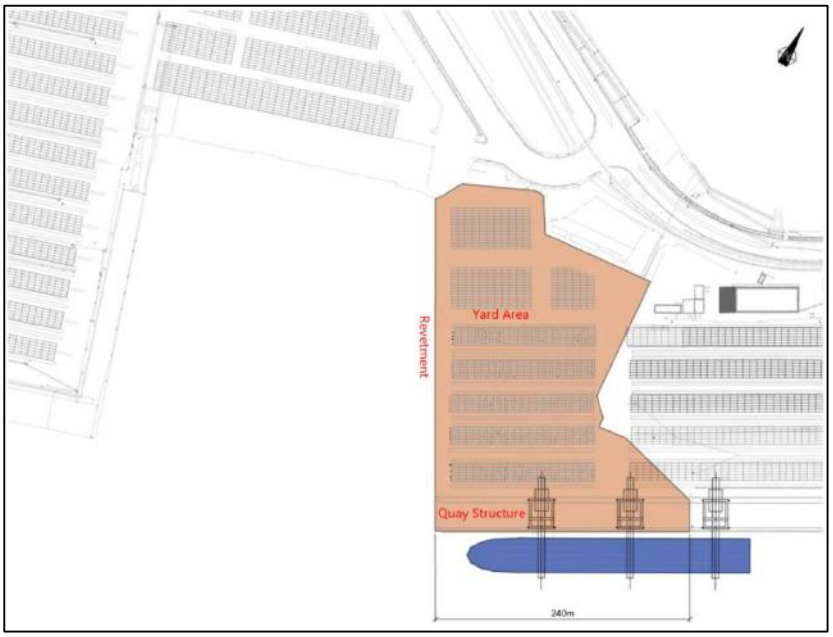


Figure 37 Approx. 240m quay extension of CT 1, additional 5.6ha yard area.

7.3.2 Option B

This design option considered extending the second container terminal (CT2) eastwards towards CT 1 to create a quay line of approximately 300m quay and additional yard area of 9.8 hectares. Whereas this option would have created a longer quay line and a larger container stacking yard it would have blocked off the existing small vessel berths and the berthing line to the east of Berth No. 20. The potential gains would therefore have been wiped out. In addition, the option would have been much more expensive to implement, hence was abandoned

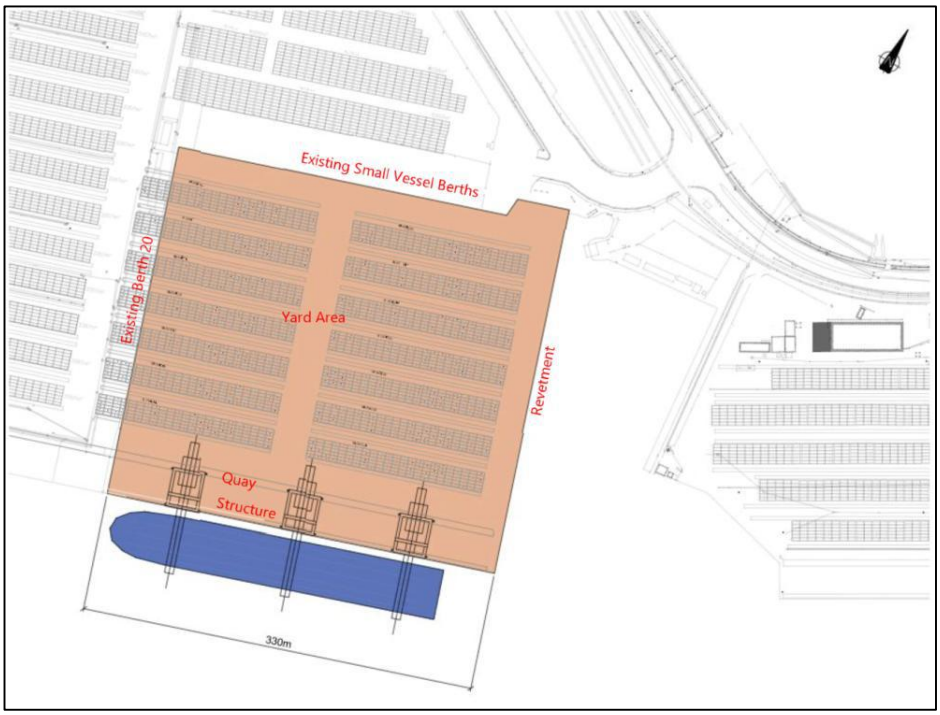


Figure 38 Approx. 300m quay extension of CT 2, additional 9.8ha yard area.

7.3.3 Option C

This option considered extending the second container terminal (CT2) by approximately 330m eastwards towards CT 1, and also extending CTI by approx. 240m towards CT2. This would be almost equivalent to a merger of options 1 and 2, and would have created an additional yard area 14.4ha. Despite creating a much larger yard area this option was abandoned because it would also have blocked off the existing small vessel berths and the berthing line to the east of Berth No. 20, and despite the much higher implementation cost it would only create 2 berthing areas.

Figure 39 240m quay extension to CT1, 330m extension to CT2, 14.4ha additional yard area

7. OCCUPATIONAL SAFETY AND HEALTH

8.1 Safety and Health Program

Effective management of worker safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. The proponent of the proposed project will develop and document an effective safety and health program for the workplace. The programme will cover among other things general elements that are critical to the development of a successful safety and health management program at the workplace in line with the provisions of the Occupational. These elements include:-

- ✓ Management commitment and employee involvement.
- ✓ Worksite analyses.
- ✓ Hazard prevention and control.
- ✓ Safety and health training.

It is essential that management will be fully committed to work safety and insist that all employees be involved. Employers will be required to provide a place of employment free from recognized hazards. To achieve this end, management will ensure that hazards are identified and effective hazard controls are developed, implemented, and remain in continuous use. Persons responsible for safety in the facility will be clearly identified.

Identification of hazards and associated safe work practices will be accomplished by conducting a system safety analysis of the facility and operations. Various techniques such as a Job Safety Analysis, which breaks jobs into a sequence of steps that can be more easily addressed, will be applied. Safety analyses will be performed formally with detailed operational procedures. Analysis will initially be accomplished on operations where experience indicates accidents and injuries are most likely to occur.

As a part of an effective safety program, management will:-

- ✓ Ensure compliance with safety and health regulations
- ✓ Establish an effective training program
- ✓ Establish emergency preparedness plans
- ✓ Establish necessary controls for visitors and outside contractors
- ✓ Ensure that the safe work practices contained in the report are evaluated and applied where applicable.
- ✓ Ensure that all equipment and machinery are in a safe operating condition, are capable of safely performing the job for which they are used, and are regularly maintained and inspected.
- ✓ Ensure that adequate procedural controls are developed and implemented for hot work, confined space entry, and other potentially hazardous operations.
- ✓ Establish and enforce general safety rules.

8.2 Berth and associated structures construction, use and operation safety

8.2.1 Safe System of Work

To ensure safe system of work during construction, use and operation of the berth and allied marine structures, the following will be adhered to:

- ✓ A task-specific risk assessment for work over/near marine water will be conducted and reviewed periodically by a competent person.
- ✓ All potential hazard(s) involved in the work over/near marine water, e.g. drowning, overturning of mobile plant/equipment into water and collapse in confined spaces, should be identified, listed out and addressed.
- ✓ A safety plan for work over/near marine water, including but not limited to the following, should be established:
  i. Planning of work.
  ii. Formulation of method statements/safe working procedures
  iii. Emergency preparedness, e.g. contingency plans, rescue/evacuation arrangements and drills.
- ✓ The safety plan for work over/near marine water should be regularly reviewed and, where necessary, revised as appropriate.
- ✓ Safe work methods should be properly implemented according to the safety plan.
- ✓ Implementation of safe work methods should be adequately monitored and supervised.
- ✓ Necessary safety information, instruction and training should be provided to workers.

8.2.2 Safe Use of Lifting Appliances/Mobile Plant

When using lifting equipment over or near marine waters the following should be adhered to:

- ✓ Lifting appliances and lifting gear should be tested and examined by a competent examiner before use and at regular intervals and inspected by a competent person at regular intervals.
- ✓ Lifting appliances/mobile plant should be operated by qualified operators.
- ✓ Operators of lifting appliances/mobile plant on vessels should be authorised by the master or owner of the vessel/ the site management before carrying out any work.
- ✓ Operation of lifting appliances/mobile plant should be supervised by works supervisors.
- ✓ Lifting appliances on vessels should be fixed and securely anchored.
- ✓ Lifting appliances/mobile plant should be kept away from dangerous locations such as openings, edges close to water.
- ✓ The operation zone should be clearly demarcated and properly fenced off.
- ✓ A signaller should be provided if the view of the operator is obstructed.
- ✓ No lifting appliance/mobile plant or lifting gear should be loaded beyond its safe working load.
- ✓ Lifting appliances/mobile plant and lifting gear should be properly maintained in safe working condition.

8.2.3 Safe Use of Lifejackets/Buoyancy Aids

To ensure safety of workers working near or over marine waters during berth construction and associated works, they should be provided with lifejackets and or buoyance aids. In providing and using lifejackets and or buoyance aids the following should be adhered to:

- ✓ Lifejackets/buoyancy aids should be provided to and worn by workers with risk of falling into water.

- ✓ Lifejackets/buoyancy aids should conform to international standards relevant to local working conditions.
- ✓ Lifejackets should be thoroughly checked by the user before each use.
- ✓ The lifejackets/buoyancy aids should be properly maintained in a good serviceable condition according to the manufacturer's instructions.
- ✓ All inflatable lifejackets should be serviced by an authorised agent at least once a year.

8.2.4 Working at Height

To ensure the safety of working at height near or above marine waters the following should be done.

- ✓ Suitable guard-rails and toe-boards should be installed at edges. Openings should be properly covered where persons are liable to fall from height, to land surfaces or into water.
- ✓ Suitable working platforms, with suitable guard-rails and toe-boards, should be provided for work at height. Safe means of access and egress should be provided for the working platform.
- ✓ Safety harnesses with continuous and effective anchorage system should be provided when it is impracticable to provide a suitable working platform, access and egress and safe place of work.

8.2.5 Safe Means of Access and Egress

- ✓ Safe means of access and egress should be provided between a vessel and:-
  - i. Another vessel
  - ii. The shore
  - iii. A workplace on land/over water
- ✓ Means of access and egress and their approaches should be free from obstruction and, as far as practicable, kept clear of any substance likely to cause a slip, trip or fall.
- ✓ A lifebuoy with a buoyant safety line of 30 metres long should be available for use, and the locations of lifebuoys should be at less than 50-metre intervals along the edges of places, in vicinity for access aboard vessels. To avoid any delays to rescue operations, lifebuoys should not be tightly tied to posts.
- ✓ Ramps of adequate strength should be provided for the access of vehicles from land to vessels, or vice versa.
- ✓ Ramps for vehicles should not be used as access gangways for people unless a suitable separation is provided.

8.2.6 Rescue and Emergency Arrangements

- ✓ Emergency procedures, including rescue/evacuation procedures, should be formulated and reviewed regularly in the safety plan for, but not limited to, adverse weather, fire, and injuries of workers.
- ✓ An emergency contact list (internal and external) should be displayed on board.
- ✓ An effective communication system should be established between front-line workers and supervisory staff in case of emergencies, including:
  - i. Provision of sufficient communication equipment
  - ii. Formulation of relevant procedures

iii. Provision of necessary information to supervisors/workers concerned.

- ✓ Necessary information on adverse weather should be made available from Kenya Meteorological Department (including any specific data/forecast to be prescribed with due regard to the peculiar site location/situation) or other reliable sources and timely/effectively communicated to personnel/workers likely affected by the weather.
- ✓ Shelters, vessels for evacuation from adverse weather, should be provided in the vicinity of workplaces over/near water.
- ✓ Evacuation procedures should be timely launched with due regard to impending adverse weather
- ✓ Rescue/evacuation teams (including first aiders) of suitable capacity should be organised to deal with emergency situations.
- ✓ The occurrence of an emergency situation should be informed immediately to the rescue team for immediate launching of appropriate rescue procedures.
- ✓ Serious emergency situations should be reported immediately to the relevant authorities including KPA Fire Services Department if required
- ✓ Sufficient rescue/evacuation boat(s) should be provided and kept ready for immediate use in case of emergency.
- ✓ Rescue facilities, including sufficient stretcher(s), portable resuscitation equipment and first aid facilities, should be provided and kept readily accessible for emergency use.

8.2.7 Safety Training

- ✓ Workers should undergo Mandatory Basic Safety Training for land-based construction work and marine construction work.
- ✓ Job specific safety training and regular refresher training should be provided to workers to enhance/maintain their safety awareness of potential hazards associated with work over water/near water/on vessels, including those during inclement weather.
- ✓ Specific safety training should be provided to workers on the use and checking procedures of lifejackets, and rescue arrangements for persons who fell into water.
- ✓ Supervisors/workers should be trained on emergency and evacuation procedures, including the conduct of regular drills, in respect of work over water/near water/on vessels.
- ✓ Specific safety training should be provided to all members of the rescue/emergency team in connection with rescue procedures and the use of rescue equipment.
- ✓ Essential safety information and contingency arrangements should be provided (such as by issuing portable safety cards) to workers engaged in work over water/near water/on vessels.

9. STAKEHOLDER CONSULTATIONS AND PUBLIC PARTICIPATION

9.1 Stakeholder mapping

Mapping of Stakeholders was done to generate an analysis that the Project Proponent used to further determine which Stakeholders will be the most useful to engage with. Stakeholder mapping enabled the evaluation of stakeholders that were affected by the proposed project and those that had an interest in the proposed project. Stakeholders mapped are listed below.

9.1.1 Government Institutions

- ✓ Kenya Port Authority
- ✓ Communications Authority of Kenya
- ✓ Coast Development Authority
- ✓ Kenya Fisheries Service, Mombasa Region
- ✓ Kenya Marine Fisheries Research Institute
- ✓ Kenya Coast Guard Services
- ✓ Kenya Fishing Industries Corporation
- ✓ Kenya National Shipping Line Limited
- ✓ Kenya Forest Service - Coast Conservancy
- ✓ Kenya Maritime Authority
- ✓ Northern Corridor Transit and Transport Co-ordination Authority
- ✓ Kenya Forest Service Mombasa County
- ✓ Kenya Pipeline Company Limited
- ✓ Kenya Railways Mombasa Office
- ✓ Bandari Maritime Academy
- ✓ Kenya Navy
- ✓ County Government of Mombasa

9.1.2 Civil society groups and Associations

- ✓ World Wide Fund for Nature
- ✓ Coastal and Marine Resource Development (COMRED)
- ✓ CORDIO East Africa
- ✓ Wildlife Conservation Society
- ✓ Eco Ethics International Union- Kenya (Eco-Ethics)
- ✓ Kenya Association of Hotel Keepers and Caterers
- ✓ Kenya Association of Tour Operators (KATO)
- ✓ Kenya Transporters Association (KTA)

9.1.3 Private Companies

- ✓ Grain Bulk Handlers
- ✓ Kenya International Freight and Warehousing Association
- ✓ Africa Gas and Oil Limited (AGOL)

9.1.4 Beach Management Units (BMUs)

- ✓ Bonje BMU
- ✓ Guya BMU

- ✓ Kitanga Juu BMU
- ✓ Mkupe BMU
- ✓ Mtongwe BMU
- ✓ Mwadumbo BMU
- ✓ Mwangala BMU
- ✓ Ngare BMU
- ✓ Tsunza BMU
- ✓ Tudor-Shimanzi BMU
- ✓ Old Town BMU
- ✓ Likoni BMU
- ✓ Bamburi BMU
- ✓ Marina BMU
- ✓ Kidongo BMU
- ✓ Shika Adabu BMU
- ✓ Timwani BMU
- ✓ Nyali BMU
- ✓ Jomvu Kuu BMU

9.1.5 Academia

- ✓ The Director, JKUAT, Mombasa CBD Campus
- ✓ The Director, Kenya Methodist University, Mombasa Campus
- ✓ The Director, Kenyatta University, Mombasa Campus
- ✓ The Director, Mount Kenya University, Mombasa Campus
- ✓ The Dean, School of Environmental and Earth Sciences, Pwani University
- ✓ The Chair Person, Environmental and Health Sciences Department, TUM
- ✓ The Director, University of Nairobi, Mombasa Campus
- ✓ The Director, Bandari Maritime Academy

9.1.6 Political Leadership

- ✓ Governor Mombasa County
- ✓ Senator Mombasa County
- ✓ Women Rep Mombasa County
- ✓ Member of Parliament Mvita Constituency
- ✓ Member of Parliament Changamwe Constituency
- ✓ Member of Parliament Nyali Constituency
- ✓ Member of Parliament Jomvu Constituency
- ✓ Member of Parliament Kisauni Constituency
- ✓ Member of Parliament Likoni Constituency

9.1.7 Mvita Sub- County Administration

- ✓ Mvita Sub-County Administrator
- ✓ Ward Administrator Tononoka Ward
- ✓ Ward Administrator Majengo Mwembe Tayari Ward
- ✓ Ward Administrator Ganjoni Shimanzi Ward
- ✓ Ward Administrator Mji Wa Kale Ward

- ✓ Ward Administrator Tudor Ward

9.2 Stakeholder Consultation methods

Methods used to consult various stakeholders include Focus Group Discussions, workshops and public meetings/ Baraza. Focussed Group Discussions were in the form of kick off meeting, site meetings and meetings with BMUs. Workshops brought together all mapped stakeholders specifically government institutions, civil society groups and private companies into one forum. All stakeholders thereafter converged in an open public meeting/ baraza each stakeholder participated in the consultative process. Invitation letters (Appendix 9) we sent out to stakeholders inviting them to the consultative meetings.

9.2.1 Focus Group Discussion

The first Focus Group Discussion held was in form of a kick off meeting between the Project Proponent (KPA) and the Project Consultant (Yooshin Engineering Corporation). It was held on 19th January 2024 at the KPA board room where the proposed construction of Berth 19B was discussed .Detailed discussions of this meeting are as per attached minutes in Appendix 10.

9.2.2. Site meeting

A site meeting was held between the KPA's Project Engineers, The Project Consultant, KPA's Environment Health and Safety Officers and EIA Team of Experts. The meeting served as a site recognisance for the EIA Team of Experts and also for the Project Proponent to explain port safety requirements for the EIA Team and what the team need to observe while undertaking the assessment. Appendix 11 captures minutes of the site meeting while plate 3 captures images taken during one of the stakeholder site meetings.

Plate 3 proposed Berth 19B stakeholder consultations Site meeting participating

9.3 Consultations BMUs from Mombasa County BMU Network

The consultation and public participation workshop with Beach Management Units (BMUs) from Mombasa County BMU Network was held at Royal Court Hotel on 15th April 2024. Key issues that were discussed included; distance from the dredging site to dumping site, distance from the dumping site to the nearest landing site, dredging method to be used, piling technology to be used, ways to mitigate oysters death, involvement of BMU on throughout the project cycle and procuring of mangrove seedlings from communities for restoration of mangrove degraded areas. Details of the list of participants and minutes of the proceedings of the workshop are in appendix 12.

Plate 4 Officials from MBUs of Mombasa County Network discussing the proposed project

9.4 Consultations with Lead Agencies Civil Society and Academia

Stakeholder consultation and public participation workshop with government agencies, academia, civil society groups and private sector was held at royal Court Hotel on 17th April 2024. Key issues that were discussed included proposed dredging depths, proposed source of reclamation materials, project alternatives, sources of water that is to be used in the project, energy to be used in the port to be from renewable sources, impacts of dumping of dredged materials, impacts of sand harvesting, impacts on marine cables, traffic management measures that need to be put in place, land planning requirement for reclaimed land. Details of the list of participants and minutes of the proceedings of the second stakeholders' workshop are in appendix 13.


Plate 5 Proceedings during the second stakeholder consultative meeting

9.5 Public Baraza

Public Baraza was conducted on 14th August 2024 at Tononoka Social Hall in Mvita Sub county where the project is domiciled. Tononoka Social Hall was chosen because it is easily accessible by public transport and it has a very high capacity, capable of holding over 1000 people seated. The hall has wide open doors with shaded verandas that can seat another about 500 people if required. The meeting was chaired by the Mvita Sub-county Assistant County Commissioner on behalf of the Deputy County Commissioner and was attended by senior officials of KPA, the project consultant, political leaders and the local administration (area chiefs and ward representatives). Key issues that were discussed included; impacts on marine habitats, fishermen compensation, employment for local people, benefits to Mombasa County, youth training opportunities, facilitation of BMUs with modern fishing equipment to venture into deep sea fishing and marine restoration project. Details of deliberations of this meeting are attached as Appendix 13.




Plate 6 Proceedings during the public participation meeting at Tononoka Social Hall

10. POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

10.1 Potential Positive Impacts

Potential positive impacts during the construction phase of the proposed project will include the following:

- ⇒ Employment opportunities
- ⇒ Support to existing local businesses
- ⇒ Technology transfer

During operational phase potential positive impacts will include the following:

- ⇒ Increase container handling capacity of the port.
- ⇒ Optimisation of Container Terminal 1 (CT1) into a four-berth terminal.
- ⇒ Sustain business growth.

10.1.1 Employment opportunities

Construction of the proposed project will likely create direct employment opportunities. Direct labour force will be required in all site construction activities. Other direct employment opportunities will include in the area of equipment operators such employees who will be hired to operate equipment used on site. This and other construction activities will create employment to the local community. The project also will provide indirect employment opportunities, in terms of service providers who will benefit from clientele drawn from workers at the proposed project site, other service providers such as transporters who will be hired to ferry construction equipment and materials into the site.

10.1.2 Support to existing local businesses

Once the implementation of the proposed project begins and local people and others get hired at the construction phase, they will be remunerated for their work. This will translate to more money available in the pocket hence improved purchasing power. Local businesses are likely to benefit from improved purchasing power of people in the area as a result of their remuneration. There is likelihood that there will be more money in the pockets of people who will be directly or indirectly employed in the project and that part of the money will be spent in the local economy hence benefits local businesses.

10.1.3 On-job training opportunities for local people

Implementation of the proposed project will present an opportunity for onsite kill development for and acquisition of experience for local people who will be involved in the project. During the construction phase labour sourced locally will present an opportunity to learn construction marine construction technologies.

10.1.4 Increase container handling capacity of the port

Container handling volume at the Port of Mombasa has increased by more than 60% since 2012, and is now approaching 1.5 million TEUs per year. To further enhance the handling capacity of the Port and support a long-term sustainable development plan, expansion of the existing container facilities at the Port is proposed. The proposed Berth 19B development is relevant at both a National and local level, in that it will further increase the capacity of the Port Mombasa, easing and addressing existing capacity constraints

10.1.5 Optimisation of Container Terminal 1 into a four-berth terminal

The development of Berth 19B will facilitates the optimisation of CT1 into a four-berth terminal with additional yard storage area, which has been identified by KPA as a major benefit of the project in terms of increased operational flexibility.

10.1.6 Sustain business growth

The existing container throughput capacity at Port of Mombasa is insufficient for the continuing operation and growth of port operations. Required increases in capacity of this magnitude cannot be addressed with increases in efficiency of existing infrastructure and so construction of additional quayside and yard side capacity is required. Berth 19B will support both an increase in throughput and an increase in revenue. Berth 19B will add both berth and yard capacity to the Port of Mombasa. It will supply an additional 319,000TEU/year of throughput capacity.

10.2 Potential Negative Impacts During the Construction Phase

Construction activities that will have negative impacts to the marine environment will include:

- ⇒ Dredging and disposal of dredged material
- ⇒ Sea sand harvesting and reclamation

10.2.1 Negative impacts of dredging and disposal of dredged material

Dredging that is to be done will be limited to the berth pockets and turning basin to remove sediments and debris from the bottom of the harbour to increase the depth of the berthing area and turning basin. The dredged material will be disposed offshore at a designated site. Potential negative environmental impacts of the dredging and disposal of dredged material will include:-

- ⇒ **Sediment disturbance**: The process of dredging will potentially result in the disturbance of sediments that can release contaminants into the water. This will potentially change the chemical properties of the sediment, and in turn, reduce water quality at both dredging site and disposal site of the dredged material.
- ⇒ **Release of contaminants**: Dredging may disturb contaminated sediments, releasing pollutants such as heavy metals, nutrients, or organic compounds into the water. These pollutants can have a negative impact on water quality, posing risks to both aquatic marine life and human health.
- ⇒ **Increased turbidity:** The dredging process and the suspended sediments result in increased turbidity, reducing light penetration. This therefore affects photosynthesis in aquatic plants as well as interfering with the feeding mechanisms of some aquatic organisms too, causing harm at multiple levels in the food chain.
- ⇒ **Changes in water flow and circulation**: Dredging activities can also have a negative effect on the natural flow patterns of affected marine waters. These changes can influence the distribution of nutrients, oxygen levels, and temperature, impacting the overall health of aquatic ecosystems.
- ⇒ **Habitat disturbance**: Dredging can alter or destroy marine habitats, such seagrass beds, and coral reef resulting in a reduction of biodiversity for the affected ecosystem.
- ⇒ **Nutrient release**: Dredging can cause the re-suspension of sediments. This may increase the levels of nutrients available to marine organisms. Although this can be seen as a positive, this can also have a negative effect, leading to algae blooms and oxygen depletion, which negatively impacts overall water quality and aquatic life.

⇒ **Dredging** can have negative impacts on the marine environment, such as harming biodiversity, polluting water and making coastlines more vulnerable to sea level rise.

10.2.2 Negative impacts of sand harvesting and reclamation

In order to excavate the foundation and build a container yard at a certain height behind the revetment, sea sand will be used as landfill material. Sand harvesting will therefore be done to recover the required sand from the sea bed. Potential negative impacts of sea sand harvesting will include the following:-

⇒ Removal of sand from sea beds and reefs results in immediate habitat loss and deterioration of water quality.

⇒ Sand harvesting from the sea can significantly increase turbidity. Increase in turbidity decreases the photic zone, therefore, reducing primary production, which is the basis for marine life.

⇒ Sand harvesting may result in removal of sandbanks, which assist in lessening the amount of damage that storms can cause to shoreline communities.

⇒ Marine sand mining increases beach abrasion damaging mangroves and other coastal ecosystems.

⇒ Sand harvesting may contribute to seafloor abrasion. Changing the ocean floor can redirect ocean currents, which can have an effect on nutrient dispersal, and movement of plankton.

⇒ Sand harvesting can contribute to nutrient removal from the ocean floor which is a large sink for many nutrients. When sand is removed from the sea floor, nutrients are also removed and therefore, are taken out of that ecosystem, reducing the total amount of nutrients in the environment as a whole.

10.2.3 Potential negative impacts due to piling activities

As part of the development of Berth 19B Terminal, an inclined revetment will be installed along the western boundary and will be connected to the revetment below the quay structure. The quay structure of Berth 19B will comprise a suspended deck supported on piles.. Potential negative due to piling will include the following:

⇒ **Underwater piling noise:** Pilling work will generate sound pressure which can affect marine biodiversity negatively. Pile driving has the potential to produce loud anthropogenic sounds that enter the marine environment, which can also carry over considerable distance. Pile driving will potentially result in generation, radiation and attenuation of underwater piling noise. During pile driving, it is potentially likely that energy will be radiated from the wet surface of the pile directly into the surrounding water inducing underwater sound levels. Depending on the properties of the ground material one part of the impact energy could radiate indirectly from the sea bed into the water, resulting in additional underwater noise.

⇒ **Generation of turbidity plumes:** Pile driving and associated activities will potentially disturb the seafloor by stirring up sediment leading to increased suspended sediment and turbidity in the water column within the immediate area and down current from the source. Pile driving and associated activities could potentially affect seabed morphology and the ecosystems of the seabed, the ambient seawater quality as it increases suspended solids, clarity, temperature, pH, and salinity.

10.2.4 Generation of Construction Waste

Berth construction activities will potentially generate waste. Without a proper waste management plan, generated waste will end up in the marine environment. Additionally, during construction hazardous waste consisting of used oil; empty containers of paints, varnishes, thinners and lubricating oil; rags containing oil and grease, filter materials and waste oil generated from bilge and slop oil could be generated, that if poorly managed can end-up in the marine environment coursing marine pollution.

10.2.5 Generation of Fugitive dust

Land reclamation activities, soil improvement and consolidation using fill material and construction activities will potentially generate fugitive dust. Dust would also be generated from construction equipment and vehicles delivering construction material. When inhaled; fine particles can accumulate in the respiratory system; causing various respiratory problems including persistent coughs, wheezing, and physical discomfort.

9.2.5 Occupational Accidents and injuries

Potential occupational accidents at the construction phase include falling from height, road traffic accidents from site equipment and vehicles, potential for slipping and falling into the ocean that may result into drowning, and potential collapse of scaffolding. Others are trips and falls, and injuries arising out of improper use of hand tools or failure to adhere to safety regulations.

10.2.6 Potential increase in incidents of HIV/Aids

The probable influx of immigrant workers seeking employment during the construction phase may cause increased interactions thereby increasing the prevalence of HIV / Aids.

10.3 Potential Negative Impacts During the Operations Phase

Potential negative impacts during operational phase will include:-

- ✓ Oil and lubricants spills
- ✓ Waste generation
- ✓ Accidents and injuries
- ✓ Noise
- ✓ Storm water runoff
- ✓ Invasive species

10.3.1 Oil and lubricants spills

Spills of oils and lubricants will be from ships and other marine crafts docking at the terminal. The spills could be from leakages from the vessels. Other courses could include vessel collision and leakages due to poor vessel maintenance. Such oil spills will result in pollution of the marine environment include to death to marine flora and fauna within the port area.

10.3.2 Waste generation

Potential waste that will be generated from ships berthing at the terminal will include oily waste, exhaust gas cleaning wash-water, ballast water, sewage (black water), grey-water, cargo residues, food waste, and general garbage. If the waste is poorly handled; it can end up in the marine environment as marine litter. Marine litter can cause habitat destruction including smothering of the seabed, entangled litter on coral reefs and deposition on sea-grass beds.

10.3.3 Accidents and injuries

Two important and dangerous phenomena which are responsible for causalities in mooring of a ship and which are also considered as death traps are snap back during ship mooring and rope bight.

- ✓ **Snap back during ship mooring**: The highest number of injuries and deaths during a mooring operation on a ship are due to the parting of the rope or wire hitting back to a crew member standing in the area of the rope. The area travelled by the parted rope having a force enough to kill a person on its way is known as the snap back zone. A ship has to be pulled by tugs or by ships own winches for making it close to the berth for berthing. This requires strong ropes and wire to be stretched in tension for pulling the ship. Every rope and wire has got its own endurance limit above which it will fail and part off. The endurance limit will get reduced if the rope is old or not maintained properly. The rope will break or part when it is in tension due to pulling action and when these parted rope swings back in its snap back zone and hits a person standing there, it can be a deadly blow.
- ✓ **Rope Bight:** Mooring ropes are long and heavy ropes stored on-board ships in coil form. When these ropes are under operation, they tend to form a coil or ring shape naturally known as rope bight. If a person involved in mooring operation comes under this rope bight, the pull of the rope can drag him over the ship or smash him in the hard deck over machines.
- ✓ **Self-mooring operation**: Other causes accidents include attempting of ship crew to step ashore to assist berthing the vessel that result in falling between vessel and jetty.

10.3.4 Noise

Noise emissions during operation are expected to be much lower and generally derived from facility operations such as pumps, engines, and other on-site machinery. Sound emissions from the marine crafts would mainly be generated by the operation of the vessel's engines. It is anticipated that the noise emissions from marine craft vessel engines will be substantially dampened by their placement deep within the confines of the vessel. Noise emissions from marine vessels docked at the birth are not expected to result in significant increase in level of noise within the terminal.

10.3.5 Storm water runoff

Storm water runoff from upstream of the port terminal can gathers pollutants from paved surfaces at the port and deposits them in the water, often bypassing wastewater treatment plants.

10.3.6 Invasive species

Marine animals can be taken into ships through ballast water that is used to help maintain ship balance and then transported to new habitats in Kenyan marine water where they may become invasive species that threaten the balance of local natural ecosystems.

10.4 Decommissioning phase potential negative impacts

Potential negative impacts likely during decommissioning phase will include the following:-

- ⇒ Seabed disturbance
- ⇒ Underwater noise
- ⇒ Generation of turbidity plumes

⇒ Waste
⇒ Dust pollution
⇒ Accidents and injuries

10.4.1 Seabed disturbance

Decommissioning of the foundational piles will be by use of heavy equipment. The removal of these pills will potentially result in vibrations may temporally lead to disturbance of benthic organisms' substrate anchorage, disturbance of structure of the substrate and actual disturbance of local benthic organisms. However; such disturbance will be minimal and only during the time of decommissioning.

10.4.2 Underwater noise

Decommissioning of the berth infrastructure will involve actual removal of stable piles that were driven into the bedrock below the seafloor to anchor the main marine trestle. During pile decommissioning it is anticipated that resulting sound pressure levels and sound exposure levels will potentially affect marine biodiversity in affected areas and neighbourhood.

10.4.3 Generation of turbidity plumes

Pile decommissioning and associated activities will potentially disturb the seafloor by stirring up sediment leading to increased suspended sediment and turbidity in the water column within the immediate area and down current from the source. Removing of piles anchored in the seabed and associated activities could potentially affect seabed morphology and the ecosystems of the seabed, the ambient seawater quality as it increases suspended solids, clarity, temperature, pH, and salinity.

10.4.4 Decommissioning waste

Decommissioning of berth infrastructure will potentially result in generation of waste that could pollute the marine environment. Without a proper waste management plan, waste generated during decommissioning can end up in the sea.

10.4.5 Dust pollution

Decommissioning of the jetty and associated infrastructure could result in dust emissions into the atmosphere that may affect local air quality. Fine particulates suspended in the air can be windblown from the site to adjacent windward areas within the port.

10.4.6 Accidents and injuries

Marine accidents during decommission could include slip and fall, dropping in water, drowning among others. Such accident can result in injuries to body parts, loss of body parts, down time, permanent disability or even fertility.

10.5 Proposed mitigation measures

Table 12 Proposed mitigation measures for negative impacts during the construction phase

Issue/ Concern	Proposed mitigation measures
Seabed disturbance	- Understand the nature and composition of the seabed where pilling will be done before pilling to minimise potential damage to marine micro-benthos - Minimise seabed disturbance during piling of foundational piles by restricting the pilling to actual point only.
Underwater piling noise	- **Use of Cofferdams:** Cofferdams are rigid steel tubes surrounding the pile from seabed to surface. The interspace between pile and cofferdam is completely dewatered, hence pile driving takes place in air and not in water thus decoupling the propagation of sound from the body of water. - **Vibratory Pile Driving**: Installing foundation piles by a combination of vibratory pile driving and impact pile driving contributes to the overall noise reduction as less time is needed for impact piling. Vibratory pile driving is a technique which is used to make the pile oscillate at a low frequency by means of rotating weights. - Intrinsic underwater noise measurements be carried out during piling
Turbidity	- Secure the working site with silt curtains: Silt curtains may be used to control the dispersion of water-column turbidity by modifying the current flow patterns in the vicinity of pile driving area and related marine construction operations - Onsite turbidity measurements be carried out during construction period
Increase is total suspended solids in marine water	- Secure marine construction site with silt curtains - Secure adjacent offshore construction site with silt traps - Construct catch basins at offshore site adjacent to marine construction site - Monitor suspended solids in marine water during construction period
Construction Waste	- Put in place an elaborate waste management plan that will ensure all waste is appropriately collected and reused where possible, recycled and any remnants appropriately disposed as provided for in the Sustainable Waste Management Act 2022 and Environmental Management and Coordination (Waste Management) Regulations, 2006.

Issue/ Concern	Proposed mitigation measures
	- Eliminate and or minimize waste generation by proper planning. - Contractor to provide waste receptacles for dropping generated construction waste to avoid waste dropping into marine environment. - Contractor to designate a temporary area for holding waste as it is generated before collection for disposal - Waste to be segregated on site to separate paper waste, plant matter, plastics, timber, steel to determine what can be reused and the appropriate method of disposal for waste that is to be disposed. - Waste collectors to be provided with appropriate PPEs when handling waste. - Waste to be disposed at Mwakirunge designated waste disposal site only - Vehicles used to collect waste from site for disposal to be licensed by NEMA for waste collection - Waste collection and disposal tracking documents for waste collected and disposed to be completed and copy maintained on site.
Accidents and injuries	- Workers should not work under strenuous conditions, provide for breaks to rest and refresh within an eight hour shift period. - Appropriately secure and anchor floating platforms and other floating working surfaces to deter their continuously movement in with the water while working. - Properly insulate and secure electrical outlets from coming into contact with water to avoid risks of fire, explosions, burns, and electrical shocks. - Put non-skid coating where workers are doing construction on barges or float stages to prevent workers from falling due to the slippery surface and get injured. - Secure a tag line when using a crane to haul materials can also lead to workers getting hit.

Table 13 Proposed mitigation measures of operational phase potential negative impacts

Issue/ Concern	Proposed mitigation measures
Oil and lubricants spills	- Ensure all equipment and machinery are timely serviced as per manufacturer's recommendations. - Immediately fix all noticeable leaks that can result in oil and lubricant spills.

Issue/ Concern	Proposed mitigation measures
	- Promptly collect any spills from all working services my means of appropriate oil and lubricants absorption materials.
Waste generation	- Provide waste receptacles for dropping generated waste. - Designate a temporally for holding waste as it is generated before collection for disposal. - Waste to be segregated on site to before it is disposed. - Waste collectors to be provided with appropriate PPEs when handling waste. - Waste to be disposed at Mwakirunge designated waste disposal site only - Vehicles used to collect waste to be licensed by NEMA for waste collection - Waste collection and disposal tracking documents for waste collected and disposed to be completed and copy maintained on site.
Accidents and injuries	- There should be no self-mooring where docking ships. - When docking ships ensure wires and ropes that are used to anchor the vessel are not old and damaged but are of adequate strength to hold the vessel in place at the berth. - Appropriate training of workers on work safety procedures. - Provision of appropriate working equipment in good working condition. - Timely servicing and maintenance of equipment.
Noise	- Equipment to be well maintained and serviced. - Proponent to provide ear protector/ ear plugs/ ear mufflers for ear protection - Monitor noise levels to ensure they are within the prescribed limit as provided for in the Environmental Management and Coordination (Noise and Excessive Vibration) (Control) Regulations, 2009.

10.6 Climate Risks Profile Adaptations and Mitigation

10.6.1 Climate coastal hazards

- ✓ Climate change is increasing the frequency and intensity of extreme weather events such as heat waves, droughts, floods, and tropical cyclones.
- ✓ Due to warming ocean waters, marine heat waves' frequency and intensity is increasing. Their frequency, duration, extent, and intensity are projected to increase with increasing greenhouse gas emissions.
- ✓ Climate coastal disasters damage coastal infrastructure and resources that underpin blue economy livelihoods and businesses.
- ✓ Increasing frequency and intensity of floods, tropical cyclones and droughts are expected to aggravate water management problems, reduce agricultural production and food security, increase health risks, damage critical infrastructure, and disrupt the provision of essential services such as water and sanitation, education, energy, and transport.
- ✓ Climate change has increased the frequency and severity of floods and droughts.
- ✓ Resource-based conflicts are on the rise because of climate change.
- ✓ Droughts, flood-induced agricultural damages, and reduced agricultural production due to conflicts will threaten food security as well as intensify pressure on fishery resources due to overfishing.

10.6.2 Potential negative impacts of climate change on the coastal environment

Climate drivers on marine and coastal ecosystems include warming ocean, sea level rise, acidification, de-oxygenation, storm characteristics, runoff, and changes in wind and precipitation patterns.

Table 14 Climate drivers and their impacts on physical and coastal ecosystems

Climate Drivers	Main physical and ecosystem effects on coastal systems
Increase in CO_2 concentration	Increased CO_2 fertilization: decreased seawater pH (ocean acidification) negatively impacting coral reefs and other pH-sensitive organisms
Rise in Sea surface temperature	Increased stratification/changed circulation; reduced incidence of sea ice at higher latitudes; increased coral bleaching and mortality; pole ward species migration; increased algal blooms.
Seal level rise	Inundation, flood, and storm damages; erosion, saltwater intrusion; rising water tables (impede drainage): wetland loss/change
Increase in storm intensity	Increased extreme water levels and wave heights; increased episodic erosion, storm damage, risk of flooding, and defence failure.
Uncertain climate wave	Altered wave condition, including swell; altered patterns of social erosion and accretion; change of beach orientation

Climate Drivers	Main physical and ecosystem effects on coastal systems
Uncertain storm frequency	Altered surges and storm waves and hence risk of storm damage and flooding
Runoff	Altered flood risk in coastal lowlands; altered water quality/salinity: altered fluvial sediment supply: altered circulation and nutrient supply.

10.6.3 Climate change mitigation

- ✓ **Increase in mangrove and sea grass cover**: Coastal blue carbon ecosystems (such as ocean, mangroves, salt marshes and seagrass) can help mitigate carbon emissions. Coastal and marine ecosystems absorb about 30 per cent of anthropogenic carbon dioxide. Vegetated marine habitats can store up to 1000 tC per ha, much higher than most terrestrial ecosystems.
- ✓ **Reduce greenhouse gas emissions**: Embrace the use of renewable energy to power port activities to reduce greenhouse gas emissions.
- ✓ **Embracing Green port**: Initiate the "green ports" concept to help reduce the negative ecological footprint of port operations. This will transform maritime transport towards less carbon-intensive energy sources. Among the actions that may be taken under the green port initiative are:
    - o recycling materials and water;
    - o implementing energy efficient lighting;
    - o reducing emissions from port equipment and other port operation activities;
    - o adoption of green transport solutions
    - o Effective management of noise pollution.

11. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

11.1 Introduction

This Environmental and Social Management Monitoring Plan (ESMMP) is a guidance document to measure and achieve compliance with the environmental protection and mitigation requirements of a proposed project. This ESMMP consists of identified potential negative impacts, proposed mitigation measures, proposed monitoring and institutional measures to be taken during the design, construction and operation (post construction) stages of the proposed project. The plan also includes responsible actors and budget that has to be provided for implementation of these measures.

The objective of this ESMMP is to formulate measures, which will:

- ⇒ Mitigate adverse impacts on various environmental components.
- ⇒ Protect environmental resources where possible.
- ⇒ Enhance the value of environmental components where possible.

This ESMMP covers the following:

- ⇒ Management plans to address identified construction phase negative impacts associated with dredging and disposal of dredged materials, sand harvesting and reclamation works.
- ⇒ Management plans to address identified operational phase negative impacts associated with port operation including oils spills, waste generation, accidents and injuries, noise and traffic.
- ⇒ Management plans to address identified decommissioning phase negative impacts associated with port decommissioning such as seabed disturbance, underwater noise, turbidity, waste, dust, injuries and accidents.
- ⇒ Monitoring activities
- ⇒ Training and capacity development
- ⇒ Institutional arrangement for safeguards implementation
- ⇒ Reporting
- ⇒ Environmental audit
- ⇒ Decommissioning

11.2 Environmental and social management and monitoring action plans

Table 10 is the detailed environmental and social management and monitoring action plans for construction, operation and decommissioning phases of the proposed project.

Table 15 Environmental Management Action Plans

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
CONSTRUCTION PHASE						
Dredging, disposal of dredged material and sand harvesting	- Sediment disturbance - Release of contaminants - Increased turbidity - Changes in water flow and circulation - Habitat disturbance - Nutrient release	- Dredger to incorporate an overflow valve that discharge sediment under the vessel instead of at the water's surface and a green valve that reduces air entrainment ensuring both sediments and fines sink to the seabed - Enclose the area being dredged with silt screens or air bubble screens - Tracking of barge movement during offshore dumping to ensure dumping is done at the designated site. - Prohibition of overflow during transportation of dredged material from the dredging site and dumping site - Seasonal Considerations to minimize the impact - In case dredging works overlap with other Mombasa port dredging projects, coordinate with those projects and revise and strengthen the ESMP and ESMoP as necessary.	- Water quality monitoring - Marine flora monitoring - Marine fauna monitoring	- The Project Proponent - The Project Contractor - Relevant Lead Agencies	- Baseline monitoring before dredging commencement - Compliance monitoring to be done twice daily throughout the dredging period	15,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
		- Prepare and Implement water quality and coral monitoring plan; - review dredging and dumping methods in case turbidity levels exceeds set threshold level or coral health degradation is observed				
Fugitive dust from reclamation, soil improvement and surcharge activities	- Respiratory problems including persistent coughs, wheezing, & physical discomfort	- Deploy automatic dust suppression systems, such as misting cannons and water sprays. - Secure the site with dust screens - Limit surcharge works on windy days - Use appropriate PPEs such as dust masks - Ensure regular maintenance of construction vehicles and machinery. - Use of reflective signage to improve visibility in the event of incidental dusty conditions - Regular water spraying of exposed surfaces. - Covering of stockpiles. - Construction vehicles to have inspection Certificates by NTSA	- Periodic air quality monitoring as per EMCA (Air Quality) Regulations, 2014	- Project Proponent - Contractor - Individual Employees	During the construction period	5,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
		- Training to KPA Environmental and Social Safeguards personnel - Cover truck loading bed when transporting loose materials (e.g. soil/sand) - Observe speed limits - Comply with the Air Quality Regulations, 2014				
Accidents & injuries including falling from height, drowning, and collapse of scaffolding	- Downtime - Loss of manpower - Delays in task completion - Damage to corporate image - Loss of life - Litigation costs	- Prepare and implement an effective Occupational Safety and Health Plan - Training & sensitization in safety - Hire experienced workers for each task - Use only well maintained and serviced equipment - Provide breaks for rest - Use appropriate PPEs - Follow correct work procedures	- Records of safety training & sensitization - Records of employee refresher safety training records - Log of accidents - Log of injuries	- Project Proponent - Project Contractor	Throughout the construction period	5,000,000
Noise and vibrations	- Potential to cause noise-induced hearing loss - Increased stress, irritability, and fatigue, potentially contributing to anxiety and depression.	- Apply Grievance Redress Mechanism to resolve complaints a site. - Adhere to the noise and excessive Vibrations regulations - Provision of appropriate PPE to the workers in excessive noisy areas and enforcement application	- Real time noise measurements on site - Feedback from port users, visitors and construction workers	- Proponent - Contractor	Throughout the construction period	5,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
	- Nuisance that may disrupt peace and quiet, impacting negatively on quality of life. - Potential damage to nearby structures, affecting structural integrity - Noise results into reduction of productivity due to fatigue	- Equip vehicles and machines with exhaust mufflers and carry out regular maintenance /servicing /inspection to all equipment - Enforce/implement speed control measures - Conduct pile-driving works in a manner that noise levels do not exceed the construction site noise standard set under Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009. - Install Safety warning signs and noise Barriers				
- Construction waste generation - Generation of hazardous waste such as waste oil and sludge	- Marine water pollution - Degradation of marine habitats - Entanglement of marine fauna	- No dropping of any construction waste in the marine environment - Opportunities for avoiding waste generation, reuse and or recycling to be sort. - Waste receptacles to be provided for dropping waste - Hazardous wastes to be stored in designated areas and with containers specialized for each waste type	- Log of type and quantity of waste generated and disposed. - Record of waste reused and or recycled - Duly completed waste tracking documents	- Project Proponent - Project Contractor	Throughout the construction period	5,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
		- Storage area to be of and or have an impermeable base with bunds. - Hazardous wastes to be collected and disposed only by NEMA-authorized firms.				
Injuries and accidents	- The resulting trauma may cause post-traumatic stress disorder, depression, and anxiety. - Reduced productivity of workers - Increased medical expenses in treating injured workers - Lasting effects (chronic pain to emotional trauma) that can impact a worker's physical abilities, mental health, and overall quality of life significantly impacting on a worker's ability to work, enjoy daily activities, and	- Ensure all work areas (camp sites) are registered with DOSH in accordance with the OSHA Regulations (2007) - Adhere ALL safety requirements prescribed in OSHA 2007 - Comply with the Merchant Shipping Act, 2009 (Part VII Section 117-168) on Safety, Health and Welfare of Seafarers - 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. - Create awareness among the channel users on the presence of the dredger and its activities as well as the required safety precautions - Provide life jackets to all workers working within the sea area and train personnel on proper use	- Inspections of construction site processes and equipment. - Spot checks and scheduled checks of the construction site. - Examine written reports and documents that form the Health and Safety management system - Risk assessments of the workplace, risk matrices and qualitative risk analysis. - Examining training records and other	- Contractor - Safety and Health Committee - Community Liaison Officer (CLO)	Throughout construction period	15,000, 000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
	maintain relationships. - Loss of productivity, low staff morale, loss of reputation and at worst closure of the site.	- Provision of Training to KPA HSE Projects team - WIBA s Insurance for workers - Inform in advance marine users the construction plan. - Installation of buoys along construction boundary. - Establish a Safety and Health Plan for the whole project, - Constitute safety and health committee for the project for implementation the Occupational safety and health plan - Identify a referral hospital for critical accidents and injuries	relevant documentation			
Oil spills during construction	- Land and water pollution	- Installation of oil/water separator (during construction) along the drainage and regularly collect residual oil. - Regular inspection of vehicles and equipment for oil and fuel leaks. Leaking vehicles and machines to be immediately moved to a designated workshop and not used until repaired. - Maintenance/repair activities to be conducted only at designated workshop with	- Physical observation of marine water - Water quality monitoring	- Contractor	Throughout construction period	20,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
		appropriate pollution control facility (e.g. oil/water separator). - Spill response kit (e.g. absorbents) to be readily available at the construction site. Spills to be removed with absorbents and contained and disposed as hazardous waste. - Fuel tank to be installed on an impermeable base with bunds. Install oil/water separator at fuelling area.				
Uncontrolled discharge of concrete wash water	- Pollution of marine waters	- Discharge of untreated concrete wash water to the environment to be strictly prohibited. - Concrete wash water to be treated at designated facilities (e.g. with wash water treatment system). - Treated wash water to be reused as far as possible. - Acquire effluent discharge license from NEMA in case discharge to environment is planned. Effluent quality to comply with discharge standard set under EMCA (Water Quality) Regulations 2006.	- Sampling and testing marine water quality	- Contractor	Throughout construction period	5,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
Wastewater discharge from temporary construction facilities	- Pollution of surface and ground water sources - Soil pollution	- Wastewater (e.g. grey/blackwater) from temporary construction facilities to be treated with sewage treatment facility (biodigester) as per Kenyan regulations or norms.	- Marine water quality sampling and testing	- Contractor	Throughout the construction period	10,000,000
Effluent Generation	- Odour / pungent smell that will pollute local air quality - Surface and ground water sources pollution	- All washrooms and facilities generating sewage waste to be connected to a biodigester system. - Comply with the Water Quality Regulations, 2006 - Comply with the Marpol Convention 73/78, The EMCA Cap 387 of the Laws of Kenya and The KMA Act, 2012	- Marine water quality sampling and testing	- Contractor	Throughout the construction period	10,000,000
Traffic increase in and out of the port	- Delays to port users	- Put in place an elaborate Traffic Management Plan	- Traffic counts	- Contractor	Throughout the construction period	2,000,000
Labour influx	- Increased risk of exposure to communicable diseases such as HIV/AIDS	- Develop a comprehensive STDS, HIV and AIDs control and awareness program such as provision of condoms to workers both male and female Provision of STDs, HIV /AIDS and ADSA program prevention measures to workers. - Creation of awareness of STDs, HIV/AIDS in workers 'camps through	- Feedback from peer educators	- Project Sociologist	Throughout the construction period	10,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
		trainings and installation of posters - Adhere to and implement the Sexual Offences Act, 2006 and its amendment 2012				
Gender issues including people with Disabilities (PWDs)	- Potential Discrimination at work place - Potential Sexual harassment - Challenges to PWDs in movements and access to opportunities	- Prepare a comprehensive Gender Based Violence (GBV) Prevention Plan and execute the same - Develop policy to prohibit sexual harassment and gender discrimination through the works - Provide equity and equality in employment opportunities for men, women, - Provide a policy enabling opportunities for People living with Disabilities (PWDs)	- Feedback from workers and local community	- Contractor - Project Proponent	Throughout the project cycle	5,000,000
Stakeholder Engagements	- Stakeholder concerns with adverse impacts during the construction period - Community concerns issues such as employment, material sites, security, etc.	- Prepare a comprehensive Stakeholders Engagement Plan - Engage a Liaison Person drawn from the community as a Stakeholders link desk - Establish a social record register for emergent concerns - Institutionalize linkage with the GRM and associated GRCs as constituted,	- Feedback from affected and interested stockholders	- Contractor - Project Proponent	Throughout the project cycle	15,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
	- Potential lack of political goodwill	- Consult the Resident Engineer on conflicting Stakeholders matters to the extent possible for guidance				
Employment and Labour Issues	- Possible conflicts on the exploitation of local labour - Possible exploitation of underage - (child labour) - Importation of unskilled labour in disregard of the local manpower - Labour inequality on gender basis - Lack of experience and skills among the residents	- Recruit a Liaison Officer to facilitate local labour engagement. - Prepare and execute a Childs Protection Plan to safeguard against child labour - Ensure gender considerations as per the law (at least 30% women) - Provide opportunities for local labour with at least 60% of the project workforce for unskilled jobs to the extent of availability - Procure local materials for construction to the extent possible based on availability	- Adherence to Labour Laws - Feedback from stakeholders	- Contractor	Throughout the project cycle	3,000,000
OPERATIONAL PHASE						
Oil and lubricants spills	- Marine environment pollution - Destruction of marine habitats including	- Find and resolve source of leak - Use PPE and isolate area: identify slip hazards, place warning cones & barricades - Contain the spill by using booms and spill berms	- Satellite monitoring - Airborne monitoring - Monitoring with radar	- Project proponent - Shipping Lines	Throughout the operation period	20,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
	mangroves, sea grass beds and coral reefs	- Prevent oil from entering storm or sewer drains (seal floor drains, drain inlets and curb inlets); - Activate the National Oil Spill Response Contingency Plan (NOSRCP) in the event of major spills				
Waste generation	- Habitat destruction - Smothering of the seabed - Entangled litter on coral reefs - Deposition on sea-grass beds	- No dropping of any construction waste in the marine environment - Ensure reduction of waste generation using the 3Rs principle - reduce, reuse and or recycling as far as possible; - Waste receptacles to be provided for dropping waste	- Log of type and quantity of waste generated and disposed. - Records of waste reuse and or recycling - Duly completed waste tracking documents	Project proponent	Throughout the operational period	10,000,000
Accidents and injuries	- Downtime - Loss of manpower - Delays in task completion - Damage to corporate image - Loss of life - Litigation costs	- Training & sensitization in safety - Hire experienced workers for each task - Use only well maintained and serviced equipment - Provide breaks for rest - Use appropriate PPEs - Follow correct work procedures	- Accident reporting and investigation records - Records of safety training & sensitization - Records of employee refresher safety training - Availability of logs/statistics of accidents and incidents	- Project proponent - KMA - Shipping Lines involved	Throughout the operation period	4,000,000

Issue/Concern	Potential impact	Mitigation	Monitoring	Responsibility	Timeframe	Budget (KES)
Air quality	- Local ambient air pollution	- Promotion of Cleaner Fuels - Training/Capacity Building to KPA Environment and Social Safeguards team - Reducing congestion - Regular Cleaning / Sweeping - Maintenance of Equipment	- Air quality monitoring to ensure compliance with EMCA (Air Quality Regulations), 2014	- Project proponent	Throughout the operation period	20,000,000
GHG Emissions/Climate Change	- Local ambient air pollution - Contribution to global warming through GHG emissions - Contribution to local climate change	- Pursue the implementation of KPA's Green Port Policy. - Provide shore power facility - Energy-saving Enhancements - Clean Energy Initiatives	- Sample and analysis local air quality for GHGs	- Project Proponent	Throughout the operation period	35,000.000
Water Quality	- Pollution of ground and surface water bodies	- Capacity Building/ training of KPA staff - Installation and Maintenance of Biodigester - Clearing and cleaning of Storm Drains - Waste management - Comply with 4th & 5th Schedule of EMCA (Water Quality Regulations) 2006	- Sampling and analysis of marine water	- Project Proponent	Throughout the operation period	5,000,000

11.3 Construction -Environmental & Social Management Plan

In order for the Contractor to carry out environmental management activities during construction, the Contractor will be required to draw up a Construction -Environmental & Social Management Plan (C-ESMP) of his own to show how he will implement the mitigation measures during the construction period. The C-ESMMP includes the development and implementation of a number of management plans for different phases of the Project such as Code of Conduct, Occupational Health and Safety Plan, Grievance Redress Mechanism plan, Waste Management Plan, stakeholder engagement Plan, Traffic Management Plan, Emergency Preparedness and Response Plan, Gender based violence Sexual Exploitation and Response Plan, Air quality Monitoring Plan, Water quality Monitoring Plan, Noise and Excessive Vibration Monitoring Plan, Biodiversity Monitoring Plan"

11.4 Environmental monitoring

11.4.1 Noise and excessive vibrations monitoring

Noise and Vibration levels should be monitored to ensure they are in within the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 as highlighted in the table 15 below.

Table 16 Maximum permissible noise levels for constructions sites (Measurement taken within the facility)

Facility		**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

Timeframe: Day; 6:01am-6:00pm & Night; 6:01pm-6:00am

Source: Second schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

11.4.2 Air Quality Monitoring

Air quality monitoring to be done to ensure project activities adhere to the provisions of the ambient air quality regulations at property boundary for general pollutants. Part (b) of the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014 require that the particulate matter at a property boundary should not exceed 70µg/m^3.

11.4.3 Solid waste disposal monitoring

Monitoring of waste management activities will be done in adherence to the provisions of the Sustainable Waste Management Act, 2022 and the Environmental Management and Co-Ordination

(Waste Management) Regulations 2006. Monitoring will be done for the type of solid waste generated, quantity of solid waste generated, frequency of collection and disposal, where the waste is disposed and proof of waste tracking documents in the format provided in FORM III schedule one of the Environmental Management and Co-Ordination (Waste Management) Regulations 2006.

11.4.4 Marine water quality

Marine water quality will be monitored for turbidity within port area and adjacent creeks against the established baseline values. Maximum of 10 and 5 NTU will be allowed above the established baseline turbidity values in the port area and creeks respectively.

11.5 Training and capacity building

It is proposed that training and capacity building be undertaken as follows:

- Sensitization of the Contractor's staff on the importance of the environmental Management and monitoring plan, its contents, how it is applied and who is responsible for its implementation.
- Training and capacity building for Contractor on the importance and proper use of PPEs.
- Training and capacity building for Contractor on acceptable waste management practices.
- Training and capacity building of the site occupational safety and health safety committee on site occupational safety and health requirements and individual safety obligations.
- Training and capacity building on site first aid.
- Training and capacity building on site fire safety
- Sensitization on HIV and AIDS and other communicable diseases

11.6 Institutional arrangements for safeguard implementation and reporting

11.6.1 Institutional arrangement

The responsibility of implementation of the safeguards is vested on the project proponent while the National Environment Management Authority (NEMA) ensures compliance through enforcement. NEMA will coordinate with relevant lead agencies to ensure compliance and enforcement. There will be periodic site visits by relevant lead agencies coordinated by NEMA to assess compliance. Inspection reports of the outcome of the site visits will be prepared by the lead agencies/NEMA and served to the proponent for implementation.

The proponent will be required to prepare periodic monitoring reports and annual environmental audit reports and submit these reports to NEMA. Further the proponent will be required to promptly respond to NEMA improvement orders by compiling a report on the issues raised and how the concern has been addressed. The contractor will be required to prepare monthly progress reports and submit the progress reports to the proponent on the contractor's contractual obligations on safeguards implementation responsibilities specified in the EMP. The contractor will be supervised on the ground directly by the proponent.

11.6.2 Reporting obligations

The following reports will be prepared:

- ✓ Monthly progress reports by the contractor on the implementation status of every obligation of the contractor on safeguards implementation specified in the EMP. These monthly reports will be submitted by the contractor to the Proponent.
- ✓ Periodic monitoring reports to be prepared by the proponent and submitted to NEMA. Specifically; waste management report, air quality monitoring report and marine water quality monitoring reports.
- ✓ Reports responding to NEMA improvement orders to be prepared by the proponent and submitted to NEMA as and when such improvement orders are issued.

12. GRIEVANCE REDRESS MECHANISM

12.1 General

Persons affected by a development project (PAP) 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 (e.g., employment), and/or social losses, can emerge at different stages of the project cycle. Some grievances may arise before construction, while others may come up during construction or operation. Not only should 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 PAPs and the project. It is equally important that PAPs have access to legitimate, reliable, transparent, and efficient institutional mechanisms that are responsive to their complaints. In the absence of a project specific GRM, PAPs may seek solutions to their grievances through GRMs that exist outside the project such as the national judicial system, public administration, or the agencies that funds the project. Engagement of such external GRMs could lead to a number of adverse consequences for both the PAPs and the project implementers, for example:

- It would probably absorb a relatively longer time and substantial resources, which are generally unaffordable to many PAPs. People need relatively quick solutions or relief for their problems, particularly when projects are likely to cause property loss and displacement.
- Not all PAPs have equal access and the capacity to approach external GRMs. Thus, they would be deprived of their rights to be heard and to find a fair and just solution. This could further push the APs into a state of high vulnerability, insecurity, and impoverishment.
- Depriving PAPs access to GRMs could induce them to develop hostility toward the project and sometimes to engage in violent behavior that might hamper the smooth implementation of the project and its related activities and delay its overall accomplishments.
- Delays in project implementation will increase government expenditures such as compensation to contractors for loss of work, and staff maintenance. Delay can also affect the reputation of the proponent.

In this document, "an aggrieved person or complainant" means an individual, group or organization who articulates a grievance to the Project.

12.2 Objective of GRM

This project sets the objective of GRM as follows in order to keep or restore good relationship with the communities.

- To ensure that grievances are addressed and resolved in a fair and transparent manner.
- To ensure careful documentation and reporting of grievance and corrective actions.

12.3 Types of Grievances

Anyone will be able to submit a grievance to the Project if they believe a practice is having a negative impact on the community, the environment, or on their quality of life. They may also submit comments and suggestions.

Grievances could include:

- Negative impacts on a person or a community (e.g., financial loss, physical harm, nuisance)
- Dangers to health and safety or the environment
- Failure of the Proponent, its contractors and sub-contractors and their workers or drivers to comply with standards or legal obligations

12.4 Confidentiality

When requested, the Project will aim to protect a person's confidentiality, and the project will guarantee anonymity in public documents. Individuals will be asked permission to disclose their identity. Investigations will be undertaken in a manner that is respectful of the aggrieved party and the principle of confidentiality. The aggrieved party will need to recognize that there may be situations when disclosure of identity is required and the Project will identify these situations to see whether the aggrieved party wishes to continue with the investigation and resolution activities.

12.5 Scope of Application

This GRM applies to grievances raised formally by an aggrieved person or complainant who may feel resentment, bitterness or anger about a situation against the project related activities and the manner in which it is either being handled or ignored. The statutory rights of the complainant to undertake legal proceedings remain unaffected by this procedure.

12.6 Procedures

The steps in implementation of the GRM are shown below.

Step 1: Grievance Submission

Step 2: Recording, registering and acknowledgement

Step 3: Assessment of grievances

Step 4: Closure for irrelevant grievances

Step 5: Making decisions and implementing the resolution process

Step 6: Tracking, monitoring, documentation, and evaluation.

Should a complainant seek redress through legal means at any stage during the Grievance Procedure, the Proponent shall be informed immediately and will provide necessary guidance as required.

12.6.1 Step 1: Grievance Submission

Grievances may be submitted in the following ways.

- In writing by mail addressed to the Proponent, the Consultant, the Contractor or the sub-Contractor
- In writing via email addressed to the Proponent, the Consultant, the Contractor or the sub-Contractor
- Verbally via telephone (or SMS text message) to the Proponent, the Consultant, the Contractor or the sub-Contractor
- Verbally in person to the Proponent, the Consultant, the Contractor or the sub-Contractor

12.6.2 Step 2: Recording, Registering, and Acknowledgement

The procedures that will be followed to register grievances are listed below:

- The Contractor and the sub-Contractors shall inform the Consultant and the Proponent once a potential grievance is identified regardless of the form of submission.
- Grievances will be recorded by the Proponent and/or the Consultant
- A registration form will be filled out within 24 hours of submission for all grievances including those that are verbally submitted. This form must be signed by the complainant.
- All the grievances will be reported to the Proponent after the registration form was completed.
- The Proponent and/or the Consultant will log the information on the grievance forms into the database register with a file number to enable tracking of the resolution progress.
- The Proponent and/or the Consultant will maintain records and related documentation for grievances in the database, as well as hard copies of official responses.
- The Proponent will send the letter of acknowledgement to the complainant within a week after the registration.

12.6.3 Step 3: Assessment of Grievance

1) Simple Grievance

For simple grievances, the Proponent and/or the Consultant will assess and resolve the grievance immediately. In other cases, the Proponent and/or the Consultant will carry out the assessment, which may involve baseline study, legal framework and impact analysis to identify what the grievance is all about. Before the commencement of the assessment, the complainant will be explained about the methodology of the assessment to be undertaken. the Proponent will keep record of the comments from the complainant on the methodology and take them into consideration in the assessment. An assessment report will be prepared and explained to the complainant in a transparent way. In case the complainant is a group, all the members should be given the opportunity to participate in the process.

In the assessment report, recommendation should be made to keep or restore good relationship with the communities. Grievances should be solved in an amicable way through proper communication with the complainant. Firstly, mitigation measures that avoid or reduce the impact to an acceptable level should be sought for the resolution if any impacts are identified. Such mitigation measures might include the following.

- Watering for dust-suppression
- Changing working hours to avoid environmental and/or social conflicts
- Changing transportation route of construction materials
- Replanting trees for the loss
- Compensation for Economic Loss

It is generally difficult to find alternative measures for economic loss other than compensation. This sort of loss can be temporary or permanent. The loss the complainant suffered and/or will be suffered will be estimated taking into account the socio-economic conditions of the complainant that affect

the capacity to approach external GRMs as mentioned "*About GRM*". The loss shall be estimated based on proof data and information. The recommendation section of the report should propose compensatory measures to cover the loss. The compensatory measures may be provision of asset, employment opportunity, business opportunity and cash. However, cash compensation shall be the last resort so as not to induce problems among the complainants, their dependents, and others. The compensation should be rather proposed in a way to assist the complainant in restoring or improving the living condition of them in a sustainable way by making the best use of the opportunity. The compensation plan should be prepared in line with the international practice such as World Bank Operational Policy or IFC Performance Standards.

12.6.4 Closure for Irrelevant Grievance

If the initial assessment found that the grievance is irrelevant to the project, then the process will be closed with a written agreement with the complainant. In case, the complainant will not agree, the process will go on to Step 5.

12.6.5 Step 5: Making Decisions and Implementing the Resolution Process

Where an agreement between the complainant and KPA is easily made on how the grievance will be resolved, a minute of the agreement will be drafted and signed by each of the parties. The minute will also indicate timeline for resolution based on the type and procedure for resolving the grievance, and this process will not exceed two weeks. After due implementation of the measures set out in the agreement, a new minute will be signed stating that the issue has been resolved.

Where an agreement cannot be easily reached, the grievance will be addressed on a case-by-case basis.

In the event that no amicable agreement can be reached through the above mechanisms, the complainant can resort to the court, public administration or others.

If the complainant appealed to public administration, and KPA is informed about the grievance from the public administration officially, then KPA will cooperate with it.

12.6.6 Step 6: Monitoring, Documentation, and Evaluation

Whether agreements are reached through direct negotiation or mediation, all supporting documents used to achieve resolution will be maintained as part of the grievance/complaint file.

A grievance shall be considered resolved when all actions have been taken to close out the grievance and procedures are implemented that reduce the likelihood of this event reoccurring.

13. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

13.1 Findings

The main findings from the environmental and social impact assessment of the proposed Berth 19B are as follows:-

- ✓ The proposed Berth 19B is to be undertaken by Kenya Ports Authority, a state corporation whose mandate is to construct, maintain, operate and improve all sea and inland waterway ports in Kenya.
- ✓ The location of the proposed Berth 19B is west of the existing Berth 19 within Mombasa Port.
- ✓ The proposed Berth 19B will be an extension of the existing Container Terminal 1 (CT1) facility within the Mombasa Port.
- ✓ The proposed project will potentially result in both positive and negative impacts to the environment.
- ✓ Identified potential sensitive receptors for air borne contaminants, dust, noise and vibration are Kipevu Clinic, CT2 Area, KPC Oil Tanks, Engineering Department and Berth No. 17.
- ✓ Identified sensitive creeks whose water quality could be impacted were Mwache, Mteza and Tudor.

13.2 Conclusions

Whereas it has been predicted that implementation of the proposed project will potentially generate some negative impacts to physical, biophysical, social and natural environment, deployment of appropriate construction technology if implemented timely and appropriately under strict supervision of the supervising Consultant, will adequately mitigate the predicted potential negative impacts to acceptable legal limits.

13.3 Recommendations

Based on data collected during the ESIA exercise the following recommendations are made:

- ✓ Project implementation to only begin once the EIA process has been concluded and EIA license issued to KPA.
- ✓ Adequate financial resources to be set aside for the timely and full implementation of the environmental and social management plan.
- ✓ The project proponent to strictly supervise the contractor during construction phase to ensure that the contractor appropriately implements all recommended safeguards.
- ✓ Upon receipt of the EIA license, environmental baseline survey to be carried out before commencement of construction works to reconfirm the baseline condition of marine water quality, ambient air quality and noise at identified potential sensitive receptors and condition of benthos community and critical habitats specifically mangroves, coral reefs and seagrass beds.
- ✓ Upon receipt of the EIA license , before commencement of construction works, fisheries resource survey to be carried out prior to commencement of works to advice on livelihood restoration and compensation that may be required to fisher folk that will potential be impacted negatively.

APPENDICES

Appendix 1 ToR Approval

Appendix 2 Practicing license of Firm of Experts & Lead Experts

Appendix 3 Detailed baseline marine water quality report

Appendix 4 Detailed baseline ambient air quality report

Appendix 5 Detailed baseline noise level report

Appendix 6 Detailed baseline vibration level report

Appendix 7 Bills of Quantities for Berth 19B development

Appendix 8 Invitation letters to stakeholder consultative meetings

Appendix 9 Minutes of the Kick-off meeting

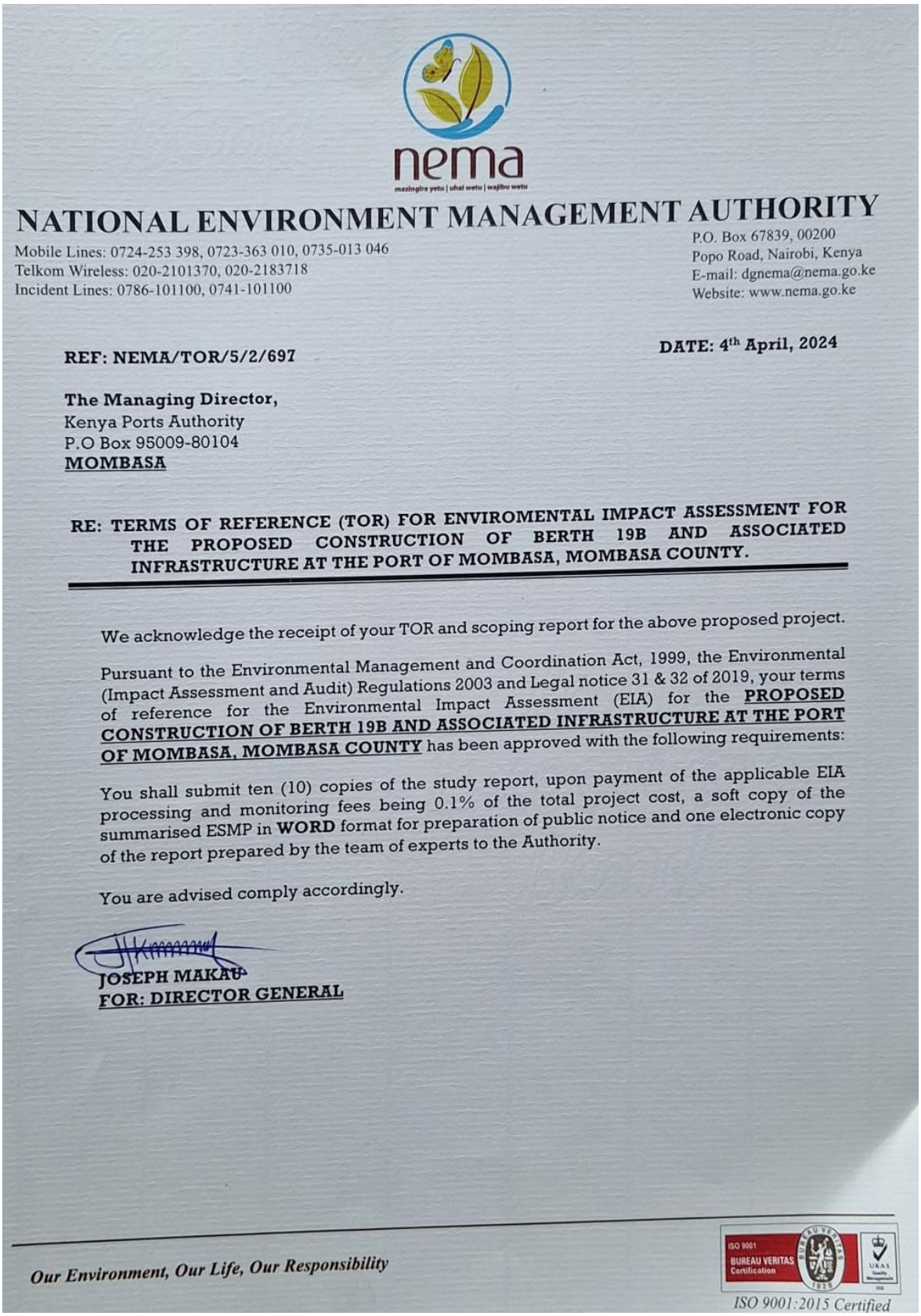
Appendix 10 Minutes of the site meetings

Appendix 11 Attendance list and minutes of meeting with BMUs

Appendix 12 Attendance list and minutes of meeting with key stakeholders

Appendix 13 Attendance list and minutes of Public Baraza

APPENDIX 1: TOR APPROVAL LETTER



nema
mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Mobile Lines: 0724-253 398, 0723-363 010, 0735-013 046
Telkom Wireless: 020-2101370, 020-2183718
Incident Lines: 0786-101100, 0741-101100

P.O. Box 67839, 00200
Popo Road, Nairobi, Kenya
E-mail: dgnema@nema.go.ke
Website: www.nema.go.ke

REF: NEMA/TOR/5/2/697

DATE: 4th April, 2024

The Managing Director,
Kenya Ports Authority
P.O Box 95009-80104
MOMBASA

RE: TERMS OF REFERENCE (TOR) FOR ENVIROMENTAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF BERTH 19B AND ASSOCIATED INFRASTRUCTURE AT THE PORT OF MOMBASA, MOMBASA COUNTY.

We acknowledge the receipt of your TOR and scoping report for the above proposed project.

Pursuant to the Environmental Management and Coordination Act, 1999, the Environmental (Impact Assessment and Audit) Regulations 2003 and Legal notice 31 & 32 of 2019, your terms of reference for the Environmental Impact Assessment (EIA) for the **PROPOSED CONSTRUCTION OF BERTH 19B AND ASSOCIATED INFRASTRUCTURE AT THE PORT OF MOMBASA, MOMBASA COUNTY** has been approved with the following requirements:

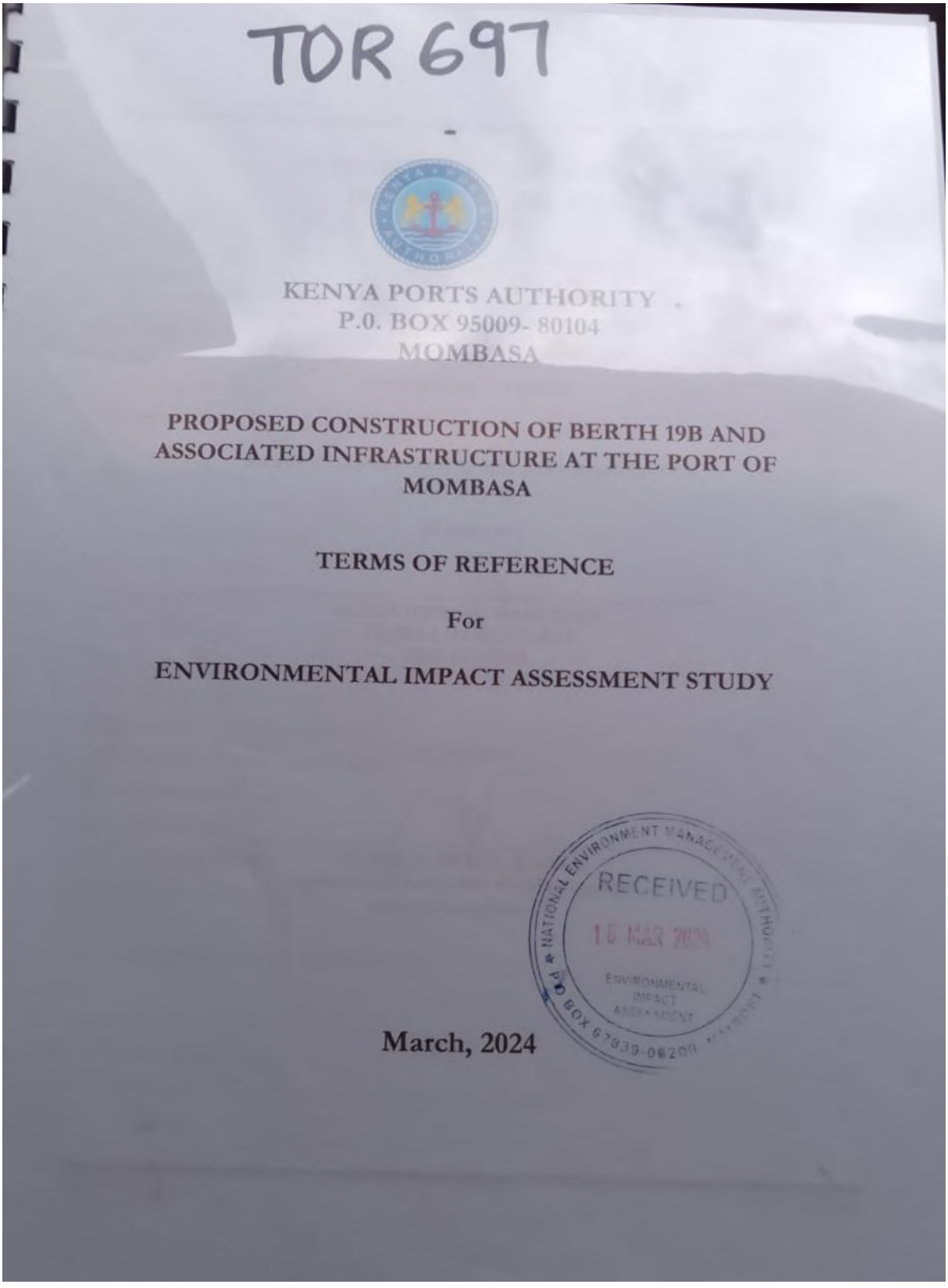
You shall submit ten (10) copies of the study report, upon payment of the applicable EIA processing and monitoring fees being 0.1% of the total project cost, a soft copy of the summarised ESMP in **WORD** format for preparation of public notice and one electronic copy of the report prepared by the team of experts to the Authority.

You are advised comply accordingly.

JOSEPH MAKAU
FOR: DIRECTOR GENERAL

Our Environment, Our Life, Our Responsibility

ISO 9001 BUREAU VERITAS Certification
ISO 9001:2015 Certified



TOR 697

KENYA PORTS AUTHORITY
P.0. BOX 95009- 80104
MOMBASA

PROPOSED CONSTRUCTION OF BERTH 19B AND ASSOCIATED INFRASTRUCTURE AT THE PORT OF MOMBASA

TERMS OF REFERENCE

For

ENVIRONMENTAL IMPACT ASSESSMENT STUDY

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY
RECEIVED
16 MAR 2024
ENVIRONMENTAL IMPACT ASSESSMENT
P.O BOX 67839-00200

March, 2024

APPENDIX 2 PRACTICING LICENSE FOR FIRM OF EXPERTS

FORM 7 (r.15(2))

EAE 23061897

nema
Mazingira Yetu | Uhai Wetu | Wajibu Wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

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

License No : NEMA/EIA/ERPL/20840

Application Reference No: NEMA/EIA/EL/27700

M/S **heztech engineering services**
(individual or firm) of address
P.O.BOX 42269-80100 MOMBASA

is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Firm of Experts** registration number **5194**

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

Issued Date: **2/12/2024** Expiry Date: **12/31/2024**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

PRACTICING LICENSE FOR LEAD EXPERT – H. ADALA

FORM 7

EAE 2 3060750

(r.15(2))

nema

Mazingira Yetu | Uhai Wetu | Wajibu Wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

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

License No : NEMA/EIA/ERPL/21222

Application Reference No: NEMA/EIA/EL/26794

M/S **HEZEKIAH ADALA**
(individual or firm) of address
P.O. Box 42265 - 80100 MOMBASA

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General

registration number **0094**

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

Issued Date: **3/12/2024** Expiry Date: **12/31/2024**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

PRACTICING LICENSE FOR LEAD EXPERT – PHILIP OMENGE

FORM 7

EAE 23060633

(r.15(2))

nema

Mazingira Yetu | Uhai Wetu | Wajibu Wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

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

License No : NEMA/EIA/ERPL/21096

Application Reference No: NEMA/EIA/EL/27013

M/S **DR. PHILIP MANYI OMENGE**
(individual or firm) of address
P.O. Box 569 - 80100 MOMBASA

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

registration number **1559**

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

Issued Date: **2/28/2024** Expiry Date: **12/31/2024**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 : 2015 Certified

APPENDIX 3 DETAILED BASELINE MARINE WATER QUALITY REPORT

BASELINE WATER QUALITY TESTING

Background Information on Marine Water Quality Testing

The National Environmental Management Authority requires that proposed development activities be subjected to an Environmental Impact Assessment in order to comprehensively understand the environmental context of the project location. The study also enables the proponent to identify and formulate strategies geared towards managing possible environmental concerns that may arise in the course of project implementations. Baseline monitoring is part of EIA study which determines the baseline environmental conditions around the project location and its findings are crucial in forming the benchmark for subsequent monitoring exercises as well as Environmental Audit.

Baseline water quality testing was conducted at key recommended locations within Kilindini Channel and Surrounding creeks of Tudor, Mwache and Tsunza. The assessment was conducted in order to document the current water quality conditions as affected by daily operations within the Port of Mombasa and other commercial/industrial operations in the neighbourhood. Kilindini channel has a number of plants and animal life, many of them endemic to this marine ecosystems. Changes in water quality as a result of development projects on the fringes of the channel has the likelihood of disrupting the normal balance existing therein.

Baseline water quality testing was expected to provide firsthand information about water quality conditions in the channel and surrounding creeks and further guide the proponent in formulation of strategies for environmental management and pollution control during the EIA study.

Scope of Work

The scope of work as per the contract with the client involved:

- Conducting Baseline water quality testing for 5 selected locations around the channels and surrounding creeks.
- To document and a comprehensive baseline water quality conditions for all the recommended locations surrounding the proposed project site.
- To establish the baseline conditions for subsequent monitoring exercise for the proposed project.

Objective of Baseline Water Quality Testing

- To test the concentration of physical and chemical parameters around the proposed monitoring locations.
- To establish the baseline water quality conditions for locations within Kilindini and surrounding creeks.
- To document the Baseline findings in a comprehensive report which will later be used as a basis to predict any environmental changes during the project implementation phase.

Testing Methodology

The methodology employed to establish the baseline marine water quality within Kilindini channel and surrounding creeks involved sampling of marine water samples and submission to the laboratory for

analysis of recommended parameters. A vertical water sampling technique was employed where the sampler was lowered into water column and used to draw marine water at depths of 0.5, 3.0 and 6.0 meters. The sampler employs the air pressure difference principle where when the valve at the top of the sampler is opened, water pressure forces water into the sampler through the bottom valve. Once the sampler is full to the capacity, the top valve is released hence sealing the sample for any possible contamination.

Samples were kept in a cooler box with ice packs to maintain the water chemistry and submitted to laboratory for analysis. A copy of chain of custody form that details sample descriptions accompanied the sample to the laboratory where sample information was registered before being relinquished to the laboratory analyst for analysis.

Laboratory Testing Protocols

Samples submitted to the laboratory were analyzed as per the test methods detailed in the table below;

Table 0-1: Parameters and their respective Test methods

Parameter	Test Method	Specification
Total Suspended Solids	Standard method for examination of water & wastewater method No. 2540-D	NEMA specification, Legal Notice I20 of 2006, Third Schedule
PH	Standard method for examination of water & wastewater method No. 4500-H	NEMA specification, Legal Notice I20 of 2006, Third Schedule
Chemical Oxygen Demand	Standard method for examination of water & wastewater method No. 5220-B	NEMA specification, Legal Notice I20 of 2006, Third Schedule
Dissolved Oxygen	Standard method for examination of water & wastewater method No. 4500-G	NEMA specification, Legal Notice I20 of 2006, Third Schedule
Turbidity	Standard method for examination of water & wastewater method No. 2130-B	NEMA specification, Legal Notice I20 of 2006, Third Schedule

Tools, Equipment and Materials

Sampler
Geographic Positioning System (GPS)
Digital camera
Oven
Desiccator
pH meter
Turbidity meter
DO meter
Filtration system

Frequency of Monitoring

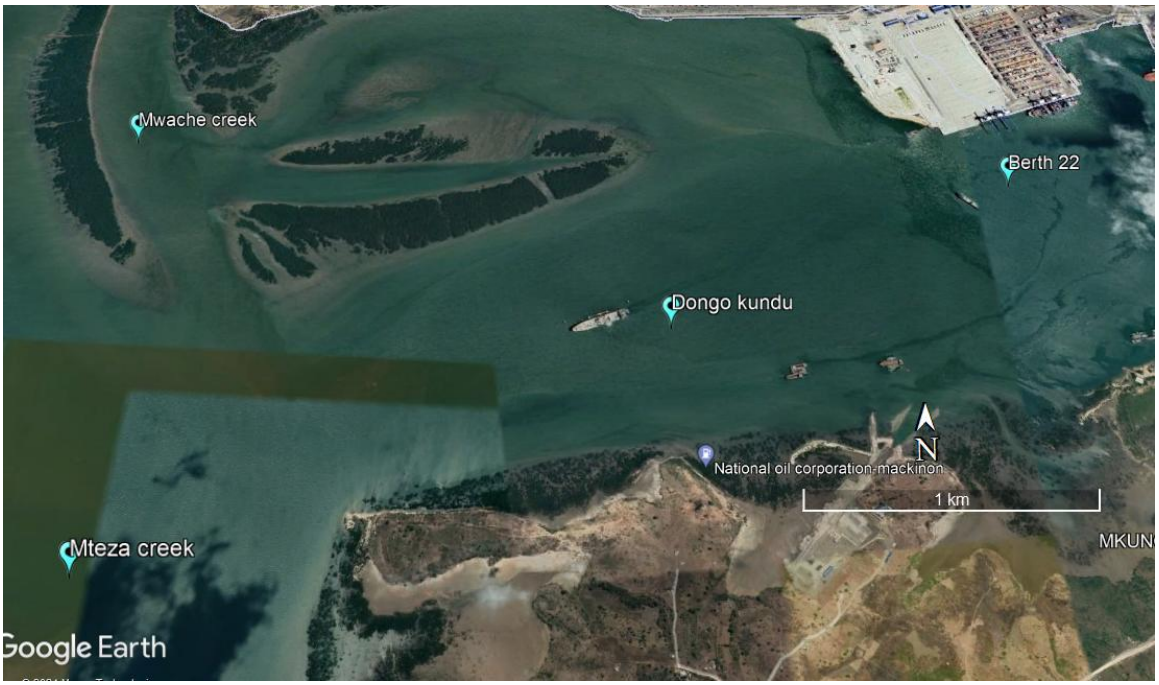
Sampling of marine water was conducted at the recommended locations within Kilindini channel and surrounding creeks once on 15th February 2024. Collected samples were submitted to the laboratory for analysis of physical and chemical parameters.

Description of the Measurement Location

Baseline marine water quality testing was conducted at 8 selected monitoring locations. The table below details the measurement locations and the rationale for point selection.

Table 0-2: Measurement locations and rationale for their selection

Measurement location	Rationale for measurement Location
Mwache creek	Testing results were to form the benchmark for monitoring impacts of port operations to water quality within the creek.
Mteza creek	Measurement location was to provide the current conditions within the creek which shall form the benchmark for subsequent monitoring during project implementation phase.
Tudor creek	Results from the location were to provide benchmark upon which subsequent marine water management and pollution control strategies shall be based.
Dongo Kundu	The point was located about 50 meters from the site for the proposed construction of the Mombasa Special Economic Zone. Baseline results will assist in implementation of measures for managing cumulative effects of pollution.
Berth 22	The point was located about 15 meters from Berth 22. Baseline results would form benchmark for monitoring water quality around the area.
Berth 17	The point was located next to berth 18 where demolition and construction of Berth 19B will take place.
Berth 16	Monitoring location was located about 30 meters from berth 16 and would be critical in monitoring pollution contributed by tidal currents during construction phase.
KPA headquarter	This location was to provide benchmark for monitoring pollution from Kilindini channel towards Tudor creek.



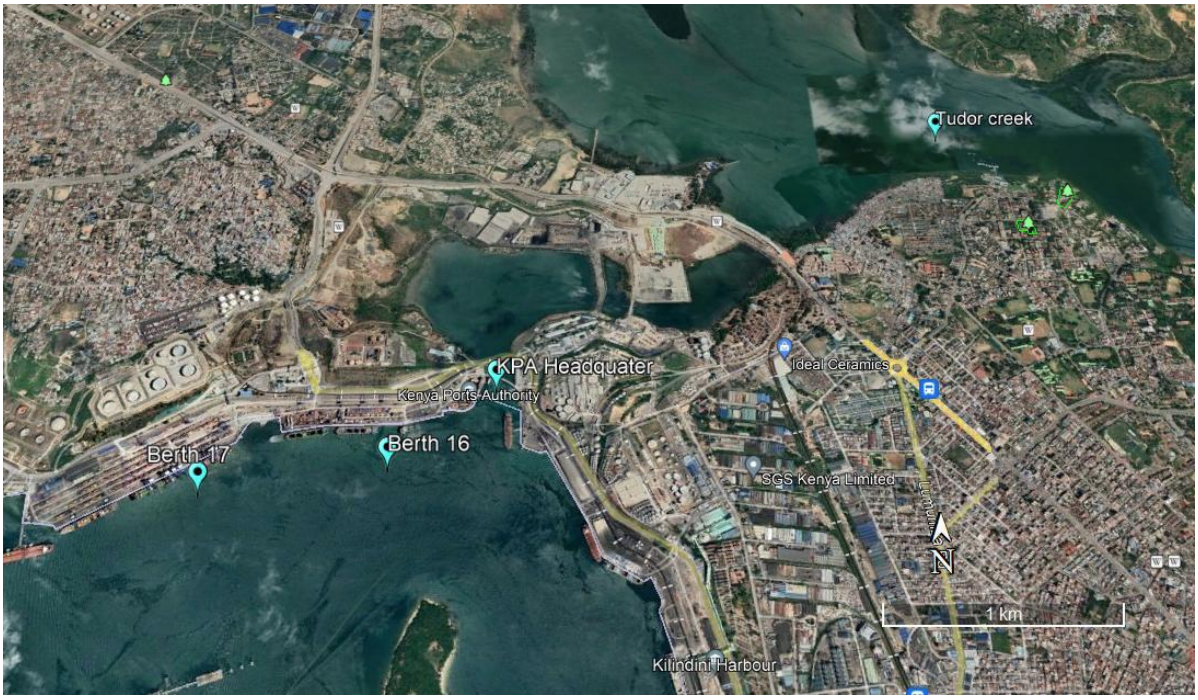


Figure 0-1: A map showing the measurement locations within Kilindini channel and surrounding creeks _Source: Google Earth

Table 0-3: Description of Monitoring locations

No.	SITE NAME	GPS CO-ORDINATES	DESCRIPTION	ONGOING ACTIVITIES
1.	Mwache creek	4° 3'4.08"S 39°35'1.40"E	Measurement location situated within Mwache creek	Fishing activities by locals
2.	Mteza creek	4° 4'1.49"S 39°35'5.43"E	Measurement point located within Mteza creek.	Fishing activities by locals
3.	Tudor creek	4° 1'42.19"S 39°39'40.59"E	Measurement location situated about 100 meters from Tudor water sport	Fishing activities by locals
4.	Dongo Kundu	4° 3'33.24"S 39°36'10.31"E	Located about 50meters from AGOL LPG terminal	Occasional speedboat movement
5.	Berth 22	4° 3'13.50"S 39°36'54.85"E	Located about 15 meters from berth 15.	Offloading of cargo from ships
6.	Berth 17	4° 2'46.70"S 39°37'44.20"E	Located about 30 meters from old KOT	Offloading of containers at berth 18.

No.	SITE NAME	GPS CO-ORDINATES	DESCRIPTION	ONGOING ACTIVITIES
7.	Berth 16	4° 2'43.30"S 39°38'10.90"E	Located about 30 meters from berth 16.	Offloading of cargo from ships
18.	KPA Headquarter	4° 2'30.62"S 39°38'26.26"E	Located between KPA headquarter offices and CCC offices	No activities

Rationale for PARAMETER Selection

pH

The pH value of a water source is a measure of its acidity or alkalinity. The pH level is a measurement of the activity of the hydrogen atom, because the hydrogen activity is a good representation of the acidity or alkalinity of the water. It's expressed on an algorithmic with pH of less than 7 being acidic while that of more than 7 being basic. Changes in marine water pH has ripple effect on a number of water quality parameters that are directly affected by it. In a construction sector such changes can result from activities such as release of wastewater into marine water.

Dissolved Oxygen

Dissolved oxygen refers to the level of free, non-compound oxygen present in water or other liquids. It is an important parameter in assessing water quality because of its influence on the organisms living within a body of water. A dissolved oxygen level that is too high or too low can harm aquatic life and affect water quality. Dissolved oxygen is necessary to many forms of life including fish, invertebrates, bacteria and plants. These organisms use oxygen in respiration, similar to organisms on land. Fish and crustaceans obtain oxygen for respiration through their gills, while plant life and phytoplankton require dissolved oxygen for respiration when there is no light for photosynthesis [4]. The amount of dissolved oxygen needed varies from creature to creature. Bottom feeders, crabs, oysters and worms need minimal amounts of oxygen, while shallow water fish need higher levels.

Chemical Oxygen Demand

Chemical oxygen demand (COD) is the amount of dissolved oxygen that must be present in water to oxidize chemical organic materials. COD measurement determines the ability of water to chemically breakdown chemical compounds therein. High chemical oxygen demand in water indicates greater levels of oxidizable organic matter and consequently, a lower amount of Dissolved Oxygen (DO). Critical DO depletion due to organic contamination can kill off aquatic life forms. A COD test indirectly measures the concentration of organic compounds in a sample of water by measuring the amount of oxygen required for oxidation of all the organic compounds present.

Turbidity

Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is a measurement of the amount of light that is scattered by material in the water when a light is shined through the water sample. The higher the intensity of scattered light, the higher the turbidity. Material that causes

water to be turbid include clay, silt, very tiny inorganic and organic matter, algae, dissolved colored organic compounds, and plankton and other microscopic organisms. High concentrations of particulate matter affect light penetration and ecological productivity, recreational values, and habitat quality, and cause lakes to fill in faster. Particles also provide attachment places for other pollutants, notably metals and bacteria. For this reason, turbidity readings can be used as an indicator of potential pollution in a water body.

Total Suspended Solids

Total Suspended Solids refers to all the particles/sediments that found within a water column in a suspension form. Suspended solids in water determine water clarity, therefore, TSS can be used to establish suitability of water for varying purposes. Suspended solids in water absorb heat energy from the environment making the water warm. When water is warm, the ability of oxygen to dissolve declines, hence impacting life. Human activities such as dredging can disturb the seabed resulting in resuspension of sediments hence high levels of TSS.

TEST RESULTS

The tables below illustrate a summary of average results for Chemical and physical water quality parameters.

Table 0-4: Marine Water Quality Average Test Results

Measurement location	pH @25.50°C	Dissolved oxygen Mg/l	Chemical Oxygen Demand Mg/l	Total Suspended Solids Mg/l	Turbidity NTU	Water Temperature °C
CCC/KPA HQ	8.10	6.52	8.33	3.53	27.60	25.57
Berth 16	8.19	6.50	8.23	2.64	34.27	25.43
Berth 18	8.15	6.52	7.47	3.32	34.40	25.43
Berth 21	8.07	6.50	7.93	2.69	34.80	25.5
Dongo Kundu	8.07	6.52	7.37	3.41	35.20	25.57
Mteza Creek	8.01	5.77	10.37	7.75	62.67	25.5
Mwache creek	7.93	6.39	11.33	11.55	72.00	25.47
Tudor creek	8.16	6.43	8.83	6.25	52.67	25.53

Graphical Representation AND DISCUSSION OF RESULTS

pH, DO, COD

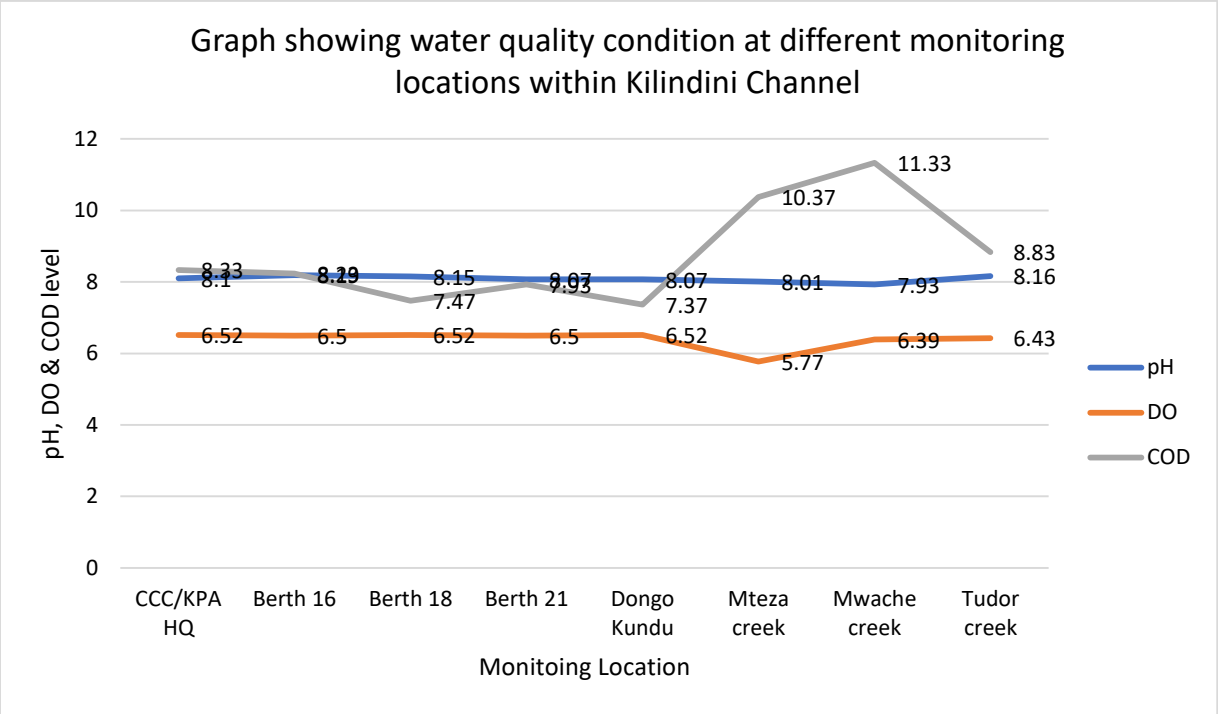


Figure 0-2: Average results of pH, Dissolved Oxygen and Chemical Oxygen Demand

Results for pH, DO and COD were compared against each monitoring location within Kilindini channel and the surrounding creeks. The levels of pH were relative the same for all the locations within the port of Mombasa and surrounding creeks. Slightly lower pH levels were recorded at Mwache as compared to Mteza and Tudor creeks. Dissolved oxygen concentrations within Kilindini channel monitoring locations, is relatively unchanged. The levels of DO recorded in all monitoring locations within the creeks of Tudor, Mwache and Mteza were lower than the levels recorded at locations within Kilindini channel. This means that dissolved oxygen depleting processes within the creeks are higher than those within Kilindini channel. Slightly higher levels of COD were recorded at locations within Tudor, Mwache and Mteza as compared to the average results for locations within Kilindini channel. Higher COD levels recorded within the creeks of Tudor, Mwache and Mteza creeks could be as a result of influx of organic and inorganic compounds from operations therein such as the construction of Mombasa southern bypass.

Turbidity, Suspended Solids and Water temperature

The levels of Total suspended solids at locations within the creeks of Tudor, Mwache and Mteza were relatively higher than the levels recorded at locations within Kilindini channel. Similarly, the average results for turbidity for locations within Tudor, Mwache and Mteza creeks were higher than the levels recorded in Kilindini channel. High turbidity and TSS levels recorded could be as a result of increased sedimentation within the creeks due to tidal currents and inundation along the riparian zones. Results for water temperature were relatively similar for all the monitoring locations.

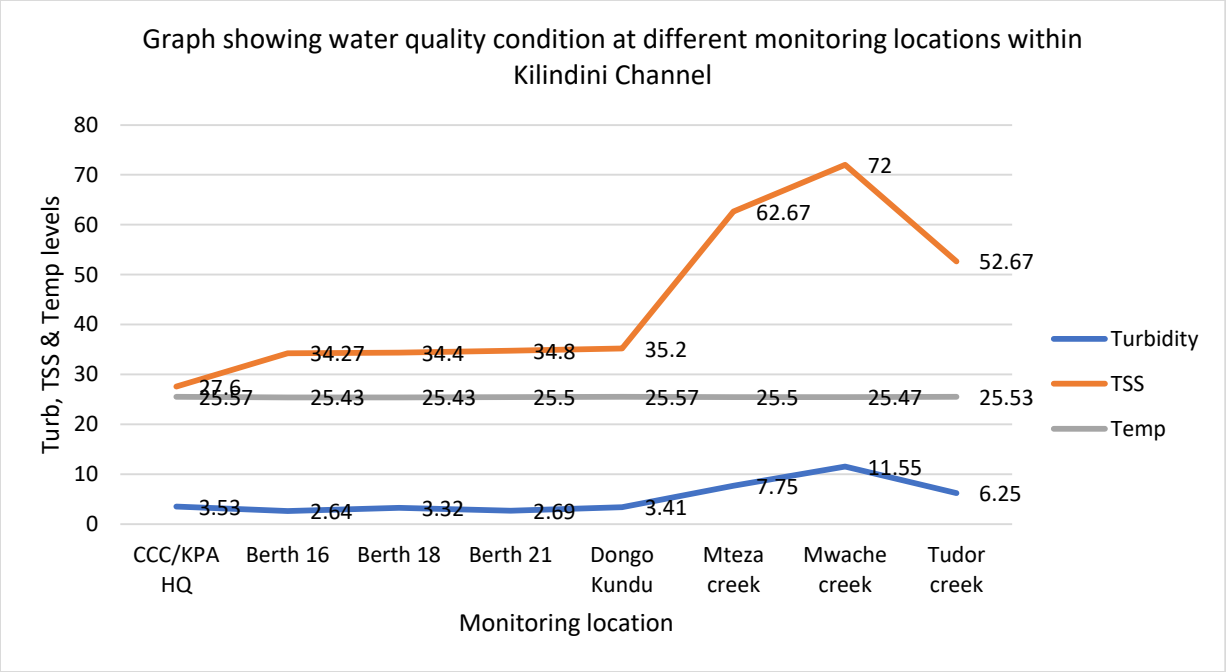


Figure 0-3: Average of Turbidity, Suspended Solids and Water temperature

Relationship Between Chemical Oxygen demand and Dissolved Oxygen

Dissolved Oxygen (DO) and Chemical Oxygen Demand (COD) are two important parameters indicating the general conditions of the water. Dissolved Oxygen indicates the total amount of oxygen dissolved in the water. Most marine organisms need oxygen for respiration and maintenance of life processes.

Chemical Oxygen Demand measures the amount of oxygen consumed by microorganisms in decomposing organic matters in water. It is generally used to reflect the level of organic pollution of environmental water. Therefore, an increase in COD levels results in a decrease in available Dissolved Oxygen.

Relationship Between Total Suspended Solids (TSS) and Turbidity

TSS measures the weight of particles suspended in the water while Turbidity is a visual description of how the water looks. The presence of suspended solids in water can result in reduced clarity, hence limiting its quality. Turbidity results can be used as a surrogate measure of TSS in statistical studies where a range of values of both parameters are used to draw a correlation.

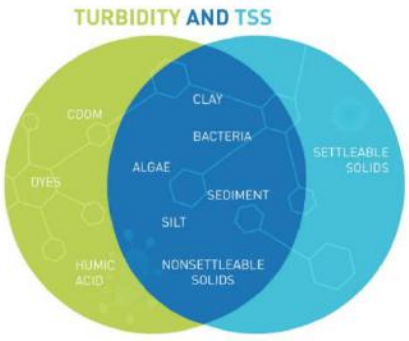


Figure 0-4: Pictorial illustration of the relationship between Turbidity and TSS

Impact of tides on marine water quality

Tidal currents in oceans are caused by rising and falling of the sea level as a result of astronomical gravitational pull-on water bodies. These currents together with weather conditions such as wind, result in movement of water which in turn circulate substances around water channels. Without these external forces, the ocean's surface would simply exist as a geopotential surface or geoid, where the water is pulled by gravity without currents or tides. Tidal currents in open oceans, creeks and channels contribute to a self-cleaning mechanism where pollutants from creeks are washed into the open oceans resulting in dilution effects. Equally, contaminants from the deep ocean are washed back to offshore waters, hence limiting their pollution. This assists in regulating the general purity of marine water, hence safeguarding the quality of life therein.

Conclusion and Recommendation

Baseline monitoring results for all the monitoring locations show that marine water quality within Kilindini channel is relatively the same. The results do not show any potential pollution hotspots, hence demonstrating the effectiveness of tidal currents in pollutant dilution and dispersion within Kilindini channel and surrounding creeks. Results for locations within the creeks of Mwache, Mteza and Tudor show a decline in water quality as compared to those for Kilindini channel.

The following measures are therefore, recommended as strategies for limiting pollution of marine water at recommended monitoring locations during demolition and construction stages of the project;

- Implement measures that control marine water pollution from the sources.
- Periodic marine water quality monitoring to document changes over time.

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HELCOM Guidelines for Management of Dredged Material at Sea - HELCOM 36-2015 on 4 March 2015

APPENDIX 4 DETAILED BASELINE AMBIENT AIR QUALITY REPORT

Background Information on Ambient Air Quality Measurement

KPA is a government agency mandated to oversees the management, operation, and coordination of seaports and inland waterways, with Mombasa serving as a pivotal location within its purview. Committed to delivering effective and competitive port services to foster global economic growth through trade facilitation, KPA recognizes the critical role ports play in advancing the Blue Economy agenda. The Authorityis focused on its expansion agenda which shall promote cargo handling capacity hence positioning themselves competitively against other players in the neighbouring nations of Tanzania and Djibouti.

Baseline ambient air quality measurement was therefore, commissioned by KPA to document a comprehensive ambient air quality at receptor sites surrounding the proposed project site. The study was to show how the ongoing operations within KPA influence the quality of air at these locations before the start of the proposed project activities. The study findings were to assist the authority in determining the benchmarks for subsequent monitoring exercises and further inform the proponent on viable control measures for adoption to minimize environmental impacts from the project site.

Scope of Work

- The scope of work as agreed with the client involved:
- Conducting baseline Air Quality measurements at selected locations around the KOT 1 project site
- Collecting ambient air data at selected measurement locations
- Correlate the finding to the EMC (Air Quality), Regulations, 2014 and WHO ambient air quality guidelines for Compliance.

Objective of Air Quality Measurement

- To measure the concentration of main Particulate Matter and Gaseous parameters at the project site
- To correlate the findings with Environmental Management and Coordination (Air Quality), Regulations, 2014 to ascertain for Compliance.
- To document the baseline findings in a comprehensive report which will later be used as a basis to monitor and assess the environmental conditions.

Measurement Methodology

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

Active and Continuous Sampling for Gaseous and Particulate Parameters

Measurement of ambient air quality was conducted using AQM 09 Air Quality Monitor system. Based on advanced sensor technology, the AQM 09 integrates the main ambient gases and meteorological parameters.

Measurements for Nitrogen Oxides, Carbon monoxide and Sulfur dioxide were done using the gas sensitive electrochemical methods of active and continuous sampling. The gas sensitive electrochemical

sensors generate nano-amp currents proportional to the gas concentration. AQM uses low noise electronics to capture these signals resulting in low detection levels.

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

The AQM 09 has a laser particle counter (LPC) for Particulate Matter (PM) measurements. It uses optimized signal processing using low noise electronics, it has algorithms that are added to correct for interferences, e.g., humidity. The equipment was mounted at about 1 – 2 M above the ground surface.

Meteorological Parameters Measurement techniques

As part of the ambient air quality measurement, meteorological parameters were measured. Temperature and humidity were measured on site while windspeed and direction were obtained from online from the Meteorological department. The following techniques were employed:

Temperature & humidity were measured using the AQM 09 Air quality Monitor station series which houses temperature and humidity sensors. Temperature was measured by way of a highly accurate Air Chip 3000 while humidity was measured using a capacitive humidity sensor (accuracy < 0.8 % / 0.1 K). To keep the effects of external influences (e.g., solar radiation) as low as possible, the sensors were in a ventilated housing with radiation protection.

Measurement Tools, Equipment and Materials

- AQM 09 Air Quality Monitoring Station
- Geographic Positioning System (GPS)
- Digital camera
- Calibration certificates

Description of the Measurement Location

Measurement points were selected at locations within and surrounding port operations areas. Point selection was based on the size of the area, ongoing operations and proximity to nearby receptors.

Table 0-5: Measurement locations

NO.	SITE NAME	GPS CO-ORDINATES	DESCRIPTION	ONGOING ACTIVITIES
1	Kipevu Clinic	4°2'34.85"S 39°37'5.78"E	Measurement point was located at entrance of Kipevu clinic.	Truck and personal service vehicle movement along the road
2	CT2 Area	4°2'40.38"S 39°36'59.67"E	Measurement location was positioned a few meters from CT2 offices, next to the parking lot.	Occasional truck movement of trucks around the loading bay.
3	KPC Oil Tanks	4°2'41.53"S 39°37'18.83"E	The location was situated about 10 meters from the gate of KPC tanks.	Activities at this location majorly included movement of port operation vehicles.

NO.	SITE NAME	GPS CO-ORDINATES	DESCRIPTION	ONGOING ACTIVITIES
4	Engineering Department	4°2'45.67"S 39°37'22.37"E	Measurement location was situated behind the Engineering canteen.	Major activities included movement of locomotive and port operation vehicles into and out of the engineering department.
5	Berth No. 17	4°2'36.18"S 39°37'48.52"E	The location was situated in Breth 17 next to the offices within KPA High level residential areas. Next to the measurement location was the conveyor belt shed for Grain Bulk Handlers limited.	Major activities included movement of locomotive and port operation vehicles. Occasional movement private motor vehicles truck movement of trucks around the loading bay

Table 0-5 and Figure 0-5 below shows the measurement locations as well as their respective GPS Coordinates.

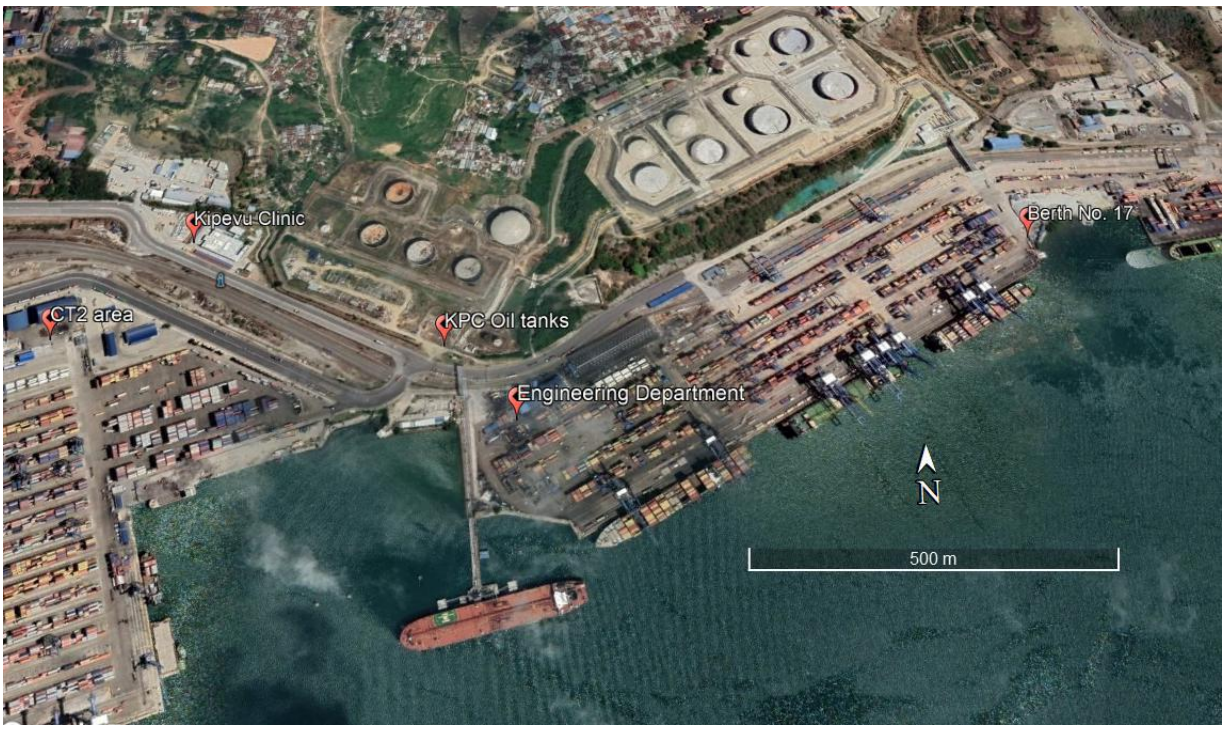

Figure 0-5: A map showing the measurement locations within Kenya Ports Authority

Rationale for Measurement Selection

Carbon Monoxide

Carbon monoxide is a product of incomplete combustion of carbon containing fuel in limited oxygen supply. In construction sector, emission of CO can result from gasoline and petrol-powered machinery movement or general operations. CO results in limited absorption of oxygen within the respiratory system, when inhaled by humans, hence can cause death.

Oxides of Nitrogen

The oxides of nitrogen (NO_X) comprise nitric oxide (NO) and Nitrogen Dioxide (NO_2). Oxides of Nitrogen are generated from combustion systems due to high pressures and temperatures, leading to oxidation of nitrogen with oxygen, both present in the air.

Particulate Matter

Particulate matter refers to is small particles that are classified as PM_{10}, $PM_{2.5}$ or $PM_{0.1}$ depending on their size. These particles have a diameter of less than 10 µm, 2.5 µm and 0.1 µm respectively; particles smaller than 0.1 µm are also called ultrafine particles (UFPs). The combustion of diesel and heavy fuel oil leads to a high amount of PM emissions. PM also develops when certain pollutants meet other substances.

The smaller the particles, the worse the effect on human health. Inhalation of inhalable particulate matter pose a great health risk. These tiny particles get into the lungs and are small enough to pass through tissues and enter the blood stream. They can then trigger inflammations which eventually cause heart and lung failures. The World Health Organization estimates that long term exposure to PM2.5 is associated with an increase in the risk of cardiopulmonary mortality by 6–13% per 10 µg/m3 of PM2.5. (Aeroqual, 2022).

Sulphur Dioxide

Sulphur dioxide is a colorless gas with a strong choking odor. It is produced from burning of fossil fuels and smelting of mineral ores such as copper, aluminum, zinc and lead. SOx (Oxides of Sulphur) comprehend a family of different chemical compounds characterized by the presence of Sulphur and Oxygen. In nature, these emissions are typically produced by volcanoes. They have harmful effects on the human body, as they stimulate nasal and throat nerves causing respiratory problems especially in asthmatic individuals.

Ozone

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

Wind Speed & Direction

The wind direction at a given time determines the general area into which a mass of gas or a cloud of particles will move. The wind speed closely specifies how rapidly the contaminant will advance into that area. Other things being equal, the concentration at a point downwind from the source will be inversely proportional to the wind speed. In rough terrain it cannot be assumed that the wind direction and speed near the source govern the subsequent motion of the contaminant. Hills may deflect the air flow either horizontally or vertically or both, the amount of deflection depending on the vertical stability of the atmosphere. In valleys the wind carrying a pollutant tends to flow either up or down valley, following its meanderings. The deeper the valley the more pronounced this channeling effect is. (Hewson, 1956).

Temperature

Temperature and sunlight (solar radiation) play an important role in the chemical reactions that occur in the atmosphere to form photochemical smog from other pollutants. Favourable conditions can lead to increased concentrations of smog.

Humidity

Like temperature and solar radiation, water vapor plays an important role in many thermal and photochemical reactions in the atmosphere. As water molecules are small and highly polar, they can bind strongly to many substances. If attached to particles suspended in the air, they can significantly increase the amount of light scattered by the particles. If the water molecules attach to corrosive gases, such as sulfur dioxide, the gas will dissolve in the water and form an acid solution that can damage health and property.

Rainfall

Rainfall normally washes particulate matter out of the atmosphere and dissolves gaseous pollutants. Removing particles improves visibility. Where there is frequent high rainfall, air quality is generally better. If the rain dissolves gaseous pollutants, such as sulfur dioxide, it can form acid rain resulting in potential damage to materials or vegetation.

LEGISLATIVE & GUIDELINES

The Environmental Management Coordination (Air Quality), Regulations), 2014.

The Kenya Air Quality Regulations 2014 impose limit values as detailed in the SPECIAL ISSUE Kenya Gazette Supplement No.41, Legislative Supplement No.15, Legal Notice No. 34, compliance with the objectives (prevention, control and abatement of air pollution to ensure clean and healthy ambient air) is a legal requirement in Kenya. Statutory requirements relevant to this study FIRST SCHEDULE are detailed in Table 1-2.

Table 0-6 Ambient Air Quality Tolerance Limits

	Pollutant	Time weighted Average			
	-	-	Industrial area	Residential, Rural & Other area	Controlled areas***
1	Sulphur Oxides (SOx)	24 hours**	125 µg/m^3	80 µg/m^3	30 µg/m^3
2	Oxides of Nitrogen (NOx)	24 hours	150 µg/m^3	80 µg/m^3	30 µg/m^3
3	Nitrogen Dioxide	24 hours	100 µg/m^3	0.1 ppm	-
4	Respirable particulate matter (<10 µg/m^3) (RPM)	24 hours**	150µg/Nm^3	100µg/Nm^3	75µg/Nm^3
5	$PM_{2.5}$	24 hours	75 µg/m^3	-	-
6	Carbon monoxide / carbon dioxide	8 Hours	5 mg/m^3	2.0 mg/m^3	1.0 mg/m^3
7	Hydrogen Sulphide	24 hours**	150 µg/m^3	-	-
8	Non-methane hydrocarbons	Instant peak	700 ppb	-	-
9	Total VOC	24 hours**	600 µg/m^3	-	-
7	Ozone	8 hours	120 µg/m^3	1.25 ppm	-

Note: (-) denotes that limits are not available in the EMC (Air Quality) Regulations, 2014

The table above is an excerpt of the FIRST SCHDEULE of the EMC (Air Quality) Regulations, 2014

World Health Organization (WHO) 2005 Air Quality Guideline

The WHO air quality guidelines are designed to offer guidance in reducing the health impacts of air pollution. These guidelines are intended to inform policymakers and to provide appropriate targets for a broad range of policy options for air quality management in different parts of the world. The new information included in this update of the Air quality guidelines relate to four common air pollutants: Particulate matter (PM), ozone (O_3), Nitrogen dioxide (NO_2) and Sulfur dioxide (SO_2). These are also listed in Table 4.1 of (IFC 2007).

Table 0-7: WHO Air Quality Guidelines

Parameter	Averaging period	Guideline value in ug/m^3
Sulphur Dioxide (SO_2)	24 – hour 10 minutes	125 (Interim target 1) 50 (Interim target 2) 20 (Guideline) 500 (Guideline)
Nitrogen Dioxide (NO_2)	1 – year 1-hour	40 (Guideline) 200 (guideline)
Particulate Matter (PM_{10})	1-year 24-hour	70 (Interim target 1) 50 (Interim target 2) 30 (Interim target 3) 20 (Guideline) 150 (Interim target 1) 100 (Interim target 1) 75 (Interim target 1) 50 (Guideline)
Particulate Matter ($PM_{2.5}$)	1-year 24-hour	35 (Interim target 1) 25 (Interim target 2) 15 (Interim target 3) 10 (Guideline) 75 (Interim target 1) 50 (Interim target 1) 37.5 (Interim target 1) 25 (Guideline)
Ozone	8-hour daily Maximum	160 (Interim target 1) 100 (guideline)

Source: (World Health Organisation, 2005)

In addition to guideline values, interim targets are given for each pollutant. These are proposed as incremental steps in a progressive reduction of air pollution and are intended for use in areas where pollution is high. These targets aim to promote a shift from high air pollutant concentrations, which have acute and serious health consequences, to lower air pollutant concentrations. If these targets were to be achieved, one could expect significant reductions in risks for acute and chronic health effects from air pollution. Progress towards the guideline values should, however, be the ultimate objective of air quality management and health risk reduction in all areas

MEASUREMENT RESULTS

The section below summarizes the 24-hour monitoring results of air quality monitoring for the six locations. Hourly concentrations for each parameter.

Table 0-8: Air quality measurement average results

Measurement location	Temperature °C	Humidity %	Wind Direction	Wind Speed	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	CO (mg/m^3)	SO_2 (ug/m^3)	NO_2 (ug/m^3)	NO (ug/m^3)	O_3 (ug/m^3)
Kipevu Clinic	**28.92**	**74.36**	**SE**	**1.97**	**11.74**	**14.59**	**0.216**	**10.28**	**24.89**	**9.35**	**162.3**
CT2 Area	**27.59**	**70.76**	**SE**	**2.14**	**9.46**	**11.32**	**0.191**	**9.67**	**21.04**	**8.38**	**142.71**
KPC Oil Tanks	**27.38**	**70.08**	**SE**	**2.21**	**15.24**	**17.43**	**0.207**	**15.64**	**26.33**	**12.16**	**126.84**
Eng. Department	**28.77**	**72.47**	**SE**	**2.09**	**12.18**	**14.66**	**0.258**	**15.08**	**25.49**	**11.28**	**159.15**
Berth No. 17	**27.64**	**71.29**	**SE**	**2.11**	**13.76**	**15.20**	**0.287**	**14.93**	**26.37**	**12.37**	**150.98**
WHO Ambient air guidelines, 2005		-	-	-	25	50	-	20	-	-	-
EMC (Air Quality) regulation 2014		-	-	-	**75**	150	5	125	100	80	150

Graphical Representation

Particulate Matter (PM_{10})

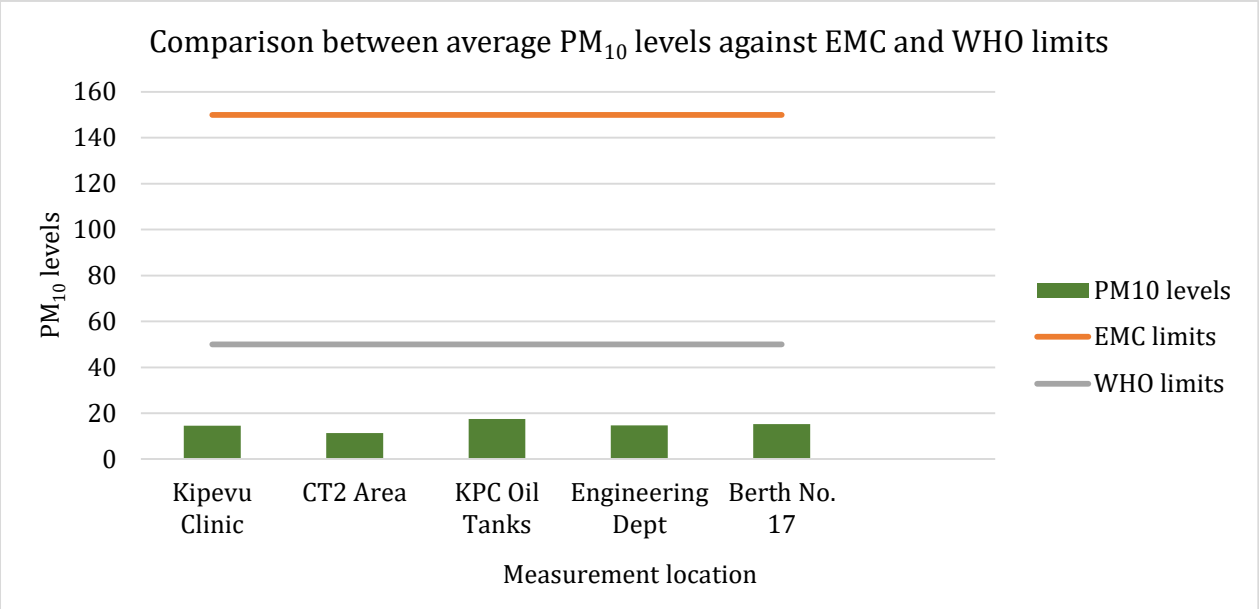

Figure 0-6 Average PM_{10} results against WHO air quality guidelines and EMC (Air Quality), Regulations, 2014

Particulate matter ($PM_{2.5}$)

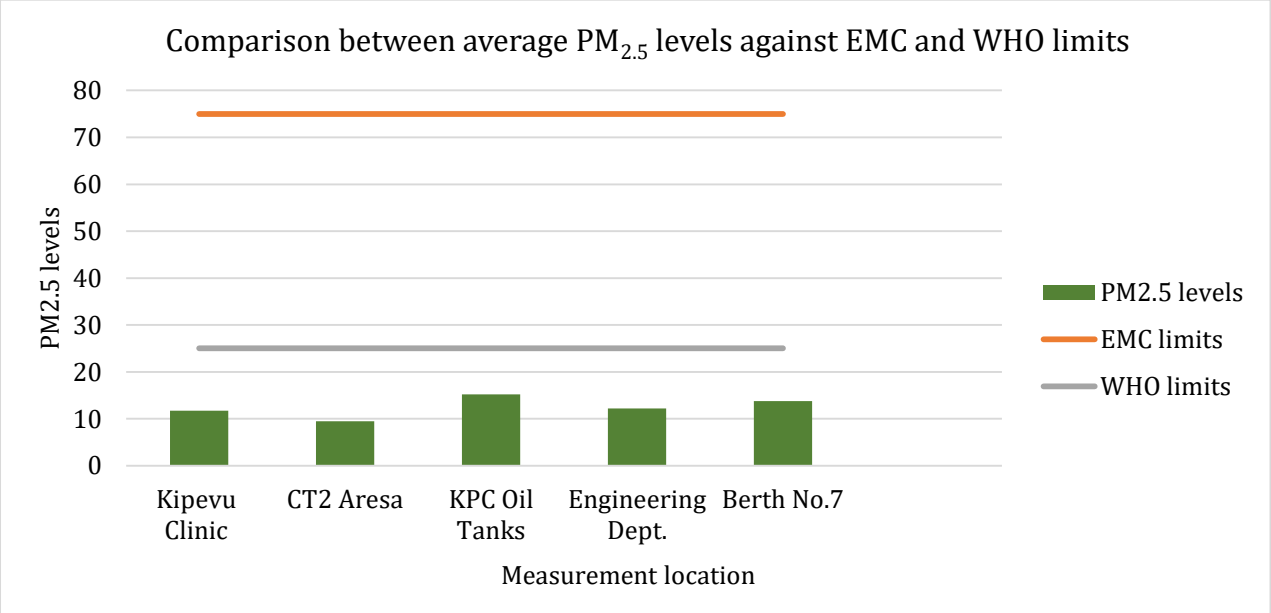

Figure 0-7: Average $PM_{2.5}$ results against the EMC (Air quality) regulation 2014 limits

Sulphur Dioxides

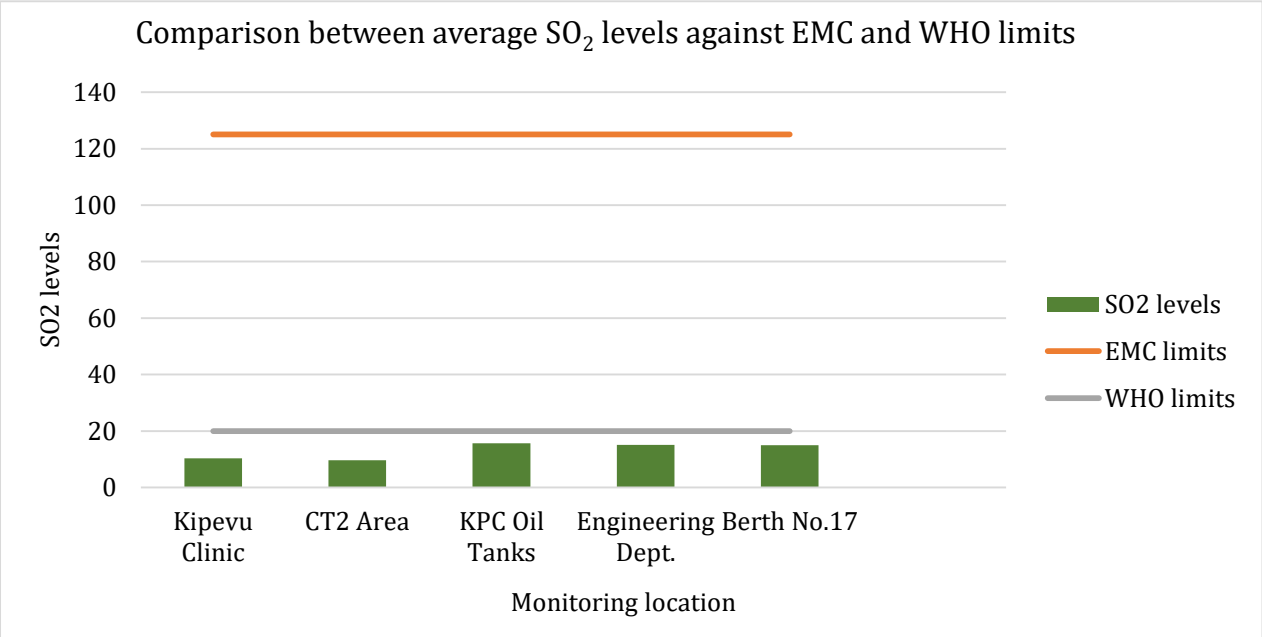

Figure 0-8: Average SO_2 against EMC (Air Quality) Regulations, 2014

Nitrogen Dioxide

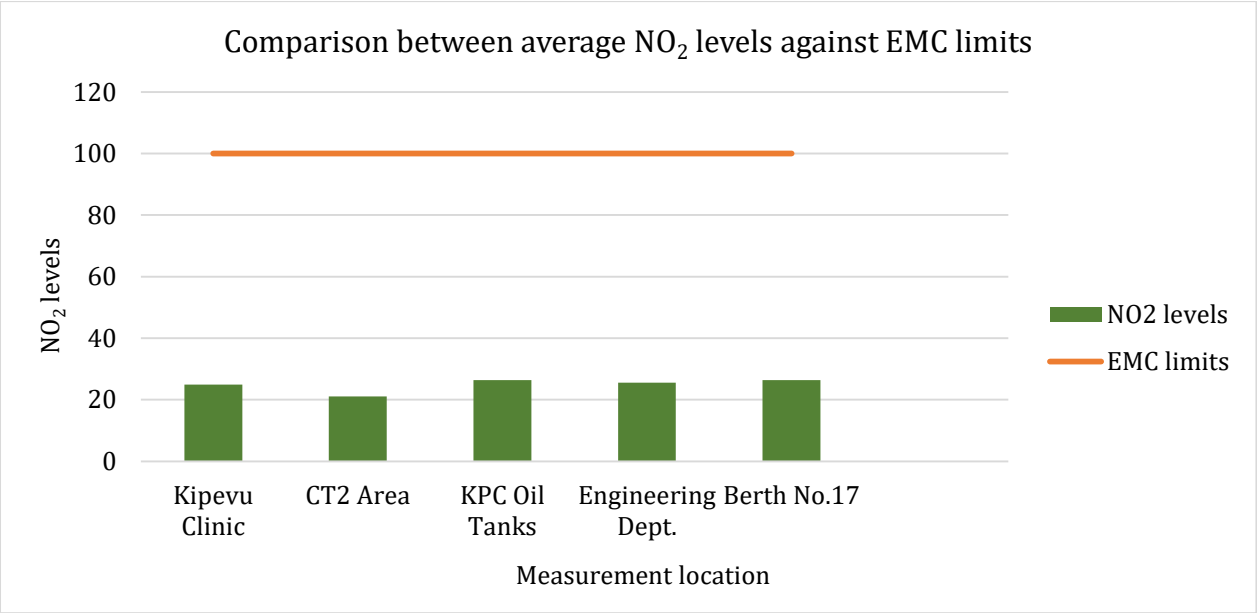

Figure 0-9: Average NO_2 against EMC (Air Quality) Regulations, 2014

Nitrogen Oxide

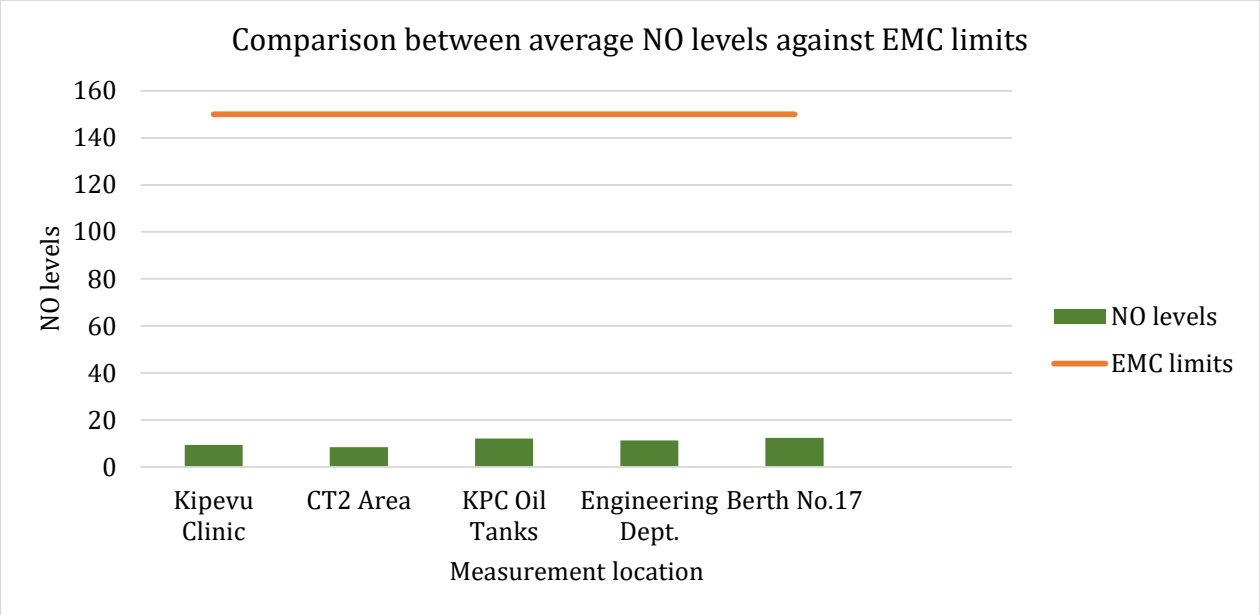

Figure 0-10: Average Nitrogen Oxide against WHO air quality guidelines

Discussion of Results

The comprehensive ambient air quality assessment was conducted at various locations within Mombasa port for both gaseous and particulate matter parameters. Notably, all the predetermined objectives were successfully met during the measurement period. All the gaseous and particulate matter parameters complied with limits set in the EMC (Air quality) regulation 2014 and WHO ambient air quality guidelines.

Potential sources of particulate matter emissions at the measurement stations encompassed activities such as truck movement around container terminals, emissions from locomotives and personal service vehicles. Other sources included fugitive emissions from windblown dust. Gaseous parameters, including Sulphur dioxide, carbon monoxide, nitrogen dioxide, and nitrogen oxide, were identified as potential outcomes of exhaust emissions from various sources, such as ships, locomotives, trucks, and personal service vehicles.

Activities that contributed to the levels recorded at CT2 area, Kipevu clinic and KPC oil tanks included occasional movement of personal service vehicles in and out of the parking areas and also truck movement along the nearby access roads.

Conclusion

Results of all the gaseous and particulate matter parameters complied with both EMC (Air quality) Regulation 2014 and WHO limits for all the measurement locations. Ongoing operations within Kenya port Authority have not deteriorated ambient air quality at receptor locations assessed during the measurement exercise.

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APPENDIX 5 DETAILED BASELINE NOISE LEVEL REPORT

Background Information on Ambient Noise Measurement

Baseline ambient noise levels measurement was conducted for the proposed construction of berth 19B and associated infrastructure at the Port of Mombasa. Recognizing the inherent environmental implications and the need for meticulous planning, this report aims to establish a baseline understanding of the existing acoustic conditions at locations surrounding the project area. As the decommissioning, demolition and construction activities unfold, this baseline will serve as a crucial reference point to evaluate and mitigate potential noise impacts on terrestrial environments, ensuring a harmonious coexistence within the port ecosystem. Through rigorous data collection and analysis, this report contributes to the project's commitment to environmental stewardship and sustainable development practices.

Noise, which is commonly described as undesired sound, is typically characterized by its intensity, frequency, periodicity (continuous or intermittent), and duration. Sound is created by the air pressure changes resulting from vibration (Thompson, 1994).

Scope of Work

The scope of work as agreed with the client includes.

Baseline noise level measurement for LAmax, LAmin and LAeq for selected measurement location.

Correlating the data against the EMC (Noise and Excessive vibration) regulation 2009 limits.

Objective of QAURTELY Noise levels Measurement

To measure diurnal and nocturnal noise levels at the selected locations

To correlate the obtained noise data with the Excessive Noise & Vibrations (EMC) Regulations of 2009.

To document the findings of the study in a comprehensive report, which will be used to determine the noise levels for compliance.

To utilize the documented report for future correlation during project construction phase.

Measurement Methodology

The Noise measurements were carried as per the ISO 1996 Parts 1, 2 and 3 standards, entailing the following:

Inspection of the vicinity and the implicated activities

Verification/Calibration of the sound level meter before and after the measurements.

Meteorological conditions during the measurement- Measurements of temperature, wind speed and relative humidity were taken before the noise level measurements. The ISO 1996 does not define the length of the measuring period and only advises on the measuring time that covers the changes in operation of the noise source. A series of short-term measurements were conducted at representative measurement locations. These allowed the nature, character and dominant noise sources surrounding and within the Study Area to be identified. Measurements were in duration of 10 to 20 minutes and

recorded the following parameters - LAeq, LAmax, and LAmin, L90 and L10. Noise levels are expressed in decibels, A-weighted sound pressure level (dBA). The measurement results are expressed as follows:

Instrumentation

The following instruments were used during the measurement:

Noise Meter: A Type 1, Data logging, precision impulse, integrating sound level meter, with a microphone (and windshield) mounted on a tripod at 1.5m above the ground level and >3m from any façade. Noise level measurement was conducted approximately 2 meters from any sound-reflecting objects, including walls and trees.

Measurement Tools, Materials and Equipment

Sound Level meter TES 1358C

Geographical Positioning System

Digital camera

Calibration Certificates

Regulatory Framework relevant to Noise Emission and Exposure Limits

The legislative controls relevant to noise emissions associated with any development is outlined in the legal notice no. 61 the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. These Regulations were established in 2009 to regulate and control noise and excessive vibration pollution in order to protect the environment and public health.

The regulations provide guidelines for the acceptable noise and vibration levels in different environments, including residential, commercial, and industrial areas. They also outline the responsibilities of various stakeholders, including developers, property owners, and regulatory authorities, in managing and controlling noise and vibration pollution. Under these regulations, any person who generates noise or vibration beyond the acceptable levels is required to take measures to reduce the pollution, including using noise reduction equipment and controlling the time and duration of noise or vibration. The regulations also establish penalties for non-compliance, which may include fines, suspension or revocation of licenses, or imprisonment.

Overall, the Kenyan Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 aim to promote sustainable development by ensuring that noise and vibration pollution is effectively managed and controlled to minimize their negative impacts on the environment and public health.

Table 0-9 EMCA Legal Notice 61. First Schedule Extract

ZONE		*Sound Level Limits dB (A) L_{eq}, 14 h*		*Noise Rating Level (NR) L_{eq}, 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

World Health Organization Guidelines for Community Noise

Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. Main sources of community noise include road, rail and air traffic, industries, construction and public work, and the neighbourhood. Health-based guidelines on community noise can serve as the basis for deriving noise standards within a framework of noise management. Key issues of noise management include abatement options; models for forecasting and for assessing source control action; setting noise emission standards for existing and planned sources; noise exposure assessment; and testing the compliance of noise exposure with noise emission standards.

Figure 0-11: WHO guideline value for community Noise

Specific Environments	Critical Health effect(s)	LAeq (dBA)	Time base	LAmax (dB)
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110

The project site can generally be categorized under the Zone of "Industrial, commercial shopping and traffic areas, indoors and outdoors."

Results of the Findings

Diurnal Noise Levels

Table 0-10: Diurnal noise average results against EMC and WHO limits

Location	LAeq (dB)	LA (max)	LA (min)
Kipevu Clinic	62.3	69.4	55.2
CT2 area	51.2	63.2	46.5
KPC Oil Tanks	60.7	67.3	52.4
Engineering Department	71.2	88.6	61.0
Berth No. 17	68.7	73.2	60.7
EMC limits	55.0	**	**
WHO Limits	70	**	**

Nocturnal Noise Levels

Table 0-11: Nocturnal noise average results against EMC and WHO limits

Location	LAeq (dB)	LA (max)	LA (min)
Kipevu Clinic	58.7	66.4	50.8
CT2 area	49.5	62.9	37.8
KPC Oil Tanks	59.9	64.3	50.7
Engineering Department	66.7	72.3	60.1
Berth No. 17	66.8	74.7	59.8
EMC limits	35.0	**	**
WHO Limits	70	**	**

Graphical Representation

Diurnal average Noise results

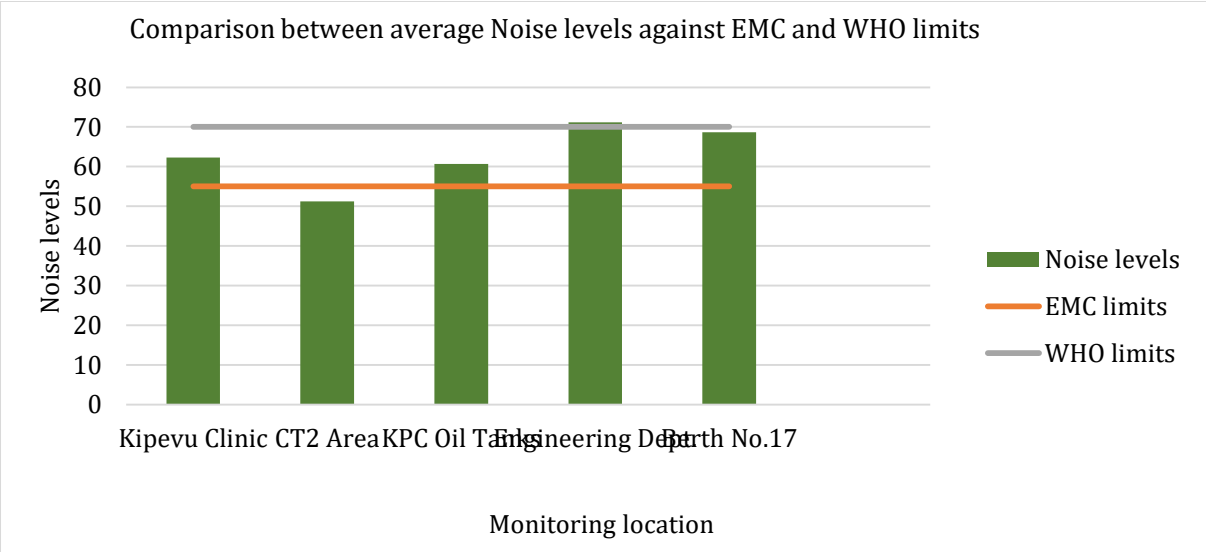

Figure 0-12 Average Diurnal LAeq against EMC (Noise & Excessive Vibrations) Regulations, 2009 and WHO Noise Guidelines.

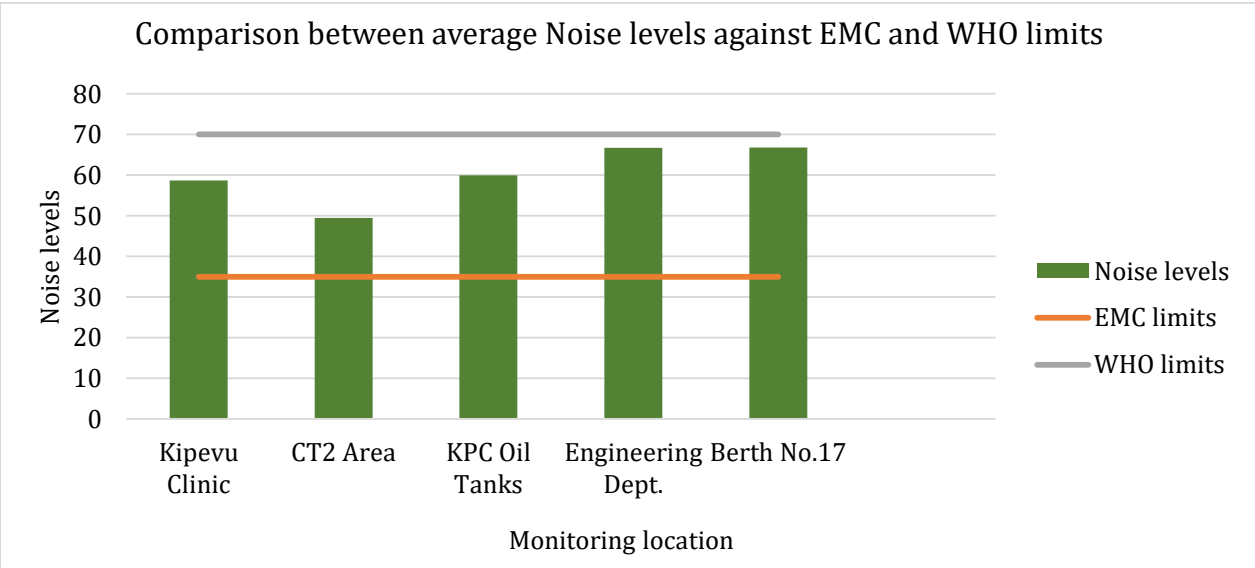

Figure 0-13: Average Nocturnal LAeq against EMC (Noise & Excessive Vibrations) Regulations, 2009 and WHO Noise Guidelines.

Discussion of Results

Noise level assessments was conducted at all the recommended locations. The average results were compared against the established noise standards outlined in the World Health Organization (WHO) and the EMC (Noise and Excessive Vibrations) Regulation 2009. The correlation revealed that all the locations had average diurnal noise levels that surpassed the EMC diurnal limits apart from CT2 area. Upon comparison with WHO limits, all the locations had average noise levels that complied with set limits apart from the Engineering department. Nocturnal average noise levels were similarly compared against regulatory limits and found to surpass against the EMC diurnal limits but complied with WHO limits for all the locations.

The highest average diurnal noise levels were recorded at the Engineering department. Container handling operations at this location such as loading & offloading of containers and truck movement, contributed to the recorded noise levels. Relatively lower levels of noise recorded at CT2 area could be as a result of reduced traffic and cargo Handling operations at this location at the time of measurement.

Nocturnal average noise levels results for all the measurement points revealed that all the points were associated with activities that generated noise beyond the regulatory limits. This is however, expected for a busy site like KPA area since noise travels faster in cooler and denser air at night as compared to daytime.

Conclusion

Baseline noise level measurement was conducted conclusively for all the recommended locations within KPA. All the study objectives were met during the assessment. Average nocturnal noise levels surpassed both EMC and WHO nocturnal noise limits. Diurnal noise levels on the other hand surpassed EMC limits for all the locations apart from CT2 area and complied with WHO limits apart from Engineering department area.

References

Environmental Management and Coordination (Noise and Excessive Vibration Control) regulations of 2009;

World Health Organization Guidelines for Community Noise.

APPENDIX 6 DETAILED BASELINE VIBRATION LEVEL REPORT

Background Information on Vibration

This baseline ground vibration report assumes a pivotal role in the comprehensive assessment of the proposed construction of Berth 19B and associated infrastructure within the Port of Mombasa. As part of the broader initiative led by the Kenya Ports Authority, this report is designed to establish a foundational understanding of the existing ground vibration as a result of daily operations within the port. Findings of the report are expected to guide the proponent on effective strategies that localize ground vibrations within the project site. Ground vibrations, in particular, are a type of mechanical oscillation that can be felt or heard when energy is transferred to the ground from a vibrating source. The potential impact of ground vibrations on nearby structures and the environment has led to increased interest and concern about vibration measurement and control.

Measurement Objectives

- To measure Vibration levels at the selected measurement location and the results to be correlated against EMC (Noise Excessive Vibration), Regulations, 2009.
- To document the findings in a comprehensive report which will form the benchmark upon which subsequent measurements will be based.

Measurement Location

Measurement of vibration levels was conducted at same receptor locations as air and noise levels. GPS locations and description of measurement locations is given section 1.5.1 below.

Tools and Equipment

- Vibration meter
- GPS
- Digital camera

Measurement Methodology

Vibration levels were assessed using a Vibration Meter connected to a sensor, which was carefully spiked into the ground to measure acceleration, velocity, and displacement ranges. Measurements were recorded at an interval of 10 minutes each hour for a 24-hour duration. Additionally, the surveyor evaluated and documented the characteristics of the surrounding area that could have influenced the measurement results hence accounting for all fluctuations recorded during the exercise.

Legislation and Guidelines

The Environmental Management and Coordination (Noise And Excessive Vibration Pollution) (Control) Regulations, 2009

These regulations prohibit any individual from creating excessive vibrations that cause annoyance, disturbance, injury, or endanger the comfort, health, safety of others and the environment, unless otherwise stated in the regulations. Additionally, creating excessive vibrations that exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source is also prohibited, unless otherwise provided. Any person found violating these provisions of the regulation is committing an offense.

Table 0-12: Typical acceptable vibration levels at 20Hz

Criteria and Relevant Standard	RMS / Peak	Acceptable Velocity Limits	Equivalent Acceleration at 20 Hz
Structural integrity (DIN4150)	Peak	10 mm/s	1.26 m/s^2

Machine service ability (AS2625)	RMS	1.8 mm/s	0.23 m/s^2
Human comfort (AS2670)	RMS	0.1 m/s	0.1 m/s^2

Table 0-13 : Regulation for Vibrations Measurement

	ACCELERATION	VELOCITY	DISPLACEMENT
FREQUENCY RANGE	1Hz-100Hz	3Hz-1kHz	3Hz-500Hz
LEVEL RANGE (FS)	1	10.0	0.100
RMS/EQP-P/EQPEAK	RMS	EQ-PEAK	EQP-P
Min	$0.01m/s^2$=60dB	0.1m/s	0.001mm
KENYA REGULATION		Regulation 0.5cm/s=5mm/s	

Results and Discussions

Vibration measurement was conducted at five receptor locations surrounding the proposed project site. Table below details a summary of results for all the locations at the time of measurement.

Table 0-14 Average Results for Vibration Measurements

Location	Acceleration (mm/s2)	Velocity (mm/s)	Displacement (mm)
Kipevu Clinic	0.03	0.3	0.004
CT2 area	0.02	0.3	0.003
KPC Oil Tanks	0.03	0.4	0.005
Engineering Department	0.05	0.7	0.003
Berth No. 17	0.07	0.8	0.005
EMC Limits	-	5mm/s	-

Graphical representation and discussion

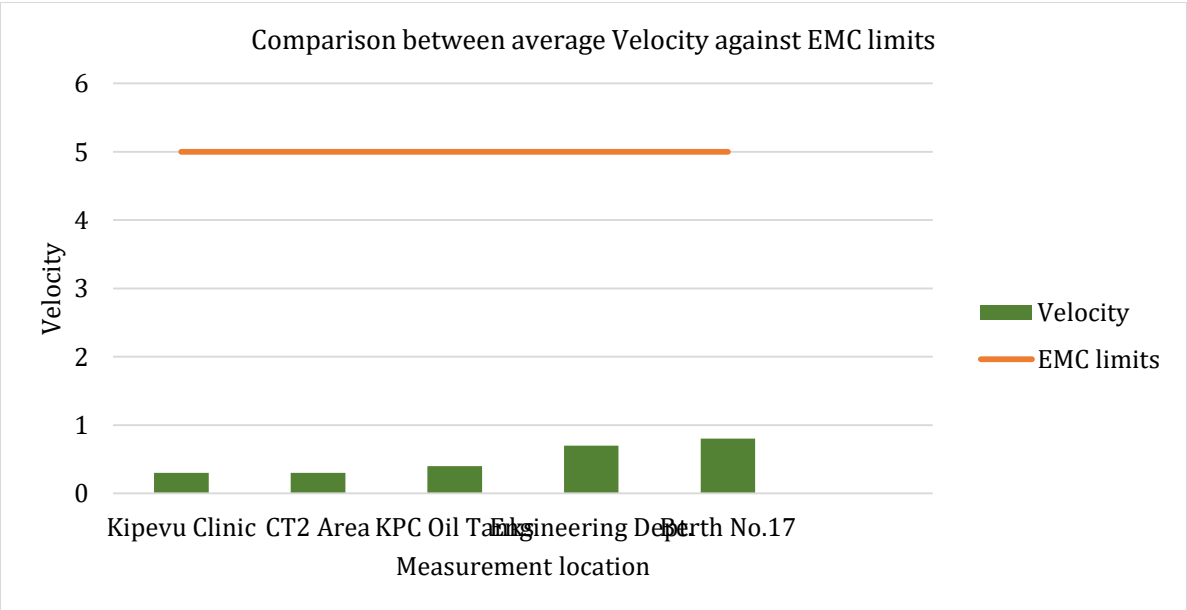

Figure 0-14 Measured velocity against EMC (Noise and Excessive Vibrations) Regulations, 2009

The measurement of vibration levels was carried out at different receptor locations surrounding the proposed project site. The average results for each location were compared against the regulatory standards outlined in the EMC (Noise and Excessive Vibration) Regulation of 2009 and found to comply with set limits.

Vibration signatures recorded during the measurement exercise were as a result of daily port operations ongoing around receptor locations such as cargo loading & offloading, truck movement, movement of locomotives and personal service vehicles.

Conclusion

All the measurement objectives were met during the study. Average velocity levels for all the measurement locations were compared against the limits set in the EMC (Noise and Excessive vibration and) Regulation and found to comply with set limits. Vibration signatures generated as a result of daily port operations around the studies locations do not interfere with the human comfort at receptor locations surrounding the proposed project site.

APPENDIX 7 BILLS OF QUANTITIES FOR BERTH 19B DEVELOPMENT

ORIGINAL

THE REPUBLIC OF KENYA

KENYA PORTS AUTHORITY

PROPOSED CONSTRUCTION OF MOMBASA BERTH 19B AND ASSOCIATED INFRASTRUCTURE

Tender No. KPA/004/2024-25/PDM

BIDDING DOCUMENTS

FOR

CONSTRUCTION OF CIVIL WORKS AND BUILDINGS

VOLUME III

Part 2: Employer's Work Requirements

Section VII: Bill of Quantities

JUNE 2024

YOOSHIN ENGINEERING CORPORATION.

Mombasa Berth 19B And Associated Infrastructure **Bill of Quantity (BOQ)**

Grand Summary

General Summary	BOQ Page	Amount (KSH)
Bill No. 1: General Requirement	BOQ-1	782,978,392.00
Bill No. 2: Civil Works	BOQ-2	7,080,559,612.00
Bill No. 3: Utility Works	BOQ-3	764,693,466.00
Bill No. 4: Building Works	BOQ-4	341,913,051.94
Bill No. 5: Provisional Sums	BOQ-5	404,322,500.00
Subtotal of Bills	(A)	9,374,467,021.94
Total for Day-work (Provisional Sum)	(B)	73,482,510.00
Total of Bills (A)+ (B)	(C)	**9,447,949,531.94**
Add Provisional Sum for Contingency Allowance (10%)	(D)	897,014,452.19
Total of Bills (C)+ (D)	(E)	**10,344,963,984.13**
Add 16% VAT	(F)	1,655,194,237.46
Bid Price (E)+(F)	(G)	**12,000,158,221.60**

Current CBK Exchange rate 1 USD=KSH 129 AS OF 16th September 2024

KES: Kenyan Shilling, USD: United States Dollar

*Contingency: (Subtotal of Bill – Provisional Sums) x 10 %,

BOQ: Bill of Quantity is attached

Date 18th Sept 2024.

Signature .....

MANAGER PROJECTS DEVELOPMENT AND MANAGEMENT
KENYA PORTS AUTHORITY
MOMBASA