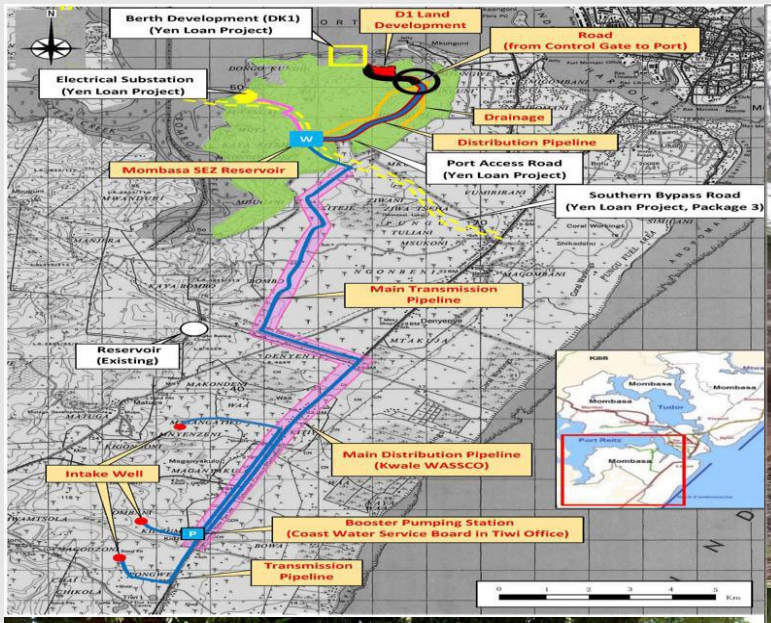
Kenya Ports Authority
KPA

Environment and Social Impact Assessment-ESIA Report in the Project for Infrastructure Development for Mombasa Special Economic Zone (SEZ)



Final Draft Report
Volume One: Main Report

Repcon Associates

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February 2020

DECLARATION PAGES

Disclosure Page

This ESIA Report is hereby disclosed for public review as follows:-

Proponent: Kenya Ports Authority
Assignment: *Environmental and Social Impact Assessment-ESIA and Resettlement Action Plan in the Project for Infrastructure Development for Mombasa Special Economic Zone (SEZ)*

Firm of Experts: *Repcon Associates Ltd- NEMA Registration No. 0002*
Contact address: The Repcon Center,
Sigona 410, off KEFRI/KARI Rd Muguga
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Signed:..... *Date*.....

Michael M. Wairagu
Lead Expert/ Team Leader

Proponent: Kenya Ports Authority

Contact address: KPA offices Mombasa

Attention of: Managing Director

Signed:..... *Date* 16/02/2020

PRINCIPAL ENVIRONMENT OFFICER
P. O. Box 95009 - 80104
16 FEB 2020
MOMBASA
KENYA PORTS AUTHORITY

FORM (r 6)

Application Reference No.....
FOR OFFICIAL USE

THE ENVIRONMENT MANAGEMENT AND COORDINATION ACT

SUBMISSION OF PROJECT REPORT

Part A: DETAILS OF THE PROPONENT

A1 Name of proponent (Person or Firm): *Kenya Ports Authority*

A2. Pin No.....

A3. Address: *Kenya Ports Authority*
P.O. Box 95009-80104 Mombasa
+254-41-2112999

A4. Name of contact person: *Managing Director*

A5. Telephone No.....A6 Fax No .....

A7. Email:

Part B. DETAILS OF THE PROJECT REPORT

B1 Title of the proposed project: *Environment and Social Impact Assessment-ESIA and Resettlement Action Plan-RAP in the Project for Infrastructure Development for Mombasa Special Economic Zone (SEZ)*

B2 Objectives and scope of the project: *The project aims at installing piping infrastructure to link the MSEZ to ground water sources in Tiwi area of Kwale, improve drainage in selected parts of the MSEZ and prepare Port area land in readiness for investors constructing.*

Water Distribution: *Targets water intake from the three already dug intake wells in Kwale county, it involves construction of the transmission lines from the intake wells to the booster pumping station at the CWSB station in Tiwi, construction of a booster pumping station at the CWSB Tiwi office, construction of the main transmission and main distribution lines in parallel from the BPS to the water reservoir at the Mombasa Special Economic Zone in Mombasa county, Construction of the Mombasa SEZ reservoir, construction of a 12 km distribution pipeline from the MSEZ reservoir to the port and free port Area within the special economic Zone, Construction of Connection Pipeline from Mombasa SEZ Reservoir to MOWASSCO trunk main of length approximately 12km.*

Drainage: *Improvement of the natural Drainage System within Mombasa SEZ by construction of diversion canals to ease water flow into the creek.*

B3 Description of the activities: *The major items of work during construction include the following;-*

i) Site clearance, Bush clearing and uprooting of trees within the construction sites for the booster pumping station at Tiwi and the Main reservoir within the special economic zone.
ii) Construction of the Booster Pumping station.
iii) Construction of the main water reservoir.
iv) Construction of three transmission lines from the three intake wells to the Booster pumping station.

v) *Construction of the parallel main transmission line and the main distribution lines from the booster pumping station to the main reservoir at the Mombasa special economic zone.*

vi) *Construction of diversion water canals for drainage system.*

B4 Location of the proposed project: *Kwale and Mombasa Counties*

Part C: DECLARATION BY THE PROJECT PROPONENT

I hereby certify that the particulars given above are correct and true to the best of my knowledge.

DANIEL M. GITHAIGI PRINCIPAL ENVI. OFFICER .....

Name Position Signature

On behalf of ... KENYA PORTS AUTHORITY .....

Date ... 16/02/2020 .....

(Firm name and seal)

PRINCIPAL ENVIRONMENT OFFICER P.O. Box 95009 - 80104 16 FEB 2020 MOMBASA KENYA PORTS AUTHORITY

Part D: DETAILS OF ENVIRONMENTAL IMPACT ASSESSMENT EXPERT

Name (Individual/firm): Michael M. Wairagu

Certificate of registration No: *0177*

Address: *The Repcon Center*
Sigona 410 off KEFRI/KARI Rd-Muguga
P.O. Box 79605-00200, Nairobi
Telefax: 254-20-2248119;

Tel: *Mobile- 0721-274358/0732274358* Email:*info@repcon.co.ke*

Part E: FOR OFFICIAL USE

Approved /not approved.....

Comments.....

.....

.....

.....

Officer.....Sign.....Date.....

NB:1. If the ESIA Study Report does not contain sufficient information required under the Environmental (Impact Assessment and Audit) Regulations the applicant may be requested to give further information concerning the projector be notified of any defects in the application and may be required to provide the additional information.

2. Any person who fraudulently makes a false statement in a ESIA Study Report or alters the ESIA Study Report commits an offence.

Important notes: Please submit the following:

a) Three copies of this form
b) Ten copies of the project report and a CD
c) The prescribed fees to

Director General
The National Environmental Management Authority
Kapiti Road, South C.
P.O Box 67839 00200
NAIROBI

Tel 254-02-609013 27 79 or 60899

EXECUTIVE SUMMARY

The Project

The Government of Kenya (GoK) with support of the Japan International Cooperation Agency-JICA is developing the Mombasa Special Economic Zone as part of the Kenya Vision 2030 Strategy aimed at delivering a globally competitive Kenya with high quality of life for all its citizens by the year 2030. Formulation of the Masterplan for Mombasa Special Economic Zone has been completed by the GOK with support of JICA under the Technical Collaboration Projects for "Mombasa Port Master Plan including Dongo Kundu" and "The Project on Master Plan for Development of Mombasa Special Economic Zone".

Implementation of the Masterplans for Mombasa Special Economic Zone is being pursued by the GoK with support of the Government of Japan through combination of Japanese Official Development Aid and private investments through Special Purpose Vehicle. Phase One of the implementation will entail two broad components namely:-

- Basic infrastructure through Japanese ODA and;
- Individual areas within the Mombasa SEZ (including Free Trade Zone and Industrial Area) through private investment to SPV.

The need to provide Basic Infrastructure to the M-SEZ

Development of the Mombasa Special Economic Zone is guided by the 2014 Masterplan for MSEZ which seeks to transform the 12 square kilometer Dongo Kundu Property owned by the Kenya Ports Authority into a commercial hub ridding on marine trade and other opportunities associated with presence of the Kilindini Harbour whose potential largely remains unexploited. Towards realization of a Special Economic Zone, the Masterplan stipulated critical anchorage to be put in place as follows:-

- Resolution of the squatter problem- currently the subject of an ongoing Resettlement Action Plan Study;
- Provision of transport infrastructure- partly to be resolved through ongoing construction of Mombasa Southern Bypass and proposed Mombasa Gate Bridge and;
- Provision of basic trunk infrastructure namely grid power connection (underway) and provision of water supply and stormwater drainage.

The Project on Infrastructure Development (PID) seeks to bridge infrastructure gaps mainly through provision of mains water supply and drainage infrastructure and thus further level the field in readiness for SEZ Investors.

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This Report highlights salient social and environmental issues associated with the design, construction and operational aspects of the Project. The Report has been prepared under contract by Lead Experts from Repcon Associates, an Environmental Firm of Experts duly registered and licensed by NEMA (NEMA Registration No. 0002) and other Government of Kenya (GoK) agencies.

Scope of the ESIA Study

Contractual Scope of the ESIA Study is defined by the Study Terms of Reference –TORs which stipulated Study Tasks as follows: -

Task 1-1 Preparation of ToR for Approval by NEMA

Task 1-2 Baseline Survey for Environment and Social Information
Task 1-3 Public Consultations on the Selection of the Location of Water Kiosk to be installed along the Transmission Main/Distribution Main connected Booster Pump Station and Mombasa SEZ Reservoir
Task 1-4 Environmental and Social Impact Forecast
Task 1-5 Impacts Evaluation and Alternative Plan
Task 1-6 Mitigation Plan
Task 1-7 Environmental Management and Monitoring Plan
Task 1-8 Environmental Check List
Task 1-9 Proposed Implementation Plan, including budget, finance source and organization
Task 1-10 Public Consultation Meetings
Task 1-11 Approval Acquisition

Approach to ESIA Study

From experience, NEMA currently does not require TORs for EIA Projects. As part of the Inception Stage activities however, NEMA was contacted and advised that this Inception Report be shared with the Authority to serve as notification of the ESIA Study. As such, once the Inception Report was accepted, the same was be shared with the NEMA Coast Regional Office for Direction.

Public Consultations / Stakeholder Engagement

Public Consultation is legal requirement in ESIA Studies. Consultations started with Two (2) Meetings for Leaders held at both Kwale and Mombasa and convened through respective sub-County Commissioners for Matuga (Kwale) and Likoni (Mombasa) respectively. Both were aimed at introducing the Project Design and Components to the Leaders and to seek support in the Public Hearing Meetings. A schedule of Public Hearing Meetings for each sub County will then be agreed with the Leaders.

Key Informant Interviews were conducted with all Lead Agencies and relevant Line Ministries.

Baseline Survey for Environment and Social Information

Some preliminary baseline characterization has been undertaken under auspices of the Inception Report. During the detailed ESIA Stage, additional baseline survey was mounted to include additional review of all available literature including the Infrastructure Project, biophysical conditions, administrative divisions, etc to identify priority baseline conditions. Baseline survey aimed at identifying the ecologically and socially vulnerable resources that are likely to be impacted adversely by project interventions as proposed.

Environmental and Social Impact Forecast

Forecasting of impacts has been undertaken at two levels thus: -

Documentation of project interventions: Each intervention proposed under the infrastructure project was analysed and documented in terms of scope, scale, resource requirements including target site. It is the potential interaction between project intervention and prevailing baseline that is likely to occasion adverse impacts.

Application of an environmental checklist: Environmental Checklists from relevant agencies including JICA were sourced and applied to identify and predict impacts from development of all components of the PID.

Impacts Evaluation and Alternative Plan

Environmental concerns obtained from impact analysis above were evaluated to determine those relevant to the PID components, their scale and severity. Analysis of severity has applied trend analysis through comparison with pre-existing date say on water quality, modelling, prescribed standards among others. It is this analysis that informed the level of mitigation.

Impact Mitigation Plan

For each impact, possible mitigation measures have been explored and assessed to pick most cost-effective mitigation package. Of necessity, mitigation included formulation of a Resettlement Action Plan to guide resolution of all economic and livelihood displacement impacts of the PID components.

Environmental Management and Monitoring Plan

The Impacts Mitigation (Management) Plan was expanded to inbuild components for monitoring. This included a time frame (phasing of mitigation), identification of the necessary budget, cost heads, objectively verifiable indicators for monitoring and Competent Authority for Monitoring.

Proposed Implementation Plan, including budget, finance source and organization

This task fits best with the RAP. However, from experience, mitigation for construction impacts mainly takes place under Contract for Works while at Operation Phase, mitigation is the responsibility for Agencies responsible. As part of the ESIA Study, agencies responsible for managing the completed PID components and their roles in the ESMP were identified.

Approval by NEMA

This Task entails Liaison with NEMA to ensure that the EIA Licence is issued without undue delay. Thus, where the ESIA Report will go into Public Review Stage, the Consultant will coordinate with NEMA and the client so as to ensure prompt drafting of texts for newspaper advertisement, prepare responses to all questions and update the Final Report as required.

Reporting procedure

The ESIA Study methodology as described above culminated with production of this Final Environmental and Social Impact Assessment Study Report formulated in line with Regulation 18 of Legal Notice 101 of EMCA. This report is presented in Twelve Chapters which integrate the content for ESIA Study Reports as stipulated in Regulation 18 of LN 101.

Findings of the Study

Empirical baseline characterization of the PID traverse helped better refine the pre-project scenario and, in the process, brought out the biophysical sensitivities in preceding project implementation as provided in summary form below.

Air quality condition

General prevalence of pollutants: The rural parts of the PID as represented by the junction with the MSBR at Ziwani have very low concentration of atmospheric pollutants. PM10, PM2.5, lead and carbon monoxide were detected in all the sites and therefore are the most prevalent amongst all pollutants monitored. The A14 junction with Mtongwe Road which is a busy urban road has highest concentration PM10.

Noise Levels: Noise levels in the non urbanised areas of PID traverse are still below statutory limits especially with regard to night noise.

Marine water quality condition

Mombasa Island side of the Likoni Channel is apparently receiving more sediment and pollutant input from Mombasa Town with increasingly higher pollution. Thus, in proceeding with development of the proposed MSEZ and the PID, the factor of elevated pollution on the northern shoreline of the Channel should inform decisions especially for runoff disposal.

Marine Sediment quality

Sediment analysis confirmed presence of heavy metals within the Likoni channel sediments. Zinc, Chromium, Antimony and Nickel have a leading prevalence while Mercury, Silver and Arsenic were not detected. All heavy metals detected in the study area share one feature in that, they are all applied in the electroplating industry- a surprise find given that, the Port Reitz area has never hosted an electroplating facility.

Monitoring of Fresh Water Quality

Despite the waters being apparently polluted, they are within NEMA limits for recreation and domestic use.

Status of floral biodiversity

Proposed land reclamation area will affect mangrove formations which are already under severe exploitation pressure.

Status of avian biodiversity

Out of 102 bird species counited, 9 birds are of concern in that 1 is listed in the IUCN RED List Data on account of being vulnerable, 8 species are listed in the Agreement on the Conservation of African-Eurasian Migratory Water Birds (AEWA) and one is listed under CMS/ Raptors.

Status of cultural heritage biodiversity

PID operations are in close vicinity of but do not directly impact three Kayas Mkumbi, Mhongani and Jiwe lakutuza which are socially revered and reservoirs of biodiversity.

Status of the Tiw Aquifer

Tiwi aquifer has a possible daily allowable yield of 19,08 cubic metres based on estimated annual recharge of 6.96 Million Cubic Metres (MCM) meaning that the current demand of 20,000 cubic metres is being met through over-abstraction. Imposition of an additional daily demand of 2000 cubic meters to supply MSEZ will only exert additional abstraction pressure with known consequences in terms of aquifer drawdown and attendant threat of vertical and horizontal saline intrusion.

Summary from Stakeholder Engagement

A total of 39 formal forums were arranged during which 951 stakeholders were met. Many more stakeholders were met during the Census survey and asset inventory implying that probably over 1000 people were engaged as part of this RAP.

The Leaders Meetings

The entry point to all stakeholder engagement process was Leaders Meetings largely called to market the proposed Project to Local Leadership who, upon being convinced would spearhead the process of introducing the project to target grassroots communities. Given that the PID spans the two Counties of Kwale and Mombasa, two (2) separate meetings targeting sub-County level leadership in Matuga (Kwale) and Likoni (Mombasa) were held bringing together 198 diverse leaders from National Government, County Government, Politicians (MPs and MCAs), security apparatus, GOK Agencies among others. These forums served as community sounding boards from which preliminary public concerns on the proposed project bounced off thus helping to shape and inform preparations for the Public Hearing Meetings.

Public Hearing Meetings

As part of the business transacted during Leaders Meetings, schedules for holding Public Hearing Meetings in all locations in respective sub-Counties were made and immediately rolled out. Six Public Hearing Meetings were held at sublocation level for purposes of engaging with local communities inclusive of potential PAPs. A core agenda in the meetings was to build consensus on the distribution and location of 10 Water Kiosks to be provided under the PID.

Salient Impacts

Born of the impact analysis highlighted above, salient observations emerged.

- Essentially, facilitation of realization of the Mombasa Special Economic Zone through provision of water supply and drainage infrastructure as proposed remains the most salient positive impact of the PID as designed. Communities resident in MMS will also benefit from enhanced water supply.

- Potential to degrade both the Tiwi aquifer through over-abstraction and the Port Reitz Ecosystem through discharge of water borne pollutants through the improved drainage flag-out as the most conspicuous environmental costs to the PID.

- Consequent to degradation of the Tiwi aquifer is the potential to cause social antagonism from those aggrieved by transfer of their badly needed water resource.

Environmental Management and Monitoring

Proposed mitigation activities at this stage are focused on minimizing hazards associated with bulk water supply within close vicinity of a creek ecosystem.

Mitigation of threats to the Tiwi Aquifer

Common problems in aquifers namely drawdown, saline intrusion and contamination are normally difficult to reverse and often lead to loss of the aquifer in which case, best

mitigation strategy is to avoid. Before such a decision is made however, perceived threats should be confirmed beyond doubt which requires that this reserve be investigated extensively to establish the Demand vs Supply scenario. The recommendation here is for Tiwi to undergo comprehensive investigation before proposed extraction as proposed for the SEZ.

Mitigation of water-born pollution into the Port Reitz Creek Ecosystem

In the short-term, developers should be required to pre-treat effluent before licensing for disposal into nature. As a long-term measure, a developer should be identified to construct a Common Effluent Treatment Facility where each developer will treat their effluent on cost recovery basis.

Overview of the ESMP

Mitigation of impacts associated with civil works has been planned in the design and allowance has been made in the Bills of Quantities (BOQs). Also, the contract for civil works bears several relevant clauses binding the contractor to implement environmental and social mitigation.

Environmental and Social Monitoring Requirements

This document provides guidance about incorporating monitoring and evaluation elements in each stage of the project cycle. At construction stage, the Contractor will conduct biannual monitoring for all parameters specified mainly through sampling (pollutants) and counts in case of flora and fauna. In case of pollutants, samples will be analysed at the SGS Laboratories.

The Monitoring Authority: The burden of implementing impact mitigation will fall on the Project Contractor under supervision by KPA in the capacity of Employer. Through the Supervisor of Works (SOW), KPA will monitor activities of the Contractor to ensure compliance with contractual requirements including implementation of this EMP. Where issues not anticipated in this report do arise, the SOW will notify KPA for action.

Need for NEMA to participate in Monthly Site Meetings: NEMA is the body charged under Cap 387 with overall coordination of environmental management in Kenya. While NEMA coordinates this by regulating the EIA process for projects, there is need for NEMA to follow-up further on implementations of ESMPs as prepared for this project. This ESMP therefore, recommends that the County Environmental Officers for Mombasa and Kwale be invited to all monthly site meetings on this project and are facilitated to attend the same under the project. By being represented in site meetings, NEMA will enjoy an excellent opportunity to monitor implementation of the ESMP and to keep track on any emerging issues.

Monitoring Reports

A number of monitoring reports will be developed as follows:

(i) **ESIA Study Report under Cap 387:** This ESIA Study Report as currently prepared provides a documentation of the baseline environment of the area traversed by the proposed PID and thus provides a useful datum against which future monitoring can take place. The ESIA Study Report also includes a project-specific ESMP detailing the means for mitigating identified impacts. It therefore lays the basis for monitoring.

(ii) Annual Audit Reports: The PID will be subject to annual environmental audit in line with Cap 387. The report will include a summary of the environmental performance of the facility/enterprise vis-à-vis the Environmental Management Plan prepared and, a synthesis of Emergent Concerns.

(iii) Signed minutes of Monthly Site Meetings: Following every site meeting, minutes of deliberations will be produced by the SOW, confirmed, signed and adopted as a basis for following up on Contractor's activity

Costs in Environmental and Social Mitigation:

A total of Ksh 149.5 Million will be required in both environmental and social mitigation while an additional Ksh 8.15 million will be required to cover Environmental and Social Monitoring Plan (ESMoP) in the Project. Ultimately the gross budget for Environmental and Social Mitigation in the PID is Ksh 157.65 million.

Recommendation

Through this ESIA Study Report, the Kenya Ports Authority-KPA (the proponent) wishes to disclose that the proposed PID has impacts that can readily be mitigated and managed. The majority of adverse impacts identified are of a short-term nature and will cease once the civil works phase is completed. Further, other impacts can be contained through effective planning and management using available means of mitigation. Displacement impact be mitigated through implementation of the RAP already prepared. By such disclosure, the prayer of the client to NEMA is for the project to be granted environmental licensing.

Acronyms

AEWA	-	African Eurasian Water Bird Agreement
AIDS	-	Acquired Immuno-Deficiency Syndrome
ARAP	-	Abbreviated Resettlement Action Plan
asl		above sea level
BOQs	-	Bill of Quantities
Cap	-	Chapter of the laws of Kenya
CBD	-	Central Business District
CDA	-	Coastal Development Authority
CIDP	-	County Integrated Development Plan
CITES	-	The Convention on Trade in Endangered Species
CMS	-	Convention on the Conservation of Migratory Species of Wild animals
DEC	-	District Environment Committee
DG	-	Director General
EA	-	Environmental Assessment
EIA	-	Environmental Impacts Assessment
EMCA	-	Environmental Management & Coordination Act, 1999
ESIA	-	Environmental and Social Impact assessment
ESMP	-	Environmental Social Management Plan
ESU	-	Environmental & Social Unit
EU	-	European Union
FAO	-	Food and Agriculture Organisation
g-C^{-m2} yr^{-1}	-	Grams Carbon per square metre per year
GDP	-	Growth Domestic Product
GHG	-	Green House Gas
GM(SP)	-	General Manager (Special Projects)
GoK	-	Government of Kenya
GPS	-	Global Position System
HIV	-	Human Immuno-Virus
IMP	-	Impact mitigation plan
IUCN	-	International Union for the Conservation of Nature
KALRO	-	Kenya Agriculture and Livestock Research Organization
KeNHA	-	Kenya National Highways Authority
KeRRA	-	Kenya Rural Roads Authority
KCG		Kwale County Government
KFS	-	Kenya Forest Service
KMA	-	Kenya Maritime Authority
KPA	-	Kenya Ports Authority
KURA	-	Kenya Urban Roads Authority
KWS	-	Kenya Wildlife Service
LN	-	Legal Notice
m, m^2, m^3		metre, square metre, cubic metre
MCA	-	Member of County Assembly
MDGs.	-	Millennium Development Goals
MOR	-	Ministry of Roads
MOU	-	Memorandum of Understanding
M-SEZ		Mombasa Special Economic Zone
MTP	-	Medium Term Plan
NEMA	-	National Environment Management Authority
NMK	-	National Museum of Kenya
NMK-CFCU	-	NMK Costal Forest Conservation Unit
OHS	-	Occupational Health and Safety
OP	-	Operational Policy
OSHA	-	Occupational Safety and Health Act
PCU	-	Project Coordination Unit

PE	-	Project Engineer
PET	-	Potential Evapo-transpiration
PID		Project on Infrastructure Development
ppm		parts per million
PRSP	-	Poverty Reduction Strategy Paper
RAP	-	Resettlement Action Plan
RE	-	Resident Engineer
TOR	-	Terms of Reference
UNCED	-	United Nations Conference on Environment and Development
UNEP	-	United Nations Environment Programme
UNFCCC	-	United Nations Framework Convention on Climate Change
USAID/REDSO/ WCA – Abidjan	-	United States Agency for International Aid / Regional Development Services Office / West and Central Africa
WB	-	The World Bank
WB SGPs	-	World Bank Safe Guard Policies
WMCA	-	Wildlife Management and Conservation Act
WRA	-	Water Management Authority
µg		microgram (unit of measure)
µs		micro-siemen (measure of salinity)

Table of Contents

CHAPTER ONE: INTRODUCTION

1.1: Background

1.1.1 The Project

The Government of Kenya (GoK) with support of the Japan International Cooperation Agency-JICA is developing the Mombasa Special Economic Zone as part of the Kenya Vision 2030 Strategy aimed at delivering a globally competitive Kenya with high quality of life for all its citizens by the year 2030. Formulation of the Masterplan for Mombasa Special Economic Zone has been completed by the GOK with support of JICA under the Technical Collaboration Projects for "Mombasa Port Master Plan including Dongo Kundu" and "The Project on Master Plan for Development of Mombasa Special Economic Zone".

Implementation of the Masterplans for Mombasa Special Economic Zone is being pursued through combination of Japanese Official Development Aid and private investments through Special Purpose Vehicle. Phase One of the implementation will entail two broad components namely:-

- Basic infrastructure through Japanese ODA and;
- Individual areas within the Mombasa SEZ (including Free Trade Zone and Industrial Area) through private investment to SPV.

1.1.2: The need to provide Basic Infrastructure to the M-SEZ

Development of the Mombasa Special Economic Zone is guided by the 2014 Masterplan for MSEZ which seeks to transform the 12 square kilometer Dongo Kundu Property owned by the Kenya Ports Authority into a commercial hub riding on marine trade and other opportunities associated with presence of the Kilindini Harbour whose potential largely remains unexploited. Dongo Kundu is one vast bushland currently undergoing systematic conversion to a rural settlement by some squatters currently numbering about 2000 and towards realization of a Special Economic Zone, the Masterplan stipulated critical anchorage to be put in place as follows:-

- Resolution of the squatter problem- currently the subject of an ongoing Resettlement Action Plan Study;
- Provision of transport infrastructure- partly to be resolved through ongoing construction of Mombasa Southern Bypass and proposed Mombasa Gate Bridge and;
- Provision of basic trunk infrastructure namely grid power connection (underway) and provision of water supply and stormwater drainage.

The Project on Infrastructure Development (PID) currently undergoing Detailed Engineering Design seeks to bridge infrastructure gaps mainly through provision of mains water supply and drainage infrastructure and thus further level the field in readiness for SEZ Investors. As part of the Contract for Detailed Design and in line with existing national legislation and international practice, the Consultant is expected to undertake Environmental and Social Impact Assessment (ESIA) for the design, implementation, commissioning and decommissioning phases of the project as specified in the Terms of Reference (Appendix 1.1). This Report highlights salient social and environmental issues associated with the design, construction and operational aspects of the Project. The Report has been prepared under contract by Lead Experts from Repcon Associates, an Environmental Firm of Experts duly registered and licensed by NEMA

(NEMA Registration No. 0002) and other Government of Kenya (GoK) agencies. Profiles of the key staff who undertook the study is presented in the Appendix 1.2.

1.2: Scope of the ESIA Study

1.2.1: Geographical Scope

A full disclosure of the Project for Infrastructure Development (PID) in the Mombasa Special Economic Zone (M-SEZ) is provided in Chapter Two below. The project aims at installing piping infrastructure to link the MSEZ to ground water sources in Tiwi area of Kwale, improve drainage in selected parts of the MSEZ and prepare Port area land in readiness for investors constructing.

1.2.2: Legal Scope in the ESIA Study

Conduct of ESIA Studies in Kenya is legally anchored in the Environmental Management and Coordination Act (EMCA) Cap 387 and its 2015 Amendment. Section 58 of EMCA as amended in 2015 requires all projects proposed for implementation in Kenya be subjected to integrated environmental impact assessment as directed by NEMA. The Second Schedule of EMCA specifies projects that require to be subjected to EIA studies and particularly lists criteria under section 1 (General) as follows:-

(a) an activity out of character with its surrounding;

(b) any structure of a scale not in keeping with its surrounding;

(c) major changes in land use.

Screened against this Schedule and criteria, the proposed PID for MSEZ is deemed to require a full cycle ESIA Study in that the Project seeks to extract groundwater from the small but poorly understood Tiwi aquifer, will acquire a 24.83 Kilometre Way leave with known displacement impact while the disposal of runoff and water through the proposed drainage poses known threats to the Port Reitz ecosystem.

1.2.3: Contractual Scope

Contractual Scope of the ESIA Study is defined by the Study Terms of Reference –TORs (Appendix 1.1) which stipulate Study Tasks as follows: -

The entire assignment is trapped in the TORs issued for both studies and as later elaborated in the Methodology Statement and pre-contract discussions. Towards delivering on the ESIA the TORs have stipulated 11 tasks to be pursued as follows:-

Task 1-1 Preparation of ToR for Approval by NEMA
Task 1-2 Baseline Survey for Environment and Social Information
Task 1-3 Public Consultations on the Selection of the Location of Water Kiosk to be installed along the Transmission Main/Distribution Main connected Booster Pump Station and Mombasa SEZ Reservoir
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Task 1-9 Proposed Implementation Plan, including budget, finance source and organization
Task 1-10 Public Consultation Meetings

Task 1-11 Approval Acquisition

In sections below, specific approach to the 11 Tasks stipulated for the ESIA Study is unveiled. Chapter Three below provides an exposition of measures taken to ensure conformity with TOR requirements that the ESIA Study be conducted in line with national legislation for environmental management and the JICA Guidelines for Environmental and Social Considerations.

1.2.4: Thematic Scope of the Study

The substantial focus and scope of ESIA Studies is stipulated in the Third Schedule to Legal Notice 101 of EMCA. The following issues may, among others, be considered in the making of environmental impact assessments.

1. Ecological Considerations -

(a) Biological diversity including -
- (i) effect of proposal on number, diversity, breeding habits, etc. of wild animals and vegetation;
- (ii) gene pool of domesticated plants and animals e.g. monoculture as opposed to wild types.

(b) Sustainable use including -
- (i) effect of proposal on soil fertility;
- (ii) breeding populations of fish, game or wild animals;
- (iii) natural regeneration of woodland and sustainable yield;
- (iv) wetland resource degrading or wise use of wetlands.

(c) Ecosystem maintenance including -
- (i) effect of proposal on food chains;
- (ii) nutrient cycles ;
- (iii) aquifer recharge, water run-off rates etc;
- (iv) a real extent of habitants;
- (v) fragile ecosystems.

2. Social considerations including -

(a) economic impacts;
(b) social cohesion or disruption;
(c) effect on human health;
(d) immigration or emigration
(e) communication - roads opened up, closed, rerouted
(f) effects on culture and objects of culture value

3. Landscape -

(a) views opened up or closed;
(b) visual impacts (features, removal of vegetation, etc;
(c) compatibility with surrounding area;
(d) amenity opened up or closed, e.g recreation possibilities.

4. Land uses -

(a) effects of proposal on current land uses and land use potentials in the project area.
(b) possibility of multiple use.
(c) effects of proposal on surrounding land uses and land use potentials.

5. Water:

Important aspects to consider are the effects of the proposal on:

(a) water sources (quantity and quality) -
- (i) rivers;
- (ii) springs;
- (iii) lakes (natural and man-made);

(iv) underground water;
(v) oceans;
(b) drainage patterns / drainage systems;

In designing the scope of investigations under the ESIA Study for the PID, this Third Schedule to EMCA formed a fundamental technical and legal checklist.

I.3: Approach to ESIA Study

Essentially, a full cycle ESIA Study entailed four major stages namely;- Project Report/ Scoping, Detailed Investigations, Public Review and Final Report Stage activities under which are briefly highlighted in sections below.

1.3.1: Screening Stage

The process of developing a project report is a legal requirement under Section 58(1) of the EMCA-1999 (Principal Statute) and its 2015 amendment. Further, Section 6 of part 1 of the LN 101 stipulates that *"An application for an Environmental Impact Assessment License shall be in the form of a Project Report in the form set out in the First Schedule to these Regulations, and the applicant shall submit the application together with the prescribed fee to the Authority.*

However, towards fast tracking the ESIA Process, NEMA now requires all largescale ESIA Projects to proceed straight to Detailed ESIA Stage without need for preparation of a Project Report.

1.3.2: Approach to TOR Tasks

Registering the ESIA Study with NEMA

From experience, NEMA currently does not require TORs for EIA Projects. As part of the Inception Stage activities however, Terms of Reference in the ESIA Study were prepared and submitted to NEMA and latter approved vide NEMATOR/5/2/8.

Public Consultations / Stakeholder Engagement

Public Consultation is legal requirement in ESIA Studies. Consultations will start with Two (2) Meetings for Leaders in Kwale and Mombasa Counties to inform them about proposed IDP,

Leaders Meetings*:* Two Leaders Meetings were held at both Kwale and Mombasa and convened through respective sub-County Commissioners for Matuga (Kwale) and Likoni (Mombasa) respectively at venues decided with the JST. All meetings targeted the local leadership including Members of Parliament, MCAs, Women Rep, Senators, County Government, Agencies, Security, etc and aimed at introducing the Project Design and Components to the Leaders and to seek support in the Public Hearing Meetings. A schedule of Public Hearing Meetings for each sub County was then agreed with the Leaders.

Public Hearing Meetings: Were scheduled in each of the four administrative locations of traverse for purposes explained above. The meetings were scheduled with assistance of local chiefs. Minutes were kept for each meeting. At least three meetings were held as the ESIA Study developed and additional ones scheduled on a need basis.

Key Informant Interviews: These were conducted with all Lead Agencies and relevant Line Ministries. A suitable data capture tool as prepared for this process is appended in Appendix 2.1.

Stakeholder engagement in allocation and citing of water Kiosks: During Public Hearing Meetings, each location was be required to consult internally and build consensus on optimum sites for Kiosk location and membership to management committees for said facilities.

Baseline Survey for Environment and Social Information

During the detailed ESIA Stage, baseline survey was mounted to include additional review of all available literature including the Infrastructure Project, biophysical conditions, administrative divisions, etc to identify priority baseline conditions. Baseline survey also aimed at identifying the ecologically and socially vulnerable resources that are likely to be impacted adversely by project interventions as proposed.

Some environmental monitoring targeting water quality, air, noise/vibrations survey was undertaken for sites determined in consultation with the JST. Where current data was available from past or ongoing projects, the same was applied for comparison.

Environmental and Social Impact Forecast

Forecasting of impacts has been undertaken at two levels thus: -

Documentation of project interventions: Each intervention proposed under the infrastructure project was analysed and documented in terms of scope, scale, resource requirements including target site. It is the potential interaction between project intervention and prevailing baseline that is likely to occasion adverse impacts as already identified under 1.7 above.

Application of an environmental checklist: Environmental Checklists from relevant agencies including JICA were sourced and applied to identify and predict impacts from development of all components of the PID. Appendix 2.2 provides copies of all checklists applied in Impact Identification.

Impacts Evaluation and Alternative Plan

Environmental concerns obtained from impact analysis above were evaluated to determine those relevant to the PID components, their scale and severity. Analysis of severity has applied trend analysis through comparison with pre-existing date say on water quality, modelling, prescribed standards among others. It is this analysis that informed the level of mitigation.

Impact Mitigation Plan

For each impact, possible mitigation measures have been explored and assessed to pick most cost-effective mitigation package. Of necessity, mitigation included formulation of a Resettlement Action Plan to guide resolution of all economic and livelihood displacement impacts of the PID components.

Environmental Management and Monitoring Plan

The Impacts Mitigation (Management) Plan was expanded to inbuild components for monitoring. This included a time frame (phasing of mitigation), identification of the

necessary budget, cost heads, objectively verifiable indicators for monitoring and Competent Authority for Monitoring. An annotated Matrix was developed.

Proposed Implementation Plan, including budget, finance source and organization
This task fits best with the RAP. However, from experience mitigation for construction impacts mainly takes place under Contract for Works while at Operation Phase, mitigation is the responsibility for Agencies responsible. As part of the ESIA Study, agencies responsible for managing the completed PID components and their roles in the ESMP were identified.

Approval by NEMA
This Task entailedlLiaison with NEMA to ensure that the EIA Licence is issued without undue delay. Thus, where the ESIA Report will go into Public Review Stage, the Consultant will coordinate with NEMA and the client so as to ensure prompt drafting of texts for newspaper advertisement, prepare responses to all questions and update the Final Report as required.

1.3.3: Detailed ESIA Stage

Activities of the Detailed ESIA Stage followed the Study workplan approved as part of the Project Report and entailed the following:-

(i) Data collection
Secondary data for the route of traverse was obtained from diverse sources such as GOK planning documents and policy blue prints, professional reports and releases, etc all of which provided an insight into the socio-economic and biophysical baseline for the target area. Preliminary opinions formed from review of such documentation were re-validated during fieldwork undertaken within districts to be traversed by the road.

(ii) Field work and public consultations
Fieldwork largely entailed onsite investigations to familiarize with the baseline environment of the area potentially affected by the project. Analysis of potential impacts was based on investigations undertaken along the entire traverse where data on physiographic, pedology, hydrology and drainage, ecology and cover vegetation, land tenure, settlement and land-use patterns, ecologically and economically sensitive resources were collected. Fieldwork entailed several standalone studies namely;-

- The flora and fauna mapping study
- Water quality monitoring survey
- Stakeholder engagement and socio-economic survey

Findings from these surveys are reported starting Chapter Five below whereby accruing information formed the basis for impact prediction.

(iv)Data analysis and impact prediction
Upon data analysis, potential environmental impacts (both positive and adverse) were predicted based on available tools. The magnitude, significance, and acceptability of predicted impacts were evaluated with a view to determining whether observed adverse impacts are significant enough to warrant mitigation. The potential environmental impacts were described in both quantitative and qualitative terms through application of existing body of knowledge, checklists, flow charts, and monographs and from input

from diverse stakeholders. In particular, impact prediction in this study drew heavily on five documents namely:-

i) The Third Schedule to Legal Notice 101
ii) JICA Guidelines for Environmental and Social Considerations
iii) The World Bank Safeguard Policies
iv) The Sectoral checklists for the Roads Sector developed by the World Bank;
v) The Checklist of Environmental Characteristics developed by the Department of Environmental Affairs of the Republic of South Africa and,
vi) The Reference Guidelines for Environmental Assessments (which incorporates the Leopold Matrix) developed by USAID / REDSO / WCA–Abidjan.

Impacts were further screened for occurrence and significance of residual (those which cannot be mitigated satisfactorily) and cumulative impacts with a view to providing a basis of making recommendations on the way forward for the project.

(v) Formulation of an Environmental and Social Management Plan
Measures or interventions necessary to minimize, reduce, avoid or offset identified adverse impacts were evaluated and presented in form of an Impact Mitigation Plan for the proposed development. Such evaluation also included an assessment of Project Alternatives as reported in Chapter Five below. The ESMP also identified modalities for monitoring and evaluation to ensure compliance in implementation of proposed mitigation measures. This involved development of monitoring indicators and procedures for continuous generation of project monitoring data and information.

(vi) Reporting procedure
The ESIA Study methodology as described above culminated with production of a Draft Environmental and Social Impact Assessment Study Report. The study was formulated in line with Regulation 18 of Legal Notice 101 of EMCA which requires that:-

(1) A proponent shall submit to the Authority, an environmental impact assessment study report incorporating but not limited to the environmental following information:-

a) the proposed location of the project;
b) a concise description of the national environmental legislative and regulatory framework, baseline information,
c) and any other relevant information related to the project; the objectives of the project;
d) the technology, procedures and processes to be used, in the implementation of the project;
e) the materials to be used in the construction and implementation of the project;
f) the products, by-products and waste generated project;
g) a description of the potentially affected environment;
h) the environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;

i) *alternative technologies and processes available and reasons for preferring the chosen technology and processes;*

j) *Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies.*

k) *an environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures;*

l) *provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the cause of carrying out activities or major industrial and other development projects;*

m) *the measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies;*

n) *an identification of gaps in knowledge and uncertainties which were encountered in compiling the information;*

o) *an economic and social analysis of the project;*

p) *an indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures; and such other matters as the Authority may require.*

1.4: The ESIA Study Team

This Environmental and Social Impact Assessment study was undertaken by a multi-disciplinary team bringing together skills as follows:-

- Mr. Michael Wairagu- Environmental and Social Safeguards expert
- Charles Ngatia--Marine Biologist
- Alex Katana-Bird Expert
- Mr. Norman Gachathi-Ecologist
- Edwin Obadha-Biometrician

CVs for this Team are attached as Appendix 1.2 to this report.

The ESIA Study also drew heavily from technical input from the JICA Study Team of counterparts namely:-

1.5: Presentation of this Report

This report is presented in Twelve Chapters which integrate the content for ESIA Study Reports as stipulated in Regulation 18 of LN 101. The Chapters have further been lumped in three Sections for ease of handling as follows:-

i) Chapter One (this chapter) outlines the background and procedure to the ESIA Study Process;

ii) Chapter Two provides a description of the project as proposed by KPA;

iii) Chapter Three reviews relevant policies,

iv) Chapter Four analysis legal, regulatory and administrative frameworks governing conduct of environmental assessment in Kenya;

v) Chapter Five provides the pre-project baseline environment;

vi) Chapters Six and Seven report on the outcome of empirical characterization based on measurements and studies.

vii) Chapter Eight reports on the outcome of stakeholder consultations;

viii) Chapter Nine provides an analysis of alternatives in project development

ix) Chapter Ten analyses potential impacts of the project

x) Chapter eleven provides the Environmental / Social Management and Monitoring Plan (ESMP) developed for the project;

xi) Chapter Twelve provides the conclusion and recommendations of this Environmental and Social Impact Assessment Study.

Volume Two: Appendices to the Study

CHAPTER TWO: PROJECT FOR INFRASTRCTURE DEVELOPMNT IN THE MSEZ

2.1: Background and Context

2.1.1: Context

The Government of Kenya, in an effort to stimulate growth of the economy, adopted the Kenya Vision 2030 – the country's development blueprint covering 2008 to 2030 aimed at transforming the country into a newly industrialized middle-income economy providing high quality life for all the citizens by the year 2030. The Vision is anchored on three key pillars: Economic; Social and Political. One of its goals is the realization of the Millennium Development Goals (MDGs) by the year 2015. Strategies of the economic pillar are aimed at generating sufficient resources to attain the Vision and MDGs which requires, among others, a 25-year economic growth-rate averaging 10% per annum. Towards this, the Economic Pillar has identified six key sectors to drive high and sustainable economic growth, namely tourism, agriculture, wholesale and retail trade, manufacturing, business process outsourcing and financial services.

Attainment of the Medium-Term Plan (2008-2012) goal of raising GDP growth to the target 10% by 2012 was pegged on implementation of sectoral flagship projects with capacity to attract foreign direct investment towards increasing export-oriented manufacturing, probably drawing from the experience of South East Asian Economies. Under this model, Special Economic Zones (SEZ) rank very highly on account of their potential to simultaneously attract Foreign Direct Investment, manufacture for Export and create employment and were therefore identified priority Flagship Projects to anchor the Economic Pillar. The 1st Medium Term Expenditure Plan (2008-2012) targeted for economic growth however proved elusive to attain as Kenya was hit by several disruptive events;- the post-election violence of 2008 which caused economic activity to plummet in fear of violence and political uncertainty and as the political situation calmed, the agriculture sector faced a severe drought in 2009 which continued to dampen economic output. Propelling GDP growth from the 2012 average of 4.6% up to the target 10% will require aggressive pursuit of the flagship projects hence the re-energised interest in proposed development of SEZ in Nairobi, Mombasa and Kisumu within the 2nd MTEP (2013 to 2018). This is the rationale and momentum propelling the Master Plan for the proposed Mombasa SEZ.

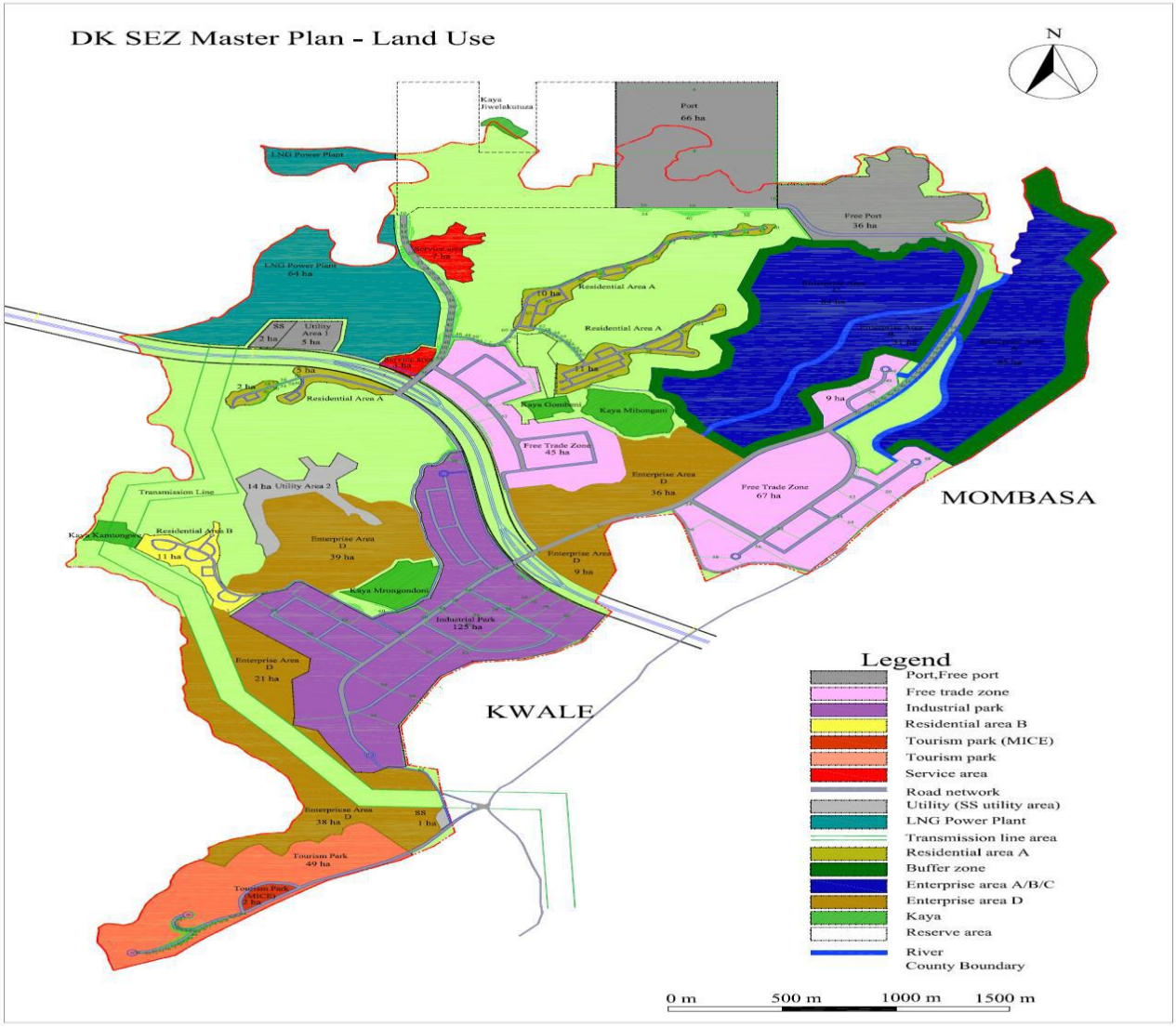
2.1.2: Outputs / Objectives of the Master Plan Study

Under the Record of Discussion, the Master Plan Study for the Mombasa SEZ will pursue eight specified tasks namely:

- To collect and analyze relevant information,
- To Study vision and concept of the Mombasa SEZ,
- To identify industries and function of the Mombasa SEZ
- To prepare a general plan for infrastructure development required for Mombasa SEZ based on the above study,
- To study financial arrangements for the Mombasa SEZ
- To identify operation and management models for the Mombasa SEZ,
- To formulate a human resource development plan
- To take necessary action for environment and social considerations.

2.1.3: Conceptual Design of Mombasa SEZ

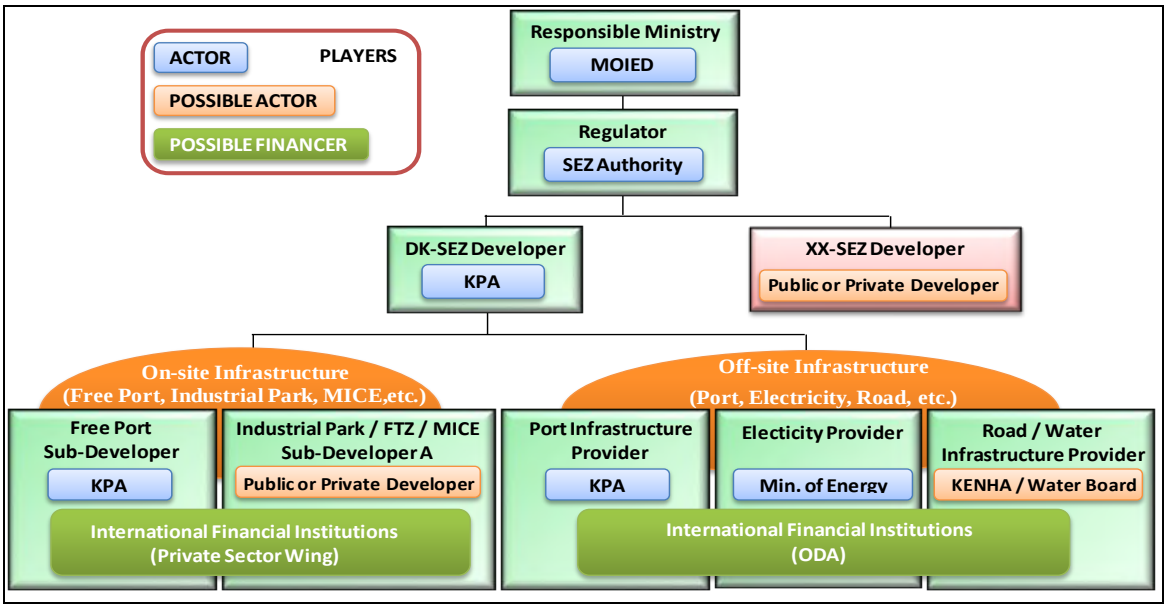
To fully utilize its advantage of the proximity to the international port, DK-SEZ needs to be developed as a logistic and industrial base with components such as Free port, Free Trade Zone (FTZ), Industrial park and energy base. In addition, residential and tourism function is recommendable to create a modern and integrated SEZ. High grade and globally competitive infrastructure including power supply, water supply, waste treatment and telecommunication should be developed to support the activities of investors. **Error! Reference source not found.** illustrates various components that form the basis of DK-SEZ development.



Source: JICA Study Team
Figure 2.1 Land Use Plan of Mombasa SEZ

2.1.4: Organization Structure

Organization structure for the implementation of SEZ is proposed in harmony with the approved SEZ Bill (draft Act) as summarized in Figure 2.2 below.



Source: JICA Study Team
Figure 2.2 Proposed Organization Structure

2.2: Project on Infrastructure Development for Mombasa Special Economic Zone

2.2.1: Project ownership

The Project for Development of Infrastructure to the Mombasa Special Economic Zone is an undertaking of the Government of the Republic of Kenya with the support of JICA. For purposes of the ESIA Study however, the Kenya Ports Authority is the designated Project Proponent who will provide institutional housing and reference for the ESIA and ARAP Studies. Other agencies that have direct impact on the ESIA Study include are summarised below.

Table 2.1: Other Agencies relevant to the PID

SN	Institution	Relevance
1	Kenya Port Authority	Designated Project Owner and Proponent to the ESIA Study
2	NEMA	Environmental Regulator who will police the ESIA Process
3	National Lands Commission	Will handle and manage the land acquisition process
4	Coast Water Service Board	Owns the land where the booster pump will be constructed
5	Kwale Water and Sewerage Company	Owns the pipeline linking Mombasa to the source area at Tiwi
6	County Governments of Mombasa and Kwale	Have planning jurisdiction over the project area
7	Ministry of Interior and Coordination of National Government	Have coordination function over all GOK agencies
8	Road Agencies-KENHA and KeRRA	Have mandate for management of road reserves targeted for passage of water infrastructure

Source: This Study

2.2.2: Administrative jurisdiction

As designed, the PID traverses the two Counties of Kwale and Mombasa (Table 2.2). Within Kwale County, PID components traverse the 3 locations of Tiwi, Waa and Ngombeni while in Mombasa PID components are restricted to the Mtongwe sublocation otherwise called Dongo Kundu.

Table 2.2: Administrative and Management jurisdiction of the PID Traverse

SN	Road Section	Designated Authority	County	Location	S/location	Village
1	Intake One: Chai to Pongwe Road	KCG	Kwale	Tiwi	Simkumbe	Chai Village
2	Intake One: Chai to Pongwe Road C214	KeRRA				Pongwe Village
3	Intake One (ii): Pongwe to Tiwi Station (A7)	KeNHA				
4	Intake Two: Chidzumu to Tiwi Station	KCG		Waa	Kombani	Chidzumu Village
5	Intake III: Dzangazangani - Maganyakulo	KCG			Matuga	Dzangazangani, Mzangaifu, Mwamshipi, Gwirani Villages
6	Intake Three (ii) A7 from Maganyakulo - Tiwi Station	KeNHA			Kitivo, Kombani	Majengo Mapya, Mganykulo,
7	Tiwi Pumping Station	CWSB		Waa	Kombani	Mabriva Village
8	A7 Road from Tiwi Station to Magandiya & Crossing the C 106 at Kombani	KeNHA		Waa & Ngombeni	Kombani, Kitivo, Ng'ombeni	Majengo Mapya, Mganykulo,
9	Magandiya - Maida (Matuga RD Junction)	CWSB		Ngombeni	Ngombeni	Maida Village
10	Madibwani- Kiteje-Mkumbi	KCG			Ng'ombeni and Kiteje	Bombo, Kiteje Ziwani, Mkummbi, Kiteje One
11	MPARD III :Mkumbi to MSEZ Reservoir	KeNHA	Mombasa	Mtongwe	Mtongwe	Mtongwe
12	Mombasa Reservoir to Port	KPA				
13	Drainage Infrastructure	KPA				
14	Land Leveling in Port Area	KPA				

Source: Thus Study

2.2.3: Management jurisdiction

The PID is designed to largely exploit existing reserves controlled by diverse authorities namely KeNHA, KeRRA, KCG, CWSB and the KPA. As such, in the creation of a Way Leave for the PID, the assumption is that reserves controlled by respective State Agencies are available and will not require acquisition. Indeed, the same has been discussed and confirmed with respective Agencies. Compensation therefore, will only be paid for private land and land-based assets including of those occurring in the road reserve.

2.3: Project Design

2.3.1: Conceptual framework

The design objective of the Project on Infrastructure Development is to install facilities to supply water and enhance drainage in the Mombasa Special Economic Zone area. Within this arrangement, water will be sourced from wells drilled in Tiwi area and transmitted by pipelines to a reservoir in Dongo Kundu for onward reticulation to the MSEZ consumers. Other design interventions target improvement of drainage within the Dongo Kundu north of the MPARDIII all of which is targeted to put in place trunk infrastructure to supply services required in operationalization of the SEZ. Details are provided under diverse components below.

2.3.2: Scope and Design

Fig 2.1 below is a schematic presentation of the PID Design. The Project targets to provide basic infrastructure (water, road, drainage, water distribution system, etc) to the Mombasa Special Economic Zone. Main components and their layout are schematically illustrated in Plate 1.1 below namely;-

1. 3 Intake Wells in Kwale County, including Transmission Pipeline to the Booster Pumping Station.
2. Construction of a Booster Pumping Station (BPS) in the CWSB Tiwi Office.
3. Construction of a water Transmission Main and Distribution Main in parallel of length approximately 22km from BPS to water reservoir at SEZ in Mombasa County, including water kiosks.
4. Construction of Mombasa SEZ Reservoir.
5. Construction of Distribution Pipeline of length 12km to supply water from water reservoir to port (DK-1) and freeport (D1) area within Mombasa SEZ.
6. Construction of Connection Pipeline from Mombasa SEZ Reservoir to MOWASSCO trunk main of length approximately 12km.
7. Improvement of Drainage System within Mombasa SEZ (north part of Mombasa Southern By-pass road).
8. Land Grading of D1 (freeport) area with approximately 10ha within Mombasa SEZ, including gate and road facilities.

Brief highlights on the role of each component are proved in sections below.

2.3.3: Water Infrastructure

Water Sourcing: Water supply to the MSEZ is essentially the largest component of the PID. Under this arrangements, water will be sourced from 3 already drilled but yet to be equipped wells (Table 2.3) namely: Intake One:-Chai, Intake Two- Pongwe and Intake Three- Dzangazangani located in the Tiwi and Waa locations of Matuga sub County in Kwale. Yields from the three intakes are 50, 11 and 36 cubic metres per hour equivalent to combined yield of 97 M^3hr-1and 2,328 M^3 per day respectively.

Table 2.3: Details of Intake areas (wells)

SN	Borehole	Village	Location	Plot	Area (Ha)	Eastings	Northings	Elevation (masl)	Distance to Tiwi	Access Road
1	Well No 5/Intake 1	Chai	Tiwi	K/T/245	0.031	563464.5	9534781.9	50	2.48	Chai-pongwe
2	Well No 3/Intake 2	Chidzumu	Waa	K/W/1843	0.032	563852.2	9535723.1	48	1.38	Mabriva-Chidzumu-Kombani
3	Well No 2/Intake 3	Dzangadzangani	Waa	K/W/	0.042	564459.1	9538147.5	67	5.34	Maganyakulo-Msangatifu-Matuga GTI

Source: This Study

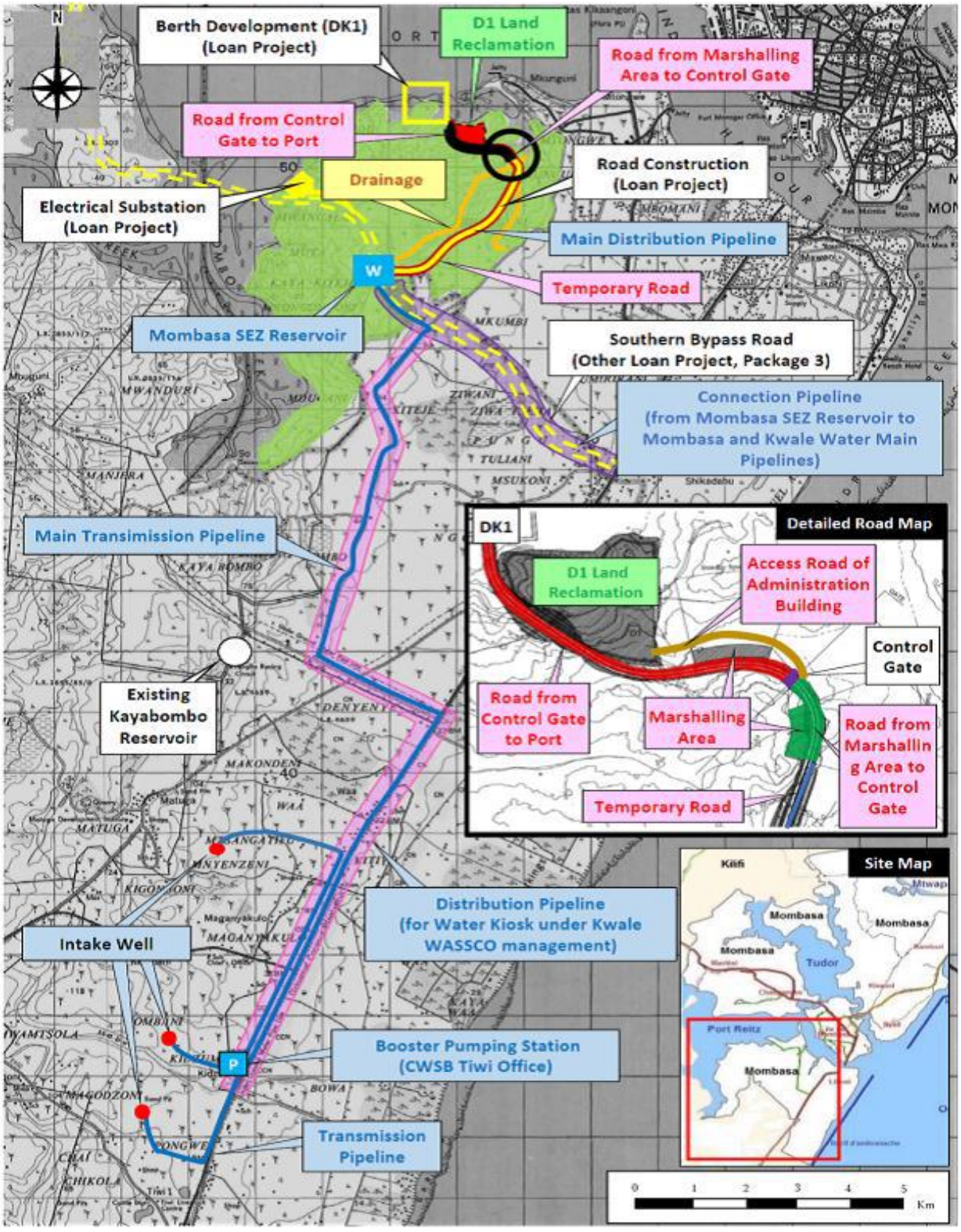
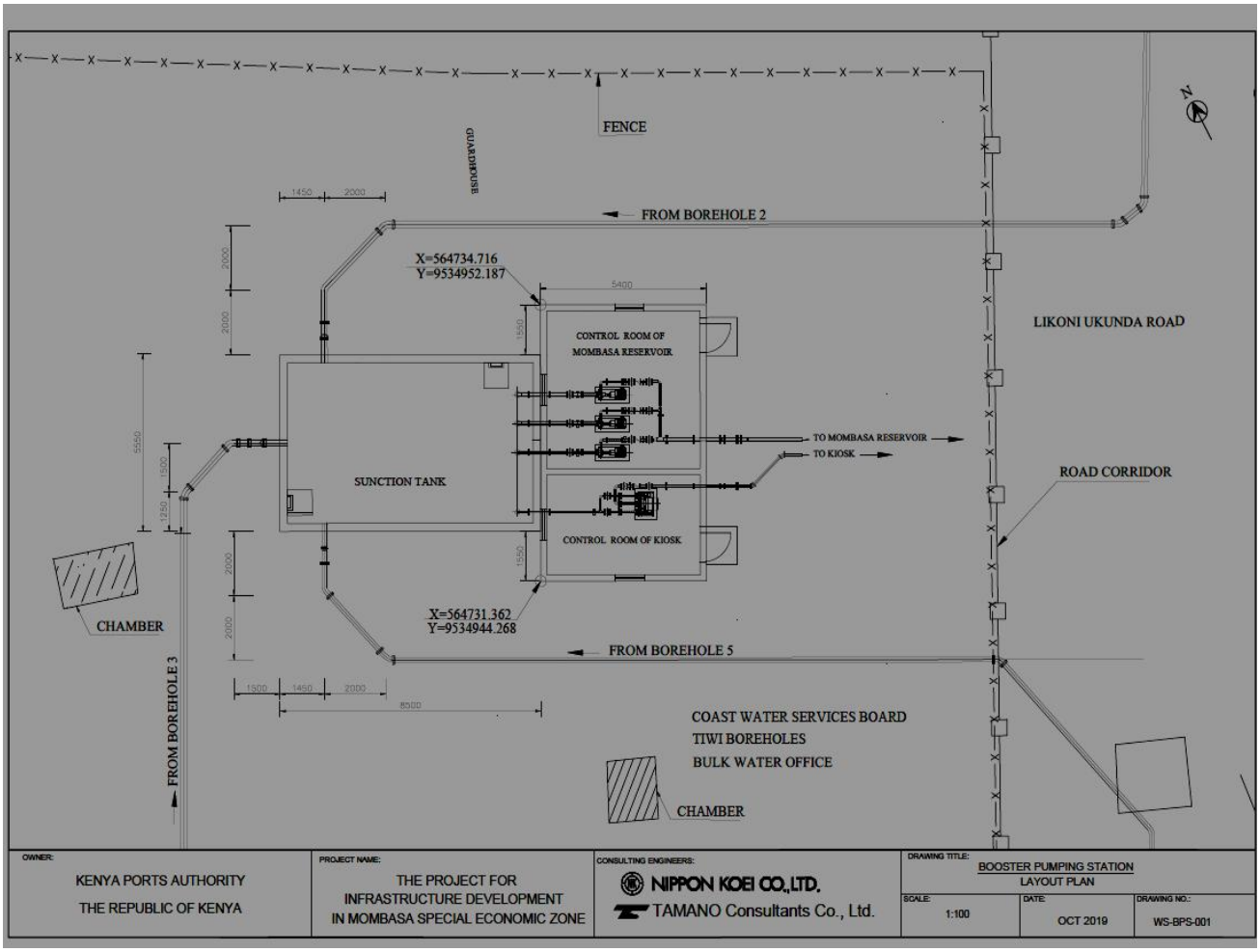


Fig 2.1: Map of PID Traverse in Mombasa and Kwale Counties
Source: This Study

Water transmission: Water from the three wells will be transmitted by pipelines to the CWSB pumping station at Tiwi on the A7 road and then pumped through a main distribution line to a new reservoir to be constructed in the Mombasa Special Economic Zone area. Development off the transmission and distribution network linking the source area in Tiwi to the consumption area in Dongo Kundu through Tiwi pumping station will require creation of a 24.80-kilometer long way leave largely traversing reserves controlled by KeNHA, KeRRA, KCG and CWSB but also slightingly encroaching on private land estimated at 2.1 hectares.

PID targets a daily supply of 2000M^3 to the MSEZ. The surplus of 328M^3 of water will be offloaded into a MOWASSCO Pipeline to supply Mombasa MS (300M^3) with the reminder 28 M^3 being supplied to communities along the pipeline through provision of 10 Water Kiosks along the pipeline route.



Source: JICA Study Team for PID
Fig 2.2: Site layout for proposed Booster Pumping Station at Tiwi

Water Storage: The daily supply of 2000M3 of water will partly be stored in the new 1000M3 Mombasa Reservoir to be constructed within Dongo Kundu area from where it will be reticulated by gravity flow through a 12kilometer long pipeline. Another 10-kilometer-long pipeline will be laid to connect the Mombasa Reservoir to the MOWASCO pipeline on the A7 so as to deliver water to Likoni.

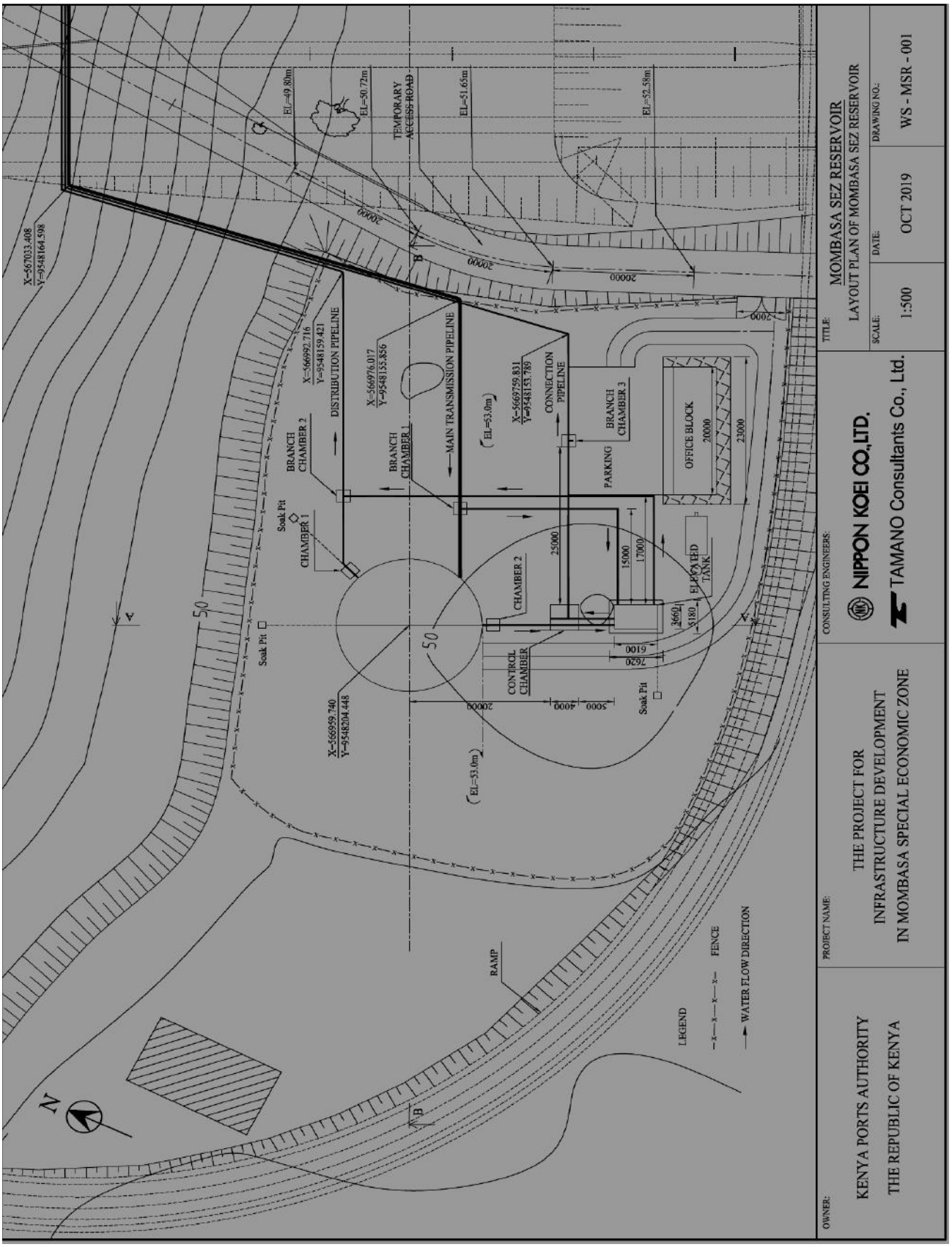


Fig 2.3: Schematic layout of the Mombasa Reservoir area

2.3.4: Improvement of Drainage System within Mombasa SEZ

Target Valleys:

Drainage intervention targets to improve water flow within the three valleys of Vizioni, Mbuta and Mwayongo located to the north of the MPRDIII (Fig 2.4).

Vizioni Valley: Vizioni valley is 2.74 kilometers long and starts from the proposed interchange of Port Access Road and MPARDIII to the immediate north of Mrongondoni Mosque. The valley drains northwards to join the Mbuta Valley then draining to form the Mtishe swamp that adjoins the Port Reiz Creek near the KDF base at Mtongwe.

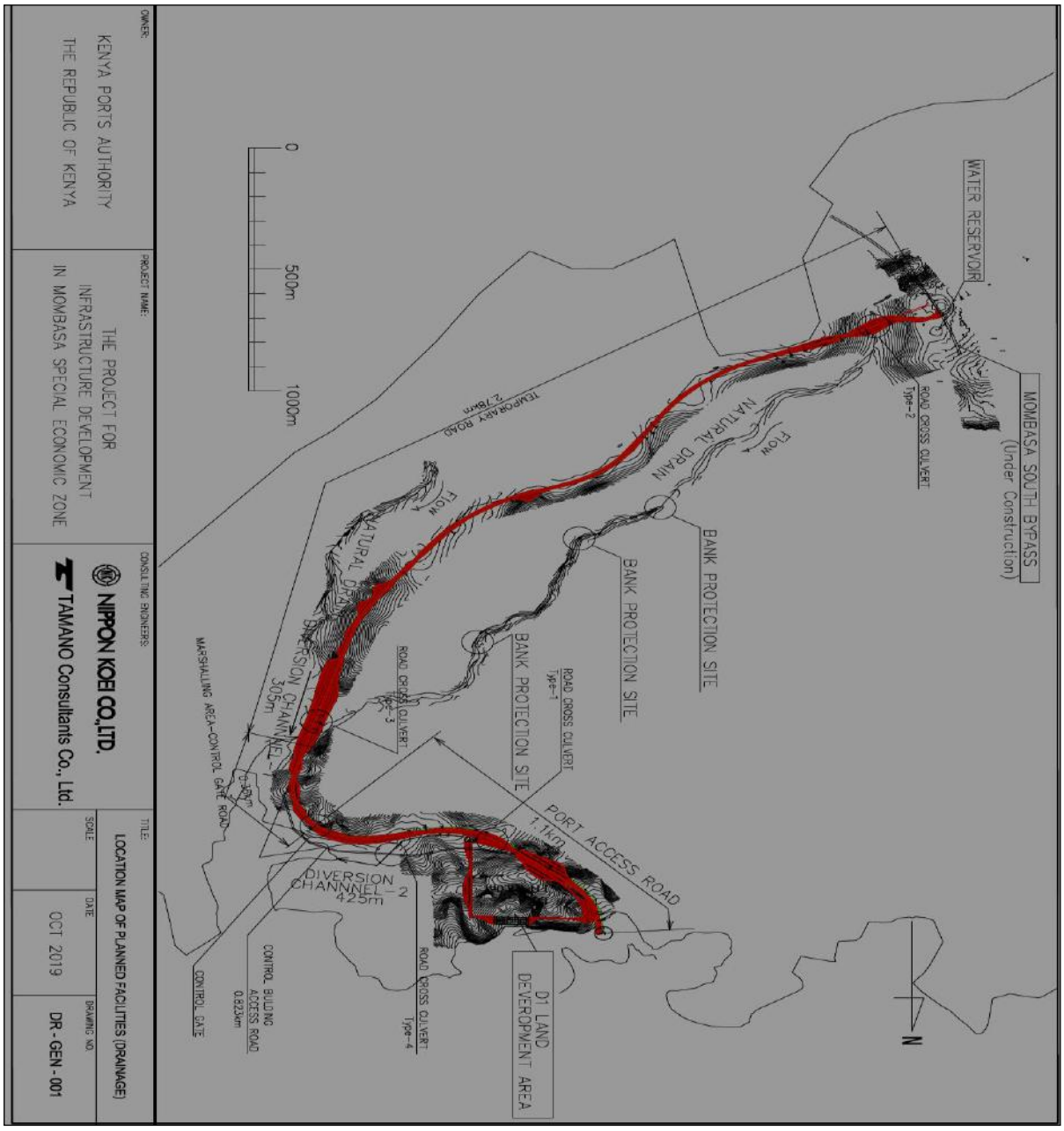


Fig 2.4: Schematic layout of the Port Access Road and the proposed drainage improvement points

Mbuta Valley: Mbuta is a small 1.73-kilometer-long valley originating to the North of Mbuta Health Center and draining northwards to join the Vizioni and then on to the Port Reitz Creek.

Mwayongo Valley: Mayongo is the second longest Valley in the MSEZ area, starting off on the road to DCC Compound and winds to enter Port Reitz through the Mtishe swamp.

Proposed Drainage Interventions:

Proposed drainage interventions in the MSEZ area are schematically illustrated in Fig 2.4 and highlighted in sections below:-

Interventions in the Vizioni Valley: Interventions here will target riverbank protection works at 4 points (Fig 2.4) entailing installation of gabion works protected geofabric membrane. Culverts will also be installed where the Port Access Road crosses the Vizioni Valley.

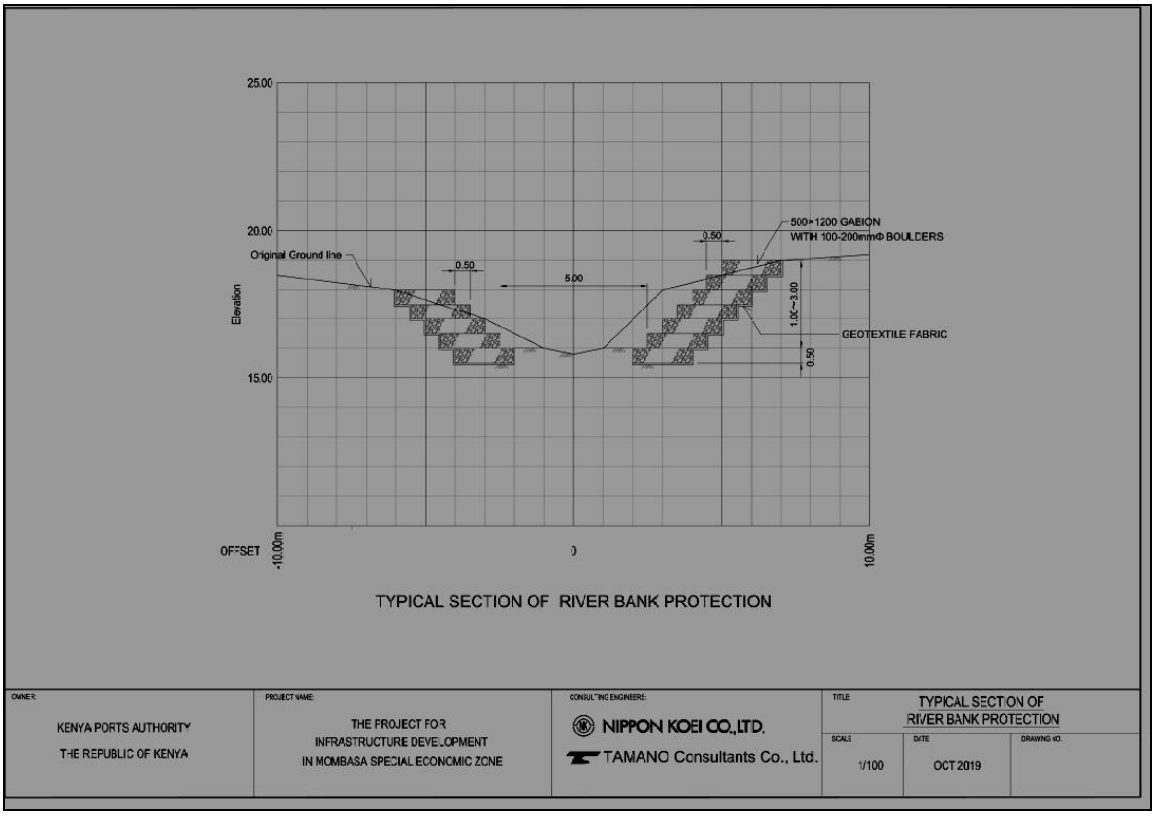


Fig 2.4: Cross section of river protection works

Interventions at Mbuta Valley: Just before confluence with the Vizioni, the Mbuta Valley will be diverted by a 305m long diversion channel so as to join the Vizion downstream of the crossing with Port Access Road.

Interventions in the Mwayongo Valley: Intervention targets the lower reaches of this

valley which will be diverted through a 425m long channel to clear the alignment of the Port Access Road. Construction of 2 diversion channels totaling 0.75kilometres is apparently the main drainage intervention under the PID.

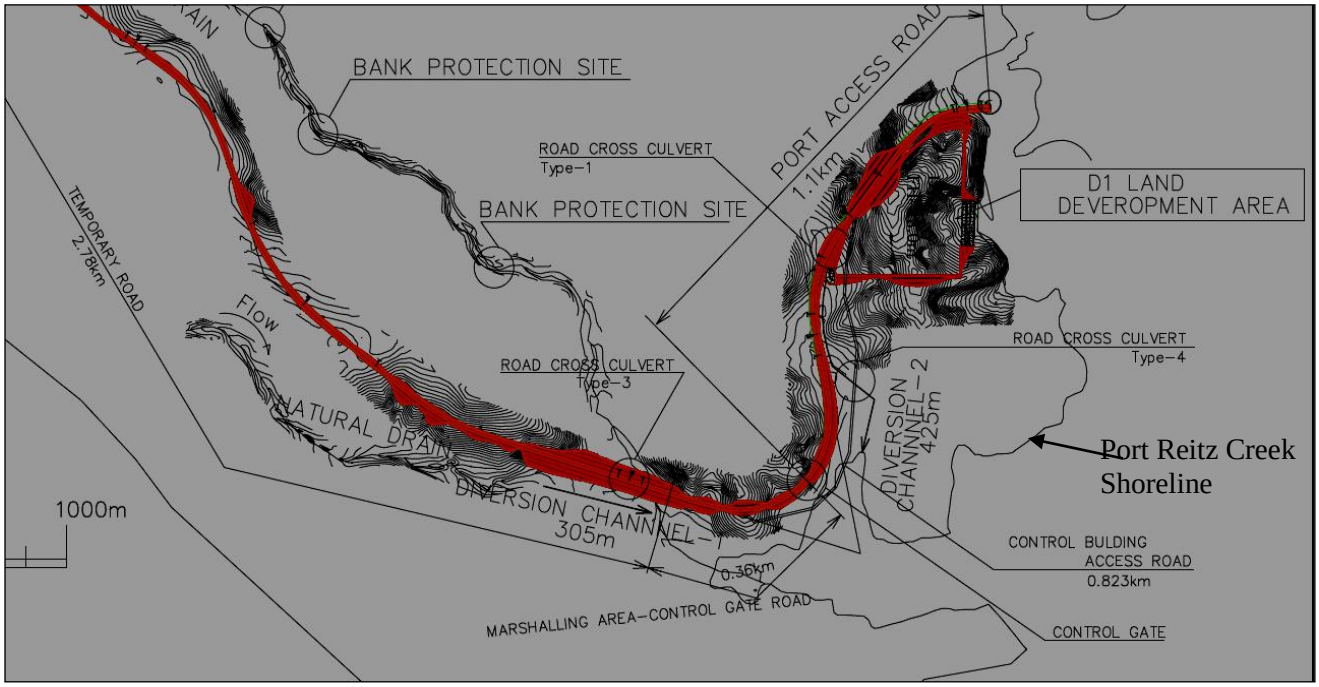


Fig 2.5: Proposed diversion works in the Mtishe swamp area

2.3.5: Land Development and Access Road

Land Development has two components namely:- development of a Port Access Road and Landscaping to create level Ground for development of Marshalling Area.

Port Access Road (Fig. 2.5): A 1.1 Km long road will be constructed linking the marshalling area to the Control Gate.

Land Development for Marshalling yard: Landscaping will entail cut and fill activity to create a 7.5ha area flat ground that will host both the KPA Complex and marshalling area for trucks. Main operation will entail cutting off rugged areas to fill depressions and, in the process, create level ground whose slopes will then be stabilized to prevent mass wash. A total of 551,000m^3 of soil will be excavated of which, 135,000 m^3 will be applied locally with the rest being disposed locally.

Table 2.3: Specifications in Land Development Component

Parameter	Quantities
Area	- 7.5ha
Cut & fill volume	- Cut Excavation Volume: 551,000 m3, Land Fill Volume: 135,000 m3
Fill material	- Excavated soil in work site

Temporary land	- As excavated soil is transported to land fill sites immediately after excavation, temporary stock of soil near work site is not considered.
Disposal	- Excess of excavated soil is disposed at a disposal area within SEZ area.
Slope protection	- Cut slope – Shot concrete, Fill slope – Concrete frame and placing of vegetation mat
Coast land and mangrove	- No negative impacts to coast and mangrove are presumed though the impact assessment is not carried out by us.
Site plan	- A site yard is planned in area for the road ramp to be constructed under Yen-loan project, where located at other side of premises of the water center (Water Supply Component of the Grant Aid Project) across the Mombasa South Bypass under construction. The area of the yard is 10,000 m^2.
Material for land plane	- At D1 Land, there is no material for leveling.

Source: This Study

2.4: Operation Stage Activities

The Project targets to develop infrastructure which will be applied in operationalizing components of the MSEZ. Operation stage activities in each component are summarized in Table 2.4 below. Concerns identified are analyzed in detail in Chapter Ten under Impact Assessment.

Table 2.4: Analysis of Operation Stage Activities

SN	Component	Operation Stage Activity	Emergent Concerns
1	Water Supply	Water extraction, pumping and transmission to MSEZ	Impacts at the water source area
			Generation of effluent water in MSEZ area
2	Drainage improvement	None	Accelerated flow of runoff into Port Reitz Creek
3	Land Development and Port Access Road	Parking and operation of trucks	Discharge of oils and waste spares, Noise from trucks
		Office operations	Generation of office waste and effluent

Source: This Study

CHAPTER THREE: POLICY FRAMEWORK

This chapter defines the policy frameworks which will govern development, implementation and operationalization of the proposed Mombasa Project for Infrastructure Development (PID) for Mombasa Special Economic Zone -M-SEZ.

By design, the PID project cuts across many sectors of the economy, some of which enjoy protection under diverse local, national, regional and global policy/ legal tools. An analysis of requirements of such tools has been undertaken as part of the ESIA process to ensure that the Project output attains the goals of social acceptability, economic viability and technically sustainability in line with internationally accepted standards for good practice. A detailed analysis of potential inter-phasing of the Project with diverse legal instruments is summarised in Appendix 3.1 and briefly highlighted in sections below.

3.1: The Policy Framework

Policy Thrust: Since independence, successive governments have pursued the policy of sustainable development. This was later on captured and elaborated in the Environmental Management and Coordination Act EMCA of 1999 and later on accorded constitutional weight in the National Constitution 2010 which declared a safe environment to be a universal right for every Kenyan.

Four policy frameworks are considered relevant to development of the PID Project namely: -

- National Policy Framework for development planning
- National Policy Frameworks for Transport including the roads sub sector
- National Policy Framework for environmental management
- Policy frameworks for the Mombasa County Government

3.1.1: Policy Framework for Development Planning in Kenya

National Constitution 2010:
See under 4.2.1 below.

Sessional Paper Number 10 of 2012 on Kenya Vision 2030
Sessional Paper Number 10 of 2012 on Kenya Vision 2030 is the National Policy Economic Blueprint that entrenches Kenya Vision 2030 as the long-term development strategy for Kenya towards achieving a "globally competitive and prosperous country with a high quality of life by 2030. Specifically, Vision 2030 aims at transforming Kenya into "a newly industrializing, middle income country providing a high quality of life to all its citizens in a clean and secure environment as anticipated in the Millennium Development Goals which is anchored on 3 pillars[1]:

- The Economic Pillar aims to achieve a sustained annual growth rate of 10% by 2030,

[1] *Kenya Vision 2030, http://www.vision2030.go.ke/ (accessed August 26, 2014)*

- The Social Pillar seeks to create a just, cohesive and equitable social development, and;
- The Political Pillar envisions a democratic system that is issue based, people centered, results oriented and is accountable to the public.

The Kenya Vision 2030 is being implemented in five year successive Medium Term Plans (MTP). The first plan covered the period 2008-2012. The Medium Term Plan (MTP 2013-17) is the second in a series of successive 5-year plans. The second MTP 2013-2017 draws on lessons learnt in implementing the first MTP. It seeks to implement the flagship projects identified under Vision 2030 over the five year period together with incomplete flagship and other projects and programs in the previous Medium Term Plan. It will also take due cognizance of the devolved structure of government following promulgation of the Constitution of Kenya 2010 and recent discovery of oil and mineral resources.

Relevance of Mombasa Special Economic Zone and its PID to the Economic Pillar: MSEZ is a Flagship of Vision z2030 under its Economic Pillar. By promoting investment in the six priority sectors of tourism; agriculture; wholesale and retail trade; manufacturing; IT enabled services (previously known as business process outsourcing); and financial services identified under the Economic Pillar [2], Vision 2030 seeks to achieve and sustain annual GDP growth rate at 10% up to 2030 and thereby generating resources required to address targets set out in the Sustainable Development Goals. This creates the urgent need of investing in both Flagship Projects and requisite infrastructure. Against this backdrop, by helping achievement of the MSEZ, the PID as currently conceived is fully harmonized with the vision as it will touch and underpin all six areas identified under the Economic Pillar.

Relevance to the Social Pillar: With regard to environmental quality, Vision 2030 anticipates a Kenyan nation characterized by a clean, secure and sustainable environment by 2030 and sets the goals for 2012 and which are yet to be achieved as: (i) to increase forest cover from less than 3% at present to 4% and (ii) to lessen by half all environment-related diseases. Specific strategies will involve promoting environmental conservation in order to provide better support to the economic pillar flagship projects and for the purposes of achieving the Sustainable Development Goals (SDGs); improving pollution and waste management through the design and application of economic incentives; and the commissioning of public-private partnerships (PPPs) for improved efficiency in water and sanitation delivery. Kenya will also enhance disaster preparedness in all disaster-prone areas and improve the capacity for adaptation to global climate change. In addition, the country will harmonize environment-related laws for better environmental planning and governance.

The PID as an enabler to Vision 2030: Realisation of the objectives and targets of the three pillars hinges on successful implementation of the enablers or foundations namely;- Infrastructure, ICT, Science, Technology and Innovation, Land Reforms, Public Sector Reforms, Labour & Employment, Ending Drought Emergencies, National values and Ethics, Security, Peace Building and Conflict Resolution.

[2] *Recently, a seventh Sector on Oil and Mineral Processing has been added to the economic pillar (GOK, 2013: Mombasa County Development Profile).*

Sector Plan for Infrastructure 2013 – 2017: The Second Infrastructure Medium Term Sector Plan provides a road map for Kenya's economic, social and political development over the 2013/14 to 2017/18 fiscal years. The Plan 2013-2017 identifies key programmes/projects, policy, legal and institutional reforms that the government will implement towards realization of the Constitution of Kenya 2010, sector priorities, and the long-term objective of Kenya Vision 2030. Efficient, accessible and reliable infrastructure is an enabler for sustained economic growth, development and poverty reduction. Accordingly, the vision of the infrastructure sector is "Deploying World Class Infrastructure Facilities and Services". The targets for the infrastructure under the Second MTP will be to gradually close Kenya's infrastructure deficit while building on the achievement of the First MTP 2008-2012. In this regard, the Second MTP recognizes the aspirations of Vision 2030, achievements, emerging issues and challenges of the First Medium Term Plan (MTP 2008-2012).

The Infrastructure Sector Plan recognizes the progress recorded in the development and expansion of airports, ports, roads, rail, pipelines, hydropower, geothermal plants, ferries, housing, buildings and other public works facilities during the implementation of the projects/programmes, policy/legal and institutional reforms during the First MTP. The implementation of infrastructure sector projects and programmes is aimed at contributing to a sustainable growth in agriculture, manufacturing, and service sectors in order to achieve an overall GDP growth rate of 10 per cent by 2017. During the plan period, 5% of the GDP is targeted to be generated from investments in the transport and infrastructure sector. The plan therefore assesses the existing capacity of infrastructure sector and identifies emerging issues and challenges which must be addressed to support enhanced growth. The Plan also outlines the policies/legal reforms to be pursued by the Government in the plan period towards the Kenya Vision 2030 aspirations.

**Sustainable Development Goals (SDG`s):** The SDG`s consist of 17 goals to be achieved by 2030. They constitute an integrated, indivisible set of global priorities for sustainable development. Their target is to build on the foundation laid by the MDGs, by seeking to complete the unfinished business of the MDGs and respond to new challenges. SDG`s are accompanied by targets and will be further elaborated through indicators focused on measurable outcomes. The goals and targets integrate economic, social and environmental aspects and recognize their inter-linkages in achieving sustainable development in all its dimensions. Each government will set its own national targets guided by the global level of ambition but taking into account national circumstances. These goals include;

Goal 1 End poverty in all its forms everywhere

Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Goal 3 Ensure healthy lives and promote well-being for all at all ages

Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Goal 5 Achieve gender equality and empower all women and girls

Goal 6 Ensure availability and sustainable management of water and sanitation for all

Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Goal 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Goal 10 Reduce inequality within and among countries

Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12 Ensure sustainable consumption and production patterns

Goal 13 Take urgent action to combat climate change and its impacts*

Goal 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Goal 17 Strengthen the means of implementation and revitalize the global partnership for sustainable development

The implementation of the sustainable development goals will depend on a global partnership for sustainable development with the active engagement of Governments, as well as civil society, the private sector and the United Nations system.

The National Poverty Eradication Plan: The NPEP has the objective of reducing the incidence of poverty in both rural and urban areas by 50 percent by the year 2015; as well as strengthening the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow gender and geographical disparities and create a healthy, better-educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for the Social Development (WSSD) of 1995. The plan focuses on the four WSSD themes of the poverty eradication; reduction of unemployment; social integration of the disadvantaged people and the creation of an enabling economic, political, and cultural environment. This plan is to be implemented by the Poverty Eradication Commission (PEC) formed in collaboration with Government Ministries, community-based organizations and private sector.

The Poverty Reduction Strategy Paper (1999): This strategy paper was published by the Government in 2001. The two key goals of the strategy is poverty reduction and economic growth. The document outlines the priorities and measure necessary for poverty reduction and economic growth. The objectives of economic growth and poverty reduction are borne out of realization that economic growth is not a sufficient condition to ensure poverty reduction. In this regard, measures geared towards improved economic performance and priority actions that must be implemented to reduce the incidence of poverty among Kenyans have been identified. With respect to the environment the paper proposes that adequate awareness be created among stakeholders regarding environmental costs and benefits. It further calls for community involvement and participation in environmental management and conservation.

Towards ensuring harmony with this policy thrust, the ESMP requires priority job placement to be accorded to residents of the traverse area.

Sessional Paper No. 3 of 2009 on National Land Policy: The National Land Policy was formulated with the aim of securing rights over land and provide for sustainable growth, investment and reduction of poverty in line with Government overall development objectives. The policy will offer a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide:-

(a) All citizens with opportunity to access and beneficially occupy and use land;

(b) Economically viable, socially equitable and environmentally sustainable allocation and use of land;

(c) Efficient, effective and economical operation of land markets;

(d) Efficient and effective utilization of land and land-based resources; and

(e) Efficient and transparent land dispute resolution mechanisms.

Requirements of this Policy will be triggered in the project which will entail land acquisition towards creating a reserve for the new roads. A comprehensive Resettlement Action Plan will be developed to guide resolution of all displacement impacts associated by the Road.

3.1.2: Policy Frameworks for Environment and Development

Sessional Paper No 1 of 1996 on Environment and Development: Sessional Paper No 1 of 1996 is the official statement on national policy on environment and was released in 1996 following recommendations of the National Environment Action Plan (NEAP) of 1994. The NEAP process had been launched earlier in 1992 following the Country's participation in the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro during which Kenya alongside other nations became a signatory to Agenda 21 which called on all nations to pay closer attention to environmental management at national level. Through Sessional Paper No 1 of 1996, the Kenya Government guarantees every citizen the inalienable right to a clean and healthy environment and commits to pursue a policy strategy of integrating environmental sensitivity into national development planning process and sets broad policy objectives as follows:

- Optimal use of natural land and water resources in improving the quality of human environment;
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development;
- Meeting of national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.
- Among other provisions, Sessional Paper No. 1 of 1996 also sets out sectoral priorities for environmental sustainability which in most cases have been operationalized through formulation of guidelines for quality and

environmental management in respective sectors. The Environment Management and Coordination Act (EMCA, 1999) has since also been enacted to secure implementation of the national policy on environment.

Execution of an ESIA Study for the MNBR and BLR in line with Cap 387 and LN 101 of EMCA will secure harmony with the aspirations of the National Policy on Environment and Development.

3.1.3: Policy Frameworks for Mombasa County Government

The Mombasa County Integrated Development Plan 2013-2017: This County Government of Mombasa has already developed a County Integrated development plan which is modelled along the Vision 2030 format and cascades down the various pillars to relevant issues within the County.

The Strategy paper outlines the National Status and aspirations for each pillar, to provide a background to the County situation analysis and Strategy. On infrastructure, the vision is "to provide cost-effective world -class infrastructure facilities and services in support of Vision 2030". Poor infrastructure has been identified as a major constraint to doing business. It's repeatedly cited as a necessity in improving the livelihoods by people living farming and pastoralist areas.

The CIDP`s (2013-2017) operating Vision is to make Mombasa County a vibrant modern regional and commercial hub with a high standard of living for its residents. This vision appreciates that Infrastructure is a basic pillar for global competitiveness and a foundational enabler towards the county`s vision. Further, the County hopes to leverage on development of the proposed M-SEZ toward Investment for purposes of creating jobs for the youth who comprise 62% of the population and 42% of the labour-fource which is largely unemployed.

Essentially, the development of the Mombasa PID as an enabler to the MSEZ as proposed is in line with stated strategies for economic transformation in the County. The project enjoys overwhelming support within the County leadership.

3.2: JICA Guidelines for Environmental and Social Consideration

3.2.1: Categorization

JICA classifies projects under three categories according to the extent of environmental and social impacts. To make this classification, JICA considers an outline of the project, the scale, the site condition, and the environmental impact assessment scheme in host countries.

Category A: Projects are classified as Category A if they are likely to have significant adverse impacts on the environment and society. Projects with complicated impacts or unprecedented impacts, which are difficult to assess or which have a wide range of impacts or irreversible impacts, are also classified as Category A. Projects are also classified as Category A if they require a detailed environment impact assessment by environmental laws and the standards of the recipient governments. The impacts may affect an area broader than the sites or facilities subject to physical construction. Category A, in principle, includes projects in sensitive sectors (i.e., characteristics that are liable to cause adverse environmental impact) and projects located in or near sensitive areas.

The proposed PID falls among Appendix 2.1(7/8) for sensitive sectors and accompanies

large scale resettlement and is therefore decidedly a Category B project.

Category B: Projects are classified as Category B if their potential adverse impacts on the environment and society are less adverse than those of Category A projects. Generally, they are site-specific; few if any are irreversible; and in most cases normal mitigation measures can be designed more readily.

Category C: Projects are classified as Category C if they are likely to have minimal or little adverse impacts on the environment and society.

3.2.2: Screening of PID against JICA Checklist

(i) Gap Analysis between Kenya System and JICA Guidelines:
JICA requires that, in principle, appropriate environmental and social considerations be undertaken, according to the nature of the project, and along procedures set by host governments, Cap 387 in case of Kenya. Table 4.1 provides an analysis of measures taken to ensure compliance of the PID to JICA requirements/ principles for environmental and social considerations. Gaps should be compensated in this ESIA.

Table 3.1: Gap Analysis between Kenya System and JICA Guidelines

Subject	JICA Guidelines	System of (Country)	Comparison/Gap and Project Policy
Underlying Principles	- Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan. (JICA Guidelines, Appendix 1.1)	- There is no system to examine alternatives and mitigation measures on early stage.	On this survey, stakeholders meetings and public consultation meetings are held, and their opinions are reflected on a route selection, alternatives and mitigation measures.
Information Disclosure	- EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them. - EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted. (JICA Guidelines,	- Language of EIA report is not designated. Official language is English, and EIA report is written with English.	- There is no gap about the language on information disclosure. -

Subject	JICA Guidelines	System of (Country)	Comparison/Gap and Project Policy
	Appendix 2)		
Consultations with Local Stakeholders	-For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans. (JICA Guidelines, Appendix 1.5 Social Acceptability 1) - In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared. - Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared. (JICA Guidelines, Appendix 2. EIA Reports for Category A Projects)	- Three times stakeholder meetings on affected areas and communities are compulsory during EIA survey. On the stakeholder meetings, project outlines and impacts are explained, and opinions are gathered. -	- On the early stage, the survey team held stakeholders meetings and public consultation meetings. And the opinions were reflected to route selection and other planning matters.
Scope of Impacts to Be Assessed	- The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. (JICA	- On the EIA, below items are examined (not limited) : Ecosystem Economic and social impacts Landscape Land use Water area - Evaluation for the derivative, secondary, and cumulative impacts is not described. The impacts throughout the project cycle are not	- Impact items of JICA Guidelines are included in EIA report. - In case that derivative, secondary and cumulative impacts are expected, these impacts are evaluated in EIA

Subject	JICA Guidelines	System of (Country)	Comparison/Gap and Project Policy
	Guidelines, Appendix1.3 Scope of Impacts to Be Assessed 1） - In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project. (JICA Guidelines, Appendix1.3 Scope of Impacts to Be Assessed 2）	considered.	report.
Monitoring, Grievance Mechanism	- Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders. (JICA Guidelines, Appendix1.8 Monitoring 3) - When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems. (JICA Guidelines, Appendix 1.8 Monitoring 4)	- There is no description about disclosure of monitoring results. EIA documents submitted to NEMA are available by prescribed manner.	- Easy access for EIA report is encouraged and agreed with KPA.
Ecosystem and Biota	Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests. (JICA Guidelines, Appendix 1.6)	GOK may declare a lake shore, wetland, coastal zone or river bank to be protected area and impose such restrictions as he considers necessary, to protect the lake shore, wetlands, coastal zone and river bank from environmental degradation.	There is no gap.
Indigenous Peoples	Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to	Constitution of Kenya describes obligation for needs of indigenous people.	In case that the existence of indigenous people is confirmed in the project site,

Subject	JICA Guidelines	System of (Country)	Comparison/Gap and Project Policy
	minimize impacts and to compensate indigenous peoples for their losses. (JICA Guidelines, Appendix 1.8)		appropriate measurements are applied.

(ii) Analysis of Measures to Mitigate Impacts: Multiple alternatives must be examined in order to avoid or minimize adverse impacts and to choose better project options in terms of environmental and social considerations. In the examination of measures, priority is to be given to avoidance of environmental impacts; when this is not possible, minimization and reduction of impacts must be considered next. Compensation measures must be examined only when impacts cannot be avoided by any of the measures.

Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; the costs of implementing such plans and systems, and the financial methods to fund such costs, must be determined. Plans for projects with particularly large potential adverse impacts must be accompanied by detailed environmental management plans.

(iii) Scope of Impacts to be assessed: The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.

In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project.

(iv) Compliance with Laws, Standards, and Plans: Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by the governments that have jurisdiction over project sites (including both national and local governments). They must also conform to the environmental and social consideration policies and plans of the governments that have such jurisdiction. Projects must, in principle, be undertaken outside of protected areas that are specifically designated by laws or ordinances for the conservation of nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such areas). Projects are also not to impose significant adverse impacts on designated conservation areas.

(v) Social Acceptability: Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which they are planned. For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans.

Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all members of which are susceptible to environmental and social impacts and may have little access to decision-making processes within society.

(vi) Ecosystems and Biota: Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests.
Illegal logging of forests must be avoided. Project proponents etc. are encouraged to obtain certification by forest certification systems as a way to ensure the prevention of illegal logging.

(vii) Involuntary Resettlement: Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected.

People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponents etc. in a timely manner. Prior compensation, at full replacement cost, must be provided as much as possible. Host countries must make efforts to enable people affected by projects and to improve their standard of living, income opportunities, and production levels, or at least to restore these to pre-project levels. Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting means for an alternative sustainable livelihood, and providing the expenses necessary for the relocation and re-establishment of communities at resettlement sites.

Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of resettlement action plans and measures to prevent the loss of their means of livelihood. In addition, appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

For projects that will result in large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. It is desirable that the resettlement action plan include elements laid out in Annex A of OP 4.12.

(viii) Indigenous Peoples: Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after

such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses.

When projects may have adverse impacts on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of relevant international declarations and treaties, including the United Nations Declaration on the Rights of Indigenous Peoples. Efforts must be made to obtain the consent of indigenous peoples in a process of free, prior, and informed consultation.

Measures for the affected indigenous peoples must be prepared as an indigenous peoples plan (which may constitute a part of other documents for environmental and social consideration) and must be made public in compliance with the relevant laws and ordinances of the host country. In preparing the indigenous peoples plan, consultations must be made with the affected indigenous peoples based on sufficient information made available to them in advance. When consultations are held, it is desirable that explanations be given in a form, manner, and language that are understandable to the people concerned. It is desirable that the indigenous peoples plan include the elements laid out in Annex B of OP4.10.

(ix) Monitoring: After projects begin, project proponents etc. monitor whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessment's prediction. They then take appropriate measures based on the results of such monitoring.

In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, such as projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents etc. must ensure that project plans include feasible monitoring plans.

Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders.

When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems.

Table 3.2: Environmental Checklist: 14. Water Supply（1）

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations	Responsibility
Permits and Explanation	1) EIA and Environmental Permits	① Have EIA reports been officially completed?	EIA License will be obtained at the end of ESIA Process. Other permits will be obtained before groundbreaking.	KPA

	(2) Explanation to the Public	① Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public?	Extensive public participation undertaken and will continue especially towards implementation of the RAP. Public support quite high	KPA
Mitigation Measures	1) Air Quality		Baseline studies undertaken to document project ambient air quality status. Construction and operation phase air emissions likely to increase and will require close monitoring.	KPA
	(2) Water Quality	① Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas?	Effluent quality will be monitored closely during operation phase.	KPA
	(3) Noise and vibration	① Do noise and vibrations from vehicle and train traffic comply with the country's standards?	Data is available on pre-project noise levels. Construction and operation phase will escalate noise level and monitoring will be required.	KPA
Natural Environment	(1) Protected Areas	① Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	Project will not traverse protected areas	KPA
	(2) Ecosystem and biota		As above.	KPA

		② Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	9 special case birds were recorded in the section	
		⑥ In cases where the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	There is a possibility of introduction of the invasive weed - *Prosopis chilensis* in building materials which will call for extensive screening of material sites and post project surveillance for presence of Prosopis.	
Social	(1) Resettlement	① Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	Project has minimal impact on settlements and livelihoods.	KPA
		② Is adequate explanation on relocation and compensation given to affected persons prior to resettlement?	PID alignment selected road reserves to reduce impacts	
		③ Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	Resettlement Plan, Compensation, livelihood restoration plan have been developed. The same will take place during tendering phase.	

		④ Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, and people below the poverty line, ethnic minorities and indigenous peoples?	RAP identified Vulnerable Groups but these are not likely to be impacted by PID ROW	
		⑤ Are agreements with the affected persons obtained prior to resettlement?	A RAP has been prepared complete with an Entitlement Matrix rationalized through consensus with PAPs.	
		⑥ Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	An implementation framework was proposed and funds are being identified.	
		⑦ Is a plan developed to monitor the impacts of resettlement?	A RAP monitoring Plan was put in place.	
	(2) Living and Livelihood	① Where roads or railways are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers?	ROW has potential to block rural access roads but this will be mitigated at design stage.	KPA
		Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts?	None	
		② Is there a possibility that the project will adversely affect the	Yes. PID will attract speculators who	

		living conditions of inhabitants other than the affected inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	will demand housing, services etc. As per ESMP	
		③ Is there a possibility that diseases, including communicable diseases, such as HIV will be introduced due to immigration of workers associated with the project?	Likely through influx of job seekers and other speculators.	
		Are adequate considerations given to public health, if necessary?	Yes. As part of ESMP	
		④ Is there a possibility that the project will adversely affect road traffic in the surrounding areas (e.g., by causing increases in traffic congestion and traffic accidents)?	Possible. Some access roads could be closed during laying of pipelines or excavation within reserves.	
		⑤ Is there a possibility that pipelines impede the movement of inhabitants?		
		⑥ Is there a possibility that structures associated with Project will cause a sun shading and radio interference?	No	
	(3) Heritage	① Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	None	KPA
	(4) Landscape	① Is there a possibility that the project will adversely affect the local landscape? Are necessary measures	Not likely.	KPA

		taken?		
	(5) Ethnic Minorities and Indigenous Peoples	① Where ethnic minorities and indigenous peoples are living in the rights-of-way, are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples?	There are no ethnic minorities along the ROW.	KPA
		② Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples?	Project been screened against local and World Bank safeguards and found to be compliant.	
	(6) Working conditions	① Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	Construction phase will adhere to all relevant labor and safety laws in Kenya.	KPA
		② Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents and management of hazardous materials?	Yes. Section 11.4.12 of ESMP	
		③ Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public sanitation) for workers etc.?	These will be taken care of in line with the OHSA 2007.	
		④ Are appropriate measures being taken to ensure that security guards involved in the	As above Project will obey all relevant local laws including the	

		project do not violate safety of other individuals involved, or local residents?	Penal Code.	
Others	(1) Impacts during Construction	① Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	Pre-project baseline mapping was undertaken and data will be used to monitor parameters during construction and operation The ESMP has adequate social safeguards.	KPA
		② If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?		
		③ If construction activities adversely affect the social environment, are adequate measures considered reducing impacts?		
	2) Monitoring	① Does the proponent develops and implement monitoring program for the environmental items that are considered to have potential impacts?	A monitoring Plan has been developed	KPA
		② Are the items, methods and frequencies included in the monitoring program judged to be appropriate?	Yes but M&E framework has room for improvement	
		③ Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	The Monitoring Plan is being updated to be comprehensive	
		④ Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to	As above Monitoring will conform to requirements of Legal Notice 101 of EMCA.	

		the regulatory authorities?		
Note	Reference to Checklist of Other Sectors	① Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation).	Project will only displace 445 trees which will be replanted	KPA
	Note on using Environmental Checklist	① If necessary, the impacts to trans boundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as trans boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	Project has no capacity to trigger transboundary issues, acid rain or destruction of ozone layer.	KPA

3.2.3: World Bank's Safeguard Policies

The World Bank is not involved in any way in the development of the Mombasa PID. However, the Bank is an international pace-setter in securing sustainable development in which case, the Safeguard Polices find direct application in any project pursuing sustainability. As such, this ESIA Study Report has been formulated to address and cater for both Kenyan and World Bank requirements for impact assessment. The World Bank's safeguard policies are designed to ensure that projects proposed for Bank financing are environmentally and socially sustainable, and thus improve decision-making. An analysis of possible triggers of the WB SGPs by the PID (Table 3.3) indicates that the project is likely to trigger 3 out of 10 WB safeguards which are briefly highlighted in sections below. For a full description of all WB safeguard policies, the reader is referred to www.worldbank.org.

Table 3.3: Analysis of Potential Triggers to World Bank Safeguards Policies

World Bank Safeguard policy		Triggers	Trigger mechanism
1	Environmental Assessment (OP4.01)	Triggered	Project is category B and must undergo mandatory Environmental Assessment in line with OP4.01
2	Natural Habitats (OP 4.04)	Triggered	Project passes through some natural marshlands
3	Forestry (OP 4.36)	No trigger	Project does not traverse protected forests
4	Pest Management (OP 4.09)	No trigger	Project has no known interaction with this trigger

5	Physical Cultural Property (OP 4.11)	No trigger	No trigger
6	Indigenous Peoples (OP4.10)	No trigger	Not triggered
7	Involuntary Resettlement (OP 4.12)	Triggered	PID Wayleave will require modest land acquisition.
8	Safety of Dams (OP 4.38)	No Trigger	Project will not involve construction of dams
9	Projects on International Waters (OP 7.50)	No Trigger	No project activities are planned for in International Waters
10	Projects in Disputed Territories (OP 7.60)	No Trigger	PID does not traverse disputed territories
	Total triggers	3	

Environmental Assessment (OP 4.01): OP 4.01 requires Environmental Assessment (EA) for projects proposed for Bank financing to ensure that they are environmentally sound and sustainable, and as a basis for decision making. Under OP 4.01 projects are screened and assigned either of four categories each of which requires different levels of environmental assessment as follows:-

- *Category A:* A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.
- *Category B:* A proposed project is classified as Category B if it's potential adverse environmental impacts on human populations or environmentally important areas—including wetlands, forests, grasslands, and other natural habitats—are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than for Category A projects.
- *Category C*: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.
- *Category FI:* A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary in subprojects that may result in adverse environmental impacts.

The proposed construction of PID has been assigned Environmental Category B and hence requiring environmental assessment. From experience, subjecting of proposed projects to environmental and social impact assessment as stipulated under Cap 387 and its tools simultaneously resolves requirements of OP 4.01 and the same will be achieved in terms of the project under review.

OP 4.01 also requires full disclosure of Projects which, in the case of the PID has been partly achieved through stakeholder consultations as reported in Chapter Eight above while more disclosure will take place during the Public Review Period stipulated for ESIA Study Reports. During this process, the ESIA Study Report will be made publicly available to project-affected groups within the entire route of traverse at places to be specified by NEMA following which, their comments will be incorporated into the final

ESIA Study Report and will also influence design of the project.

OP 4.12 on Involuntary Resettlement: OP 4.12 requires that a Resettlement Action Plan (RAP) be prepared for all projects that anticipate displacement of both settlements and livelihoods. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. Given that reserves for the proposed PID do in some areas, land acquisition will be inevitable thus displacing people from livelihoods and property in full trigger of OP 4.12. A RAP process is already underway.

OP 4.04 on Natural Habitats: This Policy seeks to ensure that World Bank-supported infrastructure and other development projects consider the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society. The policy strictly limits the circumstances under which any Bank-supported project can damage natural habitats (land and water areas where most of the native plant and animal species are still present). Specifically, the policy prohibits Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are legally protected, officially proposed for protection, or unprotected but of known high conservation value.

A full botanic mapping of the route of traverse for the PID has been conducted as reported in Chapter Six below.

OP 4.10 on Indigenous People: Communities fitting the description of Indigenous Peoples as defined in OP 4.10 have not been encountered within the traverse, more so in-spite of claims of occurrence of such people in Mombasa County. However, the PID traverses areas in close vicinity of sacred shrines locally revered and preserved as centres for traditional worship and belief handed down through generations from ancestors. As such, while the people may not answer to the description of indigenous, the shrines and their usage are indigenous in character and require recognition as such.

Kenya has no local law addressed to conservation of shrines especially if not gazette under any other law in which case, OP 4.10 will have overriding effect in minimizing potential impact on kayas and groves along the traverse.

OP 4.11 on Physical Cultural Property: This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

Harmonization of WB and GOK requirements for social and environmental sustainability: Experience has shown that both OP 4.10 of the World Bank and EMCA 1999 are generally aligned in principle and objective in that:-

- Both require Environmental Assessment before project implementation leading to development of comprehensive Environmental and social Management plans to guide resolution of social and environmental impacts as anticipated.

- Both require public disclosure of ESIA Study Report and stakeholder consultation during preparation,
- While OP 4.01 of World Bank stipulates different scales of ESIA Study Report for different category of projects, EMCA requires ESIA Study Report for all sizes of projects, which are required to be scoped as relevant
- Where EMCA requires consultation of Lead Agencies comprising of relevant sectors with legal mandate under GoK laws, the WB has equivalent safeguards for specific interests.
- The Bank requires that stakeholder consultations be undertaken during planning, implementation and operation phases of the project which is equivalent to the statutory annual environmental audits at the operation phase of projects in Kenya.

The understanding of this ESIA Study Report study is that, pursuit of an in-depth ESIA Study process as stipulated by EMCA 1999 is adequate to address all World Bank requirements for environmental and social assessment.

CHAPTER FOUR: LEGAL AND ADMINISTRATIVE FRAMEWORK

4.1: Legal Regulatory Framework for Environmental Management In Kenya

4.1.1: Constitutional Provisions

Kenya now has a new Supreme law in form of the National Constitution which was promulgated on the 27th of August 2010 and which takes supremacy over all aspects of life and activity in the New Republic. Section 42 of the Constitution guarantees the right to a clean and healthy environment for all citizens through a raft of measures while Section 69 (1)-*f* requires the State to *Establish systems of environmental impact assessment, environmental audit and monitoring of the environment.* In Sections 69 and 70, the Constitution has *inter alia* identified National Obligations in respect of the environment and Enforcement of Environmental Rights respectively as follows:-

Section 69 (1): The State shall—

(a) ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;

(b) work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;

(c) protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;

(d) encourage public participation in the management, protection and conservation of the environment;

(e) protect genetic resources and biological diversity;

(f) establish systems of environmental impact assessment, environmental audit and monitoring of the environment;

(g) eliminate processes and activities that are likely to endanger the environment; and

(h) Utilise the environment and natural resources for the benefit of the people of Kenya.

Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

Section 70 provides for enforcement of environmental rights thus:- If a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter. On application under clause (1), the court may make any order, or give any directions, it considers appropriate—

(a) to prevent, stop or discontinue any act or omission that is harmful to the environment;

(b) to compel any public officer to take measures to prevent or discontinue any act or omission that is harmful to the environment; or

(c) to provide compensation for any victim of a violation of the right to a clean and healthy environment.

For the purposes of this Article, an applicant does not have to demonstrate that any person has incurred loss or suffered injury.

Essentially, the New Constitution has embraced and provided further anchorage to the spirit and letter of Cap 387 whose requirements for environmental protection and management have largely informed Sections 69 through to 71 of the Document. In Section 72 however, the new constitution allows for enactment of laws towards enforcement of any new provisions of the Supreme Law.

4.1.2: Requirements of reigning environmental legislation in Kenya

The framework law on environment, the Environmental Management and Coordination Act, 1999, was amended in May 2015 and took effect on 17 June 2015. The Act makes diverse provisions towards securing sustainable environmental management as follows:-

(i) EMCA requires EIA for all new projects

Section 58 requires that an Environmental Impact Assessment (EIA) study precede all development activities proposed to be implemented in Kenya. The Act further requires that EIA studies so designed, be executed in accordance with the Guidelines for Conduct of EIAs and Environmental Audits (Kenya Gazette Supplement No. 56 of 13th June 2003) as published by the National Environmental Management Authority (NEMA).

The Second Schedule of Cap 387 specifies projects that require to be subjected to EIA studies. Under this schedule, there is no minimum size threshold below which an EIA is not necessary. Indeed, an appraisal of the proposed Project triggers requirements for an EIA under this Second Schedule. The EIA Report has thus been prepared in compliance with this requirement.

(ii) EMCA provides for gazettement of Environmental Regulations:

Under Cap 387, NEMA has gazetted legal tools that govern conduct of EIAs and general environmental protection. The PID has been screened against these tools with results that (Table 4.4) all nine tools will be triggered. Detailed analysis of the trigger mechanism and modalities for mitigation are provided in Chapter 8. Specifications of these guidelines would require to be captured in the Contracts for Construction to ensure that contractors are legally bound to undertake mitigation alongside general construction work.

Table 4.1: Analysis of the Project triggers to Cap 387 and its tools

Regulation	Focus	Status
Legal Notice 101 of June 2003 - Environmental (Impact Assessment and Audit) Regulations, 2003	This is the tool that gives legal foundation to conduct of ESIA Studies in Kenya.	Triggered
Legal Notice 160 of 1st Dec 2006- Environmental Management and Co-ordination Act (Conservation of Biological Diversity) Regulations 2006	This legislation requires full measures be taken to prevent introduction of alien/ invasive species of flora and fauna and is important because of the Prosopis menace in the coast.	Triggered
Legal Notice 19 (Wetlands, River Banks, Lake Shores and Sea Shore Management)	Regulation 17 requires special measures to be taken to prevent siltation of the seashore.	Triggered

Regulations, 2009		
Legal Notice 61 of 22nd May 2009- Environmental Management and Co-ordination Act (Noise, and Excessive Vibration Pollution) (Control) Regulations, 2009	Sets standards for noise levels	Triggered
Legal Notice 120 of 29th Sept 2006- Environmental Management and Co-ordination Act (Water Quality Standards) Regulations 2006	Regulation 24 prohibits any kind of pollution of water meant for fisheries, recreation or any other use and sets quality standards for diverse waters.	Triggered
Legal Notice 121 of 29th Sept 2006- Environmental Management and Co-ordination Act (Waste Management) Regulations 2006	Sets standards for waste management	Triggered
Prevention of Pollution in Coastal Zone and other segments of the environment regulations, 2003	Regulation 3 prohibits discharge any hazardous substance, chemical, oil or oily mixture into the territorial waters of Kenya or any segment of the environment.	Triggered
National Sand Harvesting Guidelines, 2007	Sets guidelines for sustainable sand harvesting in Kenya	Triggered
Legal Notice 73 of 31st May 2007 - Environmental Management and Co-ordination Act (Controlled Substances) Regulations	Sets guidelines on handling and use of controlled substances. There will be need to screen the PID for controlled substances	Triggered
Legal Notice No.34 Environmental Management and Co-ordination (Air Quality) Regulations, 2014	Sets standards for Air Quality	Triggered

(iii) EMCA requires inter-Sectoral Coordination in project development

In recognition that Cap 387 is an umbrella law coordinating diverse sectoral statutes all of which are still in force, Legal Notice 101 requires that the respective sectors be consulted as Lead Agencies in making decisions pertaining to environmental assessment for projects in respective sectors. This is to ensure that NEMA does not approve projects that contradict sector policies and legislation. In conformity with this requirement, we have screened the proposed development against most relevant statutes to map out the potential triggers. In sections below, we highlight sectoral laws and policies likely to be triggered by the PID as currently proposed.

Kenya Ports Authority Act-1978:

Cap 381 became effective on 20th January 1978 with the objective of providing for the establishment of the Kenya Ports Authority and connected purposes. The Act provides a

generally generous mandate to the KPA but, section 2 (j) is relevant to construction activity in the PID as it confers power on the KPA to prohibit, control or regulate the use by any person of the services performed, or the facilities provided, by the Authority; or the presence of any person, ship, vehicle or goods within any port or on any premises occupied by the Authority. Deployment of all construction equipment for use in the PID will require authorization by the KPA.

Fisheries Act-1989:

Act No.5 of 1989 provides for the development, management, exploitation, utilization and conservation of fisheries and for connected purposes. Sections 7(1) and 8(5) are relevant in bridge construction as they criminalize illegal fishing thus:-

7(1) No person shall use any vessel for fishing in Kenya's fishery waters unless there is in force in relation to the vessel a valid certificate of registration.

8(5)Any person who catches fish in Kenya fishery waters without a licence, or in contravention of the conditions imposed on a licence, issued under this Act shall be guilty of an offence and liable to a fine not exceeding twenty thousand shillings or to imprisonment for a term not exceeding two years or to both.

Contractors and staff engaged in bridge construction will require to adhere to provisions of this law.

Explosive Act Cap 115:

This Act makes diverse requirements in the handling and use of explosives thus:-

8. Licence necessary to deal in explosives
   (1) No person, other than the manufacturer, shall sell, deal in or dispose of any explosive unless he is in possession of a licence granted under this Act.
   (2) For the purposes of this section, a manager, as defined in the Mining (Safety) Regulations (Cap. 306, Sub. Leg), who in outlying districts and in accordance with rules supplies other consumers, shall not be deemed to be a dealer, unless he sells at a profit.
   (3) Any person who contravenes subsection (1) shall be guilty of an offence and liable to a fine not exceeding three thousand shillings or, in default of payment, to imprisonment for a term not exceeding one year.
9. Permit necessary to acquire blasting materials
   (1) No person shall purchase or otherwise acquire blasting materials except under the authority of, and to the extent authorized in, a written permit issued by an inspector.
   (2) No person shall sell or dispose of blasting materials to any person who fails to produce at the time of the transaction a permit of the type referred to in subsection (1) nor shall any person sell or dispose of any such materials in excess of the quantity referred to in such permit.
   (3) Any person who contravenes this section shall be guilty of an offence and liable to a fine not exceeding three thousand shillings or, in default of payment, to imprisonment for a term not exceeding one year.
10. Prohibition of importation and exportation of explosives without permit
    No person shall import or export, or cause to be imported or exported, any explosive, unless he has obtained a permit issued, in the case of blasting materials,

under the authority of an inspector, or, in the case of other explosives, by any person authorized by the Commissioner to issue such a permit

All blasting works in the construction of the PID will adhere to requirements of this statute.

The Occupational Health and Safety Act of 2007

The Occupational Safety and Health Act, 2007, is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. The Act applies to all workplaces and workers associated with it; whether temporary or permanent. The main aim of the Act is to safeguard the safety, health and welfare of workers and non-workers. Part 9 states that the occupier or employer shall establish a health and safety committee where twenty or more people are employed and such an employee shall prepare a written statement of his general policy with respect to the safety and health at the work place. Further, the occupier shall prepare annual safety and health audits by a qualified person.

It is thus recommended that all Sections of the Act related to this project, such as provision of protective clothing, clean water and insurance cover are observed so as to protect all from work related injuries or other health hazards. The same are captured in the ESMP including commentaries in section 10.4.5.

The Public Health Act (Cap. 242)

The Public Health Act provides for the protection of human health through prevention and guarding against introduction of infectious diseases into Kenya from outside, to promote public health and the prevention, limitation or suppression of infectious, communicable or preventable diseases within Kenya, to advice and direct local authorities in regard to matters affecting the public health to promote or carry out research and investigations in connection with the prevention or treatment of human diseases. This Act provides the impetus for a healthy environment and gives regulations to waste management, pollution and human health all of which are infringed by construction activities.

Part IX section 115 states that no person shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires Local Authorities to take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable for injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 waste pipes, sewers, drains or refuse pits in such a state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health. Other nuisances are accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbour rats or other vermin.

All camps established for purposes of construction of the PID shall be operated in harmony with the Public Health Act Cap 242 which has largely informed section 10.4.5 below.

The Penal Code (Cap. 63)

Section 191 of the Penal Code states that any person who voluntarily corrupts or fouls water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an

offence. Section 192 of the same act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons in dwellings or business premises in the neighbourhood or those passing along public way, commit an offence.

The Water Act 2002:

In March 2003 the *Water Act 2002* came into effect. The *Water Act 2002* provided the legal framework for management and conservation of water resources in line with the new policy changes. New institutions with separate functions were established, and decentralized decision making is reflected in autonomous regional bodies.

Section 25 of the Act requires a permit to be obtained for among others any use of water from a water resources, discharge of a pollutant into any water resource. According to section 29 of the same Act, application for such a permit shall be subject to public consultation as well as an environmental impact assessment as per the Environmental Management and Coordination Act, 1999. Under Section 35, conditions of the permit may also be varied if the Authority feels that the water so used is causing deterioration of water quality or causing shortage of water for other purposes that the Authority may consider has priority.

Section 25 of Water Act is largely triggered given that the Project is about water extraction, transmission, supply and disposal of water. Construction activity under the PID Project especially pertaining to sourcing of water and operations within riparian areas will adhere to conditions of the Water Act 2002 and its Legal Notice 171 of 28th Sept 2007 (The Water Resource Management Rules 2007).

The Physical Planning Act (Cap 286):

Cap 286 provides for the preparation and implementation of physical development plans for connected purposes. It establishes the responsibility for the physical planning at various levels of government mainly the District Level. The Act provides for a hierarchy of plans in which guidelines are laid down for the future physical development of areas referred to in the specific plan. The intention is that the three-tier order plans, the national development plan, regional development plan, and the local physical development plan should concentrate on broad policy issues. The Act also promotes public participation in the preparation of plans and requires that in preparation of plans, proper consideration be given to the potential for economic and social development.

The Wildlife Management and Conservation Act 2013:

The Wildlife Conservation and Management Act, 2013, came into force on 27th December 2013 and apply to all wildlife resources on public, community and private land. Under Section 34, the WCMA enforces the requirement for Environmental assessment thus;- A user or other related right shall not be granted under this Act where the requirement for a strategic environmental, cultural, economic and social impact assessment licence under the Environmental Management and Coordination Act, 1999 has not been complied with.

The wildlife resource base of the traverse is not fully understood in which case, this study has taken liberty to conduct a full inventory of fauna and flora of the traverse as reported in Chapter Seven below.

Schedule Six and Seven of the Wildlife Management and Conservation Act 2013 lists

species that are considered endangered and invasive in Kenya respectively. The same have been applied as screening tools in this ESIA Study.

The Forest Conservation and Management Act, 2016

This is an ACT of Parliament to give effect to Article 69 of the Constitution with regard to forest resources; to provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and for connected purposes.

The Forest Conservation and Management Act, 2016 applies to all forests on state, community and private land whereby the focus is on:-

a) good governance in accordance with Article 10 of the Constitution;
b) public participation and community involvement in the management of forests;
c) consultation and co-operation between the national and county governments;
d) the values and principles of public service in accordance with Article 232 of the Constitution;
e) protection of indigenous knowledge and intellectual property rights of forests resources; and,
f) international best practices in management and conservation of forests.

As part of this ESIA Study, all the sacred groves occurring near the traverse have been mapped and clearly documented to ensure informed decision making in construction activity.

Roads Act 2007:

The core feature of the Kenya Roads Act 2007 which came into effect in September 2007 was the creation of three autonomous Authorities (KeNHA, KeRRA and KURA) to take care of national, rural and urban roads respectively. Sections 3(2) (b), 4(2) (b) and 10(2) (b) are quite relevant to development and operation of power distribution lines as they place all road reserves under the respective jurisdictions of KeNHA, KeRRA and KURA depending on the category of the road. In essence, any infrastructure service provider intending to utilize a road reserve will require consent of the respective road authority. Further, under Section 27, the respective road authority has power to cause relocation of infrastructure from the road reserve thus:-

> (2) *Where any infrastructure utility is located within a road reserve, the provider or operator of such infrastructure utility shall, upon written request by the responsible Authority, relocate such infrastructure utility to a location or alignment approved by the Authority at no cost to the Authority.*
>
> *(3) Where an Authority intends to exercise any power under sub-section (2) it shall give reasonable notice of its intention to do so to the person having control of such infrastructure utility, and such person shall cause to be removed such infrastructure utility within sixty days.*
>
> *(4) Where, under subsection (2) or (3), any person having control of an infrastructure utility fails to remove such infrastructure utility within the time stated in the notice, the concerned Authority may remove such infrastructure utility at the cost of the person who was unable to comply with the notice under subsection (3).*

Given the provisions of the Roads Act 2007, it is important that all developers targeting to use road reserves to liaise closely with the relevant road authorities. The same position was articulated during consultations with KeNHA and KeRRA undertaken as part of this study.

The County Government Act 2012

The County Government Act of 2012, which has been adapted to the Constitution's State and County structure in relation to devolution, stipulates the County planning issues in Part IX. The County Government Act declares the County Integrated Plan to be central to the County's administration and prohibits any public spending outside of the plan. The Act clarifies that the County Integrated Plan to be broken down into the economic plan, physical plan, social environmental plan and spatial plan. Also, the Act states that the County Plan commands,

- County Integrated Development Plan
- County Sectoral Plans
- County Spatial Plan
- Cities and urban areas plans as stipulated by Urban Areas and Cities Act

The Lands Act No. 6 of 2012:

The Land Act was enacted by Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. The Act applies to all land declared as (*a*) public land under Article 62 of the Constitution; (*b*) private land under Article 64 of the Constitution; and (*c*) community land under Article 63 of the Constitution and any other written law relating to community land.

The Land Act guarantees security of tenure for land under (*a*) freehold; (*b*) leasehold; (*c*) such forms of partial interest as may be defined under the Act and other law, including but not limited to easements; and (*d*) customary land rights, where consistent with the Constitution and guarantees 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.

Under the Lands Act 2012, The Wayleaves Act, Cap 292 and The Land Acquisition Act, Cap. 295 have been revoked but Sections 8 and 9 allow for Compulsory Acquisition as an option in acquiring land for public utility. This section will come in handy in formulating a Resettlement Action Plan for the Project.

The Land Registration Act, No. 3 of 2012:

The Land Registration Act (LRA), 2012 was assented to on 27th April, 2012 and commenced on 2nd May, 2012 with the objective and purpose of revising, consolidating and rationalizing the registration of titles to land to give effect to the principles and objects of devolved government.

Sections 18 to 21 of the LRA 2012 deal with establishment and maintenance of boundaries to land. Section 21(1) is relevant to development of power distribution lines in it that it criminalizes interference with boundaries thus;- Any person who defaces,

removes, injures or otherwise impairs a boundary feature or any part of it unless authorized to do so by the Registrar commits an offence and is liable on conviction to imprisonment for a term not exceeding two years or to a fine not exceeding two hundred thousand shillings or to both. This is relevant to all road construction including setting of new reserves for roads as proposed under the PID Project which should subsequently respect all boundaries.

Under the LRA 2012, Statutes previously related to land property namely;- The Indian Transfer of Property Act 1882, The Government Lands Act, (Cap 280), The Registration of Titles Act, (Cap 281), The Land Titles Act, (Chapter 282) and The Registered Land Act, (Cap. 300) now stand repealed.

The Environment and Land Court Act No.19 of 2011:

This law was assented to on 27th August 2012 and commenced on 30th August 2012 to give effect to Article 162(2)(b) of the Constitution; to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of, and title to, land, and to make provision for its jurisdiction functions and powers, and for connected purposes. Section 13 (1) of the Act gives the Court original and appellate jurisdiction to hear and determine all disputes in accordance with Article 162(2)(*b*) of the Constitution and with the provisions of this Act or any other written law relating to environment and land. In exercise of its jurisdiction under Article 162 (2) (*b*) of the Constitution, the Court shall have power to hear and determine disputes relating to environment and land, including disputes:-

- relating to environmental planning and protection, trade, climate issues, land use planning, title, tenure, boundaries, rates, rents, valuations, mining, minerals and other natural resources;
- relating to compulsory acquisition of land;
- relating to land administration and management;
- relating to public, private and community land and contracts, choses in action or other instruments granting any enforceable interests in land; and
- any other dispute relating to environment and land.

This statute is deemed relevant to all development proposed for implementation in Kenya as it provides for legal recourse for disputes relating to environment and land. This is a law that any developer including KPA could take recourse to especially given the numerous disputes associated with land acquisition in the coast area.

The Agriculture Act, Cap 318:

This statute seeks to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry. This Act primarily guides and regulates farming practices. The Agriculture Act is the principal land use statute covering, inter-alia, soil conservation and agricultural land use in general.

In 2009, the Minister for Agriculture gazetted **The Agriculture (Farm Forestry) Rules, 2009** with the objective and purpose of promoting and maintaining farm forest cover of at least 10 per cent of every agricultural land holding and to preserve and sustain the

environment in combating climate change and global warming.

Rule 5 (1) requires every person who owns or occupies agricultural land shall establish and maintain a minimum of 10% of the land under farm forestry which may include trees on soil conservation structures or rangeland and cropland in any suitable configurations; provided that the species of trees or varieties planted shall not have adverse effects on water sources, crops, livestock, soil fertility and the neighbourhood and should not be of invasive nature.

Rule 6 allows an inspector to take action within area of jurisdiction to ensure that land owners and occupiers comply with requirements of rule 5 above. Regulation 10 on harvesting of farm trees requires the following:

- Every land owner or occupier shall ensure that harvesting of trees shall be done in such a manner as to maintain a 10 per cent tree cover at all times, with large scale harvesting requiring a harvesting plan as governed by the provisions of the Forests 2005.
- The District Agricultural Committee shall establish mechanisms to facilitate the process of notification and approval for ease of harvesting by land owners or occupiers.
- A person shall not harvest trees from a farm forest without notification and approval as provided for in paragraph (ii).
- Harvesting, processing and movement of farm forest products for commercial purposes shall be governed by the provisions of the Forests Act 2005.

From this analysis, it is apparent that an innovative approach to treatment of on-farm trees has been established. As such, contrary to past practices, contractors contemplating removal of farm trees to create way leaves will require authority from the Sub County Agricultural committees.

Public Procurement and Disposal Act 2005:

The purpose of this Act is to establish procedures for procurement and the disposal of unserviceable, obsolete or surplus stores and equipment by public entities to achieve the following objectives -

- to maximize economy and efficiency;
- to promote competition and ensure that competitors are treated fairly;
- to promote the integrity and fairness of those procedures;
- to increase transparency and accountability in those procedures; and
- to increase public confidence in those procedures;
- to facilitate the promotion of local industry and economic development.

All procurement of services related to the Mombasa PID will be subject to this statute.

The National Museums and Heritage Act-Cap 216 (2006):

Kenya is rich in its antiquities, monuments, cultural and natural sites which are spread all over the country and the Act aims to preserve this national heritage. The National Museums of Kenya is the custodian of the country's cultural heritage, its principal

mission being to collect, document, preserve and enhance knowledge, appreciation, management and the use of these resources for the benefit of Kenya and the world. Through the National Museums of Kenya many of these sites are protected by law by having them gazetted under the Act.

Section 30 of the Act requires all discoveries of buried artefacts to be reported to the NMK/ GOK. In is a requirement under this law for Cultural Impact Assessment Studies coordinated by the NMK to precede development in any culturally sensitive site including the entire Kenya's coastline in which case, the NMK has been contacted in the case of the PID development planning.

4.1.3: National legal provisions on gender equity and mainstreaming

Gender issues in the country are institutionalized through: -

(i) The National Constitution of August 2010

In the New Constitution, Chapter Four—The Bill Of Rights, Section 21 (3) All State organs and all public officers have the duty to address the needs of vulnerable groups within society, including women, older members of society, persons with disabilities, children, youth, members of minority or marginalized communities, and members of particular ethnic, religious or cultural communities Section 27 (3) Women and men have the right to equal treatment, including the right to equal opportunities in political, economic, cultural and social spheres.

Part 2 on the Composition and Membership of Parliament, Section 97 (1) The National Assembly consists of, a) two hundred and ninety members, each elected by the registered voters of single member constituencies; (b) forty-seven women, each elected by the registered voters of the counties, each county constituting a single member constituency;

Section 98. (1) The Senate consists of— (a) forty-seven members each elected by the registered voters of the counties, each county constituting a single member constituency; (b) sixteen women members who shall be nominated by political parties according to their proportion of members of the Senate elected under clause (a) in accordance with Article 90; (c) two members, being one man and one woman, representing the youth; (d) two members, being one man and one woman, representing persons with disabilities;

Section 100: Parliament shall enact legislation to promote the representation in Parliament of— (a) women;

Section 127 (1) Establishes the Parliamentary Service Commission consisting of (2) (a) The Speaker of the National Assembly, as chairperson; (b) A vice-chairperson elected by the Commission from the members appointed under paragraph (c); (c) Seven members appointed by Parliament from among its members of whom, Four shall be nominated equally from both Houses by the party or coalition of parties forming the national government, of whom at least two shall be women;

In Chapter Thirteen, on the Public Service, Part 1—Values and Principles of Public Service
Section 232 (1) The values and principles of public service include—(i) affording adequate and equal opportunities for appointment, training and advancement, at all levels of the public service, of—

(i) Men and women;
(ii) The members of all ethnic groups; and
(iii) Persons with disabilities.

Section 232 (2) the values and principles of public service apply to public service in— (a) All State organs in both levels of government; and (b) All State corporations. (3) Parliament shall enact legislation to give full effect to this Article. In the composition, appointment and terms of office, the new constitution says that the chairperson and vice-chairperson of a commission shall not be of the same gender. In addition clause (8) says that the State shall take legislative and other measures to implement the principle that not more than two-thirds of the members of elective or appointive bodies shall be of the same gender.

The new constitution provides for the elimination of gender discrimination in law, customs and practices related to land and property. Under Kenya's previous law, inheritance was governed by customary law, often preventing women from inheriting property from their parents or laying claim to joint assets when their husbands died. In summary, the New Constitution provides as follows-

- The New Kenyan Constitution ensures that women will be able to pass on citizen ship to their children regardless of whether or not they are married to Kenyans.
- Article 14 (1)
- The New Kenyan Constitution provides that parties to a marriage will be entitled to equal rights at the time of marriage, during the marriage and at its dissolution. Article 45 (3)
- The New Kenyan Constitution assures that parental responsibility shall be shared between parents regardless of marital status. Article 53 (1) (e).
- The New Kenyan Constitution eliminates gender discrimination in relation to land and property and gives everyone including women the right to inheritance and unbiased access to land. Article 60 (1) (f).
- The New Kenyan Constitution provides for the enactment of legislation for the protection of matrimonial property with special interest on the matrimonial home during, and upon the termination of the marriage. Article 68 (c) (iii).
- The New Kenyan Constitution maintains a one third requirement for either gender in elective bodies giving women of Kenya at least 1/3 minimum in elective public bodies. Article 81 (b).
- The New Kenyan Constitution ensures that gender equality is maintained in political parties providing a basic requirement for political parties as amongst other to respect and promote gender equality. Article 91 (f)
- The New Kenyan Constitution provides that Parliament shall formulate law to promote the representation of women, persons of disabilities, ethnic and other minorities and marginalized communities in Parliament. Article 100.
- The New Kenyan Constitution ensures that women and men will have the right to equal treatment and opportunities in political, economic, cultural and social spheres without discrimination. Article 27 (3).
- The New Kenyan Constitution accords the right to health including reproductive health to all. Article 43 (1) (a).
- The New Kenyan Constitution affords adequate and equal opportunities for appointment, training and advancement for women and men at all levels within the Public Service Commission. Article 232 (i).

(ii) National Gender and Development Policy (2000):

The National Gender and Development Policy provide a framework for advancement of women and an approach that would lead to greater efficiency in resource allocation and utilisation to ensure empowerment of women. The National Policy on Gender and Development is consistent with the Government's efforts of spurring economic growth and thereby reducing poverty and unemployment, by considering the needs and aspirations of all Kenyan men, women, boys and girls across economic, social and cultural lines. The policy is also consistent with the Environmental and Social Impact Assessment ESIA Study Report Government's commitment to implementing the National Plan of Action based on the Beijing Platform for Action (PFA). The overall objective of the Gender and Development Policy is to facilitate the mainstreaming of the needs and concerns of men and women in all areas in the development process in the country.

The Policy's concerns cover the following critical areas: -

i) The Economy; -To enable men and women to have equal access to economic and employment opportunities.

ii) Poverty and Sustainable Livelihoods; - To remove obstacles to women's access to and control over productive assets, wealth and economic opportunities, shelter, safe drinking water, and promote measures for conserving the environment.

iii) Law; - To guarantee Kenyan men and women equality before the law, as provided for in the Constitution and under the obligations of the Kenyan State in international law.

iv) Political Participation and Decision- Making; - To enhance gender parity in political participation and decision – making

v) Education and Training; - To enhance and sustain measures to eliminate gender disparities in access, retention, transition and performance in education for both boys and girls

vi) Health and Population; - To achieve the highest attainable standard of health for both men and women through addressing gender inequalities pertaining to access and use of basic health services and facilities at an affordable cost.

vii) The Media; - To increase the participation of women in the media and communications sector and promote gender sensitive portrayal of both men and women in the media

viii) Policy Implementation Framework and Resource Mobilisation- empowering both men and women to be equal partners in development- It focuses on the elimination of existing disparities between the two genders. It also advocates for an affirmative action to address gender disparities.

(iii) The Sexual Offences Act (No. 3 of 2006)

24- Sexual offences relating to position of authority and persons in position of trust.

25- Sexual relationship which pre-date position of authority or trust.

26- Deliberate transmission of HIV or any other life threatening sexually transmitted disease.

(iv) Other Policy/legal provisions for Gender mainstreaming:

Other provisions include:

i) The National Constitution 2010

ii) Vision 2030 Flagship projects

iii) The Presidential Directive of 2006 on 30% women's' appointments to all positions of leadership employment and promotions

iv) MTPs handbook has gender outcome indicators

v) Sessional Paper No.2 of 2006

vi) Gender Department in the Ministry for Gender Children and Social Development.

vii) The National Commission on Gender and Development created through an Act of Parliament in 2003 is mandated to Monitor Government Implementation of its Commitments to Women's Rights and Gender issues:-

- ✓ Employment Act, No. 11 of 2007 : the Act prohibits
- ✓ discrimination in access to employment and in employment
- ✓ security on the basis of sex, among others
- ✓ Guarantees equality of opportunity in employment
- ✓ Provides for equal pay for work of equal value
- ✓ Prohibits sexual harassment which the law defines to include use of language, whether written or spoken, of a sexual nature

(vi) A National Framework on Gender-based Violence:

The government through the National Commission on Gender and Development has developed a National Framework on Gender Based Violence (February 2009) to form that basis of investigation of instances of sexual violence and strengthen coordination of responses to stem the vice Launch of same on 09.11.2009 by Minister for Gender, children and social development

4.2: International Conventions, Treaties And Agreements

4.2.1: General Treaties

According to the Registrar of International Treaties and other Agreements in Environment, there are about 232 treaties which are legally binding to Kenya. A total of 9 such treaties can be triggered in the PID Project as tabulated in 4.2 below.

Table 4.2: International treaties deemed relevant to the PID

No	Convention	Status	Reason
1	Convention on International Trade in Endangered Species of Wild Fauna and Flora	Triggered	Threats to biodiversity largely remain unknown as most of the floral species not assessed for IUCN Red List data. One bird species identified as Vulnerable under IUCN Data lists

2	Convention on the Elimination of all forms of Discrimination against Women, 1979.	Triggered	Women form the bulk of poor rural population in the Project area
3	Convention on the Conservation of Migratory Species of Wild Animals, 1979.	Triggered	Nine Special Case Birds; 1 IUCN, 8 CMS and (7 AEWA) spp were encountered in the traverse area respectively.
4	The 1985 Vienna Convention on Protection of the Ozone Layer	Not Triggered	There is no likelihood of use on Ozone depleting substances in the PID construction.
5	The 1987 United Nations Montreal Protocol on substances that deplete the ozone layer	Not triggered	As above
6	The 1992 United Nations Framework Convention on Climate Change (UNFCCC) which led to the Kyoto Protocol of 1997	Triggered	Any activity that involves heavy use of fossil fuels and importation of materials such as steel in bridge construction has a heavy carbon foot print.
7	Convention on Biological Diversity	Triggered	Special case (IUCN, CMS & AEWA) birds encountered.
8	Cartagena Protocol on Biosafety to the Convention on Biological Diversity, 2000	Not triggered	No activities that raise biosafety concerns are anticipated.
9	International Plant Protection Convention (Revised), 1997	Not triggered	The Project will not involve introduction of Pest Spp
10	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	Not triggered	There no possibility of use of controlled substances in fonstruction
11	Stockholm Convention on Persistent Organic Pollutants	Not triggered	As above
12	African Convention on the Conservation of Nature and Natural Resources (1968)	Triggered	Exploitation of water resources and rangelands will trigger this convention
13	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972	Triggered	Land Development in close vicinity of marine areas could cause siltation of the sea and creeks
14	The Convention on Wetlands of International Importance (Ramsar 1971)	Triggered	Possible impact on some wetlands and mangrove swamps
15	Convention on the Protection of World Cultural and Natural Heritage, 1972, which also protects threatened plants	Triggered	Special case Birds identified in the PID traverse. There are no designated cultural sites.
16	United Nations Convention to Combat Desertification 1994	Triggered	Land development construction will convert natural vegetation to a concrete surface

	Total Triggers	9	

4.2.2: Treaties specific to Marine Pollution

Kenya has ratified several conventions in effort to regulate the ship source pollution;

The MARPO 73/78 Convention addresses pollution from ships by oil; by noxious liquid substances carried in bulk; harmful substances carried by sea in packaged form; sewage, garbage; and the prevention of air pollution from ships. The Convention, as modified by the 1978 Protocol, is known as the "International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto", or, in short form, "MARPOL 73/78". Regulations covering the various sources of ship-generated pollution are contained in the five Annexes of the Convention. The Convention has also been modified by the Protocol of 1997, whereby a sixth Annex was added.

The International Convention on Oil Pollution Preparedness, Response and Co-operation 1990 (OPRC 90) is the international instrument that provides a framework designed to facilitate international co-operation and mutual assistance in preparing for and responding to major oil pollution incidents and requires States to plan and prepare by developing national systems for pollution response in their respective countries, and by maintaining adequate capacity and resources to address oil pollution emergencies. Most importantly, OPRC 90 and OPRC-HNS Protocol 2000 provide the mechanism for Parties to request assistance from any other state Party, when faced with a major pollution incident.

International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 which provides for intervention in the deep sea incase pollution in the high sea is likely to cause pollution in our territorial sea to prevent, mitigate or eliminate grave and imminent danger to the coastline or related interests from pollution or threat of pollution of the sea by oil or substances other than oil, following upon a maritime casualty or acts related to such a casualty, which may reasonably be expected to result in major harmful consequences.

Annex V of Marpol is relevant to the bridge construction stage as it generally prohibits the discharge of all garbage into the sea, except as provided otherwise in regulations 4, 5, and 6 of the Annex, which are related to food waste, cargo residues, cleaning agents and additives and animal carcasses. Under the revised MARPOL Annex V, garbage includes all kinds of food, domestic and operational waste, all plastics, cargo residues, incinerator ashes, cooking oil, fishing gear, and animal carcasses generated during the normal operation of the ship and liable to be disposed of continuously or periodically. Garbage does not include fresh fish and parts thereof generated as a result of fishing activities undertaken during the voyage, or as a result of aquaculture activities.

Convention on the prevention of Marine pollution by Dumping of Wastes and other matter 1972 (London Convention, 72) which aims to prevent, reduce and where practicable, eliminate pollution caused by dumping or incineration at sea of wastes.

4.3: The Institutional Framework

This Study recognizes 2 institutional set-ups that are critical to the successful execution

of the EIA process as outlined below.

4.3.1: Institutional framework under Cap 387

In 2001, the Government established administrative structures to implement EMCA, 1999 (now Cap 387) as follows:-

The National Environment Council: The National Environment Council (the Council) is responsible for policy formulation and directions for the purposes of the law. The Council also sets national goals and objectives and determines policies and priorities for the protection of the environment.

The National Environmental Management Authority: Cap 387 allows for formation of the National Environmental Management Authority (NEMA) as the body charged with overall responsibility of exercising general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies relating to the environment. Under the Act, NEMA was established in 2001 when the first Director General was appointed by the President.

In order to align to requirements of National Constitution 2010, Cap 387 has devolved functions to Counties. Thus, this ESIA Study recognizes NEMA as the sole regulator of EIA processes in Kenya. Indeed, the second objective of the ESIA Study Report is to facilitate Environmental Licensing of the PID in which case, the Report has to ensure compliance with all standards as set out by NEMA in capacity of Environmental Regulator in Kenya. The ESIA Study process has thus been tied up to the NEMA institutional framework at Head Office and County levels.

Public Complaints Committee*:* Under Cap 387, a Public Complaints Committee has been established to provide an administrative mechanism for addressing environmental harm. The Committee whose membership include representatives from the Law Society of Kenya, NGOs and the business community has the mandate to investigate complaints relating to environmental damage and degradation.

4.3.2: The Ports Authority-KPA

In the capacity of Employer, KPA has administrative jurisdiction over the ESIA process and will also act custodian of the ESMP emanating from this study.

4.4: Permits required in Project Development

Pursuant to requirements of statutory regimes reviewed above, diverse permits and licenses will be required in course of rolling out the PID as outlined in Table 4.3 below. Both the Proponent and Contractor will require to fulfil legal obligations pertinent to all permits. Additionally, the Contractor will require to always operate within the law, obtaining all Work Permits for Foreign personnel as required.

Table 4.3: Statutory Permits required in development of the PID

No.	Activity	Statute	Requirement	Competent Authority	Competent Applicant	Date of Acquisition	Duration
1	Constructing the Water Transmission Line	Environmental Management and Coordination Act (EMCA)	ESIA Report with confirmation that RAP is being carried out	NEMA	KPA	On Completion of ESIA Study	Max 90 Days from date of submission of
2	Traversing through an area of Cultural Heritage	National Museums and Heritage Act, 2012	Approval Application ESIA Report	National Museums of Kenya (NMK)	KPA	On Completion of ESIA Study	Indefinite
3	Clearing of trees including	Forest Management and Conservation Act, 2016	Obtain Permission to cut forest trees	Kenya Forest Service (KFS)	KPA	Before clearing	Indefinite
4	Construction Activities	Occupational Safety and Health Act (OSHA), 2007	Registration of a Working Area	Directorate of Occupational	Contractor	Upon site handover	Annual renewable
5	Road Cutting for Pipe passage	Roads Act 2007	Obtain permission to Cut a road.	KENHA,	Contractor	Once	Once
6	Construction and Operation of Water Transmission Line	County Governments Act No 17 of 2012 revixes 2017	Approval application	County Governments of Kwale and	KPA	On Completion of ESIA Study	Indefinite
Construction Stage							
1	Blasting of construction site bedrocks (If required)	Explosives Act, 2016	Application for transportation and use permits	Mines and Geology Department in Ministry of Environment and Forestry	Contractor	Before blasting	Max of 1 month
2	Noise during blasting	Environmental Management and Coordination Act (EMCA) Cap 387, Rev 2018	Approval Application	NEMA	Contractor	When required	1 – 5 days
3	Setting up of camp sites	Environmental Management and Coordination Act (EMCA) Cap 387, Rev 2018	EIA Reports for independent sub-projects	NEMA	Contractor	If required	1 – 1.5 months
4	Water Abstraction	· Water Act, 2012 and EMCA Cap 387	Water Permit preceded by application	Water Resources Authority (WRA)	Contractor	Before abstraction of water	1 – 1.5 months
5	Waste Disposal	Environmental Management and Coordination Act (EMCA) Cap 387, Rev 2018	Waste disposal Permit /Effluent Discharge Permit	NEMA	Contractor	Construction period	Before operations
1	Initial Environmental Audit	Environmental Management and Coordination Act (EMCA) Cap 387, Rev 2018	Initial Environmental Audit Report – Fulfillment of ESMaP/ ESMoP	NEMA	KPA	Initial Environmental Audit is done after 1st year of operation	Within 24 months of commissioning
2	Regular Environmental Audits	Environmental Management and Coordination Act (EMCA) Cap 387, Rev 2018	Regular Environmental Audit Reports as NEMA may deem necessary – Fulfillment of improvement orders	NEMA	KPA	As determined by NEMA	2-3 weeks

Source: This Study

CHAPTER FIVE: THE BASELINE ENVIRONMENT

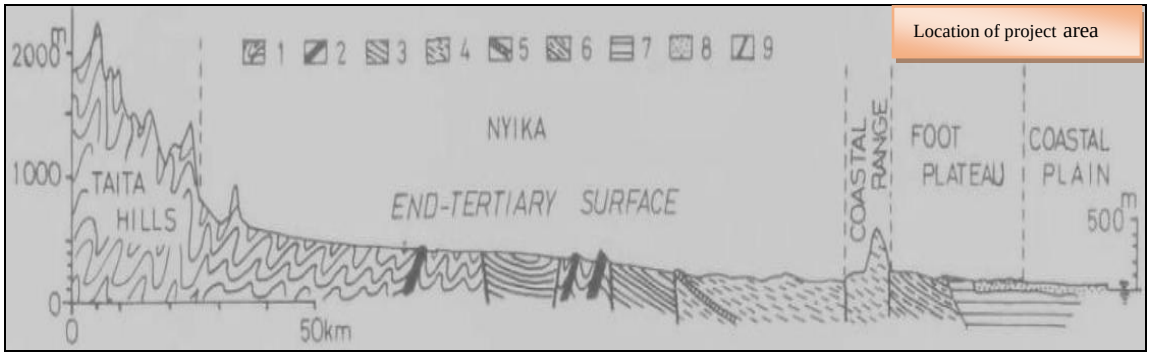
5.1: Approach to Baseline Characterization

Documentation of the baseline environment for this Study had the objective of providing a firm, clarified profile of the pre-project environment, against which, potential impacts would be analysed and interpreted. As such, comprehensive analysis based on both secondary and empirical data was undertaken for this ESIA Study as unveiled in sections below. Data collection in the ESIA was restricted to unearthing basic facts, trends and processes in the Project's area of influence with the goal of defining potential impact area.

This chapter presents the result of analysis based on the secondary data. In addition to this, Chapters Six, Seven and Eight provide in-depth analysis of key natural resources namely;- air quality, biodiversity, ground water and the socio-economic profile based on various surveys that were undertaken as part of the detailed ESIA study.

5.2: The Physical Profile

The most dominant physiographic feature in the study area id the Indian Ocean Coastline located to the immediate East of the Study area. From brief survey of available literature (Hiroshi Toya, Hiroshi Kadomura, Toshikazu Tamura And Nobuyuki Hori, 1973;) backed up by field observations (Plates 1.7 and 1.8), the project area is situated on the Coastal plain and Foot Plateau areas along the Coastline of Southern Kenya where altitude ranges from about 10 to 50 metres above mean sea level. The Terrain is generally flat at the coastal plain but becomes undulating in the upper reaches dominated by minor ridges and closed depressions.



Source: Hiroshi Toya, et al, 1973
Plate 1.0: Geomorphology of South Kenya Coast including the Project area

Geology and Soils: Soils of the coastal plain and foot plateau were developed on sandy sediments of the Miocene, Pliocene/Pleistocene and Jurassic ages which have weathered deeply to produce Ferralo-chromatic LUVISOLs to ACRISOLS dominated by well drained moderately deep to deep friable sandy clay loam to sandy clay. The Pliocene sediments have been heavily exploited for building sand within the Tiwi area leaving behind muddy and calcareous sediments which accumulate water in places.

Plate 1.2: The Coastal Plateau showing Pleistocene Sands (heavily exploited for building sand) overlying the Miocene muddy and calcareous deposits

5.3: Climatic patterns

5.3.1: Temperature, Wind Run, Relative Humidity and Sunshine

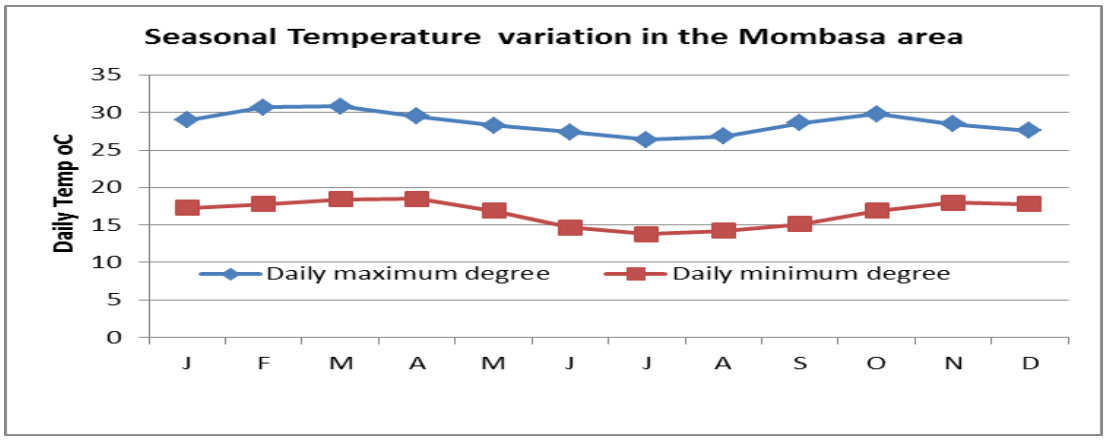
Temperature

Given the low altitude location, Mombasa remains generally hot throughout the year with mean temperatures averaging 26.3 °C with a range from 22.4 to 30.2 °C. Temperatures are generally highest in February and October and lowest in July (Figure 5.1).

Table 5.1: Climatic Records at Moi Port Reitz International Airport Met Station

Temperatures			Relative Humidity		Daily Sunshine (hrs)	Daily Wind Run (km)	Daily Evap (mm)	Monthly Mean Rainfall (mm)
Month	Daily max (°C)	Daily min (°C)	Daily Max (%)	Daily Min (%)				
Jan	31.6	24.2	76	66	8.3	141.3	210	25
Feb	32.3	24.6	75	63	8.9	143.2	203	17
Mar	32.6	25.2	77	63	8.9	138	221	65
Apr	31.2	24.7	81	71	7.6	158	184	200
May	29	23.4	85	76	6.5	162.3	155	325
Jun	28.3	22.6	83	72	7.3	168.6	144	118
Jul	27.7	21.8	83	72	7	162.2	138	91
Aug	27.8	21.6	83	72	8	158.1	158	64
Sep	28.4	22	80	70	8.4	153.8	178	63
Oct	29.5	23	78	69	8.9	148.2	197	85
Nov	30.9	23.8	77	69	8.9	123	188	98
Dec	31.4	24.1	78	69	8.7	128.5	191	59
Total					97.4	1785.7	2167	1210
Max.	32.6	25.2	85	76	8.9	168.6	221	325
Min.	27.7	21.6	75	63	6.5	123	138	17
Ave.	30.1	23.4	79	69	8.1	148.8	180	100

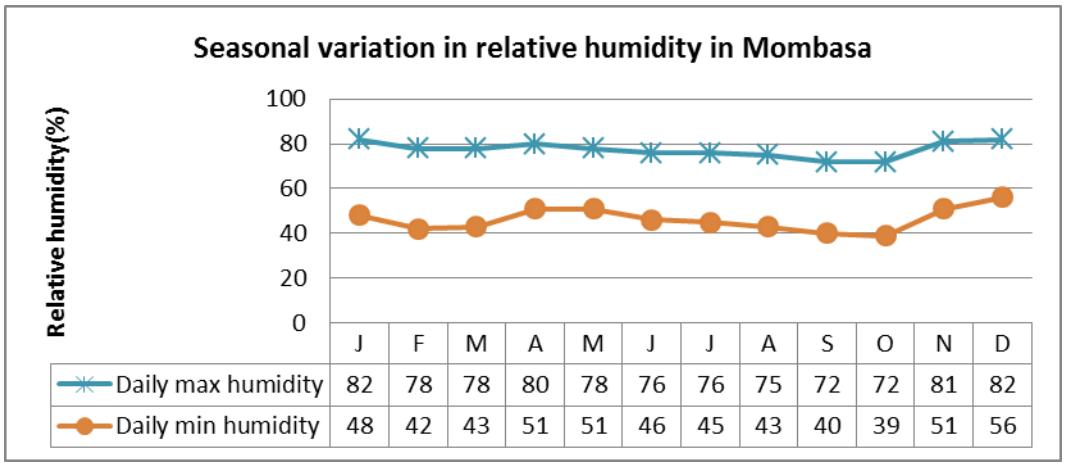
Source: Ralph and Jaetzhold, 2006



Source: Study of the National Water Master Plan, 1992

Fig 5.3: Seasonal Variation of Daily Temperature in the Mombasa Area

Relative HumidityFig **5.**4 trace the seasonal variation of relative humidity in Mombasa. Mombasa is generally humid with a long-term (1959-1990) average of 61.5% and a range of 46% to 77%. Relative humidity does not display extreme seasonal variation as the maximum recorded is generally in the range of 72 to 82% with the months of January, April, November and December recording somewhat elevated humidity while February, September and October recording the lowest levels, according to the Study of the National Water Master Plan in 1992.



	J	F	M	A	M	J	J	A	S	O	N	D
Daily max humidity	82	78	78	80	78	76	76	75	72	72	81	82
Daily min humidity	48	42	43	51	51	46	45	43	40	39	51	56

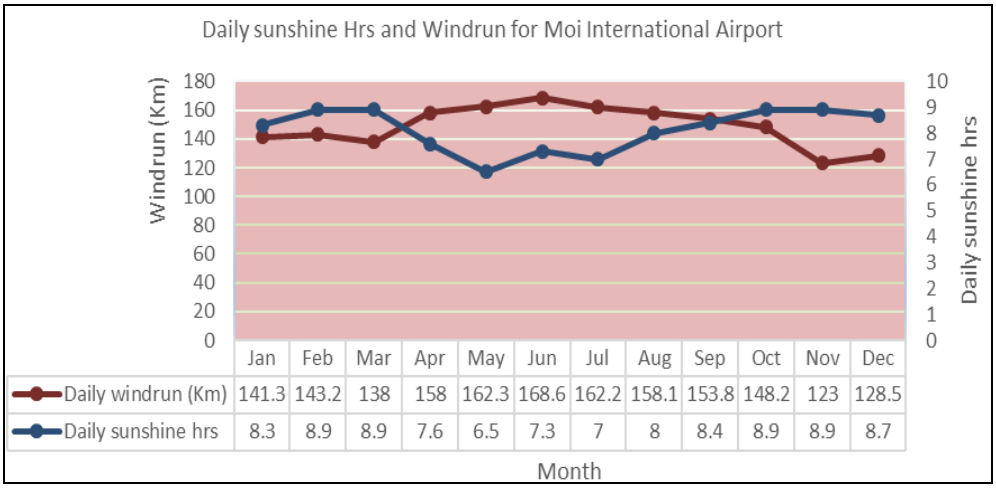
Source: Study of the National Water Master Plan, 1992

Fig 5.4: Seasonal Variation of Relative Humidity in the Mombasa Area

Wind run and number of sunshine hours:

Daily wind run displays a very high seasonal variability with a prominent limb building up from July to peak in October then dropping drastically in November and December. Wind run is lowest in April to June.

Daily sunshine in Mombasa ranges from 6.5 to 8.9 hours whose average of 8.1 hours is among the highest recorded in Kenya. The period September to January has the highest stretch of sunshine hours with July and August recording the lowest.



Source: Study of the National Water Master Plan, 1992

Fig 5.5: Seasonal Variation in Daily Wind Run and Sunshine Hours

5.3.2: Rainfall

Climate for the Tiwi Catchment and intervention area is best referenced by 8 climatic stations listed in Table 5.1 and Fig. 5.6 all of which are found in the immediate vicinity and immediate west of the target area and hence afford the best estimate of rainfall input into the area.

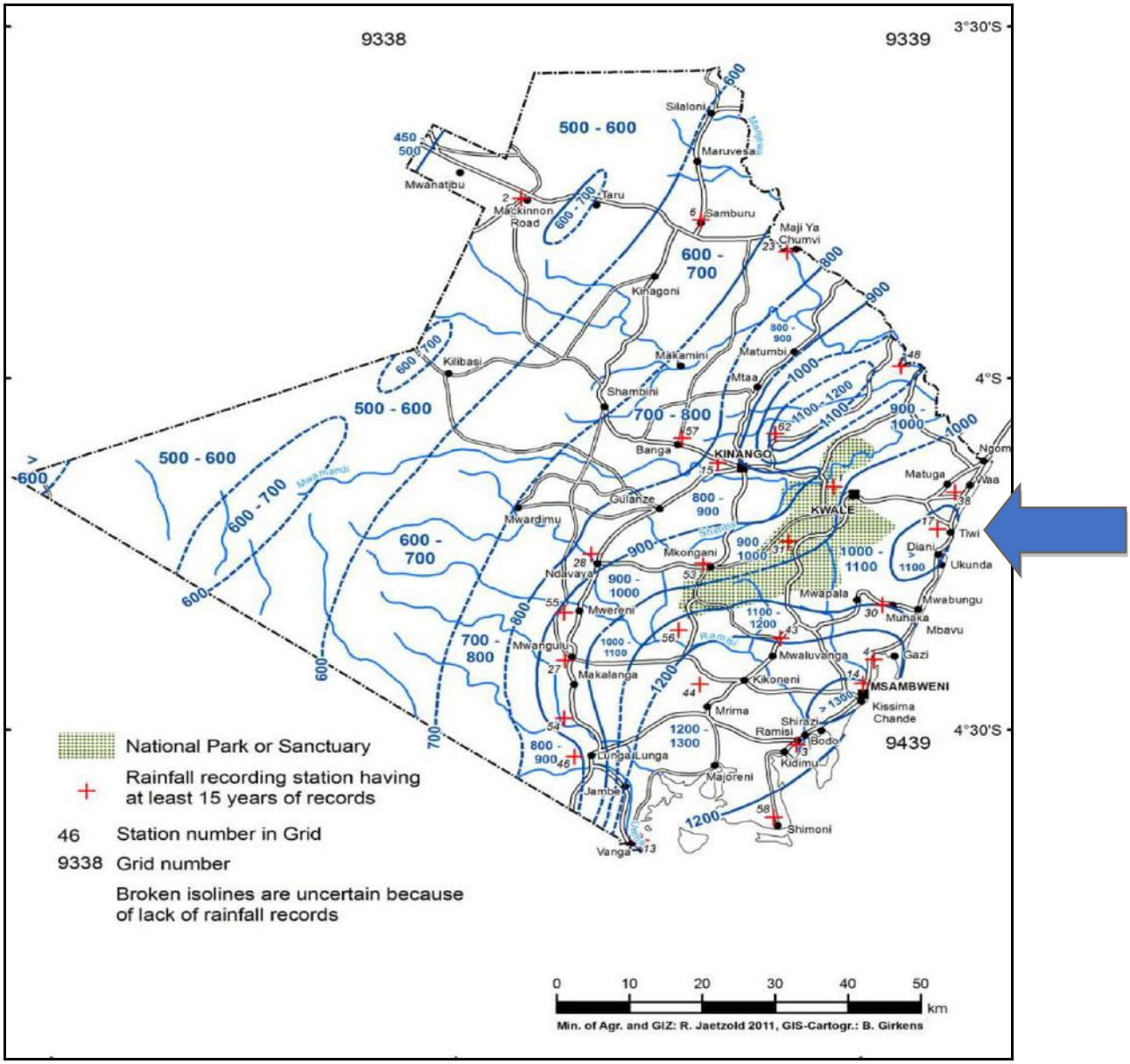
Annual rainfall:

From Table 5.2, mean annual rainfall in the intervention area including Tiwi Catchment is 1176mm. Annual rainfall generally increases to the south (Fig 5.6) with highest catch being recorded around Msambweni and it immediately decreases to the west of Tiwi towards the Shimba Hills/ Kwale Town area.

Table 5.2: Meteorological Stations within the Tiwi Catchment area

SN	Station	Rainfall (mm)												Annual rainfall
		J	F	M	A	M	J	J	A	S	O	N	D	mm
1	Waa Dispensary	14	16	29	155	292	121	90	51	67	70	59	49	1013
2	Tiwi Dispensary	25	13	46	197	291	113	88	69	59	76	78	57	1112
3	Muhaka I.C.P.E. Coast.Field	14	16	30	160	286	117	100	64	63	82	79	56	1067
4	Gazi Association Sugar Works	18	14	43	234	354	131	113	65	68	89	74	42	1245
5	Msabweni District Office	24	19	55	256	351	189	114	75	64	91	108	40	1386
6	Associated Sugar Works Ltd	26	12	47	240	303	159	129	78	60	78	77	57	1266
7	Shimba Hills Station	23	19	50	204	260	104	93	79	59	93	105	40	1129
8	Matuga Dev Center	2	15	79	183	263	114	87	69	54	114	117	74	1192
	Average	18	16	47	204	300	131	102	69	62	87	87	52	1176

Source: Ralph and Jaetzhold, 2006

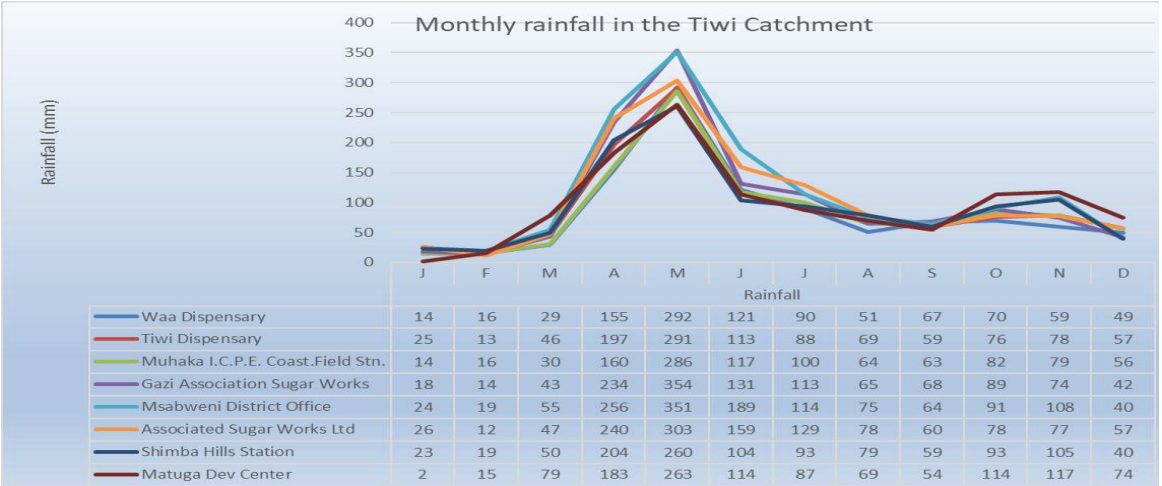


Source: Ralph and Jaetzhold, 2006

Fig 5.6: Isohyet map of Kwale and South Coast

Seasonal rainfall occurrence and distribution:

Rainfall occurrence in Kenya's coast region associated with the semi-annual passage of the inter-tropical convergence zone and the monsoons – the *North Easterly Monsoon (NEM)* from December to March and the *South Easterly Monsoon* from May to October. Most of the rainfall occurs between the monsoons when convection activity is enhanced. Annual rainfall is delivered in one long season lasting from March to July and a minor one in October and November. With a long-term average of 300 mm, May is the wettest month in the catchment area while the period between January and mid-March is the driest.



	J	F	M	A	M	J	J	A	S	O	N	D
Waa Dispensary	14	16	29	155	292	121	90	51	67	70	59	49
Tiwi Dispensary	25	13	46	197	291	113	88	69	59	76	78	57
Muhaka I.C.P.E. Coast.Field Stn.	14	16	30	160	286	117	100	64	63	82	79	56
Gazi Association Sugar Works	18	14	43	234	354	131	113	65	68	89	74	42
Msabweni District Office	24	19	55	256	351	189	114	75	64	91	108	40
Associated Sugar Works Ltd	26	12	47	240	303	159	129	78	60	78	77	57
Shimba Hills Station	23	19	50	204	260	104	93	79	59	93	105	40
Matuga Dev Center	2	15	79	183	263	114	87	69	54	114	117	74

Fig 5.7: Seasonal rainfall in the Tiwi catchment and vicinity

5.3.3: Climatic potential of rainfall

Table 5.3 provides an analysis of the climatic potential of rainfall input into the Tiwi catchment based on computation of the climatic index as determined by the ratio of rainfall (r) to potential evapo-transpiration (Eo) based on the method of Sombroek et. al, 1982.[3] Computation of the R/Eo ration has relied on rainfall data for Eight (8) Stations (Table 5.2) and Potential Evaporation for Mombasa Port Reitz Station (lowlands) and Kwale Met Station (highlands). From Table 5.2, R/Eo ratios for the study are range from 0.47 to 0.72 implying long-term climate ranging from transitional semi-humid to semi-humid. However, on account of highly seasonal nature of rainfall, climatic designation is highly variable ranging from hyper-arid (0.1) to per-humid (3.3).

Table 5.3: Analysis of long-term climate in the Tiwi catchment

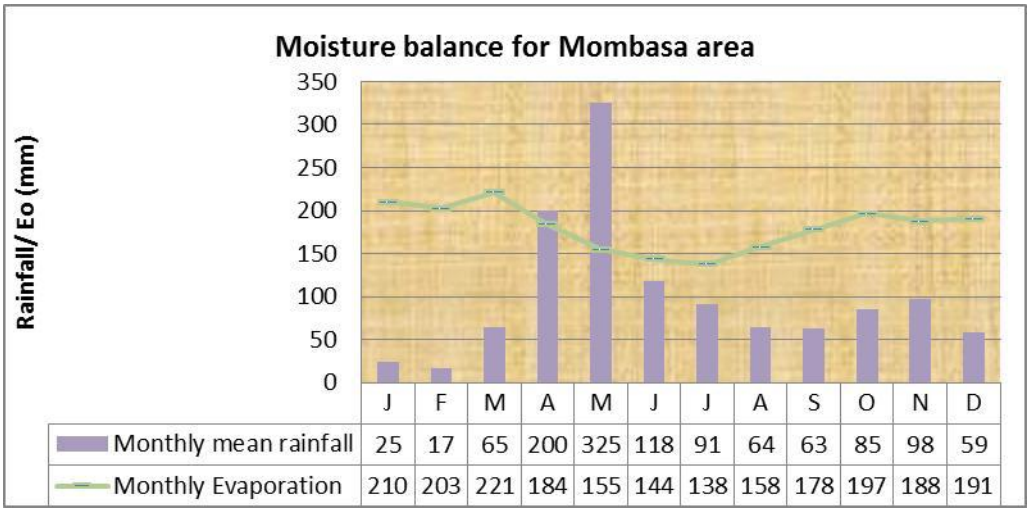
SN	Station	Annual rainfall-R (mm)	Annual Evaporation-Eo (mm)	R/Eo ratio	Climatic designation
1	Waa Dispensary	1013	2167	0.47	Transition
2	Tiwi Dispensary	1112	2167	0.51	Semi-humid
3	Muhaka I.C.P.E. Center	1067	2167	0.49	Transition
4	Gazi Associated Sugar Works	1245	2167	0.57	Semi humid
5	Msabweni District Office	1386	2167	0.64	Semi-humid
6	Associated Sugar Works Ltd	1266	2167	0.58	Semi-humid
7	Shimba Hills Station	1129	2167	0.52	Semi-humid
8	Matuga Dev Center	1192	2167	0.55	Semi-humid

Source: This Study

[3] Classification of climate based on ratio of rainfall to Potential evaporation after Sombroek et al, 1982

Climatic Zone	r/ Eo ratio	Climatic designation
I	>0.8	Humid
II	0.65-0.8	Sub-humid
III	0.50-0.65	Semi-humid
IV	0.40-0.50	transition
V	0.25-0.40	Semi-arid
VI	0.15-0.25	Arid
VII	<0.15	Very arid

Such a high variability poses severe challenges in terms of vegetation development and semi-deciduous vegetation adapted to cope with seasonal moisture scarcity dominates the area. A seasonal moisture scarcity building from June to February imposes major limitation to rain-fed crop production and, as will appear in sections below, majority of the traverse area is food insecure on account of poor crop yield associated with inadequacy of soil moisture.



	J	F	M	A	M	J	J	A	S	O	N	D
Monthly mean rainfall	25	17	65	200	325	118	91	64	63	85	98	59
Monthly Evaporation	210	203	221	184	155	144	138	158	178	197	188	191

Source: Ralph and Jaetzhold, 2006
Fig 5.8: Seasonal Moisture Balance for the Mombasa area

5.3.4: The Factor in Occult Precipitation

Another unique feature of climate in the area is the presence of the Shimba Hills Forest, which despite growing in an area with less than 1500 mm of annual rainfall, depicts characteristics of a tropical rain forest and is dominated by species such as *Chlorophora excelsa, Antiaris toxicaria, Sterculia appendiculata* and *Neutonia pacijuga.* Such tree species characterize the forests of Mt. Kenya, the Aberdares and Mt. Elgon and to some extent, the rainforests of Kakamega and Nandi all of which receive annual rainfall exceeding 2000 mm. Many studies (Pereira, 1974; Jaetzold and Schimdt, 1984), have opined that for the Shimba Hills Forest to thrive under the current climatic conditions, it must be receiving supplemental water supply. The most likely source is through extraction of moisture from inward bound fogs and mists coming from the Indian Ocean in the process termed occult precipitation. Majority of tree species occurring in the Shimba Hills forest and traverse area were observed to harbour fluffy growths (lichen and climbers), which ostensibly assist the tree to trap relative humidity from air masses which coalesces to form dew drops on the surface of plants. There is a possibility that some of the occult precipitation is intercepted by the dense vegetation of the forest floor whereby it is evaporated and thus cuts down moisture loss through evapo-transpiration. Any soil moisture saved in this way has potential to seep downwards and recharge the groundwater aquifers.

5.4: Ecology and Natural Vegetation

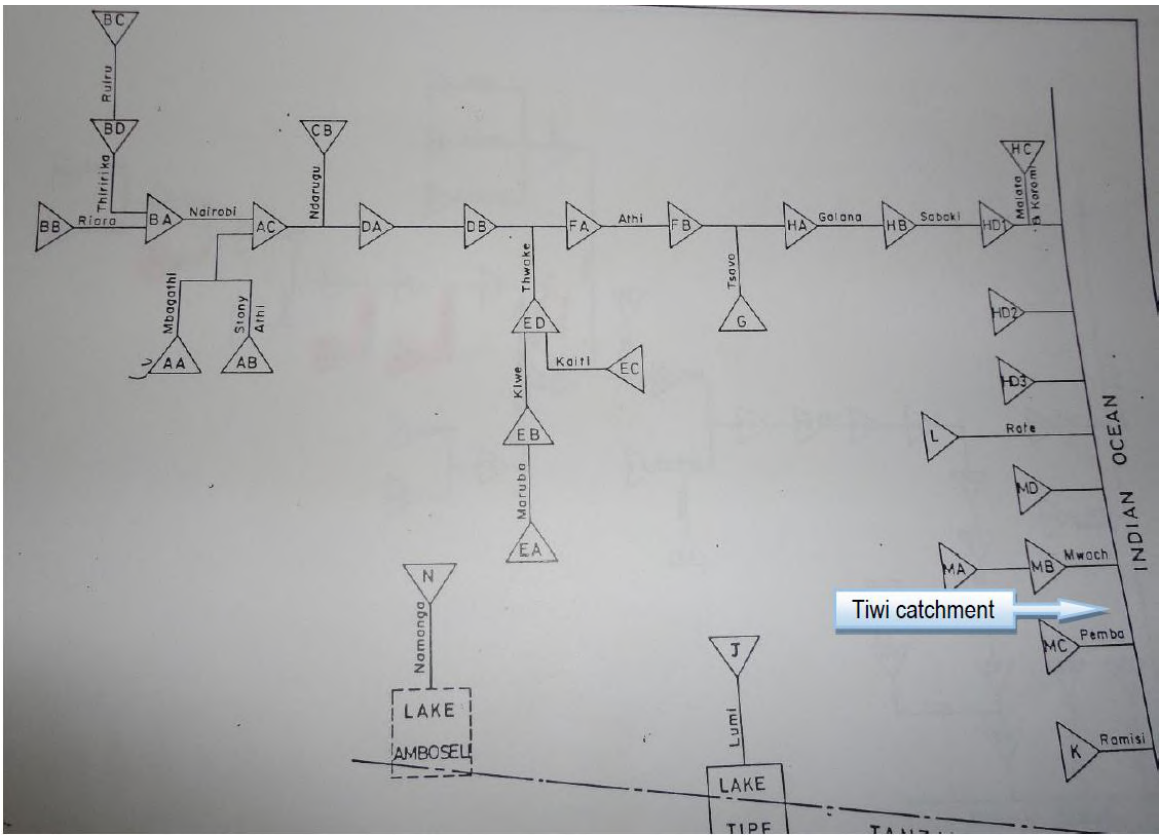
Ecology is a function of all factors;- drainage, climate, groundwater, salinity, etc which impact on soil moisture quality and availability. Given high humidity associated with a semi-humid climate, the warm ecology of the coastal plain and coastal plateau originally supported a dense luxuriant coastal humid forest that linked the mangrove formation on the coastline to the coastal dry forest of the coastal ridge ultimately thinning out into the savannah woodlands of the Nyika plateau. This formation has largely given way to agricultural and semi-urban settlements and is only encountered in remnant forest patches such as found in Kayas and others formations. Vegetation today within the traverse is largely dominated by agricultural tree crops;- cashew nut, mango, coconut, etc.

5.5: Hydrology and drainage

Surface Water

With the exception of Lamu and Tana River Counties, the entire coastal zone of Kenya falls under Drainage Basin 3 where the main river is the Athi-Sabaki-Galana system. South of the Sabaki-Galana however, the land is drained by so called shoreline tributaries that drain directly into the Indian Ocean. In case of South Coast Kenya, main shoreline tributaries include Mwache and Bombo which drain into Port Reitz Creek, Mkurumudzi, Pemba, Ramisi, Umba among others.

Hydrology and drainage are a function of the local physiography and soils. On account of generally flat topography and deep well draining soils, the area between Likoni and Ukunda has no surface drainage as all rainwater input infiltrates the soil. The numemerous into depressions however accumulate water and convert into minor lakes in the wet season and are considered locally important as recharge points that feed local groundwater systems such as the Tiwi and Msambweni Aquifers.



Groundwater occurrence

A comprehensive analysis of the groundwater potential in the Tiwi aquifer targeted for exploitation to surve the MSEZ is provided in section 6.11 below. For purposes of water supply to the MSEZ, the Tiwi aquifer is set for exploitation through three yet to be commissioned boreholes. When operational, the three will add to another existing 12 boreholes with a combined output of 11,000m^3 per day.

5.6: Socio-economic profile

A detailed socio-economic profile will be assembled and documented as part of the detailed ESIA Study. In section below, brief highlights are provided based on available data and on-the-ground observations.

The people: The entire area commonly called Kenya's south coast is dominated the Digo subtribe of the Miji Kenda Community. Settlers from upcountry mainly Kamba, Meru and others will be found but largely in small numbers.

Population and settlement: Table 1.3 presents data on population patterns for Wards hosting the Project. Population density is generally low within the rural areas but builds up along the A7 highway owing to commercial settlements.

Table 5.4: Population distribution within the traverse area[4]

Sub County	County Assembly Ward	Area (Km^2)	Population	Population density (Pers/ Km^2)
Matuga (Kwale)	Waa	114	37,783	331.4
	Tiwi	49.4	19,409	392.9
Likoni (Mombasa)	Mtongwe	25.5	28,168	1105
	(MSEZ area)	12	2,639	219.9

Source: Diverse sources

Agriculture and land-use patterns: The combination of a sub-humid climatic regime, high coastal temperatures and deep fertile soils confers a medium to high agricultural potential in the project area which has been tapped widely to make the areas prime area for agricultural production and thus comprise the food basket for Kwale District. The area is renowned for production of fruits (mangoes, oranges, coconut, pawpaw) and food crops (cassava, maize, potatoes, pulses) among others.

Livelihood systems and income patterns: Data on income patterns will be derived as part of both the ESIA and RAP studies. Briefly however, the local economy is driven by Mombasa City which the economic, business and administrative hub, the A7 Highway as the main transport artery for god and passenger transport and to a less extent, the tourism industry. Away from the A7 highway, subsistence farming is the economic mainstay for majority households supplemented by trade, sand harvesting among others.

5.7: Emergent Concerns

From above analysis, core concerns that will require further analysis have emerged as follows:-

Potential displacement from land and property: Both the spatial and linear infrastructure will require space and this may occasion displacement from land, livelihoods and shelter and the same will be investigated and quantified as part of the RAP process.

Threat to socio-cultural resources: Given observed occurrence of Sacred Groves (Kaya) along the traverse of proposed pipeline at Kiteje (Kaya Mkumbi), the entire traverse and vicinity will be screened for physical cultural resources for detailed analysis so as to inform identification of mitigation measures.

Potential impact on social cohesion: A brief discussion with one lady resident in the Borehole Site One area revealed a deep expectation that they too will be supplied with water from the project. The ESIA Study sought to unearth all community perceptions and expectations for purposes of informing a management/ mitigation system. Indeed, such consultation was crucial in informing the citing and allocation of proposed water kiosks.

Threats to groundwater resources: Given the known vulnerability of coastal groundwater resources to saline intrusion, the potential impact of cumulative increase in abstraction from the Tiwi aquifer has been investigated based on modelling modelling of local water balance to establish relationship between extraction and recharge into the aquifer so as to infer future trends.

[4] This is based on 2009 data. The 2019 data for sub-counties and below is yet to be released.

CHAPTER SIX: EMPIRICAL CHARACTERIZATION OF THE BASELINE ENVIRONMENT

Characterization of the pre-project baseline for the PID employed both secondary data (as reported above) and empirical data procured through standalone studies. Two r studies were commissioned as part of this ESIA study namely: -

- Biodiversity (fauna and flora) mapping studies
- Groundwater quality monitoring

As well, monitoring data Ambient air quality, Noise levels, Sediment and Quality of fresh and marine water from the recently concluded ESIA Study for Mombasa Gate Bridge has been applied in baseline characterization in the PID ESIA. Findings from these surveys were further applied in characterizing the pre-project baseline scenario as unveiled in sections below.

6.1: Air Quality and Noise Monitoring Surveys

6.1.1: Objectives of the Air Quality Survey

The objective of the environmental (ambient air quality and noise) analysis is to investigate and document the pre-project status of ambient air quality and noise level in the traverse for the PID.

6.1.2: Scope of survey

Data Source: The air quality and noise monitoring survey focused on monitoring of 7 parameters (Table 6.1) entailing 6 pollutants (PM_{10}, $PM_{2.5}$, NO_x, So_x, TVOC, $_{CO}$, P_b) and 2 meteorological factors namely winds seed and direction.

Monitoring sites: In profiling the air quality scenario for the traverse area, this study relied on data from several recently concluded studies namely (i) ESIA for the Mombasa Gate Bridge Project, (ii) ESIA for Port Access Road and (ii) ESIA for the Power Transmission Line whose geographic scope overlaps with the PID. The technical specifications for air monitoring relied on data from six sites some falling within the PID traverse of the PID in Mombasa Mainland South. All six (6) sampling sites (Fig 6.1) were geo-referenced in GPS and site conditions documented as summarised in table 6.1 below.

Table 6.1: Sites for Ambient Air Monitoring

Parameter	Particulate Matter (PM_{10}, $PM_{2.5}$), Nitrogen Oxides (NO_X), Sulphur Oxides (SO_X), Carbon Monoxide (CO), Ozone (O_3), Lead (Pb) and wind direction and wind speed					
Details of survey site	Mwangala 2.3Km west of land reclamation site	Old Mtongwe Rd near Polytechnic represents A7 highway	Within PID Traverse near proposed Mombasa	Land Development site	Junction of pipeline from Reservoir with MOWASSCO pipeline on A7	Ziwani lake
	4° 4'36.28"S 39°35'22.95"E	4o5'41.568"S 39o38'20.99"E	4°5'20.73" S, 39°36'31.58" E	4° 4'12.98"S, 39°36'51.15"E	4o5'44.236'S 39o38'12.05"4E	$4^0$3'51.024"S 39^o37'55.896"E
	20masl	17masl	46masl		19masl	38masl
Data source	ESIA for PTL	ESIA for MGB	ESIA for PAR	ESIA for PAR		Site is traversed by the PID
Survey Method	Continuous measurement with air sampler					

Source: Diverse

6.1.3: Methods in measurements

Air sampling: Air sampling basically targeted to generate baseline date on atmospheric air quality. Field extraction of samples including direct monitoring of meteorological parameters was entrusted to the Polucon Laboratories and the SGS for comparability whose staff undertook all the field work under supervision of the EIA Lead Expert. Air samples were extracted at roughly 2 metres above ground level.

Air samples were collected using an electric generator driven suction pump whose flow rate was calibrated to 3.46 litres per minute. The air was scrubbed through appropriate trapping solutions for sulphur dioxide, nitrogen dioxide, lead and ozone for periods of 15 minutes per sample. Sulphur dioxide was trapped in jars containing sodium-tetra-chloro-merculate solution while Carbon monoxide was trapped in silica impregnated with ammonium molybdinate. Nitrogen dioxide was trapped in tri-ethanolamine solution while lead was trapped in dilute sulfuric acid and preserved in nitric acid. Ozone was trapped in potassium iodide solution while suitable pre-weighed and pre-conditioned membrane filters were used to trap inhalable particulate matter (PM_{10}).

Wind Measurement: Wind speed and direction were measured with a portable anemometer mounted at 1.5 m height above ground**.**

Laboratory Analysis: All sample bottles were maintained in airtight conditions to prevent leakage or contamination. Once in the laboratory, analysis applied standard procedure summarized in Table 6.2 below. Data accruing was analysed against set standards either as recommended by NEMA and the WHO following which, this write-up was prepared.

Table 6.2: Laboratory analysis methods

Parameter	Measurement methods	Detection Limits	Authority
Sulphur dioxide	Pararosaniline method	0.2 -6.6 µg/m^3	NAAQS[1]
Nitrogen dioxide	Modified Griess-Saltzman method	4 to 10,000 µg/m^3 (0.002 to 5 ppm (v)	ASTM[2] D1607-91 (2011)
Particulate matter (PM10)	The Filtration Technique	0.01-0.25 mg/m^3	NAAQS
Carbon Monoxide	Spectrophotometric method	0-100 ppm	NAAQS
Lead	Atomic Absorption Spectrophotometry	1.05 µg/m^3	VDI[3] 2267 (12): 2008
Ozone	Spectrophotometric methods	10 µg/m^3	VDI 2468 (4)

(1) National Ambient Air Quality Standards (NAAQS)*:* www.epa.gov/air/criteria
(2) *ASTM (*American S*ociety for Testing and Materials)* Standard Test Method for Nitrogen Dioxide Content of the Atmosphere (Griess-Saltzman Reaction)*:* www.astm.org/Standards/D1607
(3)*VDI (Verein Deutscher Ingenieure-The Association of German Engineers) Guidelines:* www.vdi.de*;* www.umweltbundesamt.de/luft/messeinrichtungen/4Appendix2.pdf

6.1.4: Findings of the Study

(a) Overview

A detailed description of the outcome of laboratory analysis is available as Appendix 6.1. In this section, an overview of the core observations is provided based on which, monitoring of future impacts of the project on ambient air quality has been modelled. Data for the 6 sites is summarized in Table 6.3 and Fig 6.2 and has also been compared with the tolerance limits specified by NEMA or the World Health Organization. Units of measure for the standards are either in milligrams per cubic meter (mg/m^3) for carbon monoxide and micrograms per cubic meter of air ($\mu g/m^3$) respectively. Brief comments on the prevalence of each parameter are provided below.

Table 6.3: Preliminary data from air monitoring along the PID traverse[5]

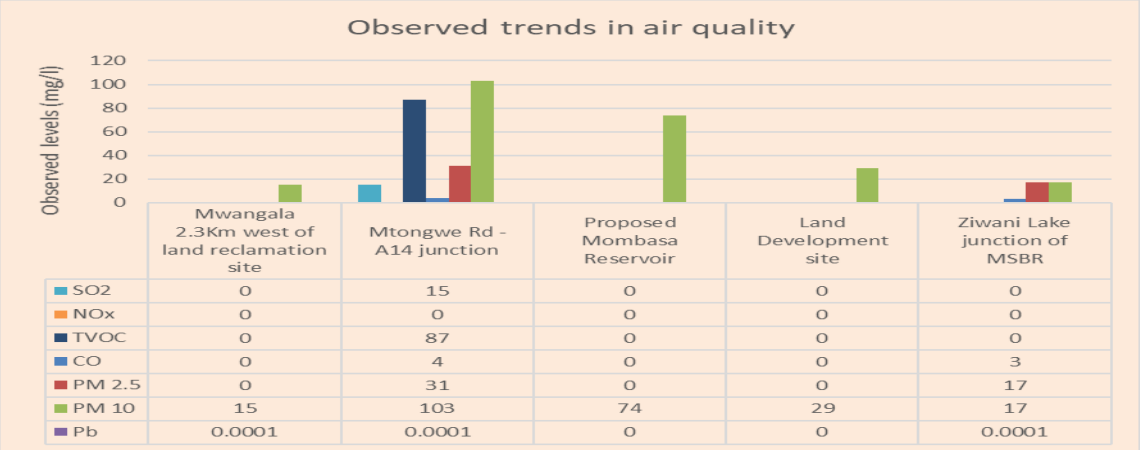
Monitoring site		**Laboratory outcome ($\mu g/m^3$)**						
Name	*Limits*	*SO_2*	*NO_X*	*TVOC*	*CO (mg/m^3)*	*$PM_{2.5}$*	*PM_{10}*	*Pb*
Mwangala 2.3Km west of land reclamation site		BDL	BDL	BDL			28	0.0001
Mtongwe Rd -A14 junction		15	BDL	87	4	31	103	0.0001
Within PID Traverse near proposed Mombasa Reservoir		BDL	BDL				74	
Land Development site		BDL	BDL				29	
Ziwani Lake junction of MSBR		BDL	BDL	BDL	3	17	17	0.0001
NEMA limits for controlled areas	$\mu g/m^3$ (24hrs)	150	125	600			75	0.75
	1hr				2			
	8hrs				1			
	24hrs						50	0.5
WHO Limits	$\mu g/m^3$ 10 min	500			100			
	$\mu g/m^3$1 hr	350			35			
	$\mu g/m^3$ 8 hrs		120		10			
	$\mu g/m^3$ 24hrs	125			7	25	70	
	$\mu g/m^3$ 1 yr	60	40					0.5-1

Source: ESIA Study for MGB

(b) General prevalence of pollutants

Fig. 6.2 traces prevalence of pollutants along the traverse of the PID. Essentially, pollutant levels are highest at the A14 junction with Mtongwe Road which is a busy urban road. PM_{10}, $PM_{2.5}$, lead and carbon monoxide were detected in all sites and therefore are the most prevalent amongst all pollutants monitored. Within the PID area, prevalence of both pollutants was highest at the A14 junction with Mtongwe Rd but was was exceptionally low in all the non-highway sites namely;- Javi la wageni, Mtongwe Polytechnic and Junction with MSBR (Kiteje) which are all removed from heavily motorised roads possibly indicating absence of emissions from motor vehicles.

[5] Red shading indicates point where NEMA limit is exceeded



	Mwangala 2.3Km west of land reclamation site	Mtongwe Rd - A14 junction	Proposed Mombasa Reservoir	Land Development site	Ziwani Lake junction of MSBR
SO2	0	15	0	0	0
NOx	0	0	0	0	0
TVOC	0	87	0	0	0
CO	0	4	0	0	3
PM 2.5	0	31	0	0	17
PM 10	15	103	74	29	17
Pb	0.0001	0.0001	0	0	0.0001

Source: Diverse ESIA Studies

Fig 6.2: General prevalence of pollutants along sections and vicinity of PID traverse

(c) Trends in prevalence of specific pollutants

Total Volatile Organic Compounds (TVOCs): Volatile organic compounds (VOC) refer to any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates and ammonium carbonate, whose composition makes it possible for them to evaporate under normal atmospheric conditions of temperature and pressure and can therefore participate in atmospheric photochemical reactions namely smog formation. Total VOC therefore are important as compounds that contribute to smog formation and mainly originate from storage and use of liquid and gaseous fuels, the storage and use of solvents and the combustion of fuels.

Within the traverse of the PID, TVOC was recorded at the A14 junction with Mtongwe road which is a busy road used by both light and heavy vehicles. Absence of this pollutant along the rural non-motorised section of the traverse seems to suggest that TVOC is an emission from MVs and is therefore likely to increase with build-up of motorised traffic during both construction and operation phase of PID.

Particulate Matter: Corse Particulate Matter (PM_{10}) is the dominant pollutant within the traverse recorded in all sites and showing the highest concentration. In the PID area, highest concentration was recorded at the A14 junction with Mtongwe road in levels far exceeding both the NEMA and WHO limits for tolerance particularly at Mtongwe Rd junction with the A14 which is a busy road section implying that PM_{10} originates from motor vehicle emissions. The fact that PM is least common in the semi-rural sections of the traverse which have lowest count of motorised traffic and is exceptionally high along the busy roads leads to the conclusion that this pollutant is largely an emission from motor vehicles.

Sulphur dioxide: In the PID area, Sulphur dioxide was detected at the A14 junction with Mtongwe Road which recorded the highest levels of SO_2 possibly reflecting high emission levels from motor vehicles.

Carbon monoxide: This pollutant was detected at rates of 3 to 4 milligrams per kilogramme of air in two sites. Further, this rate is way above the 1 and 2 mg/kg tolerance limit stipulated by NEMA for both 8 and 1hr exposures which makes CO to be one of the most severe pollutants within the traverse area. Carbon monoxide (CO) gas is generated mainly from incomplete combustion of carbonaceous fuels such as wood, petrol, coal, natural gas and kerosene. Consequently, high concentrations of CO generally occur in areas with heavy traffic congestion and in cities, as much

as 95 percent of all CO emissions may come from motor vehicle exhaust (U.S. EPA, 2008). The scenario observed for the PID traverse where busy road sections were observed to record lower concentration of CO while sites such as Javi la wageni with relatively little or no traffic recorded higher levels of the same is a misnomer. However, given that CO mixes freely with air in any proportion and moves with air via bulk transport, it is probable that observed trends in this pollutant is a result of redistribution by wind movement.

Carbon monoxide is not detectible by humans either by sight, taste or smell. Carbon monoxide primarily causes adverse effects by combining with haemoglobin to form carboxyhaemoglobin (**COHb** or **HbCO**) which is a stable complex of carbon monoxide and hemoglobin (Hb) that forms in red blood cells upon contact with carbon monoxide (CO). Exposure to small concentrations of CO hinder the ability of Hb to deliver oxygen to the body, because carboxyhaemoglobin forms more readily than does oxyhaemoglobin (HbO_2). As such, observed levels of CO, generally above the stipulated NEMA limit for tolerance is a cause for concern. However, observed levels of this pollutant and the NEMA tolerance limits are way below the WHO and European Commission's INDEX guidelines for both short and long-term exposures (Table 6.3) which are considered more representative. It is a situation that however requires intensive monitoring.

Nitrogen oxides (NO_X): Nitrogen oxides were not detected in the PID area which largely rules out motor vehicle emissions as the source of this pollutant. Nitrogen oxides (NO_x) in the ambient air consist primarily of nitric oxide (NO) and nitrogen dioxide (NO_2) both of which are significant pollutants of the lower atmosphere while another form, nitrous oxide (N_2O), is a greenhouse gas. At the point of discharge from man-made sources, nitric oxide is the predominant form of nitrogen oxide and it readily reacts with atmospheric ozone to form the much more harmful nitrogen dioxide which easily dissolves in atmospheric humidity to form nitric acid and associated acid rain.

Atmospheric lead: Lead levels are generally far below the NEMA stipulated limit of 0.5 to 0.75 micro grams per cubic meter ($\mu g/m^3$).

(d): Comparison with other data sets

Patterns of air quality observed in this study seem partially comparable with those determined during monitoring under auspices of the ESIA Study for Mombasa Southern Bypass Road in 2011. The MSBR monitoring sites of Kibudandi, Mwangala and Tsunza resemble the PID 's junction with MSBR at Ziwani, Port Reitz site is peri-urban just like Javi la Wageni and Old Mtongwe Rd sites of PID while Miritini on the A109 is similar to the PID site of A14 junction with Mtogwe Rd. Comparison has been made as follows:-

- **Sulphur oxides:** Sulphur dioxide concentrations of 5-20 $\mu g/m^3$ measured under this study are similar to the 18 $\mu g/m^3$ observed at Port Reitz under the ESIA for MSBR. While sulphur oxides were not detected for rural sites under MSBR, the same pattern repeated under this Study where the pollutant was not picked at the PID site of junction with MSBR. Sulphur dioxide is therefore essentially an urban pollutant possibly associated with motor vehicle emissions.
- **Nitrogen oxides (NO_x):** Nitrogen oxides were not detected at all in the PID traverse and neighbourhood.
- **Carbon monoxide**: This was the most prevalent pollutant as it was detected in all sites though in very low concentrations within the PID area.

(d) Other observed trends in airborne pollutants

In the Environmental Review (http://www.worldbank.org/html/pic/aboutinfo.html), for the Kipevu 2 Power Plant, the estimated background SO_2 ambient levels for 24-hour maximum was 180 ug/m^3 and therefore close to double the Kenyan guideline for 24 hr exposure and far above the WHO

guideline. The NO_2 24-hour average levels were estimated to be 50 ug/m^3 (background of 40 ug/m^3, plus Kipevu I and II impacts of 10 ug/m^3) with an annual equivalent of 12 ug/m^3 (background of 10 ug/m3, plus Kipevu I and II impacts of 2 ug/m^3) both of which are within both the Kenyan and WHO limits. Similar data were obtained from measurements made by the Kenya Meteorological Department (KMD) in six Mombasa sites namely; Mwembe Tayari, Saba saba, Kongowea, Likoni Ferry, Miritini and Digo road (Table 6.4) whereby PM_{10} level was found to exceed both the Kenyan and WHO limits for 24 hr and annual exposures.

Table 6.4: November 2008 data for Pm_{10} in Mombasa

Site	PM $_{10}$ (µg/m^3)	Remarks
Mwembe Tayari	123	All exceed the Kenyan and WHO limits for 24 hrs and annual exposure
Saba Saba	366	
Kongowea	285	
Likoni Ferry	339	
Miritini	218	
Digo Road	117	

Source: Kenya Meteorological Department, Urban Air Pollution Programme, www.unep.org/transport/pcfv/PDF/KenyaCleanFuels_Report.pdf

6.2: Monitoring Noise Levels

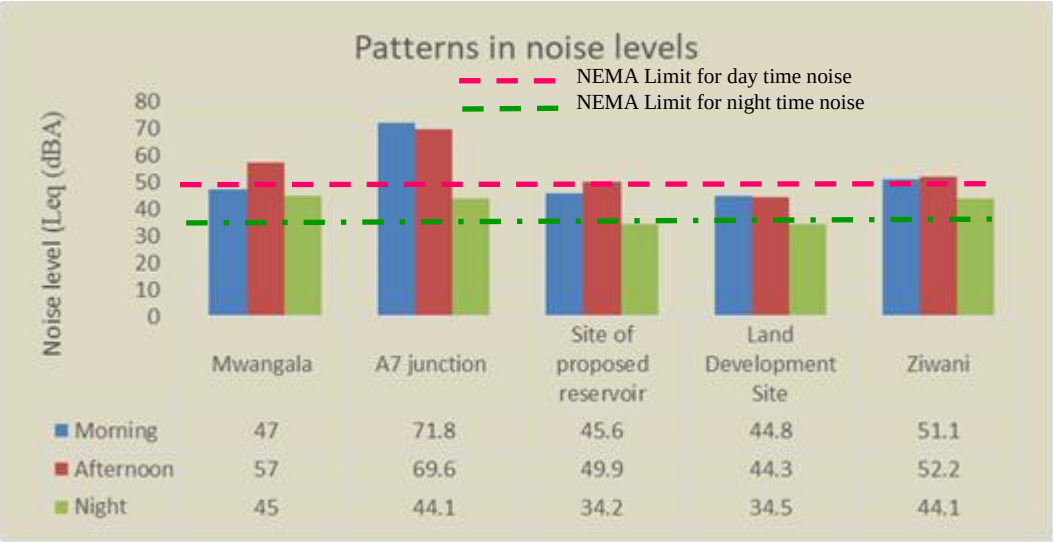
6.2.1: Basis for noise monitoring

Noise monitoring is based on measurements conducted on the six designated six point transect along the PID traverse. This data is supplemented by monitoring conducted at 2 sites namely Moi Avenue at Canon Towers and Mtongwe road near the Post office both falling within the PID traverse. Twenty four hour (24hr) noise levels at all sites were determined using a Sound analyser Meter with a built-in octave / octave band filter, which does real time 1/1 and 1/3 octave analysis. It is also fitted with a ½" electret condenser microphone with a measurement range of between 30 - 130dB and a frequency range and weighting of 25Hz–10KHz and A,C,&Z respectively. The sound level meter was calibrated in accordance with applicable centre calibration procedures during manufacturing. For all measurements taken to establish the ambient noise levels, the equivalent noise level (LAeq), the maximum sound pressure level (LAmax) and the minimum sound pressure level (LA min) during that measurement period were recorded.

6.2.2: Outcome of noise monitoring

General patterns:

Fig 6.4 traces day and night-time noise levels within the PID traverse. Essentially, Mombasa is suffering elevated noise levels as both the NEMA limits for day and night time noise is exceeded at all monitoring sites with the exception of the site no. six (junction with MSB). The implication here is that noise levels in the non urbanised areas of PID traverse are still below statutory limits.

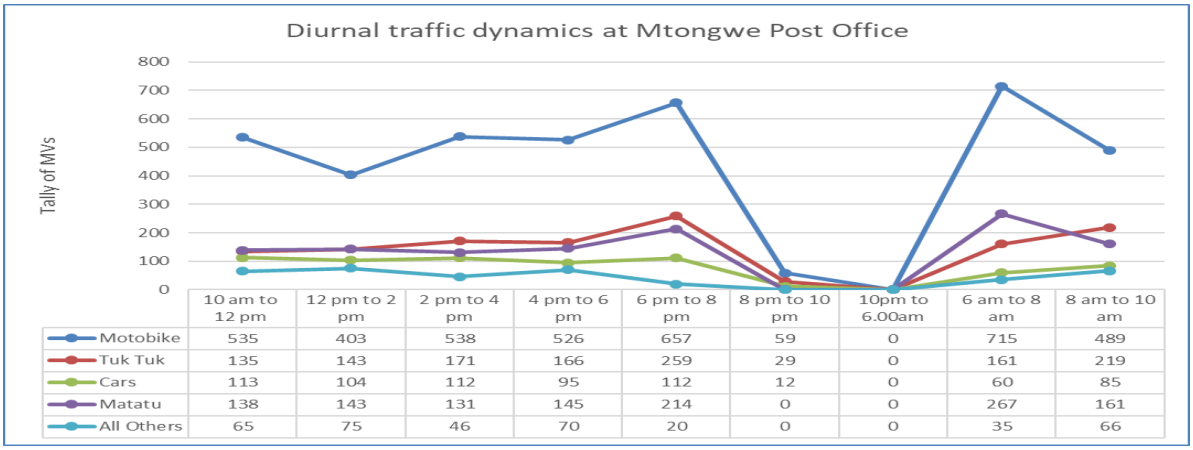


Source: Diverse ESIA Studies

Fig 6.4: Day and night-time noise levels for sections within the PID traverse and others

Possible sources of noise in mainland south:

Fig 6.7 provides an analysis of daily traffic volume in Mombasa Mainland south based on data generated at the Mtongwe Post Office on the Mtongwe Road. Traffic in Mtongwe area is largely dominated by motorcycles (boda boda), Tuk tuks and then Matatu vans all of which are passenger transport vehicles. Further, Mtongwe traffic displays two peaks; - a major one at 6.00 to 8.00am and a minor one at 6.00 to 8.00 pm reflecting the rush hour pattern of people going to and from work at both peaks.



	10 am to 12 pm	12 pm to 2 pm	2 pm to 4 pm	4 pm to 6 pm	6 pm to 8 pm	8 pm to 10 pm	10pm to 6.00am	6 am to 8 am	8 am to 10 am
Motobike	535	403	538	526	657	59	0	715	489
Tuk Tuk	135	143	171	166	259	29	0	161	219
Cars	113	104	112	95	112	12	0	60	85
Matatu	138	143	131	145	214	0	0	267	161
All Others	65	75	46	70	20	0	0	35	66

Source: Diverse ESIA Studies

Fig 6.7: Diurnal dynamics in traffic volume at Mtongwe Post Office

Correlation Between Noise Level and Traffic Volume:

Though regression analysis is yet to be conducted, noise levels at Mtongwe display some correlation with traffic volume. Noise pattern traced in Fig 6.7 displays 4 peaks at between 6.00 and 8.00am, 11.00am, 16.00 pm and between 6.00 to 8.00 pm and the same pattern is reflected in the volume of motorcycles and tuk tuks plying this road. This is also reflected by the general decline in noise levels after 8.00pm in tandem with decline in traffic (boda boda) volume. There is strong chance that boda bodas are the single most important source of noise in the Mtongwe area.

6.3: Quality Monitoring for Marine Water

6.3.1: The sampling area

Water quality monitoring was conducted for marine water samples from the Likoni Channel on the Island and Mainland south shorelines. Four samples were collected as shown in Table 6.6 and analysed in the SGS laboratories in Mombasa. Results are provided in Appendix 6.3 and highlighted in sections below.

Table 6.6: Marine water sampling points

SN	Data source	Sampling site	Geographical Reference
1	ESIA for MGB	Mombasa Island shoreline near new Grain Bulk Handlers facility	4°04'28.83''S 39°39'12.99''E
2		Mombasa Mainland South shoreline in front of the Sultan of Zanzibar Palace	4°04'07.34''S 39°39'23.33E
3	PID 1	415 m SW of DK1	4°0'3.929" S 39°36.710" E
4	PID 2	175 m SW of DK1	4°03.756" S 39°36.707" E
5	PID 3	336 m S of DK1	4°03.894" S 39°36.852" E
6	PID 4	278 m SE of DKI	4°03.722" S 39°36.963" E
7	PID 5	360 m SE of DK1	4°03.715" S 39°36.941" E
8	PID 6	321 m SE of DK1	4°03.871" S 39°36.919" E
9	PID 7	268 m E of DK1	4°03.804" S 39°36.948" E

Source: ESIA Study for MGB

6.3.2: Outcome of the Marine water testing and analysis

Table 6.7 and Fig 6.9 provide a summary of results from marine water quality analysis. Salient findings as follows: -

Total coliform: Water samples from both side of the Likoni Channel have exceptionally high coliform count in excess of 1800 MPN per 250mls sample. This is indicative of heavy interaction with human waste.

Colour and turbidity: The MI sample has more colour implying presence of more impurities when compared to the MMS sample. The MI sample has significantly higher turbidity which indicates higher presence of suspended matter and more pollution as compared to the MMS sample.

Dissolved Oxygen: Dissolved oxygen refers to the state of aeration of a water body and is a strong indicator of the capacity of an aquatic ecosystem to support life. Capacity of water bodies to dissolve oxygen is depressed by many factors, among them, elevated temperatures and presence of impurities. As such, the markedly lower level of Dissolved Oxygen in the MI sample as compared to the MMS water sample can only imply reduced capacity to support life on account of presence of pollutants. By extension, presence of higher levels of DO in the MMS sample signifies less pollution.

Table 6.7: Outcome of the marine water analysis

Parameter	Unit	PID ESIA Samples							MGB ESIA Samples		NEMA Standard
Parameter	*Units*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*MI*	*MMS*	
Total coliform	MPN/								>1800 (>720/100ml)	>1800 (>720/100ml)	500
pH		7.59	6.96	7.51	7.64	7.72	7.65	7.48	8.94	7.99	6--9
Temperature	°C	34.7	31.4	32.1	31.6	31.3	31.3	31.9	NA	NA	30
Colour	U hazen								15	10	100
Dissolved Oxygen	mg/l								8.7	9.3	NA
Turbidity	NTU								3.88	3.27	50
Oil & Grease	Mg/l								<0.1	< 0.1	5
Conductivity	µS/cm	54300	54400	53900	54200	54358	54280	54460	54600	54400	NA
TDS	(ppm)	26988	27038	26789	26938	27017	26978	27068			
TSS	mg/l								5	<500	NA
COD	mg/l								409.8	358.5	NA

Source: ESIA Studies for (i) PID and (ii) MGB

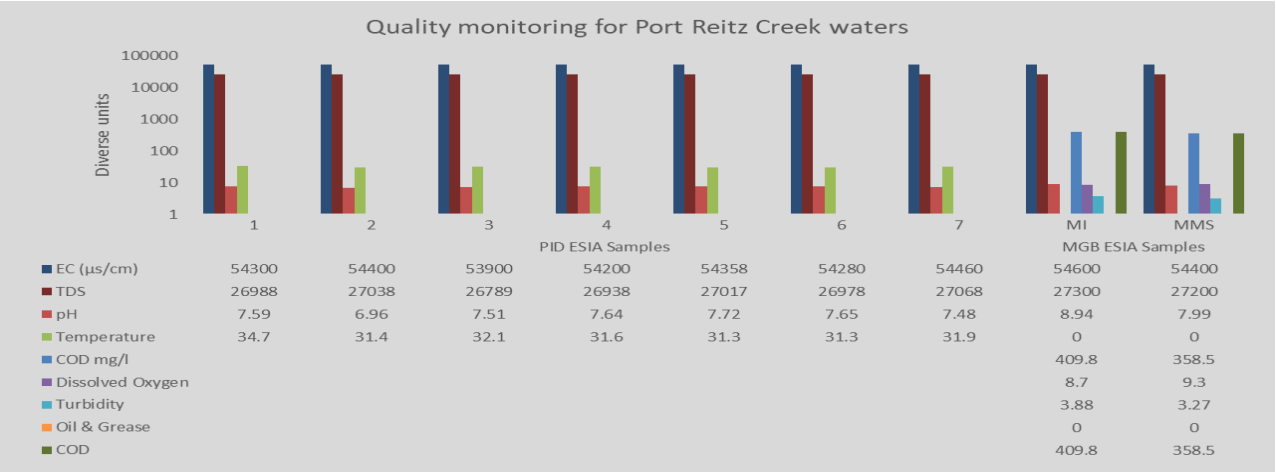
Oil and Grease: This parameter was not detected in any of the samples implying that, in spite of the Likoni Channel hosting a Marine Port which handles bulk oil imports and dispensing, oil and grease is currently not a pollutant.

Conductivity: Both samples displayed high electrical conductivity because of the high salinity typical of marine water. Conductivity of the MI sample is however slightly elevated implying presence of additional salinity which possibly also explains the higher Chemical Oxygen Demand in this sample.

Chemical Oxygen Demand: COD is a measure of the oxygen required to neutralize soluble pollutants in water. Thus, a very high COD signifies high levels of soluble and particulate matter which will require correspondingly higher amounts of oxygen to remove. High COD therefore, is another indicator that the MI sample is more polluted relative to the MMS sample.

Overall impression on pollution patterns: The picture emerging from observations made in section above, is that the Mombasa Island side of the Likoni Channel is apparently more polluted than the Mainland South shoreline where human and industrial activity is very low as compared. The MI shoreline therefore is apparently receiving more sediment and pollutant input from Mombasa Town with increasingly higher pollution. Thus, in proceeding with development of the proposed bridge, the factor of elevated pollution on the northern shoreline of the Channel should inform decisions especially for road runoff disposal.

The northern and southern shorelines are only about 700m apart yet display different scenarios of quality in a continuous water body, which implies very limited mixing in spite of the high wave activity generated by passing vessels and other port craft. The implication here is that input of point source pollutants at one point is likely to trigger detrimental-isolated accumulation of pollutants at the receiving point.



Source: ESIA Study for PI and MGB

Fig 6.8: Illustration of the results of water quality monitoring

6.4: Marine Sediment Analysis

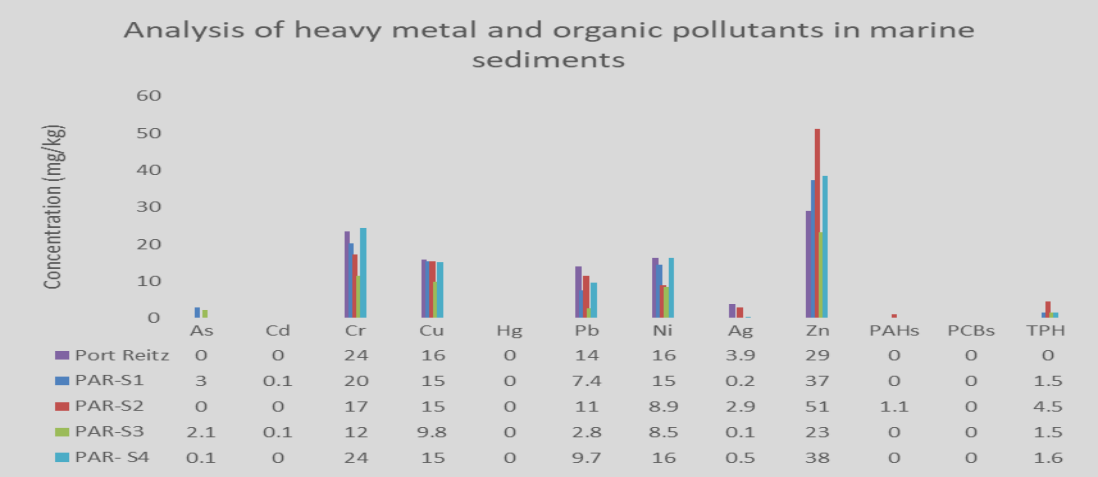
6.4.1: Basis of marine sediment analysis

Monitoring of marine sediment pollution for the PID was based on two samples extracted from the Likoni Channel seabed for analysis at SGS.

6.4.2: Outcome of the marine sediment analysis

Fig 6.10 combines tabular and graphic presentation of data from marine sediment analysis for heavy metals. Inference can be made as follows;-

Prevalence of heavy metal in the Likoni channel seabed: Results of marine sediment analysis don not display any discernible pattern unlike those of the marine water samples. However, the sediment analysis confirms presence of heavy metals within the Likoni channel sediments. Zinc, chromium, lead and nickel have a leading prevalence while silver and arsenic were detected in small quantities with mercury not being detected at all.



Source: Diverse ESIA Studies

Fig 6.9: Comparative analysis of pollutants in marine sediments of the Likoni Channel

Severity analysis for heavy metal pollutants in the Likoni Channel sediments:
Kenya has no standards for marine sediment quality in which case, to interpret implications of observed levels of pollution for Likoni Channel samples, the data had to be compared with observations from previous monitoring against the background of Canadian guidelines for sediment quality supplemented by the Interim Sediment Quality Guidelines (ISQG) developed for Australia and New Zealand with outcome being tabulated in Table 6.8 below. Data accruing from the PID Study was also compared with observation made under auspices of the Mombasa Southern Bypass ESIA Study and others.

Table 6.8: Evaluation of recorded pollutant levels

Parameter	Unit	This Study		Past Studies			Canadian		ANZECC	
		MI	MMS	Mwache conc.	Mteza conc.	Kamau, 2002	ISQG	PEL	ISQG Low	ISQG High
Copper as Cu	mg/Kg	1.16	3.24	6.98	15.83	5.5-87.2	35.7	197	65	270
Lead as Pb	mg/Kg	3.14	1.19	ND	13.93	No data	35	91.3	50	220
Chromium as Cr	mg/Kg	3.6	8.21	3.94	23.55	No data	37.3	90	80	370
Nickel as Ni	mg/Kg	1.65	4.92	0.89	16.21	No data	NGV	NGV	21	52
Silver as Ag	mg/Kg	0	0	ND	168.54	No data	NGV	NGV	1	3.7
Zinc as Zn	mg/Kg	9.59	5.25	9.14	29.12	6.5 -84.7	123	315	200	410

Source: Diverse Studies

Notes:

* Joseph Nyingi Kamau, 2002: Heavy Metal Distribution and Enrichment at Port-Reitz Creek, Mombasa. Western Indian Journal of marine Science Vol. 1, No. 1 pp65-70.

**Extracted from Australian and New Zealand (ANZECC)/Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

1. Interim Sediment Quality Guidelines-Low (ISQG-Low) Probable-effects concentrations below which biological effects would rarely occur.
2. Interim Sediment Quality Guidelines-High (ISQG-High) Probable-effects concentrations below which biological effects would possibly occur. Concentrations at or above the ISQG-High represent a probable-effects range within which effects would be expected to frequently occur.
3. PEL / Probable Effect Level: Concentration beyond which effects will be felt.

From analysis above, it is apparent that though heavy metals were detected in the Likoni Channel, concentrations are much lower compared to Canadian and Australian standards. All heavy metals detected in the study area share one feature in that, they are all applied in the electroplating industry- a surprise find given that, the Port Reitz area has never hosted an electroplating facility. Surprisingly, Silver which, other studies observed to be excessively high, was detected in very small quantities in the current study.

In a 2002 study of heavy metal occurrence within the Port Reitz creek (Kamau, 2002), a very high spatial variability in occurrence and concentration was observed for Iron, Cadmium, Copper and Zinc all of which showed a lateral decline towards the sea. The same study also found high enrichment factors for Cadmium, Copper and Zinc implying possible contribution from anthropogenic sources.

6.5: Monitoring of Fresh Water Quality

Surface water is not readily available within the PID traverse area and, as the time of the Study, surface water was only available at the Ziwani Lake where a sample was extracted and analyzed yielding the results summarized in Table 6.7 below.

6.5.1: Status of management of the Ziwani Lake resource

Ziwani is an isolated seasonal lake cum swamp formed in an internally draining depression within the Kiteje sub location of Ngombeni in Kwale County and is fed by both surface and subterranean water from the Kiteje Ridge. The size of the lake therefore changes seasonally depending on state of water supply and, on account of being the only fresh water body around, is heavily exploited for domestic and livestock watering while the surrounding grasses provide dry season grazing. Thus, as expected, waters of this lake are heavily contaminated with anthropogenic pollutants as briefly highlighted in sections below.

6.5.2: Quality Status for the Ziwani Lake Sample

Ziwani Lake waters are used for both domestic supply and recreation and were therefore analyzed against NEMA standards for both target uses with an outcome as summarized in Table 6.9 below. Despite the waters being apparently polluted, they are within the limits of all parameters for which NEMA has given a value.

Table 6.9: Surface water quality in the PID Traverse

Parameter	Test Method	Unit	Finding	NEMA Limits	
				Domestic	*Recreation*
Suspended matter	ALPHA Method 2540D	mg/l	6.80	30	NVG
Turbidity	ALPHA Method 4500-PHB+	NTU	43.0	NVG	50
pH	ALPHA Method 2540D		7.20	6.5-8.5	6-9
Temperature	ALPHA Method 2550	oC	+3	NVG	30
Colour	ALPHA Method 2120B	Hazen Units	9	NVG	100
Dissolved Oxygen	AOAC Method 973.45	mg/l	3.48	NVG	NVG
Chemical Oxygen Demand	AOAC Method 5520D	mg/l	30.72	NVG	NVG
Oil & Grease	ALPHA Method 5520D	mg/l	Nil	NVG	5
Total Coliforms	KS 05-459	Cfu/ 100ml	24	Nil	500

Source: ESIA Study for MGB

6.6: Results of flora and fauna mapping

6.6.1: Objective of the Flora and Fauna Survey

The objective of the survey was to facilitate understanding of the status of biodiversity in the vicinity of proposed PID area for purposes of determining the current status of both ecosystem and species conservation and secondly, to provide a datum against which, future monitoring will take place. This required a study design targeting mapping for flora and fauna (marine and terrestrial) species based on pre-selected criteria as follows:-

- General occurrence of fauna species
- Protected species declared as endangered or threatened species under the Wildlife (Conservation and Management) Act;
- Threatened species (grouped as EN, CR, VU) in the IUCN Red List; and
- Avian species which may occur within the AEWA (Agreement on the Conservation of African-Eurasian Migratory Water birds) List
- Locally important flora and fauna species for the livelihood of local residents

6.6.2: Study Methodology

The Survey essentially traced the traverse area for the PID from the intake area in Kwale through to components in the Dongo Kundu area) but with special focus on the marine and terrestrial ecosystems. Survey was conducted in July through October 2019.

(i) Literature survey: In spite of close proximity to the Port Reitz Creek, Dongo Kundu area is inadequately studied as a result of which, there is a dearth of data on the conservation status. The flora and fauna surveys conducted in this study largely covered Dongo Kundu generally but with special focus of the intervention area namely;- the pipeline alignment, internal distribution networks, drainage area and land development areas.

(ii) Flora Surveys: The flora survey used an ex-poste approach, and mainly a walk-over through the vegetation to establish community assemblies, principal floral components present, the floral history of the area, and presence of rare/threatened plant species. The survey was partly guided by topographic map sheets, past aerial photographs and information available in the public to make a thorough investigation along the alignment. In the field a sampling area within the alignment was selected, and its physiognomic vegetation type was described (location details). The general phyto-sociology of the locality was noted and the major floral components were recorded. A list of rare and threatened plant taxa based on IUCN Red list or local user perspectives was developed from the flora listed in the area, and these species were highlighted for further discussion. On completion, a new location was chosen and the process repeated. This process continued with sampling areas representing their physiognomic vegetation types, even though some were close together.

(iii) Faunal Surveys: Diverse methodologies were adopted depending on the site targeted for investigations.

Herpetofauna: Herpetofauna survey was conducted using identification of habitats and microhabitats, literature survey, among others. Sampling of the reptiles and amphibians was conducted using standardized time limited search and with visual encounter and interviews with the local residents. Under the Timed Limited Searches, a 30 minute sampling period making up one time limited search (TLS) by two observers was carried out in different parts of the study site. Searches took place in all possible and amphibian micro-habitats such as wetlands, tree barks,

under stones, decomposing logs, tree stumps, holes, shrubs, bushes including digging within loose soils, etc. Visual encounter surveys is non- standardized but was used for qualitative and semi-quantitative data mainly for presence or absence of species. The approach is important because it contributes immensely in inventory of species.

Interviews with local residents targeted accounts of the common reptiles and amphibian species normally encountered. Through their description and use of images of the animals in guides, the species were identified.

Bird survey: Survey was conducted between August 2018 and would proceed very early in the morning between 6.30 to 8.30 am when birds are active. Physical observation was done to identify birds; binoculars were used to improve on sight. Bird calls was also handy in identification. The entire transect from Tiwi wells was surveyed for bird diversity using both Point Count (PC) and Time Species Counts (TSC) methods with minor adoptions to suit rapid assessment.

Aquatic Invertebrates: Efforts here were focused on marine crustaceans and molluscs in the tidal flats franking the land development area. Observation was conducted along the shoreline that comprised of mangrove swamps, tidal and mud flats. In addition to this, catch landings were assessed to find out the diversity of species of commercial value.

Verbal accounts from local people: Various discussions were held with the local communities on the species diversity and their local value to the community for various taxa. Focused group discussion was employed in order to acquire further information from the local people.

6.6.3: Analysis of Conservation Status

Application of the IUCN Criteria:

The IUCN Red List data Search Engine (http://www.iucnredlist.org/) was applied to screen species for conservation status;- Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Lower Risk, Data Deficient and Not Evaluated in line with IUCN categorization;-

- EXTINCT (EX) when there is no reasonable doubt that the last individual has died, or;
- EXTINCT IN THE WILD (EW) when it is extinct in the wild and it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range;
- CRITICALLY ENDANGERED (CR) when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the criteria (A to E in the IUCN Red List Categories);
- ENDANGERED (EN) when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by any of the criteria (A to E in the IUCN Red List Categories);
- VULNERABLE (VU) when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future, as defined by any of the criteria (A to E in the IUCN Red List Categories), and;
- LOWER RISK (LR) when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Species included in the Lower Risk category are separated into three subcategories:

i. Conservation Dependent (CD): Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.
ii. Near Threatened (NT): Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
iii. Least Concern (LC): Taxa which do not qualify for Conservation Dependent or Near Threatened.

- A species is DATA DEFICIENT (DD) when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.
- Lastly, a species is NOT EVALUATED (NE) when it is has not yet been assessed against the criteria.

Requirements of the Convention on Migratory Species of Wild Animals
The Bonn Convention is a non-governmental treaty concluded under the aegis of the United Nations Environment Programme, and aims to conserve terrestrial, aquatic and avian migratory species throughout their range of habitats on a global scale. Kenya became a party to this convention in May 1999.

As the only global convention specializing in the conservation of migratory species, their habitats and migration routes, CMS complements and co-operates with a number of other international organizations, NGOs and partners in the media as well as in the corporate sector. Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species.

Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention of which, Kenya is identified as a Range State for 44 of these. In this respect, CMS acts as a Framework Convention. The Agreements may range from legally binding treaties (called Agreements) to less formal instruments, such as Memoranda of Understanding, and can be adapted to the requirements of particular regions. Kenya is a party to four MOUs namely;- AEWA (African Eurasian Water Bird Agreement) Marine Turtles Africa MOU, Marine Turtles-IOSEA and the African Elephant MOU. Under the Bonn Convention, Kenya is recognised as a Range State for 50 bird species out of which 4 namely, the *Ardoela idea, Larus saundersi, Hirundo atrocaerulea, Acrocephalus griseldis and Zoothera guttat* are Bonn Convention Appendix 1 species. As part of the Survey for flora and fauna, all birds occurring within the PID Traverse were screened for occurrence in Appendix I& II of the Bonn Convention including Kenya Country Reports on the same.

The African-Eurasian Migratory Water-bird Agreement (AEWA)
This agreement was negotiated under the provisions of Article IV of the Bonn Convention and concluded on 16 June 1995 in The Hague, the Netherlands subsequently coming into force on 1 November 1999. The aim of AEWA is to create a legal basis for concerted conservation and management policy by the Range States for migratory water bird species in pursuit of the mission to maintain migratory water bird species and their populations at a favourable conservation status or to restore them to such a status throughout their flyways, over a range of 118 countries.

Screening for local importance as per Kenyan Law

Conservation of biodiversity in Kenya basically vests under three laws namely:

- The National Constitution
- The Forest Conservation and Management Act 2016
- The Environmental Management Coordination Act (EMCA) (2015)
- The Wildlife Management and Conservation Act, 2013

Flora and fauna recorded were screened against requirements of each tool.

6.6.4: Outcome of the mapping surveys

Detailed outcome of the mapping surveys is provided in Appendix 6.4 whose salient findings are summarized in sections below.

6.7: Terrestrial Ecosystems

The terrestrial ecosystem is connected with marine systems through transportation of materials the onshore, and species that acquire their food in the intertidal areas such as birds. However, most terrestrial birds are only observed towards hinterland. The survey on terrestrial system was designed to assess the Kaya forests within the area, and specifically on LNG, Free Port Area and the tentative bridge anchoring area in Mwangala. Kayas that were visited include Kaya Jiwa la kutuza, and Kaya Mhongani located in close vicinity of PID.

6.7.1: Floral Survey

Kaya forests and sacred groves

High canopy forests originally pre-dominated the entire coastal plain and are considered to have been the most northern expression of the Miombo Woodlands of Tanzania. However, on account of human activity, such formations are today restricted to the culturally protected areas namely Kaya forests, sacred grooves and burial grounds which today are the only sites where indigenous tree formation of over 5m height will be found. To date, Kaya Forests and sacred gloves form an important feature in the traditional belief and worship of the Digo and Duruma who traditionally occupied the areas traversed by the PID. Though there are over 13 Kayas in Dongo Kundu area, three (Table 6.10 and Fig. 9.1 above) were considered occurring in close vicinity of PID components.

Table 6.10: Inventory of Kayas

Kaya	Name	Location	Proximity	Status
1	Kaya Mkumbi	Kiteje	PID pipeline	Degraded
2	Kaya Mhongani	Dongo Kundu	DK Distribution pipeline	Preserved
3	Kaya Jiwe la Kutuza	Dongo Kundu	Land Development	Degraded

Source: This Study (August 2019)

These sacred areas contained a relatively higher tree canopy species in given area space compared to the other terrestrial vegetation dynamics. Kayas have a strong presence of *Brachystegia speciformis* both as the emergent and the short tree layers. However, these layers were not consistently present and where they occurred, were devoid of canopy interlock thus depicting a woodland vegetation equivalent to the Miombo woodland of Tanzania and Northern Mozambique. This vegetation is characterized by the presence of scattered trees with a canopy cover of between 40 -60%, and the main tree floral components are *Brachystegia speciformis, Julbernadia magnistipulata* and *Salvadora persica*, all of which were recorded in the Kaya. The

Brachystegia spiciformis showed a strong presence to the extent that, it can be considered as the indicator species for former occurrence of the Miombo woodland. The presence of *Brachystegia spiciformis* and *Uapaca nintida* in the *Brachystegia* community indicates its typical similarities with the 'Miombo' woodland in Central Africa (Moomaw 1960). The *Brachystegia* communities in the *kaya* can be said to form part of the northernmost extension of 'Miombo' woodland vegetation.

The *Brachystegia* woodland vegetation was extensive and continuously into the central parts of the K*aya*, but interrupted by the termite mound clusters of size ranging from 50 to 200m^2 and height of 2 to 5m.The mould vegetation clumps are very distinct from the woodland vegetation in that they are dominated by *Salvadora persica* and *Tamarindus indica* as most common spp. The floristic variation between these termite mounds and the surrounding *Brachystegia* woodland was distinct and other spp included, *Cynometra suaheliensis, Carissa tetramera, Vitellariopsis kirkii, Dobera loranthifolia, Thespesia danis* and *Vernonia wakefieldii*. To the periphery, the *Brachystegia* woodland was replaced by *Acacia* woodland, comprising *Acacia xanthophloea (yellow) and Acacia zanzibarica* in different population densities.

Farmlands

The farmland areas were either with perennial cash crops (Cocos nucifera – coconut trees, Anacardia occidentale – cashew nut tree, Mangifera indica – mango tree, among others) and ground floor dominated by herbaceous species (especially graminoids), or carried annual subsistence crops (Zea mays – maize, Manihot esculenta – cassava, Cajanus cajan – cow pea, *Musa* sp. – Banana, etc) that had been weeded. Occasionally, the cash crops and the subsistence crops were grown in the same land parcel.

6.7.2: Threats and concerns to terrestrial floral formations

Colonization by invasive spp: Some kayas are threatened by invasive species such as Mathenge - *Prosopsis juliflora* (Plate 5.4), Azadirachta *indica, Lucaena lucocephala, Lantana camara* and strangler climber species *Pleicosepalous parviflorus* [chibugu-sichokolo]. The latter usually covers the crown of host tree and suffocates it to death. In most Kayas investigated within the traverse, both invasive species and the strangler climber plants were recorded.

Plate 5.4: The Mathenge (prosopis) weed[6] is rapidly colonizing the land

Encroachment by human activity: Though many kayas forests and groves occur widely in the route of traverse, the same are however not documented on available maps and are in poor conservation state. In addition to intrinsic threats, there were anthropogenic activities especially at Kaya Mhongani and Mkumbi that are likely to affect the vegetation and ecology of these forest areas.

6.7.3: Conservation status for flora

The list of 33 floral spp targeted for removal in the laying of PID pipelines was screened for conservation status against IUCN Red List Data with outcome as shown in Table 6.11 below. Nine of the trees is listed as threatened and neither are there local concerns on the conservation status.

Table 6.11: List of trees to be displaced by the PID pipelines

[6] Mathenge weed (*Prosopis chilensis*) is mainly dispersed in building sand especially from Voi River

SN	Common Name	Botanic Name	Simkumbe	Kombani	Matuga	Kitivo	Ng'ombeni	Kiteje	Total Trees	Iucn Status	Population status
1	Coconut	*Cocos nucifera*	*23*	*9*	*9*	*3*	*1*	*11*	56	LC	Unknown
2	Casuarina	*Casuarina equisetifolia*	*7*	*1*	*2*	*26*	*1*		37	LC	Stable
3	Ashok	*Saraca asoca*	*7*		*3*	*1*		*3*	14	LC	Unspecified
4	Mango	*Mangifera indica*	*8*	*5*	*12*	*8*	*8*	*11*	52	LC	Unspecified
5	Neem	*Azadirachta indica*	*2*	*8*	*16*	*14*	*12*	*35*	87	LC	Stable
6	Cashewnut	*Anacardium occidentale*		*7*	*15*	*5*	*4*	*27*	58	LC	Unknown
7	Moringa	*Moringa arborea*				*4*		*15*	19	LC	Unspecified
8	Pawpaw	*Carica papaya*						*2*	2	LC	Decreasing
9	Bambakofi	*Afzelia quanzensis*		*3*			*1*	*0*	4	LC	Unknown
10	Eucalyptus	*Eucalyptus globulus*	*3*				*4*	*0*	7	LC	Unknown
11	Drosina	*Dracaena sp.*					*1*	*0*	1	LC	Unknown
12	Mshilingi	*Gmelina Arborea*			*1*				1	LC	Unknown
13	Mkunazi	*Ziziphus mucronata*		*10*		*2*	*1*	*4*	17	LC	Unknown
14	Mitomoko	*Annona cherimola*	*2*		*2*		*1*	*3*	8	LC	Stable
15	Guava	*Psidium guajava*	*3*		*4*			*3*	10	LC	Unknown
16	Acasea Simea	*Acasea Simea*			*1*	*3*	*1*	*4*	9	LC	Unknown
17	Chamama	*Thevetia peruviana*			*2*	*1*			3	LC	Unknown
18	Umbrella tree	*Terminalia mantaly*					*4*	*1*	5	LC	Unknown
19	Mngongo	*Sclerocarya birrea*				*1*	*1*	*2*	4	LC	Unknown
20	Baobab	*Adansonia digitata*			*1*	*1*			2	LC	Unknown
21	Lemon	*Citrus limon*	*2*		*1*		*2*		4	LC	Unknown
22	Gravellea	*Grevillea robusta*					*3*		3	LC	Unknown
23	Mdungu	*Zanthoxylum chalybeum*						*1*	1	LC	Unknown
24	Mkungu	*Terminalia catappa*	*3*			*3*	*1*		7	LC	Unknown
25	Mbokwe	*Annona senegalensis*						*3*	3	LC	Unknown
26	Orange	*Citrus sp.*				*6*	*1*	*1*	8	LC	Unspecified
27	Mzambarau	*Syzygium Cumini*				*1*			1	LC	Unknown
28	Msufi	*Ceiba Pentandra*				*1*			1	LC	Unknown
29	Calianda	*Calliandra calothyrsus*				*1*			1	LC	Unknown
30	Mchumbu	*Lannea schweinfurthii*		*1*					1	LC	Unspecified
31	Mstafeli	*Annona muricata*	*1*						1	LC	Unknown
32	Palms				*2*			*10*	12	LC	Unknown
33	Madagascar thorn				1	*3*	*1*	*1*	6	LC	Unknown
	Total Count Per Site		***61***	***44***	***72***	***84***	***48***	***137***	**446**		

Source: This Study (August 2019)

6.8: Conservation Status for Terrestrial Fauna

6.8.1: Mammal and Herpetofauna survey

Few mammal species listed in Table 6.11 were observed during the survey of the study area. These included in Vervet monkey (Cercopithecus aethiops), Four-toed elephant-shrew (Petrodromus tetradactylus), in Tsunza Red-legged sun squirrel (Heliosciurus rufobrachium) and Four-toed hedgehog (Eraniceus albiventris) were observed while in Mwangala, the four-toed hedgehog (Eraniceus albiventris) and Crested porcupine (Hystrix cristata) were observed. Miritini recorded the Crested porcupine (Hystrix cristata) and the Four-toed hedgehog (Eraniceus albiventris). The African Hare was common in all the survey sites observed through their droppings. Among the primates, Vervet monkeys were observed moving in between the mangroves and the adjacent farmlands. The monkeys utilize the two systems for foraging and cover. During dry seasons, they are common in the mangroves searching for crabs and leaves; while during wet season they invade farms for food. All the mammal species recorded are accorded a Least Concern Category in the IUCN Red List.

Table 6.11: List of mammal species reported to occur in the Master Plan area

Common Name	SCIENTIFIC NAME	IUCN Red list Category
Vervet monkey	*Cercopithecus aethiops*	Least Concern
Four-toed elephant-shrew	*Petrodromus tetradactylus*	Least Concern
Red-legged sun squirrel	*Heliosciurus rufobrachium*	Least Concern
Four-toed hedgehog	*Eraniceus albiventris*	Least Concern
Crested porcupine	*Hystrix cristata*	Least Concern
Wild pigs	*Sus scrofa*	Least Concern
Colobus monkey	*Colobus guereza*	Least Concern

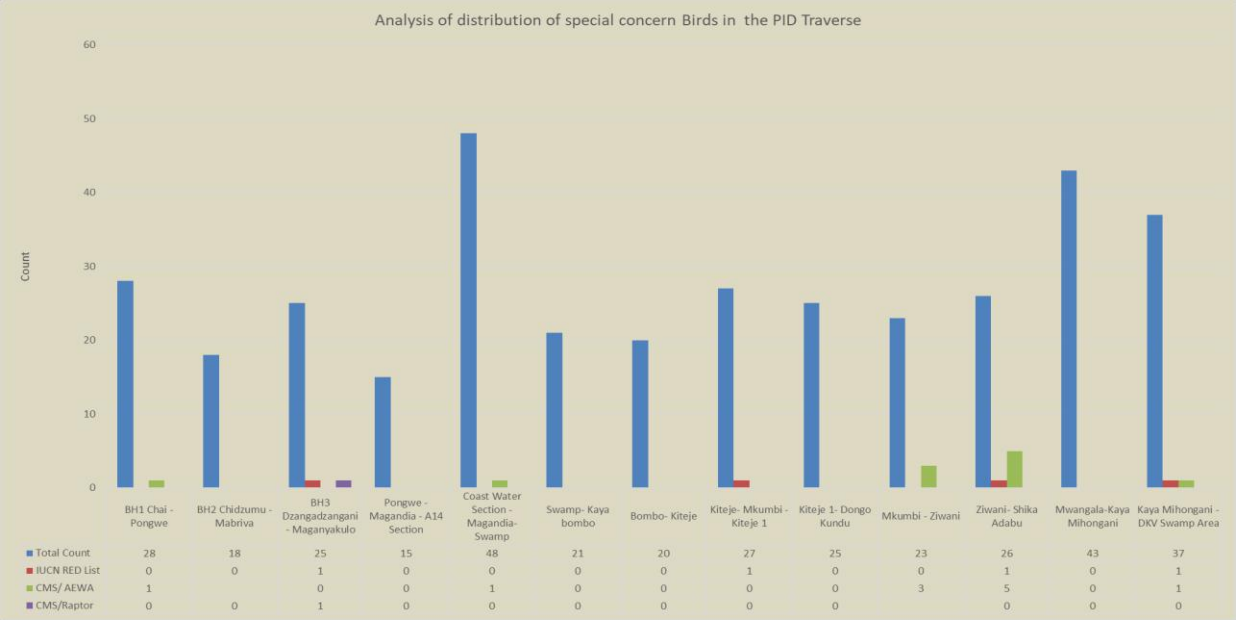
Source: This Study (August 2019)

Plate 6.9: The Vervet monkey is common along the PID Traverse

6.8.2: Conservation status for Avian Fauna-Birds

Total bird count: Appendix 6.2 provides a list of all birds recorded within the PID traverse based on a bird survey conducted in 13 sites along the PID traverse in the period July/August 2019. A total of

102 different species of Birds were counted in the entire PID traverse between the intake areas to the DK Land development site on the shoreline of Port Reitz Creek. Bird counts ranged between 15 species for the disturbed A7 Highway Reserve to 48 within vicinity of the seasonal marsh/lake at Ziwani (Fig. 6.12). The Zanzibar Sombre Greenbul and the Common Bulbul emerged the most common birds counted in 12 out of 13 sites. Highest bird count of 48 was recorded in the relatively undisturbed marshland of Magandia followed by the Kaya Mihongani area within Dongo Kundu.



Source: This Study (July/August 2019)

Fig 6.12: Occurrence of bird species within the traverse

Conservation status: All the 102 avian species recorded were screened for conservation status against the IUCN RED LIST data and CMS/ AEWA checklist with outcome that 9 birds are of concern in that 1 is listed in the IUCN RED List Data (Table 6.12) on account of being vulnerable, 8 species are listed in the Agreement on the Conservation of African-Eurasian Migratory Water Birds (AEWA) and one is listed under CMS/ Raptors. Other bird species such as the African Darter require careful watch given that though listed under Least Concern under IUCN Red List, it is declared Regionally Extinct in Europe.

Five out of the 9 special concern bird species, including the single IUCN Red List Spp were recorded in the neighbourhood of Ziwani seasonal marsh confirm the importance of this site as a habitat for birds.

Table 6.12: Special concern birds in the PID traverse

SN	Common Name	Scientific Name	IUCN RED LIST Status		Migratory Convention	
1	Roseate tern	*Sterna dougallii*	Least Concern	Unknown	CMS	AEWA
2	Sooty gull	*Larus hemprichii*	Least Concern	Decreasing	CMS	AEWA
3	Wahlberg's eagle	*Aquila walbergi*	Least Concern	Stable	CMS	Raptors
4	Egyptian goose	*Alopochen aegyptiacus*	Least Concern	Decreasing	CMS	AEWA
5	Wood sandpiper	*Tringa glareola*	Least Concern	Stable	CMS	AEWA
6	African spoonbil	*Platalea alba*	Least Concern	Stable	CMS	AEWA
7	Sacred ibis	*Threskiornis aethiopicus*	Least Concern	Stable	CMS	AEWA

8	Great white egret	*Ardea alba*	Least Concern	Unknown	CMS	AEWA
9	Woolly-necked stork	*Ciconia episcopus*	Vulnerable	Decreasing	IUCN	

Source: This Study (July/August 2019)

Baglafecht (Reichenow's) Weaver building nest

Nest of the Black-necked Weaver at Dongo Kundu

Emerald-spotted wood dove

Pintail whydah

Grey-headed bush shrike

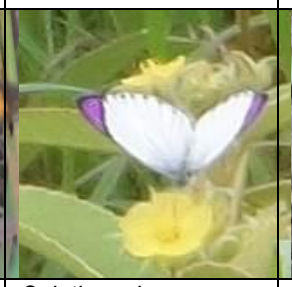
Zanzibar red bishop

Source: This Study

Plate 6.2: Diverse bird spp encountered in the Study

6.8.3: Insect Pollinators (Butterflies and Bees)

Numerous counts of insect pollinators including bees and butterflies were made in the vicinity of Kaya forests. In total, 66 butterfly species were recorded from the areas surveyed. All Kayas had high number of species in the area with Kaya Mkumbi Mhongani recording about 62 % of species in the area. Areas that recorded low richness are basically grassland such as the Free Port Area area which is shrubland. 21 % of the butterflies diversity were recorded only in Kaya forests and their immediate surroundings. These include Bicyclus safitza, Colotis protomedia, Physcaeneura leda, Ypthima asterope, Deudorix antalus, Graphium angolanus, Spialia kituina, Baliochila hildegarda, Junonia hierta, Hamanumida daedalus, Melanitis leda, Eurytela dryope, Hypolycaena philippus. Plate 6.2 shows diverse butterflies encountered in the Study area. Of all species found outside Kaya forests, at least each is represented in the forest.

			
Colotis protomedia	*Eurema floricola??*	*Junonia oenone*	*Colotis aurigineus*
			
Leptotis pirithous	*Acraea eponina*	*Colotis regina*	*Euphaedra neophron*

Source: This Study

Plate 6.3: Butterflies encountered in the Study area

None of the butterflies recorded in this Study enjoy any conservation status under the IUCN or any other known tool. In spite of this, a butterfly count of 66 compares very unfavorably with the 261 recorded for the Arabuko Sokoke Forest which is also a coastal forest ecosystem and this may imply slow loss of biodiversity on account of habitat loss.

6.8.4: Reptiles and Amphibians

The group is technically known as herptiles. They consist of reptiles (snakes, lizards, geckos) and amphibians including frogs and toads some of which were encountered during the field survey. Among snakes, Puff Udder (*Bitis arietans*) was physically recorded in Mwangala while accounts from the locals revealed it is widespread occurrence which poses threats in the area. This snake is a venomous viper normally found in savannah and grasslands. It is responsible for most fatal deaths in Africa. It normally feed on small mammals, birds, amphibians and lizards. Speckled sand snake *Psammophis punctulatus* was encountered on numerous occasions in the study area. Black mamba (*Dendroaspis polylepis*) was not observed but was accounted by the local people. Its distribution is wide due to its adaptation to variety of climates ranging from savanna, woodlands/shrubs, rocky slopes, dense forests and even humid swamps. They feed on smaller prey such as birds, rats, bush babies and small chickens.

Assessment of conservation status of this category of fauna against the IUCN Red List (Table 6.12) revealed a general classification of Least Concern (LC) while majority had no entries in the database.

Table 6.13: IUCN classification of reptiles typical of the PID area

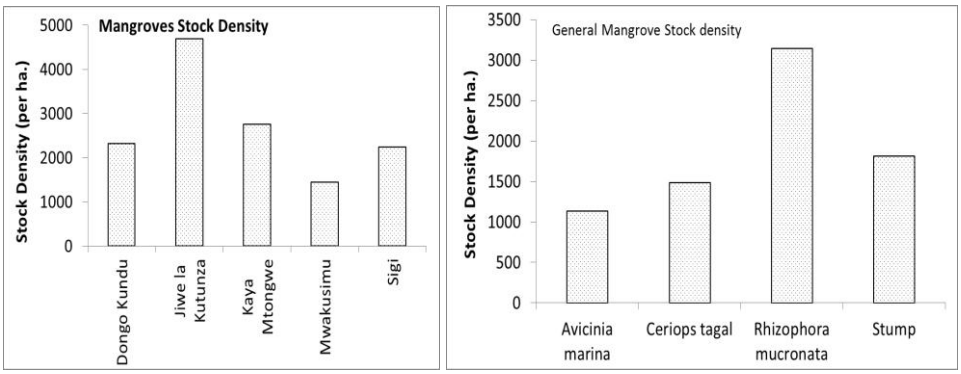
Common Name	Scientific Name	IUCN Red list Category
Puff Udder	*Bitis arietans*	No Entry Found
Speckled sand snake	*Psammophis punctulatus*	No Entry Found
Black mamba	*Dendroaspis polylepis*	Least Concern
African Clawed Frog	*Xenopus laevis*	Least Concern
African Common Toad	*Amietophrynus gutturalis*	Least Concern
Flap-necked chameleon	*Chameleon dilepis*	No Entry Found
Pygmy chameleon	*Rampholeon kerstenii*	No Entry Found
Black-collared lizard	*Agama agama cyanogaster*	No Entry Found
Black-lined plated lizard	*Gerrhosaurus nigrolineatus*	No Entry Found
Day gecko	*Lygodactylus picturatus*	Least Concern
Variable ground skink	*Mabuya varia*	No Entry Found
Long-tailed sand lizard	*Latastia longicaudata*	No Entry Found

Source: This Study (August 2019)

6.9: The Mangrove Ecosystem

6.9.1: Occurrence and extent

Mangrove forests occur along the entire coastline of Dongo Kundu, though at varying density. Of the six mangrove species recorded in Kenya, only 4 Avicenia marina, Ceriops tagal, Rhizophora mucronata and Sonneratia alba occur on the Dongo Kundu coastline. Sonneratia alba occurs in isolation between Dongo Kundu and Kaya Mtongwe area. Fig 6.13 summarizes data on mangrove prevalence by site and species in the Master Plan area. On average, mangrove stock density in the area is 5533 stems per ha with the highest density of 8,900 per ha recorded in Kaya Mtongwe followed by Dongo Kundu (4,900 stems per ha) and Jiwe la Kutunza and Mwakusimu with 4,700 stems per ha. Among the species, R. mucronata is leading with 3054 stems/ha followed by Ceriops tegal (1488 stems/ha) and Avicenia marina (1050 stems per ha).



Source: This Study (August-October 2019)

Fig 6.13: Mangrove stock density by site and species within project footprint

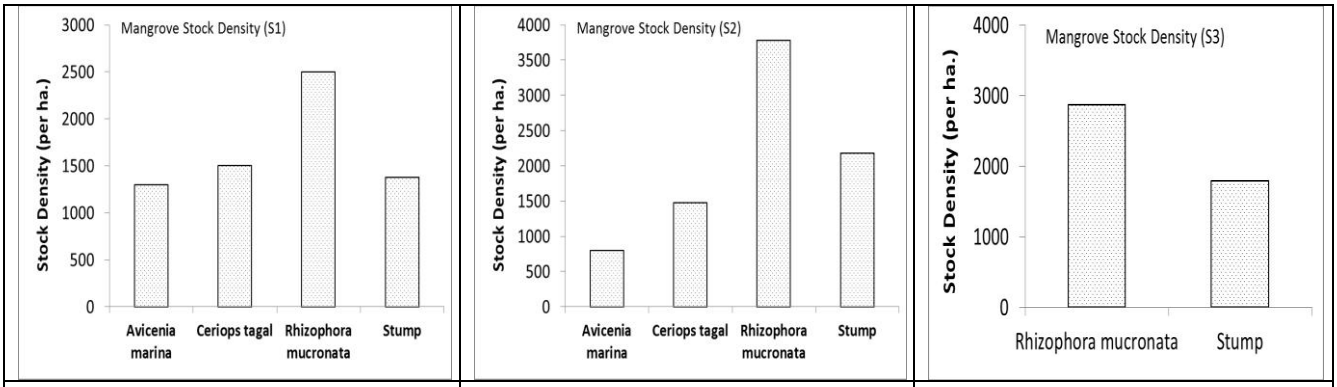
6.9.2: Interspecies density along the intertidal transects

Fig 6.14 and Table 6.14 show mangrove density and distribution along the intertidal zone. Within the inter-tidal transect between the Low Water Mark and High-Water Mark, mangrove distribution was observed to vary. Within the inter tidal zone, Rizophora mucronata dominates all zones with densities of 2500, 3783 and 2880 stems per ha respectively, Further, R. mucronata is the only species recorded in the low tide belts (LWM) of the Master Plan area probably a reflection of the increasing impact of sedimentation.

Table 6.14: Mangrove density along the inter-tidal belt

High Water Mark zone		**Middle zone**		**Low Water Mark zone**	
Species	*Density (s/ha)*	*Species*	*Density (s/ha)*	*Species*	*Density (s/ha)*
R. mucronata	2500	R. mcronata	3783	R. mucronata	2880
C. tegal	1500	C. tegal	1475	C. tegal	0
A. marina	1300	A. marina	800	A. marina	0
Total count	5300		6058		2880
Stumps	*1375*	*Stumps*	*2180*	*Stumps*	*1800*

Source: This Study (August to October 2019)



High water Mark (HWM)	Middle Zone	Low Water Mark

Source: This Study (August-October 2019)

Fig 6.14: Distribution of mangrove species along the inter-tidal belt

Source: This Study

Plate 6.3: Typical distribution of mangroves between low and high tide areas

6.9.3: Inter-site species distribution on the Dongo Kundu shoreline

Sites showed variation in the distribution of mangrove species from the shore towards the sea front ;-

- At Dongo Kundu, *Ceriops tagal* dominates the HWM with 230 individuals per ha with R. mucronata towards the LWM.
- At Jiwe la Kutunza, *R. mucronata* was the only species recorded in all sampling points.

From this analysis, trends emerge as follows:

- Frequency and diversity of mangroves is highest in the middle zone between the high and low water marks. Out of a possible count of 15, the middle site recorded 10, followed by HWM (7) and the LWM (5). Both density and diversity are lowest seaward where only *R. mucronata* are found.
- While all six out of all nine mangrove species are known to occur along the Bombo Creek in Mwakusimu and Siji. Only four were recorded in the rea likely to be affected by land Development. Dongo Kundu and Mtongwe recorded only 2 each while Jiwe la Kutunza is the worst affected as only *R. mucronata* was recorded.
- Over all, *R. mucronata* is the most abundant spp occurring in 13 out of 15 possible sites followed by *Ceriops tegal* (6 out of 15) and *Avicenia marina* with 3 out of 15 occurrences.

Plate 6.4: Stumps in both low and high tide area

6.9.4: Conservation status of mangroves

The question of Stumps

From the observations made on stumps encountered, it is apparent that mangrove forests have been exploited for any merchantable wood leaving behind only saplings. An average stumping density of 1785 stems per ha was observed in this study. With an 18km long coastline, the Dongo Kundu mangrove block is estimated at 400 hectares, an estimated 0.714 million stems of

mangroves must have been harvested previously. Close observations revealed abandoned charcoal kilns at this site implying possible over-exploitation for charcoal (Plate 6.4) probably for transport through the Port.

Socio-economic and cultural activities

The use of mangrove habitats for socio-economic benefits was surveyed within the mangrove areas. The local benefits from the mangrove trees and the habitat for socio-economic activities. Evidence of mangrove tree felling was common in most sites visited. This is probably for the benefits of timber, or fuelwood. Activities such as bee keeping were observed in some areas including Dongo Kundu area occupied by Avicenia marina (Plate 6.5). Honey production is predominant during the flowering of mangroves. Part of the beach with mangroves are secluded as Kaya Jiwe la Kutunza and Kaya Mrongondoni towards Mtongwe. These are sites considered by the local community as highly sacred sites for performance of rituals.

Source: This Study

Plate 6.5: Bee hive on *Avicenia marina* at Dongo Kundu Mudflat and Small Kaya (Mzimu) in Jiwe la Kutunza area

6.10: Marine macro-benthic Invertebrates

6.10.1: Crustaceans- Crabs

(i) Crab diversity in the PID area:

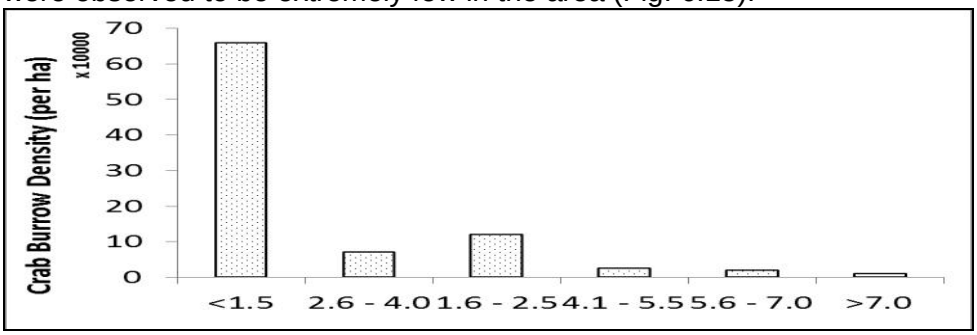
Crab species is a major and conspicuous crustacean group within the coastal shores and in mangrove habitats. Crab species common in the Stud area include Uca tetragonon, Uca urvillei, Uca inversa, U. chlorophthalmus, Dardanus deformis, Cardisoma carninfex, Scylla serrata, Calappa hepatica. Hermit crabs though rare in the area were observed on a narrow sandy beach near Dongo Kundu. U. urvillei prefers muddy substrate, often in the Rhizophora zone in the centre of mangrove forest. Scylla serrata (mangrove or mud crab) was observed grazing in the mangrove area in Kaya Mtongwe area whose adult members generally inhabit dense mangrove areas for easier shielding from predators. S. serrata is the most sought crab species for commercial fisheries and mariculture along the coast. For instance, crab farming in Tsunza is based on the species.

	
Uca urvillei,	*Uca tetragonon*
	
Uca chorophthalmus	*Metapograpsus sp.*
	
Young Scylla serrata found grazing in the near shore mangrove area; always defensive	
	
Calappa hepatica burrowing in sand	Hermit crab: *Dardanus deformis*

(ii) Population dynamics among crabs

Population dynamics of crabs was assessed in three sites- Kaya Mtongwe, Mwakusimu and Sigi based on the parameters of crab burrow density, substrate firmness and, distance from the shore. For ease of description, five clusters of crab burrow sizes (<1.5 cm, 1.6-2.5, 2.6-4.0, 4.1-5.5, 5.6-7.0 and >7.0 cm) were adopted.

The estimated crab density in the area is estimated at 1.7 x106 per hectare. Leading in this are the small size cluster (<= 1cm) with a density in excess of 650,000 burrows per hectare while all other sizes have burrow densities general less than 50, 000 per hectare. Members in cluster size =>4.1 were observed to be extremely few in the area (Fig. 6.15).

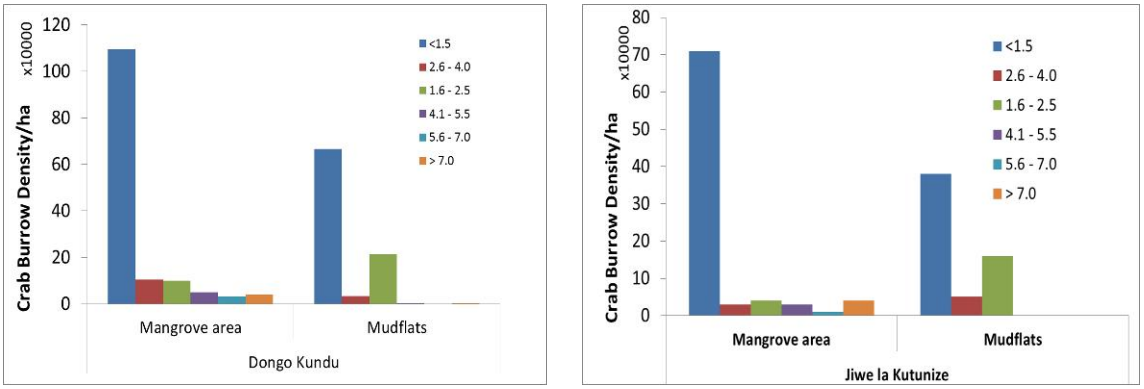


Source: This Study (August to October 2019)

Fig 6.15: Crab burrow density per cluster

(iii) Impact of cover type on crab density:

Crab burrow density was observed to be sensitive to cover type. In all sites studies, high crab burrow densities were observed in areas under mangrove bushes (Fig 6.17) compared to the open mudflats. Further, while all the six size clusters were encountered in the area covered by mangroves, the open mudflats recorded on average only three clusters, mainly in the small sizes. The large size clusters (=>4.1 cm) are comparatively few and occur exclusively in the mangrove areas only.



Source: This Study (August -October, 2019)

Fig. 6.17: Comparison of crab burrow densities across vegetation cover types

(iii) Disparities in crab distribution

With the exception of Jiwe la Kutunza, all other sites which had relatively better mangrove cover also recorded the highest occurrence of crab burrow densities with cluster one densities exceeding one million (Fig. 6.18). The implication here is that, crab population is highly dependent on

mangrove cover condition. Occurrence density of crabs was found to decrease with cluster size at all sites with the exception of Dongo Kundu and Jiwe la Kutunza where the large size cluster has relatively higher prevalence.

(iv): Trends in conservation of crabs

None of the crabs fall within the IUCN Red List data,

6.11: Cultural and Heritage Impact Assessment for PID

Coastal Kenya is characterised by a rich cultural heritage deriving from past occupation by diverse groups including Portuguese, Arabs, English and the local communities. As such, right from the onset, the need to for the PID to remain sensitive to the cultural heritage of the host community has been kept alive and has been the subject of discussion in diverse fora.

6.11.1: Approach to CIA for the PID Project

For purposes of this ESIA, diverse approaches were adopted conducting Cultural Impact Assessment as follows: -

Consultation with Kaya Elders: Once presence of sacred shrines within the traverse of PID was established for fact, the ESIA team made contact and held working sessions with Elders who subscribe to the Kaya Culture. From such meetings, a full picture of the depth and significance of the Kaya culture to the community including specific location and nature of each shrine was obtained.

Discussions with the National Museum staff in Ukunda: Two meetings were held with the NMK staff based at the CFCU at Ukundas to investigate the statutory standards in mainstreaming cultural heritage issues in project development, concerns for specific sites and the mandate of the NMK in protection of the Cultural Heritage.

Inventory and mapping of Kayas: All Kayas in Dongo Kundu were inventoried. Those considered in close proximity of the PID components were subjected to further study.

6.11.2: Outcome of the Cultural and Heritage Impact Assessment Study

Most Kayas in Kwale including those in Dongo Kundu are not gazetted but given that they are reservoirs of biodiversity, they should be preserved. The Kaya groves in Dongo Kundu also have springs which are he only sources of fresh water very vital for human survival. Certain tree species such as Bambakofi are locally threatened on account of over-harvesting Upon consideration of the rich cultural heritage including shipwrecks within the Port Reitz, there is possibility of encountering chance finds especially during seabed excavation in the sea reclamation. The NMK should be involved at all stages of land reclamation for purposes of undertaking recovery of all artefacts encountered.

6.12: Characterization of the Tiwi Aquifer

6.12.1: Approach and methodology

Sustainable water supply is fundamental to realization of the Mombasa Special Economic Zone which seeks to initially tap from the Tiwi Aquifer pending connection to the 220,000 m^3 d^{-1} capacity Mwache dam once completed. However, given the state of non-clarity as to how long it will take for Mwache dam to be operational, there is need to analyze and understand the short and long-term impacts of imposing a daily 2000 cubic metre water demand on the Tiwi Aquifer as proposed by the

SEZ. Characterization of the Tiwi aquifer has firstly sought to document the pre-SEZ Water Demand in the South Coast area against the Aquifer capacity in terms of recharge, allowable yield and perceived threats. This has helped clarify on amounts available for future exploitation including supply to the SEZ.

6.12.2: The Tiwi Aquifer

Tiwi aquifer is roughly located to the west of A7 Highway between Ngombeni and Ukunda. Actual dimensions are not known but is assumed to be between 20 and 30 square kilometers in size hence quite small.

The Tiwi aquifer, also termed the Kilindili Sands is variously categorized by WRA as strategic and major on account of its high yield and good quality water with a through flow of 42,000m^2/hr which reduces to 25,000m^2/hr to the north of Ng'ombeni due to decrease in permeability. Of the total capacity, only 20,000m^3/day is abstracted through shallow boreholes and the Coast water Service Board. The lithology is alluvial and lacustrine sand and clay and is typically not more than 70 m deep. The aquifer is semi-confined or confined, with water levels 25 to 30 mbgl. High borehole yields can be obtained, and boreholes are typically 40 – 80 m deep.

The aquifer is recharged by leakage from seasonal swamps and lakes directly overlying the aquifer and probably also from groundwater flow from the west. Water is typically good quality but vulnerable to saline intrusion. In discussion with staff of the CWSB at Tiwi, it was mentioned that some boreholes have had to be abandoned on account of salinity build up. The average flow of each borehole in this yield is around 35–40 m^3h^{-1}, and the total abstraction is about 8,000 m3/d. According to available information, groundwater potential determined for Tiwi Aquifer is approximately 20,000 m^3d^{-1} (7.5 MCM). The Tiwi Wellfield is divided into two groups of boreholes, as follow.

- The southern group, supplying water through the Magodzani Water Tank, in which most of the water goes to the local villages, the Tiwi area and Diani Beach
- The northern group, supplying water through the Kaya Bombo Water Tank, in which most of the water is conducted to Likoni area of Mombasa. The latter supply has been declining over time due to the rise in water demand in Kwale County, mostly due to the rapid development of the hotel industry in the Diani and Tiwi beach areas.

6.12.3: The Pre-SEZ Water Demand in the Region

Projected Demand at Basin Level

At national level, the Athi River Catchment which includes Kenya's South Coast has a huge moisture deficit of 65% which is expected to hit 91% mark in 2030 (Table 6.15). This is because, the Athi catchments hosts the two major cities of Nairobi and Mombasa which are major consumption areas. The implication is that, by year 2030, this basin will only be able to meet 9% of water demand.

Table 6.15: Projected water demand deficits by Catchment Area for 2010 and 2030

Catchment Area	2010			2030		
	Water Demand (a)	Water Deficit (b)	(b)/(a) (%)	Water Demand (c)	Water Deficit (d)	(d)/(c) (%)
LVNCA	228	27	12	1,337	371	28
LVSCA	385	150	39	2,953	1,304	44
RVCA	357	92	26	1,494	867	58
ACA	1,145	745	65	4,586	4,153	91
TCA	891	336	38	8,241	5,822	71
ENNCA	212	68	32	2,857	2,442	85
Total	3,218	1,418	44	21,468	14,959	70

Source: National Water Masterplan 2030

Projected demand at coast region level

Projected Urban Water Demand in the Coast Region is presented in Table 6.16 borrowed from the World Bank (WaSSiP) funded Study of the Water Supply Master Plan for Mombasa and other Towns within Coast Province (CWSB 2013). With the exception of Lamu, water demand for all coastal Kenya Towns including the Ukunda -Tiwi section hosting the Tiwi Aquifer is projected to double between years 2020 and 2035 possibly on account of projected increase in population. In the case of Lamu, demand is elevated on account the Lamu Port currently being developed under LAPSSET. It should be pointed out that projected water Demand for Mombasa and Ukunda-Tiwi transect does not factor new demand areas such as the Mombasa SEZ.

The Coast Province mostly depends on bulk water supply system (BWSS) schemes. These schemes presently comprise (from the most important source to the marginal ones) – Mzima Pipeline, Sabaki-Mombasa Pipeline, Marere Pipeline and the Tiwi Boreholes, supplying 15 of the 20 townships in Mombasa, Kwale, Kilifi and Taita Taveta counties. The other 5 townships depend on local water resources. Also, the Coast Development Authority (CDA) is promoting the design of the Mwache Dam, a multipurpose reservoir, as an additional contributor to the BWSS for domestic water supply and irrigation. The study and the detailed design are being carried out by CES/APEC, and they indicate Mwache Dam as a key resource for the Coast Province.

Table 6.16: Projected Water Demand in Coastal Kenya Towns (2035)

	County	Urban Centre	Urban Water Demand (m^3/d)				
			2012	2015	2020	2025	2035
Southern Area (Mainland)	Mombasa	Mombasa	137,611	152,302	184,372	238,874	312,554
		Total Mombasa	**137,611**	**152,302**	**184,372**	**238,874**	**312,554**
	Kwale	Kwale	3,786	4,162	4,945	6,000	8,676
		Kinango	1,775	1,951	2,365	2,949	4,489
		Msambweni	1,976	2,171	2,665	3,252	4,809
		Ukunda / Tiwi	11,098	12,250	14,676	19,671	28,453
		Lunga Lunga / Vanga	4,761	5,230	6,445	7,903	11,709
		Total Kwale	**23,397**	**25,764**	**31,097**	**39,776**	**58,136**
	Kilifi	Mariakani	4,036	4,441	5,421	6,884	10,150
		Kilifi	5,167	5,686	7,090	9,014	13,240
		Malindi / Watamu	18,694	20,574	25,616	32,067	46,064
		Marafa	1,287	1,417	1,803	2,303	3,402
		Mtwapa	8,539	9,398	11,686	14,822	21,699
		Total Kilifi	**37,723**	**41,515**	**51,615**	**65,090**	**94,555**
	Taita Taveta	Taveta	2,972	3,573	4,265	5,121	7,228
		Mwatate	2,127	2,350	2,758	3,332	4,665
		Wundanyi	2,178	2,406	2,823	3,411	4,777
		Voi / Maungu	7,501	8,286	9,708	11,630	16,358
		Total Taita Taveta	**14,778**	**16,615**	**19,554**	**23,493**	**33,028**
Northern Area	Lamu	Mpeketoni	1,800	2,753	3,272	4,263	6,749
		Lamu Island/Port	2,500	15,815	34,190	57,805	109,811
		Total Lamu	**4,300**	**18,568**	**37,462**	**62,068**	**116,559**
	Tana River	Garsen	1,456	1,567	1,866	2,269	3,302
		Hola	750	1,246	1,524	1,558	2,707
		Bura	1,391	1,527	1,817	2,209	3,213
		Total Tana River	**3,597**	**4,340**	**5,206**	**6,036**	**9,222**

Source: CWSB- 2013 (Study of the Water Supply Master Plan for Mombasa and other Towns within Coast Province)

6.12.4: Capacity assessment for the Tiwi Aquifer

Computation Methodology

Table 6.17 presents a recharge computation of recharge into the Tiwi aquifer based on climatic and edaphic factors. The model assumes that groundwater recharge is the net of rainfall input into the catchment less evaporative and soil storage components. All rainfall input first assuages the evaporative demand while the balance is held in the soil reservoir for plant use (called the available water capacity held between field capacity and permanent wilting point) to a max of 200mm beyond which it cannot be held against gravitational force and it seeps to recharge aquifers. In the case of Tiwi aquifer, the recharge is only possible in June, July and August and has been computed at 207mm which translates into 6.96 MCM (19068 M^3 per day) for the 30 Km^2 recharge area.

Table 6.17: Recharge computation for Tiwi aquifer

SN	Station	Rainfall (mm)												Annual rainfall	Ground Water Recharge		
		J	F	M	A	M	J	J	A	S	O	N	D		mm	MCM	M^3/day
1	Waa Dispensary	14	16	29	155	292	121	90	51	67	70	59	49	1013			
2	Tiwi Dispensary	25	13	46	197	291	113	88	69	59	76	78	57	1112			
3	Muhaka I.C.P.E. Coast.Field Stn.	14	16	30	160	286	117	100	64	63	82	79	56	1067			
4	Gazi Association Sugar	18	14	43	234	354	131	113	65	68	89	74	42	1245			
5	Msabweni District Office	24	19	55	256	351	189	114	75	64	91	108	40	1386			
6	Associated Sugar Works	26	12	47	240	303	159	139	78	60	78	77	57	1266			
7	Shimba Hills Station	23	19	50	204	260	104	93	79	59	93	105	40	1129			
8	Matuga Dev Center	2	15	79	183	263	114	87	69	54	114	117	74	1192			
	Mean rainfall (mm)	24	19	55	256	351	189	114	75	64	91	108	40	1386			
	Evaporation (mm)	157	152	164	134	90	104	98	104	128	145	149	146	1571			
	Balance (R-Eo) mm	-133	-133	-109	122	261	85	16	-29	-64	-54	-41	-106				
	Soil moisture recharge mm	0	0	0	70	200	200	200	171	117	63	22	0				
	GW recharge mm	0	0	0	0	131	85	16	0	0	0	0	0		232	6.96	19068

Source: This Study (September/October 2019)

The possibility of external recharge into the aquifer

It has been suggested that Tiwi aquifer receives recharge from Shimba Hills in the west. To gauge this possibility, recharge was modelled applying rainfall data for Kwale Town over an equivalent area of 30 square kilometers. A non-existent recharge potential implies that the possibility of Tiwi receiving groundwater input from the Shimba Hills is remote given the tight water balance. Indeed, from review of available literature, the catchment function of Shimba Hills is associated with presence of impervious layers that conduct water laterally into the drainages rather than through deep percolation.

Table 6.18: Modeling recharge from Shimba Hills

SN	Station	Rainfall (mm)												Annual rainfall	Ground Water Recharge		
		J	F	M	A	M	J	J	A	S	O	N	D		mm	MCM	M^3/day
1	Waa Dispensary	14	16	29	155	292	121	90	51	67	70	59	49	1013			
2	Tiwi Dispensary	25	13	46	197	291	113	88	69	59	76	78	57	1112			
3	Muhaka I.C.P.E. Coast.Field Stn.	14	16	30	160	286	117	100	64	63	82	79	56	1067			
4	Gazi Association Sugar	18	14	43	234	354	131	113	65	68	89	74	42	1245			
5	Msabweni District Office	24	19	55	256	351	189	114	75	64	91	108	40	1386			
6	Associated Sugar Works	26	12	47	240	303	159	129	78	60	78	77	57	1266			
7	Shimba Hills Station	23	19	50	204	260	104	93	79	59	93	105	40	1129			
8	Matuga Dev Center	2	15	79	183	263	114	87	69	54	114	117	74	1192			
	Mean rainfall (mm)	23	19	50	204	260	104	93	79	59	93	105	40	1129			
	Evaporation (mm)	157	152	164	134	90	104	98	104	128	145	149	146	1571			
	Balance (R-Eo) mm	-134	-133	-114	70	170	0	-5	-25	-69	-52	-44	-106				
	Soil moisture recharge mm	-200	-200	-200	-130	40	40	35	10	-59	-111	-155	-261	-442			
	GW recharge mm						0	0	0						0	0	0

Source: This Study (September/October 2019)

Comparability of modelling results

The computed safe yield of 6.96 MCM) equivalent to 19,068 m3/day is possibly of the same order with estimates of 7.5MCM (approximately 20,000 m3/d) and the 9.9 MCM (27,000 m^3/d) computed in other studies.

The model is sensitive to rainfall input given that 20% increase above the long-term mean will induce a recharge of 10.7 MCM equivalent to 29, 211 cubic metres per day.

6.12.5: Capacity of Tiwi to handle the SEZ Demand

A projected daily allowable yield of 19,08 cubic metres is apparently not enough to meet the current demand of 20,000 cubic metres implying an over abstraction at current rate. As such, imposition of the 2000 cubic meters demand to supply MSEZ can be accommodated but with known costs to the aquifer. Its probably for the same reasons that Tiwi is not factored as a source to supply future water demand in south coast preferring rather to rely on the Mwache Dam.

Parameter	MCM	CMD
Daily allowable yield	6.96	19068
Daily demand		20,000
Daily balance		-932

Source: This study

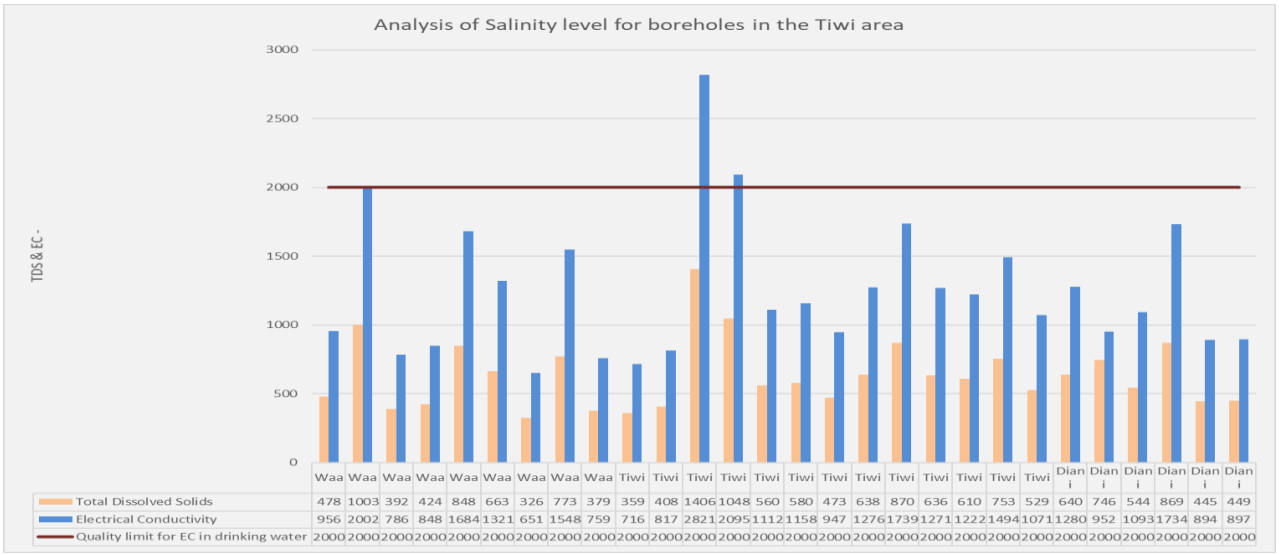
6.12.6: Threats to the Tiwi Aquifer

In course of discussion with diverse stakeholders and review of available information, Tiwi aquifer is apparently grappling with three concerns namely:- drawdown, saline intrusion and pollution.

Threat of saline intrusion:

The aquifer modelling study conducted for Tiwi under the Study of the Water Supply Master Plan for Mombasa and other Towns within Coast Province (CWSB, 2013) largely ruled out incidence of saline intrusion for this aquifer except in the rare case of over abstraction at rates in excess of 88% of recharge and attendant drawdown in excess of 8 metres below WRL. However, based on monitoring work conducted for this same aquifer, the threat of saline intrusion is real. The 1997

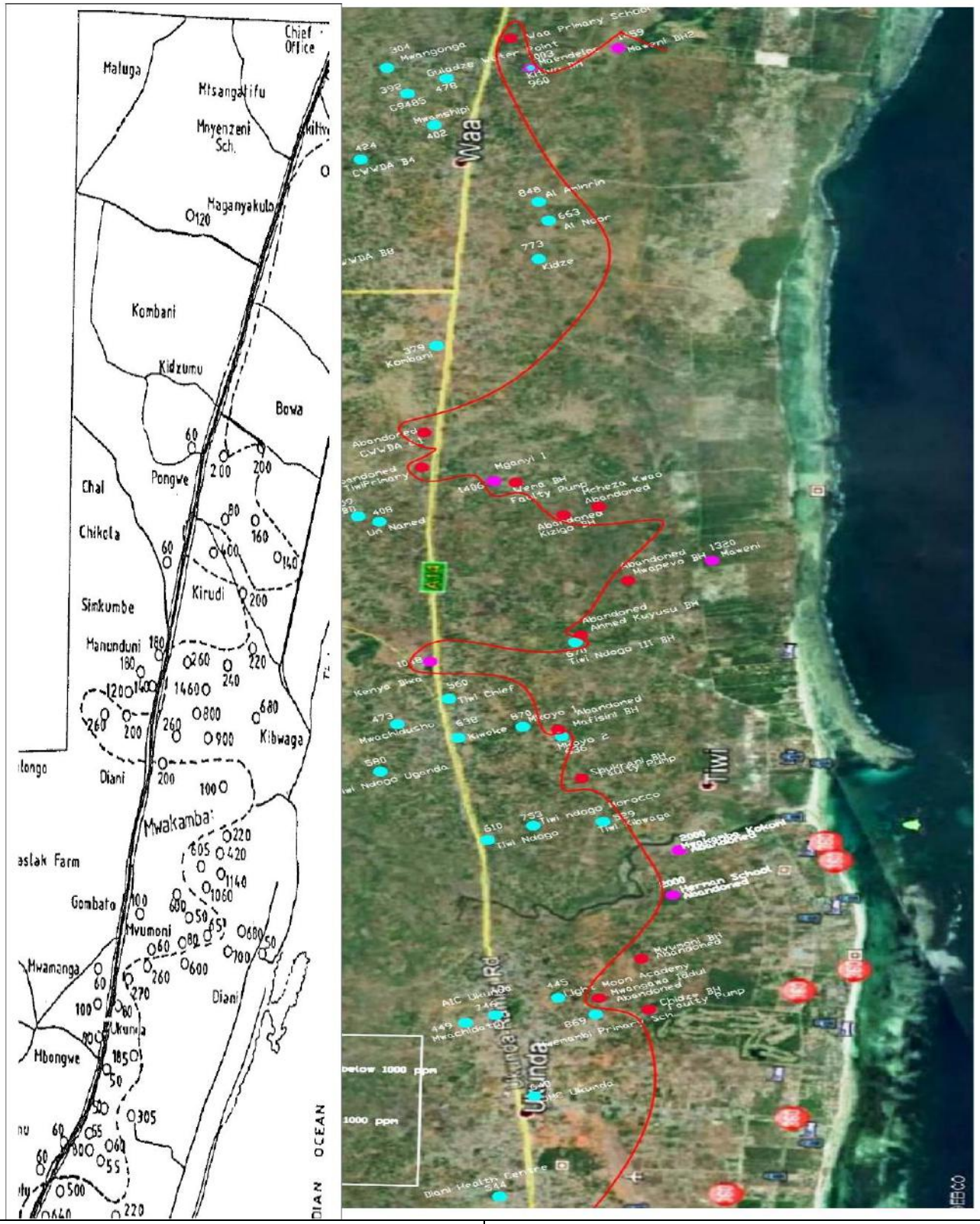
study by Mwakio Tole[7] documented extensive westward advance of the fresh/saline interface on the Tiwi-Msambweni aquifer transect (Fig 6.18). There are also local accounts of boreholes that have been abandoned on account of salinity while others proved to be too saline after drilling[8] implying that saline intrusion is no long a threat but an emerging problem at Tiwi. Indeed, this tended to be confirmed by salinity mapping undertaken under auspices of this ESIA (Fig 6.16) whereby 18 out of 28 wells monitored exceeded the 500ppm TDS value for taste and three exceeded the 1001ppm TDS value for suitability as a source of drinking water. As expected, boreholes located to the left of A7 (heading to Ukunda) had on average higher TDS values due to proximity to the Indian Ocean.



Source: This Study (September/October 2019)
Fig 6.16: Salinity monitoring for selected boreholes in the Diani-Tiwi transect

Commenting on Map in Fig 6.17, Mwakio (1997) concluded that it is evident that the Tiwi-Diani area is totally intruded by sea water for a distance of at least 1 km from the shoreline, and more commonly for more than 2 km and this was accounted for by observed over-exploitation of groundwater resources in the Tiwi-Diani area to feed the tourist industry. Based on limited data accrued between 1987 and 1993, the situation was observed to be getting worse because when the limited data available from 1987 are compared with those for 1993, as it was demonstrated that conductivity, TDS, Na and Cl have increased significantly to make the water more saline than it was previously. ON Tiwi BH by the name Kwa Mzee Juma Makalani was cited as an example since, though previously used for drinking water purposes, had to be shut down due to increased salinity.

[7] Sustainability of Water Resources under Increasing Uncertainty (Proceedings of the Rabat Symposium S1, April 1997). IAHS Publ. no. 240, 1997.
Z[Z] One BH drilled to supply MSEZ under this programme had to be abandoned on account of too high salinity

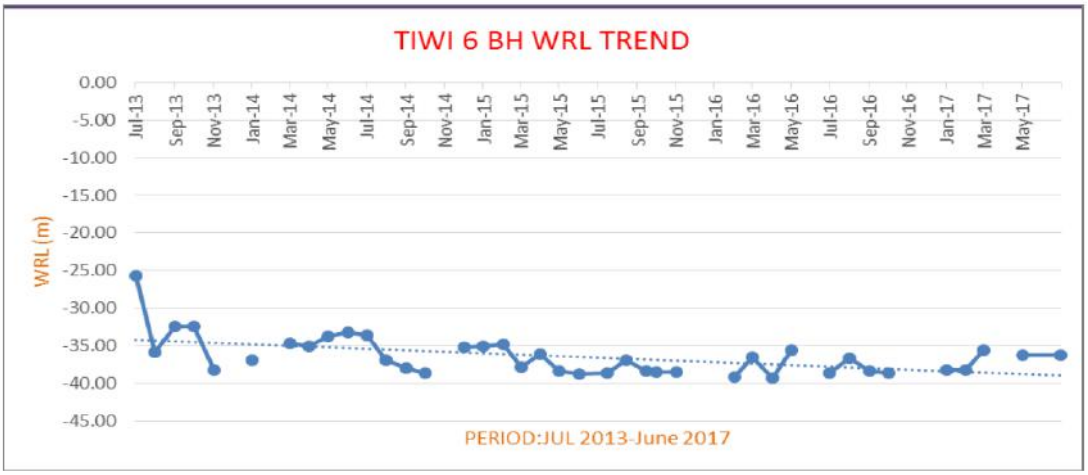


Salinity line (dotted) in the 1997 Mwakio Tole Study	Salinity line (red) in this (2019) ESIA Study for PID

Source: Mwakio Tole-1997; This Study

Fig 6.17: Saline intrusion in the Tiwi-Diani area

Threat of aquifer drawdown:
Aquifer drawdown is the systematic drop in water rest level mainly on account of over-abstraction. And though data on this is not available for the Tiwi Aquifer, discussion with WRA Staff of CRO indicated that a generally drawdown of 1 metre had been reported and this seems to be confirmed by Fig.6.18 below which traces an almost 5m systematic drawdown in Tiwi BH 6 between 2013 and 2017; a span of only 4 years. Such drawdown has huge implication for water quality and quantity as follows:-



Source: WRA (2018)
Fig 6.18: Water Rest Level Trends in Tiw Borehole No 6

Possibility of vertical saline intrusion: Morphology of Coastal fresh water aquifers is described by the Gayphen Hyberg Principle (Dunne, 1970; Price, 1987 pers comm) whereby the fresh water column occurs in form of a lense floating over the dense salt water column underneath (Fig. 6.19). The column of fresh groundwater occurring above mean sea level is usually supported by another column of fresh water of approximately 40 times its depth. In such cases, depression of the freshwater column occurring above sea level by one metre will be accompanied by an elevation of the saline water table by 40 meters and subsequent pumping may lead to salt water intrusion into the previously fresh water aquifer. This phenomenon has been described for the Kenya coast by several authorities (FAO, 1983; Michieka, et al, 1978) and it possibly explains the reason why many bore holes in both mainland and island Mombasa though originally yielding fresh water have turned saline overtime.

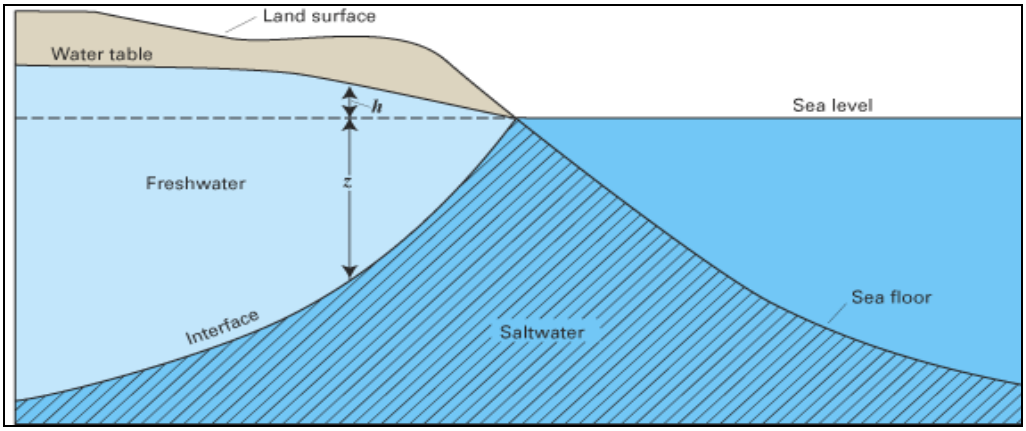


Fig 6.19: Gayphen Hyberg Principle

Long-term drop in aquifer productivity: Groundwater operates under pressure associated with the Head (in Darcy's Law) and the higher the head, the greater the pressure and associated yield. Of necessity, one of the first signs of aquifer draw down will be a drop in the yield. Indeed, in course of conducting borehole survey for this Study, the team came across numerous borehole abandoned for many reasons, loss of yield being one.

6.13 Summary Outcome from Empirical Monitoring

Empirical baseline characterization the PID traverse as reported in sections above has helped better refine the pre-project scenario and, in the process, brought out the biophysical sensitivities in preceding project implementation. The same are provided in summary form below while socio-cultural sensitivities brought out by socio-economic analysis (chapter seven) and stakeholder engagement (chapter eight) are summarised after the latter chapter.

6.13.1: Air quality condition

General prevalence of pollutants: The rural parts of the PID as represented by the junction with the MSBR at Ziwani have very low concentration of atmospheric pollutants. PM_{10}, $PM_{2.5}$, lead and carbon monoxide were detected in all the sites and therefore are the most prevalent amongst all pollutants monitored. The A14 junction with Mtongwe Road which is a busy urban road has highest concentration $PM_{10.}$

Noise Levels: Noise levels in the non urbanised areas of PID traverse are still below statutory limits especially with regard to night noise.

6.13.2: Marine water quality condition

Mombasa Island side of the Likoni Channel is apparently receiving more sediment and pollutant input from Mombasa Town with increasingly higher pollution. Thus, in proceeding with development of the proposed MSEZ and the PID, the factor of elevated pollution on the northern shoreline of the Channel should inform decisions especially for runoff disposal.

6.13.3: Marine Sediments

Sediment analysis confirmed presence of heavy metals within the Likoni channel sediments. Zinc, Chromium, Antimony and Nickel have a leading prevalence while Mercury, Silver and Arsenic were not detected. All heavy metals detected in the study area share one feature in that, they are all applied in the electroplating industry- a surprise find given that, the Port Reitz area has never hosted an electroplating facility.

6.13.4: Monitoring of Fresh Water Quality

Despite the waters being apparently polluted, they are within NEMA limits for recreation and domestic use.

6.13.5: Status of floral biodiversity

Proposed land reclamation area will affect mangrove formations which are already under severe exploitation pressure.

6.13.6: Status of avian biodiversity

Out of 102 bird species counited, 9 birds are of concern in that 1 is listed in the IUCN RED List Data on account of being vulnerable, 8 species are listed in the Agreement on the Conservation of African-Eurasian Migratory Water Birds (AEWA) and one is listed under CMS/ Raptors.

6.13.7: Status of cultural heritage biodiversity

PID operations are in close vicinity of but do not directly impact three Kayas Mkumbi, Mhongani and Jiwe lakutuza which are socially revered and reservoirs of biodiversity.

6.13.8: Status of the Tiw Aquifer

Tiwi aquifer has a possible daily allowable yield of 19,08 cubic metres based on estimated annual recharge of 6.96 Million Cubic Metres (MCM) meaning that the current demand of 20,000 cubic metres is being met through over-abstraction. Imposition of an additional daily demand of 2000 cubic meters to supply MSEZ will only exert additional abstraction pressure with known consequences in terms of aquifer drawdown and attendant threat of vertical and horizontal saline intrusion.

CHAPTER SEVEN: THE SOCIAL ECONOMIC PROFILE

7.1: Focus of The Socio-Economic Survey

The purpose of the socio-economic survey was to facilitate documentation of the baseline characteristics of the individuals along the traverse but was also used to facilitate social stratification of the potentially affected people and to document social features including wellbeing and levels of vulnerability.

7.1.1: Administrative profile

Two parallel administrative systems are operational in Kenya namely, the Central Government and County Government and both will be found within the traverse for the PID thus:-

National Government set-up

Table 7.1 shows the national government system at play within the traverse area. The PID Project traverses the two coastal Kenyan Counties of Mombasa and Kwale. Within Kwale, the PID traverse three locations in Matuga subcounty then terminates in the Mtongwe location of Likoni Sub-county in Mombasa. A total of seven sub-locations and sixteen villages are traversed.

Table 7.1: Distribution of PAPs by administrative jurisdiction

County	Sub-County	Locations	Sub-locations	Villages
Kwale	Matuga	Tiwi	Simkumbe	Chai
				Pongwe
		Waa	Kombani	Chidzumu
				Majengo Mapya
			Matuga	Dzangadzangani
				Mzangatifu
				Mwamshipi
				Gwirani
			Kitivo	Maganyakulo
		Ng'ombeni	Ng'ombeni	Maida
				Madibwani
			Kiteje	Bombo
				Kiteje Ziwani
				Mkumbi
				Kiteje 1
Mombasa	Likoni	Mtongwe	Mtongwe	Mrongondoni

Source: This Study

Parliamentary system: The Project will traverse the two constituencies of Matuga and Likoni in Kwale and Mombasa respectively.

County Government Set Up: Under the devolved system of government, the project will traverse both County 001 and County 002, Mombasa and Kwale respectively. Within Kwlae, the project falls under the Tiwi and Waa Electral Wards while in Mombasa, the PID falls under the Mtongwe Ward.

7.1.2: Population and settlement

The people:

The PID project traverse is both urban and cosmopolitan bringing together Kenyans from all tribes and races. Further, given that mainland south functions as a dormitory area for Mombasa Island, the population is largely multi-ethnic but with a strong showing of Kenyans of the Miji Kenda Group.

7.2: The Socio-economic Profile of Potentially affected population

To improve community ownership of the project, engagement approaches that calls for heavy investment on time and efforts on discussions and observations were adopted. Using local administration (Sub location chief and Village elders), affected persons were identified. The team explained to the people all the project components using printed maps. With the help of a surveyor, The PAPs were shown the proposed pipeline alignments and points at which the pipelines are affecting their properties. Data was collected between June/ July using approved ARAP questionnaire (Appendix 1.2). To enhance representation, socio-economics survey was done to 39 affected persons from the 162 affected persons.

7.2.1: Sample size in the socio-economic survey

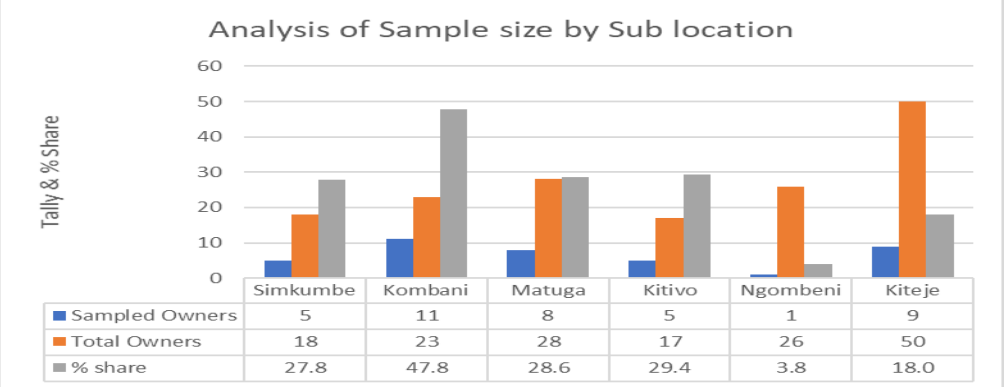
Socio-economics survey identified four main categories of property owners upon which the questionnaires were administered. The categories are:

1. Land owners: PAPs owning affected land/plots only;
2. Land and Structure owners: PAP owning both land but also have structures being affected;
3. Land, Structure and Tree: PAPs entirely owning all the affected properties;
4. Land and Tree Owners: PAPs whose securities are on land and trees alone

Figure 7.2 below shows Socio-economics sample size by property owners. The survey achieved sample size of 24.1% (39/162) across all categories of affected property owners sampled.

It is worth noting that majority of property owners have similar social and economics characteristics (having typical probability of procuring goods and services, gaining positions in life and finding inner satisfaction). Even though some socio-economics gradient exists among the PAPs, this study can confidently extrapolate the 39 (24.1%) sampled PAPs findings to the general PAPs socio-Economics conditions.

Figure 7.2: Distribution of Sampled property owners by Sub location in the project area



	Simkumbe	Kombani	Matuga	Kitivo	Ngombeni	Kiteje
Sampled Owners	5	11	8	5	1	9
Total Owners	18	23	28	17	26	50
% share	27.8	47.8	28.6	29.4	3.8	18.0

Source: This Study

7.2.2: Age characteristics of property owners

The ages of respondents were analyzed along six categories, with the youngest category being individuals aged between 20 to 30 years whereas the oldest category being individuals aged above 70 years. The dominant respondent age category is of individuals aged between 50 to 60 years account for 23.1% of the affected population. The oldest age category is significantly high representing 20.5% of the sampled population. Advances in such ages signify permanent settlement configurations among property owners in the project area, and further suggests a stronger attachment to the land and assets owned by the PAPs. Even though advance old age is an indicator of vulnerability, this project will not affect the elderly pursuant to the fact that there will be no physical displacement of PAPs. The age profile of respondents is listed in figure 7.3 below.

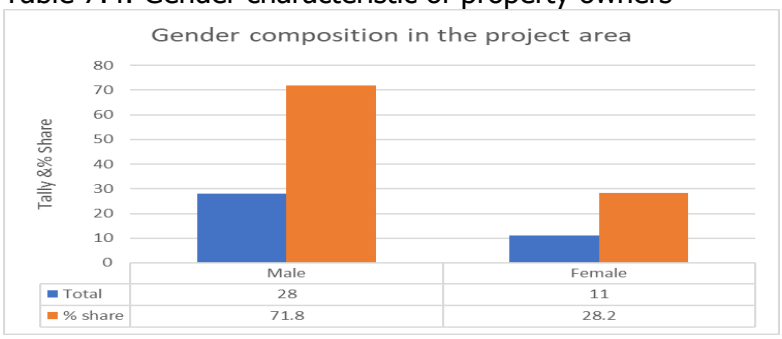
Figure 7.3: Age profile of property owners

Source: This Study

7.2.3: Gender characteristics of property owners

Gender survey among property owners sampled has depicted the project area as a male dominated corridor with 71.8% of male gender and 28.9% female gender.

Table 7.4: Gender characteristic of property owners

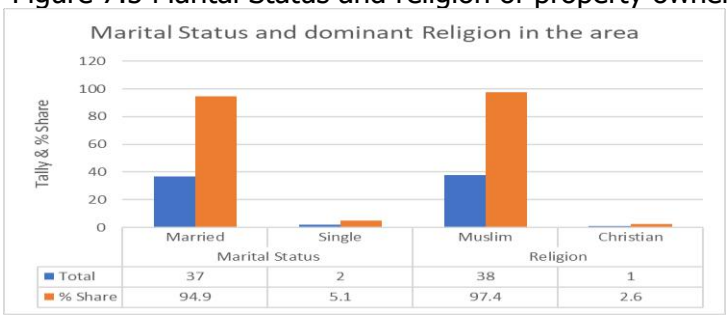


Source: This Study

7.2.4: Marital Status and Religion characteristics of property owners

The socio-economics survey Study revealed that 94.9% n=37 of all respondents are married individual and only 5.1% are single or remained unmarried/single as at the time of the survey. The survey further revealed that 97.4% n=38 of respondents are individuals of Islamic faith with only 2.6% profession Christianity.

Figure 7.5 Marital Status and religion of property owners

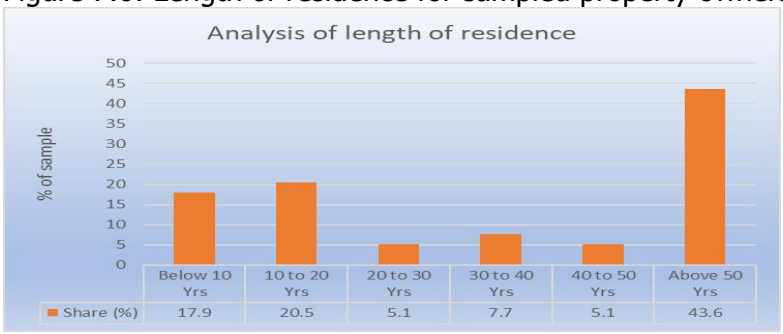


Source: This Study

7.2.5: Length of residence among respondents

A time line analysis for the PID traverse based on recorded length of residence for heads of households is presented in Fig 7.6 below. 76.9% of potential PAPs have lived in the area for over 20 years with 56.4% having lived for over 30 years. 43.6% of all PAPs have lived in the area for over 50 years implying that this is a rural ancestral settlement.

Figure 7.6: Length of residence for sampled property owners

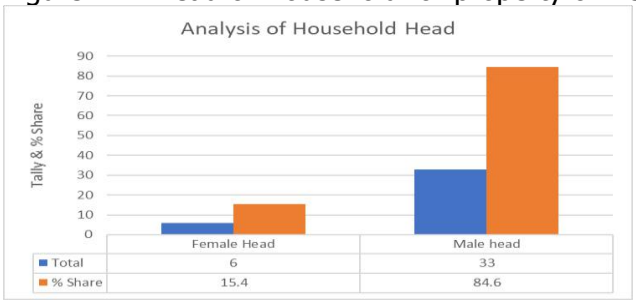


Source: This Study

7.2.6: Head of Household for property owners

Household leadership is vital in day to day decision making including decision to dispose and or acquire assets for family development. As such, the authority of the decision maker/household head must be recognized by all other household members. Results of household head are shown in Figure 7.7 below. From the figure, 84.6% n=33 of respondents have male headed household. Female headed households accounts for only 15.4% n=6 for all the sampled property owners.

Figure 7.7: Head of Household for property owners

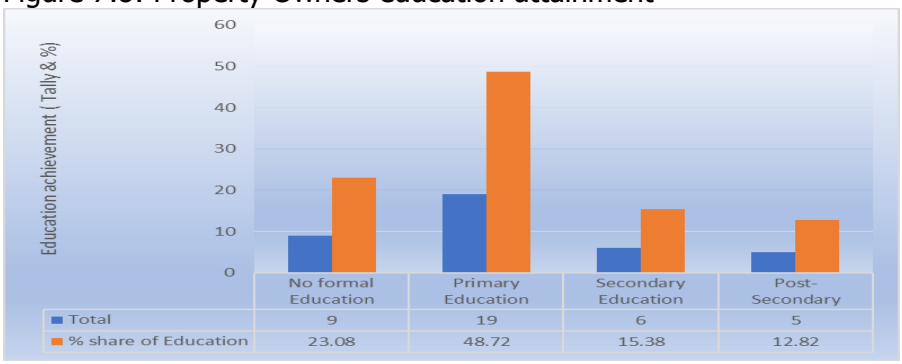


Source: This Study

7.2.7: Level of education attainment among property owners

Education level of PAPs was divided into four broad categories; PAPs with no formal education, PAPs with primary education, PAPs with secondary education and PAPs with post-secondary education as listed in figure 7.8 below. Results revealed that education attainment among property owners is random. Some property owners have high education attainment than others. However, the general education attainment pattern for the project area indicates that majority (half) of property owners have primary education followed by individuals with no formal education. Secondary and Postsecondary education both account for 38.2% of the property owner.

Figure 7.8: Property Owners education attainment

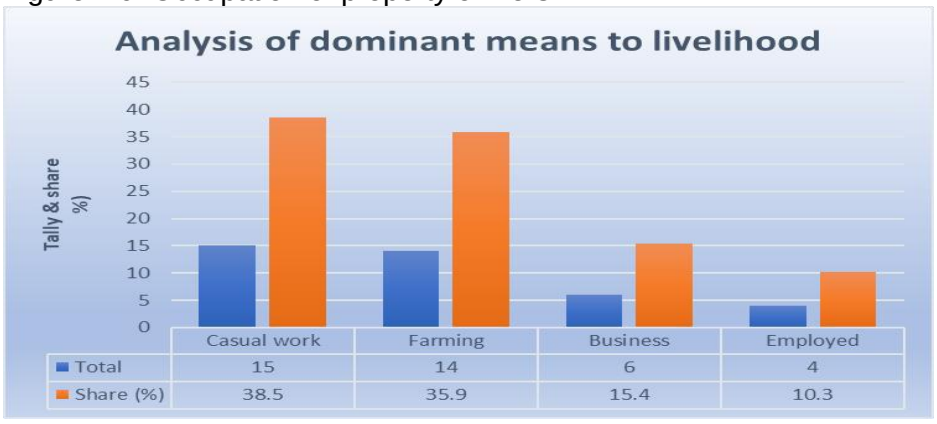


Source: This Study

7.2.8: Occupation of Property Owners

Four main occupation/livelihoods mean were documented in this study. The four main occupations are listed in figure 7.9 below. Casual work was observed to be the mainstay of the most respondents directly contributing 38.8% of the sampled property owners' means to livelihood. Another significant occupation recorded is farming activities accounting for 35.9 % of respondents. Other occupations in the project area are business activities (15.4%) and salary employment at 10.3%.

Figure 7.9: Occupation of property owners



Source: This Study

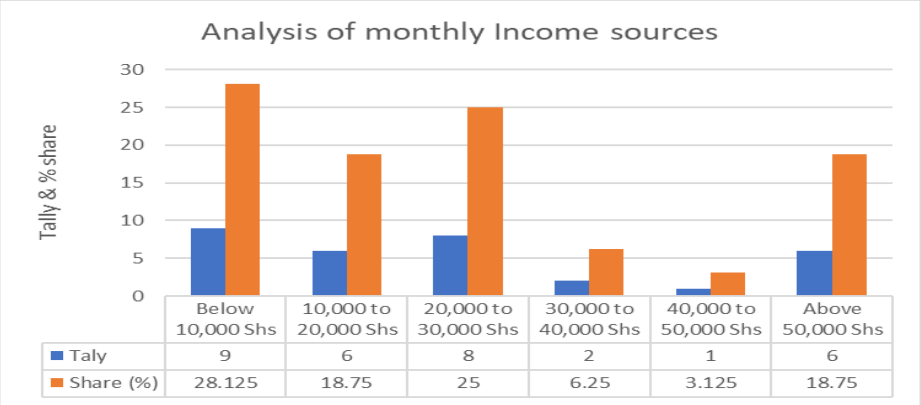
7.2.9: Income and expenditure characteristics of property owners

i. Monthly Income for property owners

Monthly incomes ranging from less than Ksh 10,000 to over Ksh. 50,000 were recorded in the survey. Analysis of monthly income revealed that majority of respondents have monthly income of

Kshs 10,000 and below which is the lowest income category recorded in this study. The highest income earning category (monthly income above 50,000 Ksh) represents 18.75% of the total sampled population in the project area. Income profiles are shown in figure 7.10 below.

Figure 7.10: Monthly income profile



Source: This Study

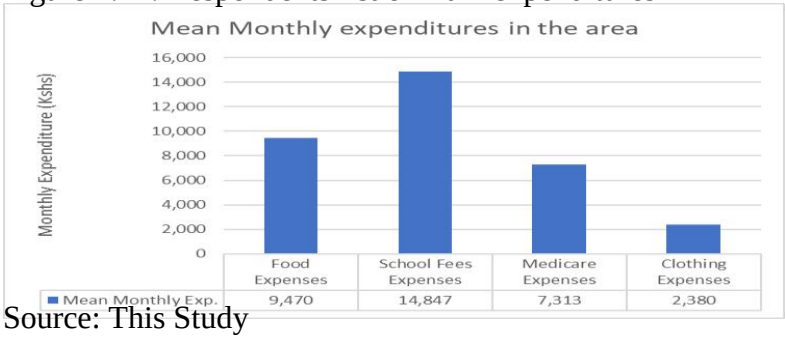
ii. Monthly expenditure for property owners

Household expenditures depend upon the available household incomes. Monthly expenditure profile for respondents are shown in Figure 7.11 below. From the table, Majority of respondents spends below 10,000 Ksh per month. However, the mean monthly expenditure for the sampled population is recorded as 17,105 Ksh per month. The list of main expenditures for sampled property owners is shown in figure 7.12

Figure 7.11: Expenditure profile for respondents

Source: This Study

Figure 7.12: Respondents list of main expenditures



Source: This Study

CHAPTER EIGHT: CONSULTATIVE PUBLIC PARTICIPATION

This Chapter outlines the progress and outcome of Stakeholder engagement under auspices of the ESIA for the PID.

8.1: Legal Foundation for Stakeholder Consultation In Kenya

8.1.1: Provisions of the National Constitution

Section 35 of the National Constitution 2010 provides for access to information as follows: *35. (1) Every citizen has the right of access to (a) information held by the State; and (b) information held by another person and required for the exercise or protection of any right or fundamental freedom.* Further, Section 69 (1) (d) requires the State to encourage public participation in the management, protection and conservation of the environment, thereby giving legal foundation for stakeholder consultation in environmental assessment process. Stakeholder consultation as conducted for this ESIA was partly in fulfilment to above stated legal obligations.

8.1.2: Requirements of EMCA 1999 (Cap 387)

Legal Notice 101 of June 2003 requires that all environmental assessment process in Kenya to incorporate public consultation. This is a requirement informed by the awareness that stakeholders are largely in the constituency likely to be impacted by proposed developments and it is imperative that they be informed of the project following which they can make informed comments and reactions to the proposed development. It is also important to ensure that all stakeholder concerns as well as aspirations are identified and incorporated in project development, implementation and operation. Against such background, a number of consultations have been undertaken with cross sections of stakeholders to the PID with objectives as follows:-

i. To inform primary, secondary and other stakeholders of the proposed development;
ii. To clarify stakeholder interests and concerns in the project area;
iii. To better define scope and magnitude of potential impacts of implementing the project based on stakeholders' feedback.

8.2: Approach to Stakeholder Analysis

8.2.1: The Strategic Approach

In addition to fulfilling statutory requirement for Project Disclosure, stakeholder engagement should also aim at securing informed consent and support of potentially affected community which requires that an effective communication/ consensus building strategy be identified and implemented. In the case of ESIA for PID, consensus building was achieved at multiple levels as schematically illustrated in tabular form below.

Strategy in the Public Engagement Process in the ESIA for PID

Action level	Stage One	Stage Two	Stage Three	Stage Four	Stage Fiver
Aim	Prepare dissemination material	Build consensus on approach	Market Project to Leaders	Engage with community groups	Investigate emergent concerns
Action	Prepare Disclosure Materia	Identify and engage core Leaders	Mount Leaders Meeting	Mount Public Hearing Meetings	Key Informant Interviews and FGDs
Outcome	Disclosure package	Date for Leaders meeting	Consensus on Public Hearing Meetings	Core Public Concerns	Better analysis of issues and core concerns
Next action	Proceed to stage Two	Proceed to Stage Three	Proceed to Stage Four	Proceed to Stage Five	Documentation of core concerns on the Project

The core strategy was to principally build consensus among political and administrative leadership who then facilitated entry and engagement with communities. Even in case where issues arose from communities as was the case with Chai Community, the fall back position was always to get the Leadership to intervene.

8.2.2: Criteria for Stakeholder Identification/Stratification

Diverse categories of stakeholders are encountered within the traverse of the PID and access roads. For ease of treatment and study, stakeholders were lumped into three broad categories as follows:-

- Fundamental Rights Holders
- Legal Mandate Holders
- Marine Trade Stakeholders
- Third Party Interests

Core features and groups within each broad category are highlighted in sections below.

(i) Fundamental Rights Holders (FRH):

A total of 11 groups which hold fundamental rights in the traverse area for PID Project were identified as summarised in Table 8.1 below. The fundamental rights extend far beyond national borders and are shared by generations yet to be born who have an inherent entitlement to a healthy, functional environment.

Table 8.1: Analysis of Fundamental Rights Holders in the PID Traverse

SN	Stakeholder category	Stake in the Mombasa PID
1.	Kenyan citizens present and in future	Constitutional /inherent right to a clean health environment
2.	Global community	Inherent right to a preserved functional global ecosystem
3.	Residents of Kenya's Mainland South	Inherent right to sustainable economic development
4.	Stakeholders to land	This category includes individual, corporate and other categories of owners and occupants to land and land-based resources in the traverse area.
5.	Investors within the traverse	This category includes all persons who have invested in property, trade, utilities and other ventures within the traverse and Mainland south.
6.	Residents along the traverse	These is the category who will have their lives changed either on account of displacement from private or common property (schools, medicare centers, places of worship, cemeteries, etc), intensified pressure from land speculators, exposure to traffic accidents, imposition of barriers to movement and access to resources, among others.
7.	Ancestral/ sentimental heritage holders	They hold special sentimental value to the property /business on account of many years of residence
8.	Traditional religious heritage holders	This category includes subscribers of the Kaya culture based on traditional religious sites/ shrines that could be displaced
9.	Vulnerable Groups	This category comprises individuals or groups who are disadvantaged in life either on account of advanced age, physical, mental, illness or other challenges.

10.	Nature-based livelihood systems	People operating livelihood systems such as traditional artisanal fishing, extraction, etc are likely to suffer displacement or blockage from resources that sustain livelihoods systems.
11.	Operators of capital resources	This category includes utility providers owning water, power supply and oil pipelines which may be affected by the project

(ii) Legal Mandate Holders (LMH) within target jurisdiction:

Stakeholders identified under this category include those in National Government, County Government and State Corporations whose mandates confer jurisdiction over areas traversed by PID. From analysis of the legal framework as documented in Chapter Four, 20 Statutes are deemed to have over-bearing influence on the area to be traversed by the PID while simultaneously conferring specific mandates to 21 respective institutions (
Table **8.**) as the *bona fide* Legal Mandate Holders for the area.

Table 8.2: Analysis of Legal Planning Mandates covering the PID traverse area

SN	Legal Tool	Custodian	Legal mandate	Relevance to PID Project
1.	KPA Act	Kenya Ports Authority	Has mandate in developing Marine Transport in Kenya	KPA is proponent in the PID
2.	Schedule 4 to National Constitution 2010	Allocates non devolved functions for National Government	Coordination of National Government	Administrative oversight, security functions in bridge development and operation
3.	Kenya Roads Act 2007	KeNHA	Development and maintenance of classified roads in Kenya	KeNHA controls the A7 highway reserve targeted to conduct PID infrastructure
		Same Act creates KeRRA and KURA	Jurisdiction over rural and urban non-classified roads	KeRRA roads will also be exploit to conduct pipelines between Tiwi and Dongo Kundu
4.	The Physical Planning Act Cap 286	State Department of Physical Planning	Coordinate all spatial planning at National and county level	Proposed development of PID has to harmonize with both National and County Spatial Plans
5.	County Government Act of 2012	County Government of Mombasa and Kwale	Have planning jurisdiction for Mombasa County	Planning for PID has to harmonize with Mombasa County CPID and CSP
6.	CDA Act Cap 446	CDA	Coordinate all development Planning in the Coast region	Has undertaken spatial planning for the area under jurisdiction
7.	WMCA 2013	KWS	Manage and preserve the national wildlife heritage	Traverse area has special case birds
8.	Museums and Heritage Act of 2006	NMK	Protection of the cultural and archaeological heritage	Entire coastal strip has a sensitive archaeology
9.	Water Act 2002	WRMA	Management of the National water resource base	Construction in riparian areas requires WRMA approval
10.	Forests Act 2005	KFS	National custodian for all vegetation including	Mangrove formations fall under Jurisdiction of KFS.
11.	National Land Commission Act 2012	National Land Commission	NLC is designated Land Acquiring Authority in Kenya	NLC will acquire land for the PID

SN	Legal Tool	Custodian	Legal mandate	Relevance to PID Project
12.	EMCA 1999/2015	NEMA	Has national mandate for environmental regulation.	Need for PID to conform to environmental regulatory standards set by NEMA.
13.	Fisheries Act	State Dept of Fisheries	Management of the fisheries resource base	Has jurisdiction over fisheries
20	Kenya Civil Aviation Act, Cap 394	KCAA	Develop and operate a safe, economically sustainable and efficient civil aviation system	Dongo Kundu falls within recovery radius imposed by the KCAA

Source: ESIA Study Team

8.2.3: Stages in Stakeholder Consultation

Stakeholder Consultation in the ARAP process took place at 4 levels namely:-

- Leaders Meetings at County Level
- Public Hearing Meetings
- Key Informant (Technical Level) Interviews and,
- Technical Consultative Forums

Progress achieved under each stage is highlighted in sections below.

8.3: Progress and Outcome from Stakeholder Engagement

8.3.1: General progress/ The Statistics

Appendix 8.1 provides a full dossier on outcome of the Stakeholder Engagement Process for this RAP, data on which is summarised in Table 4.2 below. A total of 38 formal forums were arranged during which 951 stakeholders were met. Many more stakeholders were met during the Census survey and asset inventory implying that probably over 1000 people were engaged as part of this RAP.

8.3.2: The Leaders Meetings

The entry point to all stakeholder engagement and indeed the ARAP process was Leaders Meetings largely called to market the proposed Project to Local Leadership who, upon being convinced would spearhead the process of introducing the project to target grassroots communities. Given that the PID spans the two Counties of Kwale and Mombasa, two (2) separate meetings targeting sub-County level leadership in Matuga (Kwale) and Likoni (Mombasa) were held bringing together 198 diverse leaders from National Government, County Government, Politicians (MPs and MCAs), security apparatus, GOK Agencies among others. These forums served as community sounding boards from which preliminary public concerns on the proposed project bounced off thus helping to shape and inform preparations for the Public Hearing Meetings.

8.3.3: Public Hearing Meetings

As part of the business transacted during Leaders Meetings, schedules for holding Public Hearing Meetings in all locations in respective sub-Counties were made and immediately rolled out. Six Public Hearing Meetings were held at sublocation level for purposes of engaging with local communities inclusive of potential PAPs. A core agenda in the meetings was to build consensus on the distribution and location of 10 Water Kiosks to be provided under the PID. Other matters addressed during the Public Hearing include:-

- The Project was explained to affected communities
- The process and procedure in Census Survey were explained,

- A Cut Off date was proclaimed,
- Consensus was built on the way forward,
- Villagers were given an opportunity to raise concerns on the Project,
- The schedule and programme for Census Survey was discussed and adopted.

As will appear in Table 8.2, a second public hearing meeting was held at Chai Primary (Item 35 in Table 4.2) for purposes of addressing grievances raised during the first meetings which was more.

Table 8.2: Summary outcome of Stakeholder Engagement

SN	Type of meeting	Date	Venue of meeting	Male	Femal	Total
1	Planning Meetings (3)	21/06/2019	Likoni DCC at Mombasa Golf Club	7	1	8
2		21/06/2019	CWSB at Tiwi Pumping Station	6	1	7
3		21/06/2019	Kwale WASSCO Meter Office-Tiwi	1	2	3
4	Leaders Meetings (2)	2019-12-07	ACK Guest House Likoni-Mombasa	93	33	126
5		15/07/2019	Kenya School of Government,Matuga	53	19	72
6	Key Informant	16/07/2019	Kenya Water Towers Agency-Coast Region	3	3	6
7	Interviews (21)	23/07/2019	NEMA office-Mombasa	5	4	9
8		24/07/2018	KWASCO office	9	6	15
9		24/07/2019	NEMA Kwale County (CDE Out of office)	1	2	3
10		24/07/2019	KFS Office- Kwale County	4	4	8
11		24/07/2019	KWS Office -Kwale County	5	4	9
12		25/07/2019	Department of Environment and Natural Resources-	3	6	9
13		25/07/2019	Physical Planning Office- Kwale County	4	4	8
14		25/07/2019	Roads and Public Works- Kwale County	3	4	7
15		30/07/2019	Mbunguni WRUA Office	3	2	5
16		30/07/2019	TUKO NA HOPE CBO- Office	3	2	5
17		21/08/2019	South Coast Local Tour Operators- Diani	7	4	11
18		23/08/2019	Kwale Human Rights Network - Ukunda Office	7	4	11
19		23/08/2019	South Coast Resident Association- Diani Office	3	2	5
20		26/08/2019	Tiwi M.C.A Office	5	3	8
21		26/08/2019	Sauti ya Wanawake- Tiwi	2	7	9
22		27/08/2019	World Wide Fund for Nature - Ukunda office	2	3	5
23		27/08/2019	Kwale County Natural Resources Network -Ukunda	3	4	7
24		27/08/2019	National Museums of Kenya- Kwale County- CFCU	3	2	5
25		28/08/2019	Coast Development Authority - Mombasa	3	8	11
26		30/07/2019	WRA CR Offices-Miritini	2	1	3
27		30/07/2019	KWTA Offices -Miritini	2	1	3
28	Public Hearing	25/07/2019	Borehole 1 intake site-Chai - Simkumbe Sublocation	43	20	63
29	Meetings (8)	26/07/2019	Waa Primary- Kombani Central Sub Location	72	67	139
30		29/07/2019	Kombani Social Hall - Kombani Sub location	31	12	43
31		29/07/2019	Chidzumu Primary School - Kombani Sub Location	22	17	39
32		30/07/2019	Kiteje Mwembe- Kiteje Sub location	51	32	83
33		31/07/2019	Borehole 3 intake site- Dzangazangani - Matuga Sub	36	26	62
34		28/08/2019	Madibwani - Ng'ombeni Sublocation	19	11	30
35		2019-05-09	Borehole 1 intake site-Chai - Simkumbe Sublocation	66	17	83
36	Cordination Meetings	19/09/2019	Kwale Water - Hamonisation of Water Kiosk sites	2	1	3
37	(3)	20/08/2019	Corporate Afairs Dept of KPA at KPA Board Room	9	5	14
38		29/07/2019	Consultations with the County Secretary for Kwale	3	3	6
39		22/08/2019	Kwale County Government at Health Boardroom	10	4	14
40	**Total (38)**			**606**	**351**	**957**

Source: This Study

8.3.4: Key Informant Interviews

Under this category, a cross section of stakeholders, key among them Legal Mandate Holders:- civil servants, County Government, Lead Agencies (KWS, WRA, KWTA, KFS, CWSB, NMK, etc) were engaged for purposes on interrogating issues within their mandate. Consultations took place in respective offices and in the field where possible. Consultations were made either with individual officers or in Focus Group Discussions involving several officers in a group. For this category of stakeholders, a semi-structured questionnaire was used. Discussions started with the consultant team explaining the project to the target officer following which, they were asked to identify their fundamental concerns on the same. After discussion, the officers were requested to fill and sign the form administered by the consultant. This system was deemed useful and as a strategy to cut down on paperwork work while capturing signed comments of target informants. Core outcome of such engagement is reported in sections below.

8.3.5: Planning and Coordination Meetings

Planning and coordination meetings were held either to seek support of certain Agencies in rolling out the ARAP Study or to explain the Project to strategic Coordinators as was the case with Kwale County Government and the Kenya Ports Authority. A total of five such meetings were held.

8.4: Core issues arising from Stakeholder Engagement

8.4.1: General Outcome

This section analysis in summary form outcome from the entire stakeholder engagement process. Numerous issues were raised, concerns pointed out and frustrations expressed but general conclusions can be made as follows:-

i) **Both the Mombasa Special Economic Zone and its Infrastructure Complement enjoy overwhelming Support:** This study did not encounter any die-hard opposition to both projects and indeed, public expectation is building. The Chai Community came up will a long list of expected benefits to be reaped from association with both projects.

ii) **Property owners are sceptical on prospect of compensation:** Owners of property especially land and trees likely to be displaced by the PID are sceptical that compensation as pledged may never materialize.

iii) The Question of Water extraction for Export to Mombasa County: By far, this is the most pertinence concern in developing the PID. Kwale County is concerned that their groundwater resource is increasingly being exploited to feed Mombasa County, yet their taps remain dry, their homesteads go without reliable sources of portable water. The Chai Community even refused to do business with the RSP Team unless this question is satisfactorily resolved.

iv) Benefits of the MSEZ to Kwale County: Sections of Kwale County, which shares a boundary with the MSEZ are at pains to conceive the potential benefits accruing to Kwale County from MSEZ given its restriction to Mombasa.

Concerns specific to each broad category of stakeholders are highlighted in section below.

8.4.2: Concerns emanating from the Mombasa Leaders' Meeting

Table 8.3 provides a summary of core issues from the Leaders' meetings.
The PID disclosure meeting for Mombasa intentionally combined two agendas namely:-

- To disclose findings of the ARAP for MSEZ to Dongo Kundu Community and
- To disclose the PID to Dongo Kundu Community.

Table 8.3: Outcome from the Mombasa County Leaders' Meeting held at ACK Guest House

SN	Category of Stakeholder	Organization	M	F	T	Meeting Outcome
1	National Government officials	Office of the MP, Interior and coordination, NGAO,	12	2	14	Consultation with Kwale County Government before extraction of water is needed; JICA had drilled several boreholes in Kwale to supply water to the Special Economic Zone. Water for Mombasa Special Economic Zone was to be sourced from Mwache Dam whose implementation has delayed; Project to benefit locals through installation of Seven water kiosks are to supply water to the community; Integrated system option in the compensation approach is the best option, a public meeting with the locals would be held to disclose the outcome of the RAP
2	County Government representatives	Office of the senator, MCA's office, MOWASSCO, NGAAF, PSC,	17	4	21	
3	Lead Agencies (NEMA, KFS, etc)	NEMA, KFS, KPA, NMK, CWWDA, Navy,	5	1	6	
4	Non- Governmental Organizations	ShikaAdabu Disability group, Peace and cohesion, Hekima community organization,	9	3	12	
5	JICA and Repcon Consultants	JICA study team, Repcon Consultants	5	5	10	
6	SEZ Committee members	SEZ committee	7	5	12	
7	Others (religious, associations and Civil Societies)	Likoni queens, Likoni stars, Likoni Staerlets, URAIA, PSC, Mombasa- Kilindini CFA, Sauti ya wanawake, Party leader ODM, Youth Leaders, Jipemoyo com, Smart mentorship centre, KIYO, Sheikh, Pastor, Bodaboda committee	38	13	51	
	Total		93	33	126	

As expected, the meeting's record attendance of 126 accounted for the bulk of time and effort discussing the ARAP for the MSEZ which incidentally, is also the ARAP for the DK Section of the PID. Representatives of PAPs were eager to be told when and how they would be compensated in the land acquisition for MSEZ. Ultimately, it was understood that with their land being acquired for the MSEZ, the Project on PID would ride on the same impact. Their preference was for their land to be acquired under the SEZ so as to avoid a second round of acquisitions under the PID.

Table 8.4: Outcome from the Kwale County Leaders' Meeting -KSG Matuga

Data	Meeting Outcome
Date: 15/07/2019 **Venue:** Kenya School of Government, Matuga **Attendance:** 72 (Male 53, Female 19)	• Kwale Residents lack access to clean and save water for drinking; • Provide water to Kwale residents before transmitting water to Mombasa; • Uncontrolled drilling of boreholes and digging of wells is affecting Tiwi aquifer; • More stakeholders to be brought on board as part of stakeholder mapping; • Locations of water kiosks will be proposed by the local residents, • Studies to identify other suitable aquifers should be considered; • Tiwi aquifer is being affected by sand harvesting and over abstraction;

Data	Meeting Outcome
	• Proceed with consultative meetings at location level; • Reporting and disclosure is to be done at each and every stage; • Coast Water works Agency does not distribute water equitably as more water goes to Mombasa County than Kwale County; • Most of water networks managed by Coast Water are dilapidated and vandalized this has constrained water supply to the locals; • Consultants to work closely with political leaders;

8.4.3: Concerns emanating from the Kwale (Matuga GTI) Leaders' Meeting

Proceedings of the Matuga Meeting are summarised in Table 8.4 above. Core issues emerged as follows:-

- **The Question of water transfer to Mombasa County:** From Table 8.3 above, discussions in the Kwale Leaders' meeting largely cantered on the Question of Water. The shared concern was that water us being diverted to Mombasa from Kwale while local residents do not have access to reliable water. The blame seemed to be directed to the Coast Water Development Agency (formerly CWSB) who was accused of supplying more water to Mombasa at the expense of Kwale. It was observed that the water infrastructure operated by the CWDA in Kwale is dilapidated and in need of repair. As well, water needs of Kwale should be first addressed before moving to supply areas outside of County.

  The Kwale WASSCO clarified that MSEZ had targeted to source water from the World Bank funded Mwache Dam but since development of this source had suffered delay, the PID was designed as a stop gap measure. Once Mwache is operational, the PID system would revert to supply Kwale.

- **Cumulative impacts from groundwater exploitation:** The meeting was concerned that non-controlled drilling of boreholes is likely to affect groundwater resource in the area. It was further observed that this aquifer was threatened by sand harvesting and other non sustainable land use practices. The meeting observed the need for expanded studies to identify other aquifers in the region.

- **Need to reach out to other stakeholders:** The meeting observed the need for consultations to be extended to other stakeholders especially the Roads Agencies responsible for target road reserves. Indeed, it was recommended that the Study to work in close consultation with Political Leadership.

8.4.4: Concerns emanating from the internal consultation with Kwale County Government

In course of undertaking Key Stakeholder Interviews, the Department of lands at Kwale County expressed concern that the PID had not been adequately disseminating within Kwale County Government as some Departments seemed to be in the dark. Subsequently, upon consultation with the County Secretary (Item 38 of Table 8.2), a meeting was arranged for senior management of Kwale County with a view to disseminating the PID. The latter meeting (Item 39 in Table 8.2) was chaired by the CEC for Roads and Infrastructure and brought together 4 senior officers from KCG, 3 from KPA, 2 from the JST and 5 from the Consultant and served largely to clarify any issues outstanding on the study to facilitate smooth implementation. The consultant took advantage of the meeting to raise concerns as follows:-

- Some Department of KCG were apparently not aware of the PID in spite of having participated in the Leaders Meeting held for Kwale Country of GTI Matuga;
- The Consultant was yet to receive data on layout of the Tiwi pumping station from either CWWDA and KWASSCO;
- Lack of consensus on location of Water Kiosks;
- Dispute at Chai Village (Borehole 1) whereby community had turned hostile to the PID on concerns of unfair water allocation between Kwale and Mombasa

Upon discussion, matters were clarified as follows:-

Stand of the KCG regarding MSEZ and PID: The Chair clarified that the entire KCG led by the Governor was in full support of the MSEZ and was actually leveraging so as to tap benefits from his GoK undertaking. KCG will give all support required in actualising the ESIA and RSAP for PID.

Availability of data form KWSSCO: The Consultant was directed by the CO water to pick all information from the KWSSCO CEO Mr Chalala. This information is however yet to be availed.

Regarding allocation of Water Kiosks: It was agreed that a team comprising the ARAP Consultant, KWALE WASSCO, JST, Sub County Water Engineer (Matuga), Ward Admin should meet and harmonize on location of water Kiosks. It however emerged that Kiosk location at Bombo site was contentious as the community was in preference to a location near water consumption area which is about 900m away from the Distribution Pipeline. Nobody between JST, KPA and KCG had a solution to financing the 900m of piping required to bridge the gap. After discussion, it was agreed that all parties will work towards identifying means to solving this problem.

The dispute at Chai Village: Regarding Chai, it was agreed that the Consultant should have involved the KCG in mounting the Public Hearing Meeting. This is because KCG has many interventions planned and ongoing on water supply in Matuga SC including Chai and such information should have resolved concerns by Chai. It was agreed that a second round of PH Meeting be held at Tiwi to be addressed by the Sub County Staff on Water, Ward Administration, Kwale Water Company among others. This second meeting at Chai (Item 35 in Table 4.2) was held on 5th September 2019 with representation from KCG and was able to resolve all concerns (See 8.4.5 below).

8.4.5: Concerns from Public Hearing Meetings

A total of Eight (8) Public Hearing Meetings were held under auspices of the ESIA and ARAP Studies for the PID as outlined in items 28-35 of Table 4.2. Issues emerging from this sector of public engagement are outlined under specific headings below.

Meetings at Intake No. 1-Chai Village: A Public Consultation meeting was held at the grounds of Chia Primary School on 25th July 2019 to cover Simkube Village which houses Borehole No 1. The meeting proceeded well with the Consultant being accorded all time to make a presentation in disclosure of the PID. In their reaction, the community expressed utter dissatisfaction centered on the following issues:-

- Community are concerned that their water has largely been extracted and pumped to Mombasa yet their taps have remained dry. Much as they have been promised support in return for their water, the same has not been forthcoming.
- Community is also concerned that, due to drilling of many boreholes, salinity is on the increase causing some boreholes to be abandoned. A total of 5 boreholes have been abandoned.

- Community is therefore unwilling to support another Project which will exploit and export their resource, endanger their groundwater and leave their taps dry.
- After discussion, the consultant was sent away to consult with the County Government which was not represented in the meeting and to reschedule a follow-up meeting to give community time to consult internally and build consensus on their demands on the PID.

Proceeding of the Second Meeting at Chai Village: As appointed, and in consultation with the KCG, a second meeting was held at Chai Village (Item 35 in Table 4.2) purposely to obtain feedback from the community and to allow the Team from Kwale County Government to clarify on issues of concern. Chai community through Mr. Said Salim Mwajao (Chairman, Tiwi Development Committee) started off by repeating their grievance about water being diverted to the MSEZ while their taps remained dry inspite of having six (6) boreholes in locality, and proceeded to read a list of demands previously agreed upon in a community meeting held at Tiwi Social Hall thus:-

i) Provide five (5) water points to be installed at Machema, Sports, Sokoni, Pongwe and Chai Primary School;
ii) Renovate three (3) primary schools in Chai village;
iii) Offer on permanent basis employment opportunities (skilled and unskilled labour) for the youths;
iv) Sponsor needy students at both secondary and University level; and
v) Compensate people's properties affected during project implementation.

Other complaints were made as follows:-

- On the question of land acquisition, the community is concerned that land previously acquired for development of public boreholes had not been compensated,
- Residents also complained that water bills remained high even when water was not consumed.
- Rainfed cropping was no longer reliable and construction of a dam at Wamivi would provide badly needed irrigation water which would enable community to adopt market agriculture.

In reaction, both the Consultant and KCG Team clarified as follows:-

- On the question of Water Supply, Mr. Mwinyi Juma Bwika (sub-County Water Officer) stated that there are boreholes being proposed for drilling. In addition, some boreholes have such as the one next to Mwanyaya, borehole next to the mosque, borehole at Chikola, at Chai mosque and at Mzee Mwachema's homestead have already been drilled by the KCG and only require equipping. All these will serve Chai Community when operational.
- On the demand for water supply, the consultant explained that each BH developed under the PID would be equipped with a Water Kiosk for community Water Supply. The proposal regarding other water site as requested will be escalated to KCG.
- Regarding the question of scholarships, community was advised to approach the County Government through the Ward Leadership.
- Regarding request for job, the community was assured that all labour in the construction of PID pipelines would be sourced locally. The community was immediately requested by the Consultant to identify three young men to be employed as security guards in the Borehole sites.
- On the question of displacement of property, it was clarified that land on which all three boreholes were drilled had been acquired through sale. Further, PID pipelines would exploit existing road reserves but where private property was affected, the same would be compensated for.
- On the way forward with the ESIA and ARAP Studies, the community was alerted that many consultants would visit the area to conduct studies. As well, asset inventory for ARAP would

start Monday 9th September 2019 and people should be available to identify their properties during normal working days while two elders would be hired to accompany the ARAP Team.

- The date of this meeting, 5th September 2019 at 1:15am was therefore declared a Cut Off Date for purposes of ARAP in Chai Village.

8.4.6: Concerns from other (6 No) Public Hearing Meetings

From experience, Chai Village is the only site where aggression against the project was encountered. All other villages were quite welcoming to the PID and associated studies and will therefore be analysed as a group. Generally concerns were expressed as follows:-

Some roads existing on the ground had not been surveyed: An emerging trend is that, some road reserves targeted for exploitation by the PID had not been surveyed and reserved by respective Agencies in which case, they were part of private land causing owners to wonder whether such would be compensated. It was clarified that all private property affected by the PID would be clarified.

- **On the question of compensation**: Yet still, all communities wanted a guarantee that affected properties would be compensated. An assurance was given that property would be compensated for before ground breaking.
- **Location of water kiosks:** Each community debated and made comments on suitable location of water Kiosks.
- **On employment:** Communities are near unanimous on the need to be allowed access to jobs during construction of the PID.
- **Direct connection of households to the Main Distribution Line**: Community members requested to know whether they would be allowed to tap water from the distribution line along the traverse but this could not be possible.

Table 8.5: Outcome of other Public Hearing Meetings

S/N	Meeting Details	Attendance	Meeting Outcome
25	Public consultation meeting at Waa Village **Venue:** Waa Primary- Kombani Central sublocation Date: 26/07/2019	139	All members in the public baraza proposed that a water kiosk be placed at Waa Primary School and another one at Waa Boys High School; Consultants were requested by the community to continue with engagements with them in decision making at all stages of the project; The community sought to know what would happen if the pipeline passed through their property and were informed that compensation would be done before start of civil work.
26	Public consultation meeting at Kombani Village **Venue:** Kombani Social Hall - Kombani sublocation Date: 29/07/2019	43	The community wanted to understand why an ornithologist was part of the team. They were informed that various research studies were being undertaken on the project on all biodiversity likely to be affected; Connecting water into individual homes from the distribution pipeline would not be allowed as requested by the community; the community also wanted to access water from the kiosks freely but they would be charged a fee to sustain and manage the water kiosk; CBOs and self-help groups in the area were proposed to manage the water kiosks;

			the local community requested to get the opportunity to provide labour during excavation; the community proposed a water kiosk at Waa Primary School.
27	Public consultation meeting at Chidzumu Village **Venue:** Chidzumu Primary School - Kombani sublocation Date: 29/07/2019	39	Community members insisted that the existing road was part of their land as it had not been acquired. The road therefore traversed their land; community members requested the team from Repcon Associates to investigate with County roads department and KERRA to get clear information on the status of the roads to the borehole, a water kiosk was proposed to be placed at Chidzumu primary school, the local community requested to get employment opportunities during excavation.
28	Public consultation meeting at Kiteje **Venue:** Kiteje Mwembe- Kiteje sublocation Date: 30/07/2019	83	Members requested to know what would happen if their properties were affected and were informed that compensation would be done on all affected properties, local self-help groups or a CBO was proposed to manage water kiosks, local residents requested to provide labour during excavation, Residents wanted to know how an ornithologist was part of the water project and were informed that the team was conducting biodiversity studies on both flora and fauna around the area, Community members requested to know whether they would be allowed to tap water from the distribution line along the traverse where they were informed that it could not be possible , water kiosks were proposed to be placed at Mwembe-Korosho and Mkumbi mosque
31	Public consultation meeting at BH Three Dzangazangani **Venue:** Borehole 3 intake site- Dzangazangani - Matuga Sub location Date: 31/07/2019	62	A water kiosk was proposed to be placed at the borehole site and be managed by a self-help group or a CBO, The community was inquiring whether there would be charges on water from the water kiosks and were informed that charges would only be for maintenance of the kiosk, community members requested to provide labour force during implementation, community members sought to know what would happen if their properties were affected and were informed that compensation would be done before start of civil work, members sought to know why a bird expert would be part of the project and were informed that various experts would be working in the traverse to help in biodiversity mapping , Community members wanted to know whether they can tap water to their homes and were informed that it will not be allowed as it might leave no water to reticulate to the water kiosks, Community members requested that engagements with them in decision making to continue during all stages of the project
32	Public consultation at Mdibwani	30	Water kiosks proposed to be placed at Denyenye primary School, at the mosque and at Salama

	Venue: Madibwani - Ng'ombeni Sub-location Date: 28/08/2019		Bora's Homestead, local community in the project area requested to be employed during excavation, local community members will not be allowed to tap water from the distribution pipeline as they had requested.

8.4.7: Outcome of consultation with Key Informants

A summary outcome of Key Informant Interviews is presented in Table 8.7 below. The bulk of comments pertain to conservation while those related to land acquisition largely emanated when the Study Team sought information and data on the management jurisdiction of reserves targeted by the PID. Core among this was the instruction by KeRRA for PID infrastructure to be restricted to within 2 metres of the external boundary of roads.

Table 8.7: Summary outcome from Key Informant Interviews

Institution	Core issues raised
Kenya Water Towers- Coast Region	1) Catchment degradation within Tiwi Aquifer; 2) Sustainable harvesting of ground water resources; 3) Catchment characteristics and conservation of catchment area; 4) Displacement of assets during construction period and compensation of project affected persons; 5) Employment opportunities in PID; 6) Stakeholders engagement in decision making and water management; and 7) Political cohesion and considerations.
Mombasa NEMA Office: County Director- NEMA	8) Effluent waste management and common effluent plan requirements; 9) Categorization of impacts and risks for PID; 10) Storm water management; and 11) Collaboration with relevant agencies for PID approvals
KFS-Kwale County Ecosystem Conservator	12) Presence of endangered flora and fauna species in the project area; 13) Unique ecological formations in the project area; 14) Permission to remove project affected trees; 15) Biological and cultural significance of forests in decision making; 16) Community Forest Associations in the project area; and 17) Core conservational challenges in the project area.
Kenya Wildlife Service (KWS)	18) Presence of wildlife corridor in the project area; 19) Endangered wildlife in the project;
County Government of Kwale Department of Environment and Natural Resources.	20) Modalities for engagement with Kwale County Government executives; 21) Details of land adjudication and right of way for pipeline; 22) Stakeholder mapping and engagements.
Physical Planning Office- Kwale County	23) Identification and management of road reserve for county roads; and 24) Availability of spatial planning data of the project area.
County Government of Kwale Road and Public Works	25) Terms and condition for using County designated roads for water utilities; 26) Road Reserves for pipeline transmissions; and 27) Future and or proposed development plans targeting the proposed County roads.
Tsunza- Mbunguni Community Forest Association and Mbunguni WRUA	28) Sub Catchment degradation & other challenges within Mbunguni WRUA; and 29) Management of the ten water Kiosks.

Institution	Core issues raised
TUKO NA HOPE CBO-Simkumbe Sub Location	30) Unequitable share and distribution of water resources in Tiwi location; 31) Proposed locations of the 10 water kiosk; and 32) Uncontrolled borehole drillings and Catchment degradation.
South Coast Association of Local Tour Operators -SALTO	33) Relevance of PID to tourism improvement and development in South Coast region; 34) The effects of water scarcity on tourism industry and space for SALTO in MSEZ developments; and 35) Emergent concerns in MSEZ water project.
Kwale Human Rights Network (K-HURINET)	36) Approaches to stakeholders engagement, project benefit to the locals; and 37) Collaboration and information sharing at grass root level.
South Coast Resident Association.	38) Effects of accelerated industrial growth, urbanization and population pressure on the future of ground water resources in Tiwi Aquifer; 39) Environmental concerns in the project area; 40) Social concerns and considerations in the project area; and 41) Political considerations.
Kwale County Government Member of County Assembly - Tiwi Ward.	42) Water challenges in Tiwi Ward; 43) Corporate Social Responsibilities and other potential project interventions in Tiwi area; 44) Unequitable distribution of ground water resources in Tiwi Ward; 45) Mobilisation of labour force and employment of the youths; 46) Criteria for identifying proposed sites for boreholes location; and 47) Management of the ten water kiosks.
Sauti ya Wanawake CBO – Tiwi Location	48) Unequitable distribution of water resources in Kwale County and idealistic water demand for MSEZ; 49) Emerging concerns, criteria for selecting water kiosks location, sustainability of the ten water kiosks; 50) Corporate Social Responsibilities, employment of local youths and other incentives to Tiwi population; and 51) Management of water kiosks; and available benefits to Tiwi community.
World Wide Fund for nature (WWF)- South Coast Region	52) Evidence of cultural resources, indigenous forest resources and catchment degradation in the project area; 53) Proposed safeguards and mitigation measures on biological diversities in the project area; and 54) Policies and legislations targeting conservation of diversities.
Kwale County Natural Resource Network (KCNRN)	55) Poor development and access to water infrastructure in Matuga Sub County in favor of Mombasa County; 56) Extent of natural resource base (ground water resources) and governors in Kwale County; 57) Available alternative water sources for MSEZ; 58) Environment and other social consideration for PID;
National Museums of Kenya-Coastal Forest Conservation Unit (CFCU)	59) Presence and management of cultural resources and their relevance in the project area; 60) Endangered and or critical plant species that should be flag out in the project area; 61) Potential displacement impacts and mitigation schedules provided for the project; and 62) Water challenges in the region
Coast Development Authority (CDA)	63) The role and position of CDA in the development of MSEZ and other Coastal regional; 64) Infrastructure components of the Mombasa Special Economic Zone and

Institution	Core issues raised
	justification of water infrastructure as a priority components; 65) The ESIA and RAP processes for PID; 66) Anticipated benefits of MSEZ to entire Coastal region; 67) The Mombasa Water Supply Master Plan and status of Mwache Dam project; and 68) Speculations and priming of developments around MSEZ.

8.5: Way forward with Stakeholder Engagement

Stakeholder engagement is a continuous process. With the ESIA process now proceeding to the Public Review stage, a window of opportunity for further engagement will present once the report is publicly disclosed.

CHAPTER NINE: ALTERNATIVES TO THE PROJECT

9.1: Overview

In this section, alternative approaches and options towards securing project alternatives have been explored to ensure rationalized selection of the most optimal investment package. Such analysis is a statutory requirement for all ESIA Studies under Legal Notice 101 of EMCA 1999 whose Regulation 18(1-i&j) requires an analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies. In line with this requirement, an extensive analysis of alternatives was undertaken in respect of the Mombasa PID as outlined in sections below.

9.2: Basis for Analysis of Alternatives

A comparative assessment of the project's merits of alternatives was undertaken to identify the best method for achieving the project's objectives of securing 2000 cubic meters daily for use in the development of MSEZ. The main aim of assessing PID project alternatives was to ensure that the social, financial and environmental sustainability of the project is achieved or mitigated. Table 9.1 provides an analysis of the options.

9.2.1: Levels in Analysis of Alternatives considered

In the analysis of alternatives in respect to the PID, several criteria including the three specified in Regulation 18(1) (i) & (j) of LN 101 were further amplified as follows:-

Criteria One: Merits of alternatives alignments

- Does the site optimize on net economic benefits
- Does site selection minimize on social, economic and environmental impacts
- Does site selection harmonize with land-use plans as influenced by the physical layout of the land among other factors
- Does site selection resonate with local felt needs

Criteria Two: Alternatives to the preferred design: Issues considered included,

- Alternatives to the entire projection of PID Project as currently proposed
- Alternatives to bridge type as proposed
- Alternatives in the provision of ancillary facilities

Criteria Three: Analysis of the Zero Option

- Past, current and future effect/ impacts of the road as currently existing
- Anticipated benefits of proposed upgrading.
- Any other considerations

In sections below, reasons behind decisions made in respect of the Roads are rationalized under specific headings below:-

9.2.3: Analysis of measures to avoid displacement impacts

Measures evaluated here include alternatives that will not entail sourcing and transmitting water from Tiwi. They include: -

(i) Use of alternative technology
This entails alternative provision of water to the Mombasa Special Economic Zone without creation of the 24.83 km long ROW. In this option, alternatives were assessed as follows:-

Desalination of sea water*:* Desalination is the removal of dissolved salts from ocean/sea water. This process convert's unusable water to usable water thus renders water fit for both human consumption and industrial applications. Large plants of desalination can produce adequate water to meet both industrial usage and other purposes hence making up the deficit on water resources and thus significantly reduces pressure on freshwater resources. Desalination plants can be erected near demand centers eliminating the need for long pipelines. Erecting a desalination plant in MSEZ will only require a two-way pipeline of 8.68 kilometers from the plant located in the show line to the SEZ reservoir. This can eliminate up to 70% of the pipeline length needed for transmission of water from Tiwi to MSEZ.

Existing desalination technologies require substantial amount of fossil fuel energy making the process to be expensive. It is estimated that to produce one cubic meter of freshwater before pumping to the reservoir, 1.45 US$ is needed. Of the 1.45 US$ unit cost, 60.7% goes to energy needs while only 39.3% is on initial/investment capital (Source: Coast Water Service Board – Water supply master plan 2013). The energy required to produce one cubic meter of freshwater is 10 kilowatts. Working with estimated MSEZ water demand of 2,000 cubic meters, the plant will require Ksh 290,000 and 20 Megawatts of electricity on its daily operation. The 20 Megawatts daily demand will account for 9% (n=20/225) of the total peak demand for electric power in the entire Mombasa County. Besides operational challenges, siting of desalination plants and associated infrastructures pose significant environmental threats to marine ecosystem; Desalination plants for seawater conversion are always located close to the riparian areas, the plants are further lowered below the sea level to minimize amount of energy needed to lift the sea water to the plant. This may interfere with coral formations and disturb biodiversity. Finally, resultant brim effluent from the desalination plant can affect coral life. As such, desalination is only advisable in areas where freshwater sources are not available in economic quantities.

Rain water harvesting: The option of meeting the daily MSEZ water demand of 2000m^3 from rain-water harvesting was also assessed. It was noted that, given the seasonal nature of Mombasa rainfall, rainwater would require to be harvested and stored during the April-June rainy season for use in the ensuing 8 month long dry season between July and March. An 8 month storage for the MSEZ daily demand translates to 384,000 m^3 net of storage required to offset evaporative and seepage losses. Essentially, this would require construction of a 10ha reservoir holding 10m depth of water and this has more displacement impact that the entire 7.45ha required to create the 24.83km ROW. Indirectly though, this is the same intervention being implemented through Mwache dam.

9.2.4: Analysis of measures to minimize impacts

(i) Waiting for the Mwache Dam Source:
This will mean shelfing the proposed development targeting abstraction and transmission of water from Tiwi Aquifer to the MSEZ in favor of the Mwache dam whose implementation schedule is currently delayed. By implication, the MSEZ and prospective investors would have to incur delays as an alternative source of water supply is identified. While an operational Mwache dam is the priority source of sustainable water supply to Dongo Kundu and indeed Mombasa and South Coast, it will also entail displacement impact in the laying of transmission and distribution mains.

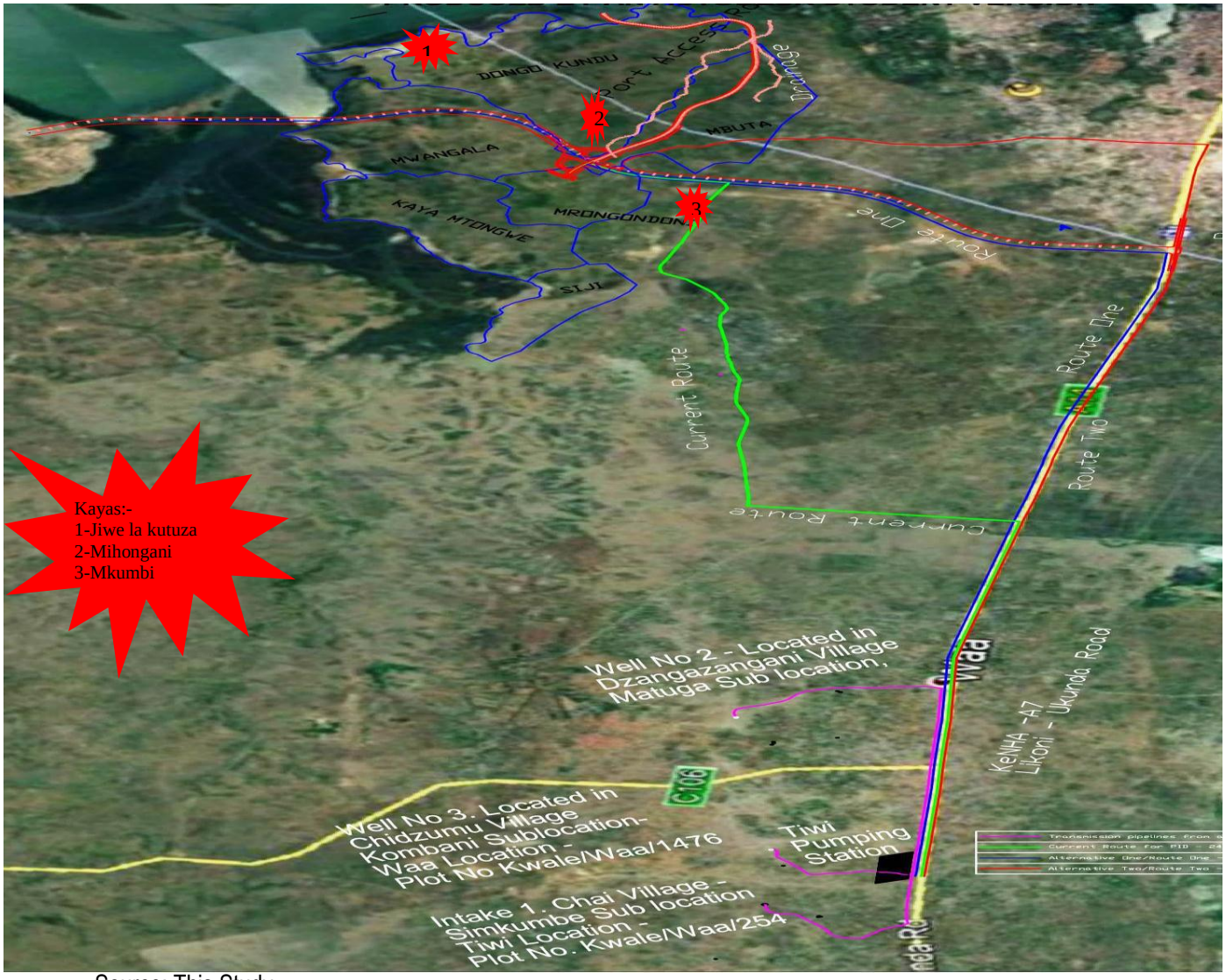
(ii) Realignment of Transmission ROW

Fig 9.1 and Table 9.1 (Items 4&5) provide analysis of diverse options to the current alignment of the pipeline. Core intervention is to align the pipelines along the A7 reserve from Tiwi and in the process cut down on displacement and attendant land acquisition. The main cost however will be removal of the pipeline from the community targeted for water supply under the CSR.

Table 9.1: Comparison of measure to minimize displacement Impact

SN	Proposed Option	Gains	Costs
1	Desalination of Sea Water	Will deflect pressure on Tiwi Aquifer	Will require land in mangrove area
		Has no displacement cost outside DK hence zero PAPs	Salt-enriched effluent is environmentally hazardous
		Potentially inexhaustible resource	High costs in pumping water uphill the DK terrain.
2	Rainwater harvesting	Sustainable source will deflect pressure from Tiwi	DK lacks suitable sites for dams, hence option likely to be costly
		Has no displacement cost outside DK hence zero PAPs	Location of reservoir outside DK to facilitate gravity flow will require minimum of 10ha which is more than the 7.45ha required for ROW
3	Abandon Tiwi source in favour of Mwache Dam supply	ROW reduces from 24.8 to 7.3 Kilometres	Commissioning date not known hence MSEZ will delay
		Deflected pressure from Tiwi Aquifer	Kiosks reduce from 10 to 5
		Based on runoff harnessing hence more secure	Loss of investment in purchase of land and drilling three wells
		Will safe on pumping costs	
4	Realign Option One to exploit A7 highway from Tiwi Kibudani, then along MSBR to Reservoir	Exploit existing A7 reserve hence PAPs reduced from 162 to 24	No reduction in ROW distance
		Pipeline will integrate with ongoing development of MSBR	Water Kiosks cut down from 10 to 4
		Pipelines will be secure from vandalism	
5	Re-align Option one from Tiwi to Corner Mpya (18.4Km), then along new Mtongwe (C109), then on to Mombasa Reservoir	Wayleave is secure	Length increases from 24.8 to 32.2Kilometres
		Pipeline is closer to MOWASSCO	Higher displacement Impacts
			Potential for conflict
6	The No Project Scenario	Will deflect pressure from Tiwi	Non realization of M-SEZ and anticipated gains
		Has zero displacement cost	Aggravated sense of political isolation in MMS
		Has zero environmental costs	Social costs associated with lagged economic development

Source: This Study



Source: This Study

Figure 9.1: Analysis of alternative alignments to current route

(i)The No-Project Scenario

The 'do nothing' or 'without project' option would entail abandoning the project so as to entirely avoid displacement impact. And given that water supply is an essential ingredient in realizing the MSEZ and its economic goals, shelving of water supply infrastructure is not really an alternative as it would kill both the MSEZ and Kenya Vision 2030. The without project scenario will perpetuate currently negative impacts associated with unexploited potential of Kenya's South Coast.

9.3: The Preferred Option

Comparative analyses of all options indicate that two options are the most competitive; that is current option and alternative one (route one) under the realignment of transmission option. However, route one has comparative advantage over the current route on land area needed for easement. Decision to use route one will only result in easement of 0.57 Hectares of land occasioned by transmission pipelines from boreholes because some sections traverse private land. Better still, in route one, the entire main transmission pipeline is traversing

secured and generous – wide enough - corridors designated only for KeNHA as opposed to current alignment which is passing through three designated authorities (KeNHA, Coast Water and Kwale County Government.). Route one also has an added advantage over the current alignment on security of the water infrastructure, and the pipeline can easily be integrated with the ongoing developments in Kibundani to Dongo Kundu section. Finally, Dongo Kundu-Kibundani section of route one can be reused to channel pipeline from SEZ reservoir to Mombasa Water pipeline for water utilization. However, route one is disadvantage in one major component of PID benefit to the local community; the component of providing 10 water kiosks to 10 villages in three locations. Out of the 10 water kiosks proposed to benefit local community, route one can only accommodate four water kiosks: - three at respective boreholes and one at Waa primary School as compared to current alignment which support provision of water in 10 villages in the project area. Component of providing 300 cubic meters of water to 10 villages in Matuga Sub County is perhaps one of the reasons why PID has received overwhelming support from the local community and other stakeholders, as such, any route that is not offering adequate water supply to the community can easily be rejected by local community. It is for this reason that route one may not be the preferred option for PID.

The preferred option therefore is the current alignment which is the only option that can support local community water demand with minimal displacement and shorter pipeline length. But several amendments need to be done in order mitigate its potential impacts on structures and minimize the area needed for way leave which apparently is the highest at 28.05% of its total land mass. Table 2.2 bellow shows measures needed to be undertaken:

Table 9.2: Realignment options on current route

SN	Pipelines	Current Length (Km)	Proposed realignment	Savings upon realignment		
				Length (Km)	*New length (Km)*	*Acquisition area (Ha)*
1	Transmission Pipeline - Well 5	1.04	Concentrate pipeline in KeRRA C214 RD between 0+760 to 1+574	0.19	0.85	0.26
2	Transmission Pipeline - Well 3	0.87	Concentrate pipeline in County RD between 0+840 to 1+817	0.41	0.46	0.14
3	Transmission Pipeline - Well 2	1.03	Concentrate pipeline in County RD between 0+460 to 1+341	0.19	0.84	0.25
4	Main Transmission Pipeline A7 S	0.29	Realign at chainage 3+580 to 3+724 and 4+320 to 4+427	0.29	0.00	0.00
5	Main Transmission Pipeline CWWDA	1.20	Restrict pipeline to CWWDA or realign leftwards	1.20	0.00	0.00
6	Main Transmission Pipeline Ng'ombeni	0.94	Concentrate pipeline to County RD	0.94	0.00	0.00
7	Main Transmission Pipeline Kiteje	1.65	concentrate pipeline to County RD	1.65	0.00	0.00
	Total	**7.02**		**4.87**	**2.15**	**0.65**

CHAPTER TEN: POTENTIAL IMPACTS AND MITIGATION MEASURES

10.1: Background

Chapters 4 through to 8 above have documented the environmental and social baseline preceding development of the PID to set the background for impact analysis - the most critical outcome of an Integrated Impact Assessment Process including ESIA Studies. It is the outcome of impact assessment that informs decision making on the future direction in project development in which case, a full-proof system for impact prediction and analysis is fundamental to the integrity of an ESIA process.

This chapter provides an analysis of the potential impacts likely to ensue from implementation of the PID as currently packaged. Impact analysis as unveiled in this Chapter was approached from different directions, applying diverse diagnostic tools and processes leading to build-up of core issues that constitute potential impacts. Tools applied include:-

- Baseline characterization to identify pre-existing environmental and social concerns including sensitive resources
- Review of requirements of policy/legal tools of the Gok
- Screening against international standards for sustainable development; and
- Screening against stated stakeholder concerns and interests.

The overall impression from impact analysis is that the PID is very small, will have a fundamental support impact on the MSEZ with vey minimum environmental costs. Unless properly handled, the PID will have a long-term irreversible impact on the groundwater resource of Kenya's South Coast area.

10.2: Design Phase Impacts

10.2.1: Positive impacts at Project identification and formulation Stage

Creation of job and employment opportunities: Generally, the design phase is associated with positive impacts mainly manifested through creation of business opportunities for professionals involved in the design work, support staff hired in the enumeration survey, etc, while the country benefits from generation of additional planning data which will influence policy decisions within long-term frames.

Generation of additional planning data: Certainly, the database compiled from design report will find consumption far beyond the confines of the PID and will provide a useful baseline for downstream projects. Specifically, baseline mapping conducted for the ESIA study generated new data as follows:-

- Comprehensive list of the flora and fauna along the PID transect
- Unearthed existence of IUCN Red List, CMS and AEWA bird species within the traverse
- The conservation importance of the local marshlands
- Contributed to better understanding of the Tiwi Aquifer

Social coherence from stakeholder engagement: During stakeholder engagement at diverse levels, communities came together to analyze concerns following which, they took a common stand especially on the question of water resource extraction and transfer, benefit sharing among others. This was seen to enhance social cohesion.

Table 10.1: Schedule of anticipated impacts at Design and Construction stages

Project Phase	Source of Impact	Serial	Potential Impact	Severity	Persistence		Potential for secondary impacts
Design Stage (1)	Design Studies, field surveys and inventories	1.1	Creation of temporary opportunities for gainful employment	P	Short-term		
		1.2	Generation of additional site-specific data and documentation of local concerns	2P	Long-term		
		1.3	Capacity building for staff employed in enumeration and field surveys	P	Long-term		
		1.4	Minor site disturbances from profile pits, bush clearing, water from test pumping of boreholes etc. during survey work	N	Short-term	Reversible	None
		1.5	Minor accidents during survey work	N	Short-term	Reversible	Minor
		1.6	Enhanced social cohesion when locals speak with one voice during stakeholder engagement	P	Long-term-term	Reversible	Major
		1.7	Tension associated with proposals for cross-County Water Transfer	N	Short-term	Reversible	Major
Construction Phase (2)	Supply of materials	2.1	Generation of GHG in the transportation of construction materials	N	Short-term	Reversible	Climate change and impacts
		2.2	Road hazards in material transportation	N	Short-term	Reversible	Irreversible impacts
		2.3	Degradation along material sourcing, transport and bulking sites	N	Long-term	Reversible	Social and economic costs
	Construction Phase	2.4	Business and employment opportunities in the material supply and construction work	2P	Long-term		
		2.5	Revenue to GoK Agencies and County Government through levies and taxes	P	Short-term		
			Cash income from compensation	P	Short-term		
			Technology transfer to local workforce	P	Longterm		
		2.6	OHS concerns in construction	N	Short term	Mixed	
		2.7	Displacement of people from land, investments and livelihood in ROW corridor	N	Long term	Reversible	Escalating poverty
		2.8	Disruption of existing infrastructure for water and power supply	N	Short-term	Reversible	Economic costs
		2.9	Slope destabilization and associated sedimentation	N	Long-term	Reversible	Ecological and economic costs
		2.10	Alteration of landscape and drainage	N	Long-term	Irreversible	Unknown

Project Phase	Source of Impact	Serial	Potential Impact	Severity	Persistence		Potential for secondary impacts
			pattern				costs
		2.11	Costs to inter-tidal biodiversity and introduction of alien species in construction material	2N	Long-term	Irreversible	Ecological costs
		2.12	Minor loss of carbon sinks in destroyed cover vegetation	N	Long-term	Reversible	GHG concerns
		2.13	Risk of fire hazards from construction camp	N	Short-term	Reversible	
		2.14	Potential siltation into the Port Reitz creek	N	Long-term	Reversible	Economic costs
		2.15	Nuisances-dust, noise, atmospheric pollutants, fumes, vibrations from operation of plant and equipment	N	Short-term	Reversible	Health risks
		2.16	Potential for illegal activity in construction	N	Short-term	Diverse	
		2.17	Socio-impacts of construction crew and labour camps	N	Short-term	Reversible	Hazards to public health
		2.18	Sanitation concerns from construction crew	N	Short-term	Reversible	
		2.19	Pollution from construction waste, waste oils and spares	N	Short-term	Reversible	ecological costs
		2.20	Carbon footprint in transport of construction materials and equipment	N	Short-term	Reversible	
		2.21	Disruption of village life in construction	N	Short-term	Reversible	
		2.22	Pressure on water resources	N	Short-term	Reversible	
				10P (10 Positive impacts, 4 long-term) 24N (24 Negative Impacts, 7 long-term, 2 irreversible) Net effect: 14N (Overwhelming net negative impact)			

Source: This Study

Capacity building and skills transfer: Project design and formulation always avails opportunities for all staff cadres involved to acquire new skills and update on state of art practices all of which contributes to capacity building. Certainly, all village elders and youth engaged as enumerators benefitted from the training offered both formerly and on the job.

10.2.2: Adverse Impacts at Design/ Project identification and formulation Stage

Hostility to proposed water transfer from Tiwi: A major concern during Project identification stage is the antagonism created by proposals to transfer water from Tiwi to Mombasa yet Tiwi residents still lack access to the resource. Though this tension was managed by the County Government, it requires to be addressed through implementation of mitigation action as proposed. The schedule of other impacts at the

Design and Construction phases are provided in Table One below with comments in appropriate sections.

Minor site disturbances during survey work: Exploratory surveys such as topographic survey, soil and foundation suitability testing, entail minor site disturbances mainly through bush clearing, profile pitting, trampling on crops etc. As well, localised water logging during test pumping of wells causes a nuisance and can even occasion other impacts such as surface erosion, movement of pollutants among others. All these are however short-term and ceased upon conclusion of field investigation.

Minor accidents during survey work: Field work exposes all involved to hazards such as injury from rough terrain, biting/stinging by poisonous insects, serpents, trees and climbers, mugging etc whose impacts are potentially severe. None of these were encountered during design stage for the PID.

10.3: Construction Phase Impacts

Construction is the phase where the bulk of impacts manifest. A total of 19 impacts are likely to manifest during construction activity out of which, only seven are likely to be positive.

10.3.1: Positive impacts

Positive impacts at construction stage will manifest as follows:-

Benefits associated with cash injection into the national and local economies: The bulk of investment of the PID will go into procurement of construction material and hiring of the contractor. Construction will thus open up extensive trade opportunities while other economic benefits will accrue through creation of employment opportunities for both skilled and semi-skilled labour engaged in construction and supervision. At local level, communities will benefit from short-term employment opportunities in the construction activity.

Opportunity to earn cash income: Compensation for land taken by the ROW and any properties so displaced will occasion opportunities opportunity to earn cash income whose prudent investment in other ventures enhances the economic wellbeing of the affected family. Indeed, investment of Kshs 16 Million in compensation will provide an opportunity for cash income while land owners still retain access to the ROW for restricted economic production.

Opportunity for technology transfer: Construction will expose local participants to expatriates in both construction and supervision and thus accord them opportunities to acquire new skills, technologies and approach to doing things all of which amount to enhancing the local technical capacity. Along the traverse, potential PAPs will also be organised into groups and will receive training both of which will find consumption even outside the project sphere and time frame.

Revenue income to Government Agencies and Departments: Both National and Local Government will benefit from revenue accrued from payment of taxies and levies while State Agencies will benefit from revenue charged for permits such as Water Permits, EIA Licence, registration with OSHA, electricity connection among others.

10.3.2: Adverse impacts of material sourcing and bulking:

Material sourcing areas: Opening up of borrow areas to reach quality stone or marram involves stripping off cover vegetation and top soil with attendant loss of biodiversity and, depending on the depth of quarrying, shallow groundwater pathways can be impacted. Non-rehabilitated quarry spoils also pose a danger to people, livestock, and wildlife and can form breeding grounds for mosquitoes. As indicated elsewhere above, some sections of the proposed the PID has no road access and construction will entail opening up new ground.

Road hazards along material transport routes: Bulk transport of materials; - cement, ballast, steel, etc has potential to aggravate road congestion and hence inconvenience other road users. Further, sourcing materials from across the Likoni Channel is likely to put pressure on the already congested ferry service to the disadvantage of commuters and other service providers. This disturbance will however be short-lived restricted to the construction phase only.

Material bulking sites: Main concerns include potential spillage and secondary erosion into waterways in case of soil spoils and sand, dust emission and safety hazards to people and property in-case of mass wasting, among others.

GHG emissions in material transport: This ESIA Study assumes that all material to be used in will be sourced locally as a way of cutting down on carbon miles. Irrespective of this, transportation to the point of construction will involve burning of fossil fuels and attendant release of GHG gases into the atmosphere. The greater the distance travelled, the more the GHG released. Though carbon emission will be greatly reduced through local sourcing of materials, importation of oil-based products such as fuels, lubricants, bitumen and the steel required in structures has a huge impact on carbon emissions.

10.3.3: Occupational Health and Safety Concerns

OHS concerns in the work place are many and diverse:-

Hazards of injury from plant and equipment: Operation of moving plant and equipment poses danger of injury to both operators, other workers and third parties who may not even be engaged in the construction. Other hazards include exposure to heavy noise, vibrations and fumes emitting from plant and equipment.

Exposure to fire hazards: Fire hazards are associated with fuel bulking and handling, use of fire in maintenance workshops, cooking areas among others.

Exposure to field accidents: These include traffic accidents, mugging by hostile mobs, exposure to serpents, rodents and insects, among others.

10.3.4: Displacement from land and assets

Displacement from land: The displacement impact anticipated from PID is summarised in tabular form below. Given the modest scope of the PID, requiring only 3m wide reserve, land acquisition is likely to be very small, just 2.09 hectares. Further, upon construction of the pipeline, respective owners will retain access to the acquire ROW which can be put to light use such as grazing and growing of non deep rooting crops. As well, the Detailed Design Phase offers an opportunity to realign and restrict pipelines to already committed reserves thus greatly cutting down on potential displacement.

Summary displacement impact in the PID

SN	Displaced Assets	Units	Quantities
1	Total PAPs	HH	162
2	Land	ha	2.09
3	Structures	No	87
4	Trees	No	445
5	Graves	No	4

Source: RAP Study for PID

Graves: A total of 4 graves are likely to be displaced.

Disruption of Infrastructure and services: Minor impacts on existing infrastructure including powerlines and water pipelines is possible but can be mitigated through comprehensive survey and mapping of pre-existing infrastructure.

Displacement of Trees and crops: From the RAP survey, a total of 447 assorted trees are likely to be displaced in the development of the PID.

10.3.5: Slope destabilization and associated sedimentation

Excavation, cut and fill activity and others civil works under the Land Development Component are likely to destabilize slopes and expose them to erosive action of rainfall generate whereby attendant release of sediments into marine waters has potential to interfere with marine aquatic ecosystems through reduction in light penetration or sedimentation of the ocean floor both of which have consequences to fauna and flora. Given the siltation threats currently faced by the Port Reitz Creek including sediment inputs from the Mwache and Mteza rivers, a comprehensive system for managing the earthworks to mitigate against soil deposition into the shoreline will have to be developed by the engineering team (Legal Notice No. 19 of EMCA 1999-The Environmental Management and Co-ordination (Wetlands, Riverbanks, Lake Shores and Sea Shore Management) Regulations, 2009).

10.3.6: Alteration of the Dongo Kundu landscape and drainage pattern

Levelling of 7.5ha adjacent to the seashore for purposes of creating the Port Yard (Land Development) will entail cutting off of hilly areas to fill up minor valleys and in the process permanently alter the landscape (Soil Catena). As well, filling up of minor depressions will alter the local drainage pattern with minor ecosystem impacts.

10.3.7: Costs to biodiversity

Issues here include:-

Potential for introduction of invasive species from constriction material: One of the most common adverse impacts of construction activity in Kenya is the introduction of invasive species brought in mainly in contaminated building material- stones, sand, ballast, etc. Once introduced, the species spreads quickly to colonize the area and become a noxious weed, of which the best example is the Prosopis chilensis (Mathenge) tree. In case of the proposed PID, there is fear that introduction of the Mathenge weed close to the intertidal areas has potential to completely colonize and destroy the mangrove ecosystem with very costly impacts even to local livelihoods and against this background, sites targeted for sourcing of river sand at both Voi and Magarini were investigated.

Without exception, both the Magarini and Voi river sources were found to be heavily infected by the Prosopis (Mathenge) weed and this would render them unsuitable for use

in project construction. However, given that the Magarini sand deposits at Mjana Heri and Timboni are very thick, they can be safely exploited on condition that the top organic layer is isolated in favour of the underlying non-contaminated layers. The environmental specialist at Construction Stage will require monitoring sand sourcing very strictly and undertake surveillance for emergence of Prosopis seedlings within the project area.

Impact on habitat for birds: Some trees that could be habitat for special case birds will be cleared for laying of pipelines and other infrastructure. However, this impact is quite modest as their roles will be taken over by other similar species common ion the area.

Impact on mammals: Most of the mammals occurring in the area are rodents. These include rats, elephant shrew, hedgehog, porcupine, squirrels, moles, african hare. Other include mammal species is monkey. Monkey and squirrel prefer areas with trees, while others prefers grass areas, woodland and near farm areas. The construction has potential of destroying habitats for the mammals. The various groups will be affected in varying magnitude depending on the habitat affected most.

Plate 10.1: Slope destabilization and landscape change from civil works in Dongo Kundu

10.3.8: Minor loss of carbon sink

Construction of both the Land Development Ara and the Mombasa Reservoir will cause conversion of close to 10ha of bushland to bare land, some under concrete and associated irretrievable loss of carbon and energy sequestration capacity. Though loss of 10ha of carbon sink is quite small, cumulatively the long-term impact is substantial.

10.3.9: Potential siltation into Port Reitz Creek

Land levelling activity in close vicinity of the shoreline has potential to expose loose uncovered soil to agents of erosion including mass wasting. Washing off of eroded sediments into the Port Reitz shoreline has potential to sediment the intertidal and open water ecosystems thus altering the habitat for respective flora and fauna. Such impact has cumulative tendency given the already expressed concern of loss of mangrove ecosystems in Kenya to siltation.

10.3.10: Generation of nuisances-dust, fumes and vibrations

Within the PID, construction activity at the Mombasa Reservoir and Land Development sites is likely to generate nuisances-dust, noise and vibrations at scales that pose hazards to local residents and plant operators while similar but lower scale impact will be felt during excavation and construction of pipelines along the traverse. Emission of intense dust bowls within the takeoff path for flights departing Moi International Airport is an incident to watch against.

Baseline monitoring of air quality undertaken as part of this ESIA indicated worrisome levels of atmospheric lead (Pb) and daytime noise levels generally exceeding statutory limits set by NEMA. As such, generation of fumes, dust and noise in infrastructure development is likely to aggravate already strained scenario which could expose people to health hazards. Elevated noise and dust levels are not desired anywhere near human settlements and will require mitigation.

10.3.11: Potential for illegal activity

Illegal activities within construction projects are many and diverse ranging from smuggling, trafficking, poaching, illegal fishing, employment of aliens etc.

10.3.12: Social concerns

The whole question of basic rights at the workplace: A trend is emerging in Kenya whereby most construction contracts are won by oriental based companies better known for cost effective delivery on contracts but with huge attendant environmental and social costs including contempt for contractual obligations sealed in law, deployment of language challenged supervisors, poor community integration, poor respect for workers' rights inclusive of basic pay, working hours, grievance procedures among others. It is becoming increasingly common to read of violent confrontations between communities and foreign oriental workers, labour disputes, worker grievances etc, largely traceable to poor work ethics.

Social vices associated with construction crews: Construction activity will engage and deploy numerous people on a daily basis to villages which have otherwise been culturally isolated from the rest of the world. Such exposure is likely to occasion cultural shocks and tendencies associated with multitudes to the detriment of local residents. Core hazards would include proliferation of social vices key among them commercial sex, drug and alcohol abuse, juvenile delinquency, among others whose pressure points would express in explosion of teenage motherhoods, breakdown of homes, escalation of sexually transmitted diseases including HIV and AIDs, social disorders, among others which would rapidly erode gains associated with cash injection from PID construction activity.

Impact on existing infrastructure and services: The project is likely to interface with several service lines such as an oil pipeline, water pipelines, power transmission and distribution lines, national highways etc all of which serve vital functions in the local, national and regional economies and whose disruption is likely to occasion massive suffering.

10.3.13: Concerns from the contractor's camp

Concerns from Contractors Camps are many and diverse causing NEMA to demand stand-alone ESIA studies. Common issues to expect include:-

Generation of liquid effluent including sewage: Cases of effluent water from Contractors' kitchens and bathroom areas being released into nature in raw form in-spite of reigning legislation are increasingly common and this has potential to compromise quality of water supply for downstream communities.

Waste oils and spares from motor vehicle maintenance yards: Where oil and spares are poorly harnessed, the same are likely to compromise aesthetic quality with potential wash off into water resources. Further, soil already contaminated by oil immediately becomes hydrophobic and can no longer attract or hold water hence rendering it agriculturally inert.

Solid and organic waste: This takes the form of waste food, paper, plastic wrapping, and obsolete computer spares among others. While organic stuff rapidly degenerations naturally, other waste have longer persistence hence posing the growing problem of solid waste accumulation.

10.3.14: Disruption of village life

Intense construction activity including movement of plant and equipment, displacement from land, excavation for pipelines etc have potential to disrupt social networks and tranquility. Indeed, influx of job seekers and other speculators seeking reside amongst villagers poses unique challenges all of which are likely to weaken social networks.

10.3.15: Pressure on water resources

This issue is explored under Operation Phase impacts below.

10.4: Operation Phase Impacts

10.4.1: Positive impacts from commissioning of the PID

(i) Major step towards realization of MSEZ

Provision of infrastructure to the MSEZ as proposed under PID is a major step towards realization of this national flagship project. As such, accomplishment of then PID will help bring closer, all economic and social goals such as manufacturing for export, employment creation, regional balancing etc aspired for in the MSEZ.

(ii) Benefits of enhanced water supply in Mombasa mainland south:

During stakeholder engagements under auspices of diverse projects, the feeling that Mombasa South Coast is a forgotten territory is quite openly expressed and the same is thought to foment political discontent. As such, improvement of service provision in mainland south is a major intervention towards eliminating the mental divide that creates this feeling of alienation.
Improvement in water supply has potential to impact positively on property prices.

10.4.2: Adverse impacts from operation of the PID

Adverse impacts from the operation phase have been identified as follows: -

(i) **Degradation of the Tiwi groundwater resource:** Based on modelling of aquifer functioning conducted on Tiwi, there are verifiable concerns that this resource is already suffering degradation associated with over-abstraction beyond available recharge. Abstraction of an additional 2000 cubic meters daily to supply the MSEZ can only aggravate a stressed-up system.

(ii) **Input of water-borne pollutants into Port Reitz Creek Ecosystem:** Main interventions of the PID target introduction of bulk water and provision of runoff drainage. The bulk of 2000 cubic metres to be supplied daily to the SEZ will require evacuation after use and hence the need to provide drainage infrastructure. And even assuming that all SEZ operators will pre-treat their effluent before discharge into nature, there is chance that many waterborne pollutants will still end up in the Port Reitz Creek Ecosystem whose sediments are near choking with heavy metals. Requirements of The Prevention of Pollution in Coastal Zone and other segments of the Environment Regulations (EMCA 1999), 2003 are quite clear on this.

(iii) **Alteration of local drainage:** Improvement of drainage as proposed will enhance runoff disposal from the catchment into the port reitz creek. In the process, water borne pollutants including sediments will move faster into the creek and therefore introduce new source of point pollution.

Table 10.2: Analysis of Operation Phase Impacts

Project Phase	Source of Impact	Serial	Potential Impact	Severity	Persistence	
	Operation of PID Components	3.11	Great step towards realization of MSEZ	P	Long-term	Irreversible
		3.12	Opportunities for employment in Operation and Maintenance	P	Long-term	
		3.13	Business opportunities in Water and Sewerage	P	Long-term	
		3.14	Enhanced water supply in the Mtongwe/Likoni areas of Mombasa and along Pipeline Route (Water Kiosks)	P	Long-term	
		3.15	Enhanced value of property prices in MMS	P	Long-term	Irreversible
		3.16	Enhanced Corporate Image	P	Longterm	
		3.17	Degradation of the Tiwi Aquifer	2N	Long-term	Irreversible
		3.18	Political/ Social tension over cross-Country water transfer	N	Long-term	Reversible
		3.19	Alteration of local drainage system	N	Long-term	Irreversible
		3.20	Improved quality of life from water supply	P	Long-term	
		3.21	Introduction of pollutants into Port Reitz through drainage	2N	Long-term	Irreversible
		3.22	Hazards associated with disposal of effluent water	2N	Long-term	Reversible
Net environmental worth of the project pre-mitigation			7P (3positive outputs, mainly long-term), 8N (6 adverse outputs, all long-term& irreversible), Net score=N (Net negative impact before mitigation)			

Source: This Study

(iv) **Potential to escalate social tension:** Any incident that makes Tiwi people feel denied of their inherent right to water will certainly be resented. And this applies to the proposed MSEZ. According to projections made in the Study of Water Supply Master Plan for Mombasa and Other Towns within Coast Province (CWSB 2013), the Diani-Tiwi transect will have a deficit in water supply to the tune of 14,676 cubic metres and this is anticipated to grow to 19,671 in 2025 and 28,453 cubic metres in 2035 when it will be resolved through supply from Mwache. A situation where Diani-Tiwi suffers a water deficit for 15years while their water resource is supplied elsewhere is likely to be a continuous cause of trouble for the MSEZ.

10.4.3: Net impacts pre-mitigation

From analysis above, the PID as aligned has a net negative impact (15N) and thus in need of an aggressive mitigation programme as outlined in Chapter Eleven below.

10.5 Salient Impacts

Born of the impact analysis highlighted above, salient observations emerge as follows:-

- Facilitation of realization o the Mombasa Special Economic Zone through provision of water supply and drainage infrastructure as proposed remains the most salient positive impact of the PID as designed. Communities resident in MMS will also benefit from enhanced water supply.
- Potential to degrade both the Tiwi aquifer through over-abstraction and the Port Reitz Ecosystem through discharge of water borne pollutants through the improved drainage flag-out as the most conspicuous environmental costs to the PID.
- Consequent to degradation of the Tiwi aquifer is the potential to cause social antagonism from those aggrieved by transfer of their badly needed water resource.

CHAPTER ELEVEN: THE ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

11.1: Overview

This chapter outlines the Environmental and Social Management Plan (ESMP) proposed for the PID Project comprising of four core elements namely: - the Impact Mitigation Plan (unveiled in Tables 11.1), the Monitoring Plan (Table 11.2), a budget for implementation (Table 11.3) and modalities for institutional coordination and role play as summarised in Table 11.4 below.

11.2: The Mitigation Strategy

The Core Mitigation Strategy is that the PID is a very small intervention whose impacts are very few. To the largest extent possible however, the strategy and action plan in formulating this ESMP is to prevent impact occurrence, then move to mitigate inevitable occurrence-a position secured by ensuring that recommendations made here-in are incorporated into and influence final outcome of the project design process in which case, the latter process also becomes part of the mitigation programme. In pursuit of this strategy, all mitigation will be sealed at Detailed Design Stage by adopting measures as follows:-

- ✓ The Environmental and Social Management Plan unveiled in Chapter Twelve below will be integrated into the Final Design Report- as a standalone chapter and also to moderate design decisions
- ✓ The same will be provided for in the BOQs to ensure funding allocation for environmental and social mitigation
- ✓ Clauses binding parties to affirmative action on the ESMP will be integrated into Contracts for Construction to ensure that the contractor is legally bound to implement impact mitigation. The full specification is provided in Appendix 11.1.

11.3: Mitigation of Design Stage Impacts:

The Impact Mitigation Plan summarised in Table 11.1 below reflects respective action at the design, construction and operation phases of the Mombasa PID. Other mitigation was adopted as follows:-

Use of existing tracks: Site disturbance during field surveys have been minimized through use of existing tracks to access sites of interest and always to avoid crop damage.

Mitigation of accidents: Towards mitigation of accidents in field, sober and serious-minded survey teams were selected and sensitized on the need to observe safety requirements during enumeration and site surveys and this has greatly mitigated incidence of accidents.

Disposal of test pumping water: All water generated in test pumping was readily infiltrated by prevailing sandy loam soils. Cases of waterlogging and localised flooding were not encountered.

Management of community level tension: Towards management of community perception and apprehension associated with cross-County water transfer, relevant departments of the KCG were engaged and deployed to better explain the wider benefits of the Mombasa Special Economic Zone to Mombasa and Kwale Counties

including Tiwi area. It was particularly pointed out that PID is a project of the KPA which already has many Tiwi residents among its senior cadres of employment.

11.4: Mitigation of other Construction Stage Impacts

The Contractor will put in place a Construction Management Plan to guide orderly scheduling, phasing and conduct of construction activity

11.4.1: Mitigation of impacts associated with material sourcing and transport

Local sourcing from pre-existing NEMA approved sources: Material sourcing will seek to exploit existing sources rather than open new ones. Any new quarries opened will have to fulfil all statutory requirements including an environmental license issued by NEMA.

Mitigation of carbon footprint in material transport: Local sourcing of quality material will cut down on both financial and environmental costs associated with emissions. In all cases, preference will be given to material from quarries operated from grid power supply. As well, the Contractor will be bound to deploy a serviceable fleet to ensure minimum emission levels.

Minimization of degradation in material transport: Material supply to construction sites will seek to utilise existing road network where possible while any new opening should target sites earmarked for pavement development. In the event that new access routes will require to be opened, the same should target areas reserved for rural roads so that, the same will be graded and later serve the community.

Mitigation of accidents in material transport: The Contractor will deploy qualified, sober and disciplined drivers who will be sufficiently motivated to adhere to professionalism and standards of quality management.

Mitigation of spills from bulked materials: See 11.5.2 (g) below.

Insurance against possible introduction of colonising species: Associated with material sourcing is the question of alien species of which *Prosopis chilensis* and *Leceana lucocephala* are the worst culprits in the coastal region. Both weeds establish from seeds ferried in construction material and thereafter, the weeds form aggressive colonies which turn impossible to control especially where roots can access sub-surface saline water. Mitigation of this occurrence will require that sand be source only from fluvial coastal deposits exploited fresh without bulking and provided that the organic layer is stripped and isolated. The Magarini Cooperative society site is recommended for this purpose.

Table 11.1: Measures towards Mitigation of Construction Stage Impacts

Project Phase	Serial	Potential Impact	Severity	Mitigation	Legal provision	Post mitigation
Design Stage (1)	1.1	Creation of temporary opportunities for gainful employment	P			
	1.2	Generation of new/ additional site-specific data and documentation of local concerns	2P			

Project Phase	Serial	Potential Impact	Severity	Mitigation	Legal provision	Post mitigation
	1.3	Capacity building for staff employed in enumeration and field surveys	P			
	1.4	Minor site disturbances from profile pits, bush clearing, water from test pumping of boreholes etc. during survey work	N	Observe safety Code of Conduct	Cap 387	N
	1.5	Minor accidents during survey work	N	Observe safety code of conduct	Cap 387	N
	1.6	Enhanced social cohesion when locals speak with one voice during stakeholder engagement	P			
	1.7	Tension associated with proposals for cross-County Water Transfer	N			
Construction Phase (2)	2.1	Generation of GHG in the transportation of construction materials	N	Local sourcing	Cap 387	N
	2.2	Road hazards in material transportation	N	Follow Traffic Code	Traffic Code	N
	2.3	Degradation along material sourcing and transport	N	Source from NEMA audited sources	Cap 387	0
	2.4	Business and employment opportunities in the material supply and construction work	2P			
	2.5	Revenue to GoK Agencies and County Government through levies and taxes	P			
	2.6	OHS concerns in construction	N	Develop and implement Health and Safety Plan	OSHA 1997, Cap 382, Cap 370	N
	2.7	Displacement of people from land, investments and livelihood in ROW corridor	N	Implement RAP recommendations	National Constitution 2010	N
	2.8	Disruption of existing infrastructure for water and power supply	N	Replace all assets before ground breaking		0
	2.9	Slope destabilization and associated sedimentation	N			
	2.10	Alteration of landscape and drainage pattern	N	NMK to implement Chance Find Procedures at Construction	Cap 261	N
	2.11	Costs to inter-tidal biodiversity and introduction of alien species in construction material	2N	Prepare a soil stabilization plan in construction plan	Cap 387	N

Project Phase	Serial	Potential Impact	Severity	Mitigation	Legal provision	Post mitigation
	2.12	Minor loss of carbon sinks in destroyed cover vegetation	N	Partner with local groups to reforests with all special concern trees	Cap 387/ Agric Act-FF Rules	P
	2.13	Risk of fire hazards from construction camp	N			
	2.14	Potential siltation into the Port Reitz creek	N			
	2.15	Nuisances-dust, noise, atmospheric pollutants, fumes, vibrations from operation of plant and equipment	N		Cap 387	N
	2.16	Potential for illegal activity in construction	N			
	2.17	Socio-impacts of construction crew and labour camps	N	Local sourcing for labour and personnel		0
	2.18	Sanitation concerns from construction crew	N	Provide for adequate gender segregated facilities	OSHA 1997	0
	2.19	Pollution from construction waste, waste oils and spares	N			
	2.2	Carbon footprint in transport of construction materials and equipment	N	Preference to already mobilized TSPs		N
	2.21	Disruption of village life in construction	N			
	2.22	Pressure on water resources	N	Stop all construction pending investigation of Tiwi.	Cap 387	P
Post mitigation severity				10N, 10P, Net 0		

N=low negative impact; 2N=moderately severe impact; 0= no impact; P= positive impact, 2P= significantly positive impact

11.5.2: Environmental, Health and Safety Measures in the Construction area

Contingency plans will be prepared covering all aspects of Occupational Health and safety during construction. Key among this is the need to deploy sober staff under supervision, enforcement of a code of operations backed up be insurance cover for all staff. A strict system for ensuring observation of a drug, alcohol, violence free working environment should be enforced. Measures have been identified as follows:-

(a) Mitigation of impacts in General Health and Safety:

The Contractor shall comply with all standard and legally required health and safety regulations as promulgated by Occupational Health and Safety Act and the Factories and Other Places of Work Regulations.

- The Contractor shall provide a standard first aid kit to field staff;
- The Contractor shall ensure that staff are made aware of the risks of contracting or spreading sexually transmitted diseases, particularly HIV/AIDS and how to prevent or minimize such risks;
- The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities;
- All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected;
- Speed limits appropriate to the vehicles driven are to be observed at all times on access and haul roads. Operators and drivers are to ensure that they limit their potential to endanger humans and animals at all times by observing strict safety precautions;
- No unauthorized firearms are permitted on site;
- The Contractor shall provide the appropriate Personal Protective Equipment for staff.

(b) Fire Prevention and control: The Contractor shall take all reasonable and precautionary steps to ensure that fires are not started as a consequence of his activities on site;

i) The Contractor shall ensure that there is basic fire-fighting equipment available on site;

ii) Flammable materials should be stored under conditions that will limit the potential for ignition and the spread of fires;

iii) 'Hot' work activities shall be restricted to a site approved by the RE;

iv) Smoking shall not be permitted in fire hazard areas.

v) The Contractor shall ensure that all site personnel are aware of the fire risks and how to deal with any fires that occur. This shall include, but not be limited to regular fire prevention talks and drills and, posting of regular reminders to staff.

vi) Any fires that occur shall be reported to the RE immediately and then to the relevant authorities;

vii) In the event of a fire, the Contractor shall immediately employ such plant and personnel as is at his disposal and take all necessary action to prevent the spread of the fire and bring the fire under control;

viii) Costs incurred through fire damage will be the responsibility of the Contractor, should the Contractor's staff be proven responsible for such a fire.

(c) Emergency Procedures: The Contractor shall submit a Method Statement/ Comprehensive Health and Safety Plan covering the procedures for the main activities which could generate emergency situations through accidents or neglect of responsibilities. These situations include, but are not limited to accidents at the work place including falling of the platforms, accidental fires; accidental leaks and spillages and vehicle and plant accidents. Specific to accidents at work place:

- The Contractor shall ensure that his employees are drilled in the procedure for working in sensitive areas including marine areas
- He shall comply with all safety conditions imposed by the Kenya Maritime Authority and other Agencies to ensure safety of workers at all times.
- The Contractor shall also ensure that the necessary equipment for work in hazardous area –protective boots, PPEs, helmets, etc., are provided.
- The Contractor will continuously train employees on safety procedures including use of PPEs.

(d) Mitigation of HIV/AIDS: The contractor in consultation with implementing agencies responsible for HIV/AIDS will mount educational campaigns to keep workers sensitized on the reality of this pandemic. He shall monitor activities regularly to assess effectiveness and impact. This should include an initial, interim and final assessment of basic knowledge, attitude and practices taking account of existing data sources and recognizing the limitations due to the short timeframe to show behaviour change. The assessment will be supported by qualitative information from observations on workers behaviour.

(e) Mitigation of Solid Waste: All storage and construction sites are to be kept clean, neat and tidy at all times. No burying or dumping of any waste materials, metallic waste, litter or refuse shall be permitted. The Contractor must adhere to Environmental Management and Co-ordination (Waste Management) Regulations 2006 and shall implement measures to minimize waste and develop a waste management plan to include the following:-

i) All personnel shall be instructed to dispose of all waste in a proper manner;

ii) At all places of work the contractor shall provide litter collection facilities;

iii) The final disposal of the site waste shall be done at the location that shall be approved by the RE, after consultation with local administration and local leaders;

iv) The provision of sufficient bins (preferably vermin and weatherproof) at the camp and work sites to store the solid waste produced on a daily basis;

v) Wherever possible, materials used or generated by construction shall be recovered at the conclusion of each task for safe disposal including recycling.

vi) Provision for responsible management of any hazardous waste generated during the construction works.

(f) Wastewater and contaminated water management: No grey water runoff or uncontrolled discharges from any site or working areas (including wash-down areas) to adjacent watercourses and/or water bodies shall be permitted;

- Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site. This particularly applies to water emanating from concrete batching plants and concrete swills;

- The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses including the creek areas;
- Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered;
- Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted;
- The Contractor shall notify the RE of any pollution incidents on site.

(g) General materials handling, use and storage: All materials shall be stored within the Contractor's camp unless otherwise approved by the RE;

- Stockpile areas shall be approved by the RE;
- All imported fill, soil and/or sand materials shall be free of weeds, litter and contaminants. Sources of imported materials shall be listed and approved by the RE;
- The Contractor shall ensure that delivery drivers are informed of all procedures and restrictions (including 'No go' areas) required;
- Any electrical or petrol driven pumps shall be equipped and positioned so as not to cause any danger of ignition of the stored product;
- Collection containers (e.g. drip trays) shall be placed under all dispensing mechanisms for hydrocarbons or hazardous liquid substances to ensure no contamination from any leaks is reduced;
- Regular checks shall be conducted by the Contractor on the dispensing mechanisms for all above ground storage tanks to ensure faulty equipment is identified and replaced in timely manner;
- Only empty and externally clean tanks may be stored on bare ground. All empty and externally dirty tanks shall be sealed and stored on an area where the ground has been protected.

11.5.3: Mitigation of displacement impacts

An Abbreviated Resettlement Action Plan (RAP) has been prepared to guide resolution of all displacement impacts. The same will be implemented in full before ground-breaking.

Compensation for standing assets: Few structures will be displaced in the PID. However, in approaching compensation**, t**he aim here should be to adopt a valuation method that rewards personal initiative and effort. Currently available rates only end up impoverishing people. In the case of commercial trees, valuation should factor in the investment cost of brining and nurturing trees to maturity and the income to be forfeited once the trees are displaced by the road.

Compensation for graves: A package that would facilitate transfer of the remains to a new site should be adopted towards removing graves hit by the pavement. Otherwise, graves falling in the general road reserve should just be marked and left intact.

Compensation for loss of livelihoods: Compensation will aim at enabling LAPs to re-establish displaced livelihoods and cover them for the duration spent away from work.

This should include all business that will close down on account of decommissioning of roads.

11.5.4: Disruption of existing infrastructure for water and power supply

All pre-existing infrastructure will be identified and mapped for preservation prior to start of construction. Any damage will be reported and repaired within 24hours of the incident.

11.5.5: Mitigation of slope destabilization and associated siltation into Port Reitz Creek:

All cut and fill areas will require stabilization with both grass and masonry structures. Soil stabilisation measures will be put in to prevent soil wash into the creek areas. Towards this,

- ✓ Clearing and stripping will be restricted to the pavement area and all downstream vegetation will be retained intact.
- ✓ Stuffed gunny bags or other appropriate technology will be deployed to stabilize soil downstream of cut and fill sites.
- ✓ Stockpiling of soil and building material will avoid slunting ground and all riparian areas,
- ✓ All stockpiled soil will be ring-guarded from intrusion by runoff

Towards mitigating impacts of excavation and construction immediately upstream of the creek areas, the following actions are prohibited:-

- ✓ Use of any chemical banned from use in Kenya,
- ✓ Use of any chemical that is harmful to marine life,
- ✓ Use of any chemical that persists in the environment or turns harmful upon contact with water,
- ✓ Use of equipment that spill oils into the water.

Use of any chemical within the creek areas will require approval by NEMA in consultation with the Kenya Maritime Authority in capacity of Lead Agency. Additionally, movement of construction equipment into the Port area will require approval by the KPA, KMA and obtain requisite permits.

11.5.6: Mitigation of landscape and drainage change:

Landscape change is irreversible but the impact will be greatly toned down through reforestation with large-canopied trees (Jacaranda, Delonix, Neem, Ficus) to mask the scarring effect and blend with remaining landscape. Use of pervious paving such as cabro will allow water to infiltrate and establish new pathways to natural drainage.

11.5.7: Mitigation of loss and damage to cultural and heritage resources

Loss of Cultural Heritage will be mitigated thus:-

Incorporation of Chance Find and Recovery Procedures: In line with requirements of OP 4.11, the services of the NMK will be retained during construction stage to facilitate monitoring for chance finds which will then be recovered as appropriate.

11.5.8: Mitigation of impacts on biodiversity and carbon sink

Measures will be taken as follows:-

Conservation of sensitive flora: Flora and fauna mapping and screening against the IUCN Red List undertaken as part of this ESIA indicated that no species considered endemic, threatened, endangered or locally important are found within the route of

traverse. Secondly, all habitats that could be displaced by the road occur extensively in the area which allows room for affected populations to re-establish and recover but this notwithstanding, measures will be taken as follows:-

(i) All trees located in the ROW reserve but outside of excavation area will be left intact,

(ii) **Mitigation against introduction of alien species:** All requirements of MARPOL 73/78 will be observed by the Contractor under close monitoring by the KMA in capacity of designated MARPOL Focal Point in Kenya.

(iii) Mitigation of impacts on habitat for avian fauna: None of the sites traversed by the PID is a designated Important Bird Area (IBA)- the nearest being the Shimba Hills Forest. One of the 9 special concern birds, none is endemic to the Kenyan Coast but, this not withstanding, all birds occur extensively elsewhere in Kenya and the region and given that this habitat range is extensive, development of the proposed PID has no chance of significantly affecting the habitat of these species. However, intensive monitoring of populations is recommended

Towards reconstruction of the carbon sink: A reforestation plan will be implemented to replace the 446 trees to be displaced by the road and to cater for those to be lost to intensified settlement. Reforestation will aim to replace lost trees as documented in section 6.6.6 above. Locally active conservation groups will be strengthened to bulk seedlings of locally important trees some of which will be used in road side reforestation and planting on communal sites.

11.5.9: Mitigation of fire hazards in Camps:

See 11.5.2 (b/c) above.

11.5.10: Mitigation of nuisances:

The Contractor will prepare an elaborate construction plan for review and approval before ground breaking. The plan will elaborate on among others;- length on construction period per component, measures to minimize dust, noise, fumes and vibrations. All operators of plant and equipment will be issued with PPEs and will work under strict supervision always.

11.5.11: Control of illegal activity:

The Contractor will commit to abide and adhere to all written laws of the land and will post a bond to insure against illegal activity. The Contract for Construction will criminalize any activity prohibited under Kenyan Law. This will include smuggling, drug and substance abuse, illegal fishing, all forms of violence, discriminatory practices among others. The RE Staff will conduct regular monitoring to track all complaints. All complaints and allegations will be investigated by RE to logical conclusion and where evidence is procured, the same will be handed over the relevant enforcement agencies for legal action.

11.5.12: Mitigation of social impacts of construction crew:

This will be mitigated through local sourcing of personnel who will revert to their homes in the evening. Additionally, the Contractor will undertake routing counselling of workers on the need for responsible behavior and will lead by example. Cases of indiscipline, crime and violence will not be tolerated.

11.5.13: Management of sanitation during construction:

Each construction site will be supplied with adequate, gender segregated toilets. The Occupational Health and Safety Act of 2007 is clear on this.

11.5.14: Modalities for managing waste:

See 11.5.2 above.

11.5.15: Towards maintaining normalcy of village life:

The Contractor will maintain closer liaison with local residents. Any activity likely to affect people will be disclosed with adequate notice.

11.6: Mitigation of Impacts at Operation Stage

Proposed mitigation activities at this stage (Table 11.2) are focused on minimizing hazards associated with bulk water supply within close vicinity of a creek ecosystem.

11.6.1: Mitigation of threats to the Tiwi Aquifer

Common problems in aquifers namely drawdown, saline intrusion and contamination are normally difficult to reverse and often lead to loss of the aquifer in which case, best mitigation strategy is to avoid. Before such a decision is made however, perceived threats should be confirmed beyond doubt which requires that this reserve be investigated extensively to establish the Demand vs Supply scenario. The recommendation here is for Tiwi to undergo comprehensive investigation before proposed extraction as proposed for the SEZ.

Table 11.2: Mitigation of Operation Phase Impacts

Project Phase	Source of Impact	Serial	Potential Impact	Severity	Mitigation	Legal provision	Post mitigation severity
		3.10	Opportunities for political and social integration	2P			
		3.11	Realization of the MSEZ	2P			
		3.12	Improved quality of life from water supply	P			
		3.16	Enhanced value of property prices in MMS	P			
			Degradation of the Tiwi Aquifer	2N	Invoke the Precautionary Principle until aquifer dynamics are established through a Modeling Study.	Cap 387	N
		3.25	Input of polluted road runoff into Port Reitz Creeks due to altered hydrology	2N	Developers to pretreat effluent before disposal. Develop a CETP as long-term measure	Cap 387	N
			Post Mitigation Status		**6P, 2N, Net 4P Overall: 4P**		

Source: This Study

Accruing information will be applied in making derisions including assuaging concerns raised by the Tiwi Community. Of course, the embargo on new drilling should also extend to other stakeholder inclusive of the Tiwi Community and Kwale County Government.

11.6.2: Mitigation of water-born pollution into the Port Reitz Creek Ecosystem

In the short-term, developers should be required to pre-treat effluent before licensing for disposal into nature. As a long-term measure, a developer should be identified to construct a Common Effluent Treatment Facility where each developer will treat their effluent on cost recovery basis.

11.6.3: Other measures

It is generally recommended that water supplied to PID be treated at source. A wide range of Kenya Bureau of Standards recommended reagents are available in the Market.

11.7 Management of Decommissioning

Several levels of decommissioning are anticipated; -

11.7.1 Decommissioning of Contractor/ Resident Engineer's Camps

This will take place upon completion and hand over of the Project to either KPA or SEZA. The proposal by communities for the camps to be handed over to them for alternative use is recommended.

11.7.2: Decommissioning upon connection to Mwache dam Supply

There is a proposal that once Mwache Dam is operational, parts of the mains pipeline after Kaya Bombo will be diverted to connect to this new supply. In this case, the rest of pipeline back to Tiwi will be modified to supply communities along the traverse. This proposal should be firmed up with at technical and management levels.

11.8: Effectiveness of The Mitigation Programme

11.8.1 Viability of Mitigation

Effectiveness of the proposed mitigation programme has been assessed based on analysis of impact prevalence before and after mitigation (Table 11.2) based on this analysis, this Environmental and Social Impact Assessment Study observes that, there is a great potential to mitigate adverse impacts and hence improve the net worth of the proposed road. From Table 11.2, it is apparent that application of mitigation measures as identified and recommended has potential to reduce tally of adverse impacts (Ns) from 26N to 15N while simultaneously increasing the positive ones (Ps) from 11 to 18. Thus, subtracting the Ns from the Ps gives an overall net tally of 3P implying a very positive net impact after mitigation. Additionally, the mitigation programme has potential to reduce long-term hazards introduced by the project from 17 to 7 after mitigation, in acknowledgment of the fact that some impacts are irreversible and persist even after mitigation.

Table 11.2: Analysis of impacts scenario before and after mitigation

Nature of impact	Pre-mitigation tally	Post-mitigation tally
Positives	10P	16P
Negatives	24N	12N
Net	10N	4P
Residue impacts		7
Irreversible adverse impacts		7

11.8.2 Prevalence of residue impacts

This study observes that 7 of the 24 adverse impacts associated with the project will persist even after mitigation. These are the impacts whose probability can be reduced substantially through mitigation but cannot be eliminated entirely. Their management requires implementation of a strict monitoring programme as outlined elsewhere below.

11.83 Net worth of the Project

The proposed project has a delicate impact balance even after mitigation. This Study recommends that project development should proceed but factor in an aggressive monitoring programme post mitigation.

11.9: The Environmental and Social Monitoring Plan

11.9.1 Overview of the ESMP

Modalities for mitigation of impacts and their phasing are presented in the Environmental Mitigation and Management Plan provided in Table 11.3 below. From Table 11.3, it is apparent that most of the mitigation activity will take place during the construction phase. However, planning for the mitigation will take place at design stage (this stage) to ensure that such mitigation is incorporated and allocated for in the project design. Thus, the first action in mitigation will be a thorough scrutiny of the Design Report to ensure that the ESMP provided in this report has been fully incorporated and allocated for. Further, all mitigation to be implemented during civil works will be allocated for in the Bills of Quantities and captured in the Contract for Construction. The General Manager (Design & Construction) will hire a qualified Supervision of Works (SOW) Engineer to ensure full implementation of contractual tasks in mitigation.

11.9.2: Feasibility of impact mitigation

Majority of impacts have readily available means for mitigation while some of the negative impacts will acquire positive effects after mitigation. Thus, upon application of the Impact Mitigation Programme, majority of the impacts are dispensed with and the project is likely to achieve an overwhelming net positive effect. It is expected that there will be no land acquisition within the scope of the proposed work.

11.9.3: Phasing of mitigation action

Mitigation of impacts associated with civil works has been planned in the design and allowance has been made in the Bills of Quantities (BOQs). Also the contract for civil works bears several relevant clauses binding the contractor to implement environmental and social mitigation as outlined in Table 11.3 below.

11.9.4: Responsibility for mitigation

As per the ESMP below, responsibility for mitigating impacts of civil works falls on the contractor under the supervision of the KPA or his appointed representative.

11.10: Environmental and Social Monitoring Requirements

11.10.1: Terminologies

Environmental monitoring refers to the systematic collection, analysis and interpretation of data on environmental parameters through periodic measurements. Accruing information would facilitate tracking of levels of anticipated impacts and to monitor compliance in implementation of mitigation measures. Through periodic observations, it is possible to detect and remedy previously non-anticipated impacts before they turn catastrophic. Further, through continuous assessment of both the negative and positive benefits of a project, it is possible to determine the net impact (change) emanating from a project and thus determine its worth. Environmental monitoring falls in three categories as follows:-

- Baseline studies to document local environmental conditions of the project site. Since project impacts are generated by interaction between local environmental conditions and project activities, a study of baseline conditions facilitates prediction of impacts as already undertaken in Chapter Seven of this EA study. The documented baseline environment also provides a permanent benchmark against which long-term changes due to project activities can be monitored.
- Routine measurement of effects through measurements on environmental parameters is undertaken during project implementation and operation so as to detect changes attributed to the project.
- Compliance monitoring is effected through regular review of monitoring returns coupled with independent periodic sampling of environmental parameters and indicators. By evaluating the level of parameters against previously agreed standards, the supervising authority is able to monitor compliance with regulatory requirements. Surveillance and routine inspections also form part of compliance monitoring.

To be successful, monitoring and evaluation begins with clear project design followed by identification and elaboration of appropriate criteria and indicators. This document provides guidance about incorporating monitoring and evaluation elements in each stage of the project cycle.

11.10.2 Requirements of the 'Impacts monitoring' programme

Table 11.3 provides the framework proposed for biophysical monitoring. At construction stage, the Contractor will conduct biannual monitoring for all parameters specified mainly through sampling (pollutants) and counts in case of flora and fauna. In case of pollutants, samples will be analysed at the SGS Laboratories.

Table 11.3: Framework for environmental monitoring

Parameter and method	Specific location	Monitoring criteria
Ambient air quality through sampling and laboratory analysis	Polytechnic, Mtongwe Rd/A7 junction, MSBR junction	Particulate Matter (PM), Carbon Monoxide (CO), Nitrogen Oxides (NO/NO_2), Sulphur Oxides (SO_2), Lead (Pb), Ozone(O_3)
Noise through onsite measurement		Equivalent sound Level (Leq: dB), Vibration level (dB), Traffic volume
Coastal water quality through sampling and laboratory analysis	Two point on MI and MMS sides	Color, Water Temperature, pH, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Turbidity, Oil/Grease

		(Petroleum Ether Extracts), Suspended solids (SS), Total Coliforms
Marine sediment quality (same)		METALS: Antimony, Cadmium, Chromium Copper, Lead, Mercury, Nickel, Silver, Zinc, Arsenic,
Surface water quality (same)	Selected but calibrated Boreholes in Tiwi Aquifer	TDS, PH, Electrical Conductivity, Total Coliforms
Floral monitoring and counts	Entire corridor	Dalbergia melanoxylon, Dialium orientale, Pseudobersama mossambicensis, Erythrina sacleuxii, Lasiodiscus ferrugineus, Psychotria punctate, Premna chrysoclada, Pavetta mangallana, Pavetta crebrifolia, Pavetta subacana, Ochna thomasiana
Bird monitoring and counts		Roseate tern, Great white egret, Woolly-necked stork, Sooty gull Wahlberg's eagle, Egyptian goose, Wood sandpiper, African spoonbill, Sacred ibis

11.10.3: The Compliance Monitoring Strategy

This activity is essential to ensure implementation of recommended mitigation measures and to thus secure the overall environmental quality of any project. The monitoring activities should primarily target implementation of recommended mitigation measures in addition to surveillance for new impacts. Table 11.4 provides an M&E matrix for the PID Project with a full complement of criteria and indicators. In addition to specification of impacts and required mitigation activities, the plan also identifies key players in each activity and the recommended timing of interventions. The Environmental and Social Action Plan for the Bridge Project also essentially constitutes its compliance monitoring program. Key features of the compliance monitoring programme are as follows:-

The Monitoring Authority: The burden of implementing impact mitigation will fall on the Project Contractor under supervision by KPA in the capacity of Employer. Through the Supervisor of Works (SOW), KPA will monitor activities of the Contractor to ensure compliance with contractual requirements including implementation of this EMP. Where issues not anticipated in this report do arise, the SOW will notify KPA for action.

Need for NEMA to participate in Monthly Site Meetings: NEMA is the body charged under Cap 387 with overall coordination of environmental management in Kenya. While NEMA coordinates this by regulating the EIA process for projects, there is need for NEMA to follow-up further on implementations of ESMPs as prepared for this project. This ESMP therefore, recommends that the County Environmental Officers for Mombasa and Kwale be invited to all monthly site meetings on this project and are facilitated to attend the same under the project. By being represented in site meetings, NEMA will enjoy an excellent opportunity to monitor implementation of the ESMP and to keep track on any emerging issues.

11.10.4: Monitoring Reports

A number of monitoring reports will be developed as follows:

(iv) ESIA Study Report under Cap 387: This ESIA Study Report as currently prepared provides a documentation of the baseline environment of the area

traversed by the PID as proposed and thus provides a useful datum against which future monitoring can take place. The ESIA Study Report also includes a project-specific ESMP detailing the means for mitigating identified impacts. It therefore lays the basis for monitoring.

(v) Annual Audit Reports: The PID will be subjected to an annual environmental audit in line with Cap 387. The report will include a summary of the environmental performance of the facility/enterprise vis-à-vis the Environmental Management Plan prepared and, a synthesis of Emergent Concerns.

(vi) Signed minutes of Monthly Site Meetings: Following every site meeting, minutes of deliberations will be produced by the SOW, confirmed, signed and adopted as a basis for following up on Contractor's activity.

Table 11.4: The Environmental and Social Management Plan

Project Phase	Item	Potential Impact	Mitigation	Implementation responsibility	Monitoring responsibility	Budget (Ksh million)
Design Stage (1)	Ecosystem	Minor site disturbances from dredging, bush clearing etc. during survey work	Minimize impacts	Technical Service Provider	Employer	0.00
	Resettlement	Displacement of people, from land, investments and livelihood from ROW corridor	Implement RAP recommendations	Technical Service Provider	Employer	16.5
	Vulnerable social groups	Elderly, poor, disabled persons affected by displacement	None			
	Livelihood	Livelihoods affected by land acquisition and property displacement	Administer Livelihood restoration budget	KPA	NLC	Under RAP
	Accidents	Minor accidents during survey work	Observe safety code of conduct	TSP	NLC	0.00
	Land use	Minor land-use change due to acquisition	Administer livelihood restoration budget	KPA	NLC	0.00
	Cultural Heritage	Potential loss of heritage resources	None			
		Disturbance to shrines and sacred sites and marine heritage resources	Avoid displacement			0.00

Project Phase	Item	Potential Impact	Mitigation	Implementation responsibility	Monitoring responsibility	Budget (Ksh million)
Construction Phase (2)	Air pollution	Emission of pollutants (Pb), dust, fumes, vibrations from operation of plant and equipment	As for 2.23 above to include supply of PPEs	Contractor	Employer	0.00
		Generation of GHG in the transportation of construction materials	Local sourcing	Contractor	Employer	0.00
	Water pollution	Discharge of waste and gray water from labour camp	Recovers and reuse all waste water	Contractor	Employer	0.00
	OHSC	Road hazards in material transportation	Implement a Traffic/ Transport Safety Code	Contractor	Employer	0.00
		OHS concerns in construction of an elevated bridge overhead a sea creek	Develop and implement Health and Safety Plan	Contractor	Employer	2.0
		Risk of fire hazards from construction equipment	As for 2.23 above	Contractor	Employer	0.0
	Land degradation	Degradation along material sourcing and transport	Source from NEMA audited suppliers	Contractor	Employer	0.00
		Land pollution from construction waste, debri, waste oils and spares	Apply 3R rule	Contractor	Employer	0.5
	Existing infrastructure and services	Disruption of existing infrastructure for water and power supply	Replace all assets before ground breaking	Contractor	Employer	0.00
		Disruption of transport and movement	Implement user negotiated traffic and construction management plan	Contractor	Employer	0.00
	Ecosystems	Potential sediment input into creek waters	Prepare a soil stabilization plan	Contractor	Ditto for 2.13 above	2.00
		Costs to marine and terrestrial biodiversity including introduction of alien species in construction material	Prepare contingency plans for all sectors at DD Stage	Contractor	Employer	0.0
		Loss of carbon sinks in destroyed cover vegetation	Partner with local groups to reforest with all special concern trees	Contractor	Employer	1.2

Project Phase	Item	Potential Impact	Mitigation	Implementation responsibility	Monitoring responsibility	Budget (Ksh million)
	Labor camps and workers	Concerns on HIV& AIDS	Local sourcing of labour, aggressive campaign and VCT services	Contractor	Employer	2.4
		Socio-impacts of construction crew and labour camps	Local sourcing for labour and personnel	Contractor	Employer	2.00
		Sanitation concerns from construction crew	Provide for adequate gender segregated facilities	Contractor	Employer	0.3
		Social tension from non-balanced labour sourcing	Put in place modalities for fair and balanced recruitment	Contractor	Employer	0.00
		Loss of production associated with industrial unrest and labour disputes	Implement statutory guidelines	Contractor	Employer	0.00
Operation phase	Labor relations	Loss of production associated with industrial unrest and labour disputes	Implement statutory guidelines	Contractor	Employer	0.00
	Water resources	Degradation of the Tiwi Aquifer	Aquifer monitoring study before commissioning	KPA	WRA	2.5
			Waste water recovery through a Common Effluent Treatment Plant-CEMP	KPA	NEMA	125
		Water wastage in leaking transmission lines	Routine maintenance and monitoring	KPA	CWWDA	0.00
	Ecosystems	Input of polluted runoff into Port Reitz	Developers to pre-treat effluent individually or jointly through a CEMP	SEZA	NEMA	0.00
		Degradation of bushlands for wood and fuel	Controlled development	County Government	State Department of Planning	0.00
	Air pollution	Air pollution from plant and equipment	Atmospheric pollutants to reduce through scrubbing	KPA	NEMA	0.00
		Air pollution from moto vehicles	Enforce traffic Code within Marshalling area	KPA	NEMA	0.00
	Waste	Pollution from solid waste and effluent	Isolate and segregate all waste sources Apply 3R principle	KPA	NEMA	0.00
		Pollution waste oil and spares in maintenance yards	Isolate all maintenance area, recovers and recycle waste	KPA	NEMA	0.00
	Land use	Proliferation of non-planned settlements	Controlled Development	County Government	State Department of Planning	0.00

Project Phase	Item	Potential Impact	Mitigation	Implementation responsibility	Monitoring responsibility	Budget (Ksh million)
Decommissioning phase	OHSC	Injuries and accidents during decommissioning	Prepare and implement decommissioning plan	KPA	MCG	0.00
	Waste	Pollution from poor disposal of waste and debri	Ditto	KPA	MCG	0.00
	Hazards in decommissioned areas	Accidents in holes and craters left after decommissioning	Ditto	KPA	MCG	0.00
		Total budget				149.5

Source: This Study

11.10.5: Monitoring Costs in ESMOP

Table 11.5 below provides an analysis of compliance monitoring requirements in the PID. A total of Ksh 8.15 Million will be required for the entire process which will entail both internal and external monitoring. Where State Agencies are involved in undertaking routine and supervisory, they will rely on own internal budgets.

Table 11.5: The Environmental and Social Monitoring Plan (ESMoP)

Project Phase	S/N	Category	Aim	Type	Method	Frequency	Implementation responsibility	Budget (Ksh million)
Design stage	1.	Ecosystem	Track ecosystem health	IM	Surveillance	Quarterly	KPA	0.2
	2.	Resettlement, Livelihoods and Vulnerable	Track PAP welfare	IM	Sampling	Quarterly	KPA	0.2
	3.			EM	Review quarterly	Once, one year after resettlement	KPA	0.6
	4.	Accidents	Accident monitoring	IM	Returns from TSP	Bimonthly till end of contract	KPA	0.2
	5.	Land use	Track trends in land use	IM	Surveillance	Ones at the end of studies	KPA	0.3
	6.	Cultural heritage	Monitor status of cultural assets	IM	Surveillance		KPA	
Construction phase	7.	Air pollution	Monitor pattern of air quality	EM	Sampling of air quality along baseline	Biannual	KPA	1.2
	8.	Water pollution	Monitoring water quality	EM	Ditto	Ditto	KPA	0.3
	9.	OHSC	Accident tracking and monitoring	IM	Monthly returns	Monthly	KPA	0
				EM	Adhoc supervision	Adhoc	DOHS	0
	10.	Waste	Monitoring conservation status	IM	Monitor ESMP	Monthly	KPA	0.5
	11.			EM	Monitor ESMP	Biannual in construction period	NEMA	0.3
	12.	Existing infrastructure and services	Monitor status	IM	Record of complaints	Monthly	KPA	0
	13.	Ecosystems	Track ecosystems health	IM	Surveillance	weekly	KPA	0.2
	14.			EM	Comparative studies	Annual in construction period	KPA	0.45
	15.	Labour camps and workers	Monitor OHS for workers	IM	Suveillance	weekly	KPA	0.8
	16.			EM	Routine inspection	quarterly	KPA	
Operation phase	17.	Labour relations	Monitor workers welfare	EM	Routine inspection	Adhoc	SDL	0
	18.	Water resources	Monitor status of Tiwi Aquifer	Baseline survey	Aquifer modelling	Once before commissioning	WRA	2.4
	19.			RM	Level and quality	Biannual	WRA	0.5
	20.	Ecosystems	As for 17 & 18 above					0
	21.	Air pollution	Particulate Matter (PM), Carbon Monoxide (CO), Nitrogen Oxides (NO/NO_2), Sulphur Oxides (SO_2), Lead (Pb), Ozone(O_3)					0
	22.	Waste	As for 14 above					0
	23.	Land use	Track long term change in land use	EM	Comparative studies	Every 5 years	KPA	0
Decommissioning	24.	OHSC	Ensure worker safety during decommissioning and safe disposal of materials	IM	Supervision reports	Daily during operation	KPA	0
	25.	Waste						0
	26.	Hazards in decommissioned areas						0
Total budget								8.15

Source: This Study

Key: IM is Impact Monitoring; EM is Effect Monitoring and RM is Resource Monitoring.

11.10.6 Costs in implementing the ESMP

A total of Ksh 149.5 Million will be required in both environmental and social mitigation while an additional Ksh 8.15 million will be required to cover Environmental and Social Monitoring Plan (ESMoP) in the Project (summary below). Ultimately the gross budget for Environmental and Social Mitigation in the PID is Ksh 157.65 million.

Summary costs in the ESMP for PID

SN	Cost Item	Amount (KSh)
1	ESMaP	149.5
2	ESMoP	8.15
	Total	**157.65**

CHAPTER TWELVE: CONCLUSION AND RECOMMENDATIONS

12.1: The Report

The Government of Kenya (GoK) with support of the Japan International Cooperation Agency-JICA is developing the Mombasa Special Economic Zone as part of the Kenya Vision 2030 Strategy aimed at delivering a globally competitive Kenya with high quality of life for all its citizens by the year 2030. Formulation of the Masterplan for Mombasa Special Economic Zone has been completed by the GOK with support of JICA under the Technical Collaboration Projects for "Mombasa Port Master Plan including Dongo Kundu" and "The Project on Master Plan for Development of Mombasa Special Economic Zone".

Implementation of the Masterplans for Mombasa Special Economic Zone is being pursued by the GoK with support of the Government of Japan through combination of Japanese Official Development Aid and private investments through Special Purpose Vehicle. Phase One of the implementation will entail two broad components namely:-

- Basic infrastructure through Japanese ODA and;
- Individual areas within the Mombasa SEZ (including Free Trade Zone and Industrial Area) through private investment to SPV.

12.2: The need to provide Basic Infrastructure to the M-SEZ

Development of the Mombasa Special Economic Zone is guided by the 2014 Masterplan for MSEZ which seeks to transform the 12 square kilometer Dongo Kundu Property owned by the Kenya Ports Authority into a commercial hub ridding on marine trade and other opportunities associated with presence of the Kilindini Harbour whose potential largely remains unexploited. Towards realization of a Special Economic Zone, the Masterplan stipulated critical anchorage to be put in place as follows:-

- Resolution of the squatter problem- currently the subject of an ongoing Resettlement Action Plan Study;
- Provision of transport infrastructure- partly to be resolved through ongoing construction of Mombasa Southern Bypass and proposed Mombasa gate Bridge and;
- Provision of basic trunk infrastructure namely grid power connection (underway) and provision of water supply and stormwater drainage.

The Project on Infrastructure Development (PID) seeks to bridge infrastructure gaps mainly through provision of mains water supply and drainage infrastructure and thus further level the field in readiness for SEZ Investors.

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This Report highlights salient social and environmental issues associated with the design, construction and operational aspects of the Project. The Report has been prepared under contract by Lead Experts from Repcon Associates, an Environmental Firm of Experts duly registered and licensed by NEMA (NEMA Registration No. 0002) and other Government of Kenya (GoK) agencies.

12.3: Scope of the ESIA Study

Contractual Scope of the ESIA Study is defined by the Study Terms of Reference –TORs which stipulated Study Tasks as follows: -

Task 1-1 Preparation of ToR for Approval by NEMA

Task 1-2 Baseline Survey for Environment and Social Information
Task 1-3 Public Consultations on the Selection of the Location of Water Kiosk to be installed along the Transmission Main/Distribution Main connected Booster Pump Station and Mombasa SEZ Reservoir
Task 1-4 Environmental and Social Impact Forecast
Task 1-5 Impacts Evaluation and Alternative Plan
Task 1-6 Mitigation Plan
Task 1-7 Environmental Management and Monitoring Plan
Task 1-8 Environmental Check List
Task 1-9 Proposed Implementation Plan, including budget, finance source and organization
Task 1-10 Public Consultation Meetings
Task 1-11 Approval Acquisition

12.4: Approach to ESIA Study

From experience, NEMA currently does not require TORs for EIA Projects. As part of the Inception Stage activities however, NEMA was contacted and advised that this Inception Report be shared with the Authority to serve as notification of the ESIA Study. As such, once the Inception Report was accepted, the same was be shared with the NEMA Coast Regional Office for Direction.

Public Consultations / Stakeholder Engagement

Public Consultation is legal requirement in ESIA Studies. Consultations started with Two (2) Meetings for Leaders held at both Kwale and Mombasa and convened through respective sub-County Commissioners for Matuga (Kwale) and Likoni (Mombasa) respectively. Both meetings targeted the local leadership including Members of Parliament, MCAs, Women Rep, Senators, County Government, Agencies, Security, etc aimed at introducing the Project Design and Components to the Leaders and to seek support in the Public Hearing Meetings. A schedule of Public Hearing Meetings for each sub County will then be agreed with the Leaders.

Key Informant Interviews were conducted with all Lead Agencies and relevant Line Ministries.

Baseline Survey for Environment and Social Information

Some preliminary baseline characterization has been undertaken under auspices of the Inception Report. During the detailed ESIA Stage, additional baseline survey will be mounted to include additional review of all available literature including the Infrastructure Project, biophysical conditions, administrative divisions, etc to identify priority baseline conditions. Baseline survey will aim at identifying the ecologically and socially vulnerable resources that are likely to be impacted adversely by project interventions as proposed.

Environmental and Social Impact Forecast

Forecasting of impacts has been undertaken at two levels thus: -

Documentation of project interventions: Each intervention proposed under the infrastructure project was analysed and documented in terms of scope, scale, resource requirements including target site. It is the potential interaction between project intervention and prevailing baseline that is likely to occasion adverse impacts.

Application of an environmental checklist: Environmental Checklists from relevant agencies including JICA were sourced and applied to identify and predict impacts from development of all components of the PID.

Impacts Evaluation and Alternative Plan

Environmental concerns obtained from impact analysis above were evaluated to determine those relevant to the PID components, their scale and severity. Analysis of severity has applied trend analysis through comparison with pre-existing date say on water quality, modelling, prescribed standards among others. It is this analysis that informed the level of mitigation.

Impact Mitigation Plan

For each impact, possible mitigation measures have been explored and assessed to pick most cost-effective mitigation package. Of necessity, mitigation included formulation of a Resettlement Action Plan to guide resolution of all economic and livelihood displacement impacts of the PID components.

Environmental Management and Monitoring Plan

The Impacts Mitigation (Management) Plan will be expanded to inbuild components for monitoring. This will include a time frame (phasing of mitigation), identification of the necessary budget, cost heads, objectively verifiable indicators for monitoring and Competent Authority for Monitoring.

Proposed Implementation Plan, including budget, finance source and organization

This task fits best with the RAP. However, from experience mitigation for construction impacts mainly takes place under Contract for Works while at Operation Phase, mitigation is the responsibility for Agencies responsible. As part of the ESIA Study, agencies responsible for managing the completed PID components and their roles in the ESMP were identified.

Approval by NEMA

This Task entails Liaison with NEMA to ensure that the EIA Licence is issued without undue delay. Thus, where the ESIA Report will go into Public Review Stage, the Consultant will coordinate with NEMA and the client so as to ensure prompt drafting of texts for newspaper advertisement, prepare responses to all questions and update the Final Report as required.

Reporting procedure

The ESIA Study methodology as described above culminated with production of this Draft Environmental and Social Impact Assessment Study Report formulated in line with Regulation 18 of Legal Notice 101 of EMCA. This report is presented in Twelve Chapters which integrate the content for ESIA Study Reports as stipulated in Regulation 18 of LN 101.

12.5: Findings of the Study

Empirical baseline characterization of the PID traverse helped better refine the pre-project scenario and, in the process, brought out the biophysical sensitivities in preceding project implementation as provided in summary form below.

Air quality condition

General prevalence of pollutants: The rural parts of the PID as represented by the junction with the MSBR at Ziwani have very low concentration of atmospheric pollutants. PM10, PM2.5, lead and carbon monoxide were detected in all the sites and therefore are the most prevalent amongst all pollutants monitored. The A14 junction with Mtongwe Road which is a busy urban road has highest concentration PM10.

Noise Levels: Noise levels in the non urbanised areas of PID traverse are still below statutory limits especially with regard to night noise.

Marine water quality condition

Mombasa Island side of the Likoni Channel is apparently receiving more sediment and pollutant input from Mombasa Town with increasingly higher pollution. Thus, in proceeding with development of the proposed MSEZ and the PID, the factor of elevated pollution on the northern shoreline of the Channel should inform decisions especially for runoff disposal.

Marine Sediment quality

Sediment analysis confirmed presence of heavy metals within the Likoni channel sediments. Zinc, Chromium, Antimony and Nickel have a leading prevalence while Mercury, Silver and Arsenic were not detected. All heavy metals detected in the study area share one feature in that, they are all applied in the electroplating industry- a surprise find given that, the Port Reitz area has never hosted an electroplating facility.

Monitoring of Fresh Water Quality

Despite the waters being apparently polluted, they are within NEMA limits for recreation and domestic use.

Status of floral biodiversity

Proposed land reclamation area will affect mangrove formations which are already under severe exploitation pressure.

Status of avian biodiversity

Out of 102 bird species counited, 9 birds are of concern in that 1 is listed in the IUCN RED List Data on account of being vulnerable, 8 species are listed in the Agreement on the Conservation of African-Eurasian Migratory Water Birds (AEWA) and one is listed under CMS/ Raptors.

Status of cultural heritage biodiversity

PID operations are in close vicinity of but do not directly impact three Kayas Mkumbi, Mhongani and Jiwe lakutuza which are socially revered and reservoirs of biodiversity.

Status of the Tiw Aquifer

Tiwi aquifer has a possible daily allowable yield of 19,08 cubic metres based on estimated annual recharge of 6.96 Million Cubic Metres (MCM) meaning that the current demand of 20,000 cubic metres is being met through over-abstraction. Imposition of an additional daily demand of 2000 cubic meters to supply MSEZ will only exert additional abstraction pressure with known consequences in terms of aquifer drawdown and attendant threat of vertical and horizontal saline intrusion.

12.6: Summary from Stakeholder Engagement

A total of 39 formal forums were arranged during which 951 stakeholders were met. Many more stakeholders were met during the Census survey and asset inventory implying that probably over 1000 people were engaged as part of this RAP.

The Leaders Meetings

The entry point to all stakeholder engagement process was Leaders Meetings largely called to market the proposed Project to Local Leadership who, upon being convinced would spearhead the process of introducing the project to target grassroots communities. Given that the PID spans the two Counties of Kwale and Mombasa, two (2) separate meetings targeting sub-County level leadership in Matuga (Kwale) and Likoni (Mombasa) were held bringing together 198 diverse leaders from National Government, County Government, Politicians (MPs and MCAs), security apparatus, GOK Agencies among others. These forums served as community sounding boards from which preliminary public concerns on the proposed project bounced off thus helping to shape and inform preparations for the Public Hearing Meetings.

Public Hearing Meetings

As part of the business transacted during Leaders Meetings, schedules for holding Public Hearing Meetings in all locations in respective sub-Counties were made and immediately rolled out. Six Public Hearing Meetings were held at sublocation level for purposes of engaging with local communities inclusive of potential PAPs. A core agenda in the meetings was to build consensus on the distribution and location of 10 Water Kiosks to be provided under the PID.

12.7: Salient Impacts

Born of the impact analysis highlighted above, salient observations emerge as follows:-

- Facilitation of realization o the Mombasa Special Economic Zone through provision of water supply and drainage infrastructure as proposed remains the most salient positive impact of the PID as designed. Communities resident in MMS will also benefit from enhanced water supply.

- Potential to degrade both the Tiwi aquifer through over-abstraction and the Port Reitz Ecosystem through discharge of water borne pollutants through the improved drainage flag-out as the most conspicuous environmental costs to the PID.

- Consequent to degradation of the Tiwi aquifer is the potential to cause social antagonism from those aggrieved by transfer of their badly needed water resource.

12.8: Environmental Management and Monitoring

Proposed mitigation activities at this stage are focused on minimizing hazards associated with bulk water supply within close vicinity of a creek ecosystem.

Mitigation of threats to the Tiwi Aquifer

Common problems in aquifers namely drawdown, saline intrusion and contamination are normally difficult to reverse and often lead to loss of the aquifer in which case, best

mitigation strategy is to avoid. Before such a decision is made however, perceived threats should be confirmed beyond doubt which requires that this reserve be investigated extensively to establish the Demand vs Supply scenario. The recommendation here is for Tiwi to undergo comprehensive investigation before proposed extraction as proposed for the SEZ.

Mitigation of water-born pollution into the Port Reitz Creek Ecosystem

In the short-term, developers should be required to pre-treat effluent before licensing for disposal into nature. As a long-term measure, a developer should be identified to construct a Common Effluent Treatment Facility where each developer will treat their effluent on cost recovery basis.

Decommissioning of Contractor/ Resident Engineer's Camps

This will take place upon completion and hand over of the Project to either KPA or SEZA. The proposal by communities for the camps to be handed over to them for alternative use is recommended.

Overview of the ESMP

Bulk of mitigation activity will take place during the construction phase. However, planning for the mitigation will take place at design stage (this stage) to ensure that such mitigation is incorporated and allocated for in the project design. Thus, the first action in mitigation will be a thorough scrutiny of the Design Report to ensure that the ESMP provided in this report has been fully incorporated and allocated for. Further, all mitigation to be implemented during civil works will be allocated for in the Bills of Quantities and captured in the Contract for Construction. The General Manager (Design & Construction) will hire a qualified Supervision of Works (SOW) Engineer to ensure full implementation of contractual tasks in mitigation.

Mitigation of impacts associated with civil works has been planned in the design and allowance has been made in the Bills of Quantities (BOQs). Also, the contract for civil works bears several relevant clauses binding the contractor to implement environmental and social mitigation.

12.9: Environmental and Social Monitoring Requirements

This document provides guidance about incorporating monitoring and evaluation elements in each stage of the project cycle. At construction stage, the Contractor will conduct biannual monitoring for all parameters specified mainly through sampling (pollutants) and counts in case of flora and fauna. In case of pollutants, samples will be analysed at the SGS Laboratories.

The Monitoring Authority: The burden of implementing impact mitigation will fall on the Project Contractor under supervision by KPA in the capacity of Employer. Through the Supervisor of Works (SOW), KPA will monitor activities of the Contractor to ensure compliance with contractual requirements including implementation of this EMP. Where issues not anticipated in this report do arise, the SOW will notify KPA for action.

Need for NEMA to participate in Monthly Site Meetings: NEMA is the body charged under Cap 387 with overall coordination of environmental management in Kenya. While NEMA coordinates this by regulating the EIA process for projects, there is need for NEMA to follow-up further on implementations of ESMPs as prepared for this project. This ESMP therefore, recommends that the County Environmental Officers for

Mombasa and Kwale be invited to all monthly site meetings on this project and are facilitated to attend the same under the project. By being represented in site meetings, NEMA will enjoy an excellent opportunity to monitor implementation of the ESMP and to keep track on any emerging issues.

Monitoring Reports

A number of monitoring reports will be developed as follows:

(vii) ESIA Study Report under Cap 387: This ESIA Study Report as currently prepared provides a documentation of the baseline environment of the area traversed by the proposed PID and thus provides a useful datum against which future monitoring can take place. The ESIA Study Report also includes a project-specific ESMP detailing the means for mitigating identified impacts. It therefore lays the basis for monitoring.

(viii) Annual Audit Reports: The PID will be subjected to an annual environmental audit in line with Cap 387. The report will include a summary of the environmental performance of the facility/enterprise vis-à-vis the Environmental Management Plan prepared and, a synthesis of Emergent Concerns.

(ix) Signed minutes of Monthly Site Meetings: Following every site meeting, minutes of deliberations will be produced by the SOW, confirmed, signed and adopted as a basis for following up on Contractor's activity

12.10: Recommendation

Through this ESIA Study Report, the Kenya Ports Authority-KPA (the proponent) wishes to disclose that the proposed PID has impacts that can readily be mitigated and managed. The majority of adverse impacts identified are of a short-term nature and will cease once the civil works phase is completed. Further, other impacts can be contained through effective planning and management using available means of mitigation. By such disclosure, the prayer of the client to NEMA is for the project to be granted environmental licensing

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APPENDICES (VOLUME TWO)