PRESIDENT'S OFFICE - FINANCE AND PLANNING

Boosting Inclusive Growth for Zanzibar (BIG-Z): Integrated Development Project

Environmental and Social Impact Assessment for the Integrated Drainage and Resilient Urban Upgrading Project in Zanzibar Municipality

FINAL REPORT

Submitted to:

Zanzibar Environment Management Authority
P. O. Box 2808.
Zanzibar, Tanzania

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ABBREVIATIONS AND ACRONYMS

BIG-Z	Boosting Inclusive Growth for Zanzibar
BOD	Biological Oxygen Demand
CBOs	Community Based Organizations
COD	Chemical Oxygen Demand
COVID-19	Corona Virus Diseases-2019
DoE	Department of Environment
DoR	Department of Roads
EIA	Environmental Impact Assessment
EMP	Environmental and Social Management Plan
ES	Environmental and Social
ESF	Environmental Social Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMF	Environmental and Social Management Framework
ESMoP	Environmental and Social Monitoring Plan
ESSs	Environmental and Social Standards
GBV	Gender Based Violation

GRM	Grievance Redress Mechanism
HIV	Human Immunodeficiency Virus
NGO	Non-Governmental Organizations
PMT	Project Management Team
PoFP	President's Office – Finance and Planning
RAP	Resettlement Action Plan
RgoZ	Revolutionary Government of Zanzibar
RPF	Resettlement Policy Framework
STDs	Sexual Transmitted Diseases
ToR	Terms of Reference
ZAWA	Zanzibar Water Authority
ZEMA	Zanzibar Environment Management Authrity
ZUMC	Zanzibar Urban Municipal Council
ZRF	Zanzibar Road Fund
ZUSP	Zanzibar Urban Services Project

Team of Experts who conducted the study

Name	Responsibility/ Position	Signature
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EXECUTIVE SUMMARY

The Revolutionary Government of Zanzibar (RGoZ) has executed and subsequently closed a project known as "The Zanzibar Urban Services Project (ZUSP)", which started in 2011 under funding from the World Bank. The ZUSP focused on infrastructure in key urban areas of the Zanzibar Municipal Council (ZMC) and Pemba Towns and supports management capacity for urban development and management. The ZUSP project supported basic infrastructure services (sanitation, flood control, and public green space) and cultural heritage. Additional finances were obtained from the World Bank under "additional financing window" (ZUSP-AF), which covers the studies and implementation of this consultancy for Integrated Drainage and Resilient Urban Upgrading in Zanzibar Town. The Revolutionary Government of Zanzibar retained ARS Progetti JV Sering Ingegneria S.r.l both, of Italy, to undertake the designs under a project titled, "*Consulting Services for Planning, Feasibility Study, Detailed Engineering Design and Bidding Documents for Integrated Drainage and Resilient Urban Upgrading in Zanzibar Town*". The project also included undertaking environmental and social impact assessment (ESIA) study of the proposed investments, of which the project was registered by ZEMA in September 2019, ToR was issued in February 2020 and a draft was completed by the consultants in December 2020 and updated by the RGoZ in July 2022.

Following closure of ZUSP, the Boosting Inclusive Growth for Zanzibar – Integrated Development Project (BIG-Z) became effective in December 2021 as a follow-on operation also financed by the World Bank. Ensuring adherence to environmental safeguards is a key element for attaining sustainability of ZUSP and now BIG-Z. High-quality-due diligence on environmental and social impacts and compliance with RGoZ and World Bank policy on environment is essential. In order to comply with the client's requirement, an Environmental and Social Impact Assessment (ESIA) was conducted to address the potential environmental and social impacts and risks of the project and provide means to manage and monitor them throughout the project life. Both RGoZ and World Bank Safeguard Standards and Guidelines were followed.

PROJECT DESCRIPTION

URBAN UPGRADING AREAS AND INFRASTRUCTURE PROPOSED

The project is located in Zanzibar Municipalities, and aims at improving conditions at critical areas prone to flooding including human settlements. It entails urban upgrading through improvement of infrastructures so that to improve the living and environment conditions of local communities. The project areas were selected through rigorous studies in collaboration with Zanzibar Municipal Council, West "B" Municipal Council, communities (Shehias) and other key stakeholders. The feasibility study conducted for this project identified several services to be undertaken under the Zanzibar Urban Upgrading Programme and includes infrastructures as summarized in Table E-1.

Table E- 1: Zanzibar Urban Upgrading proposed infrastructures

Proposed infrastructure	Components
Drainage	Secondary drainage
Streets infrastructure	Category I (bitumen street 9 m), Category II A (bitumen 6 m), Category II B (compacted soil 6 m), Category III (3-4 m), Category IV Footpath, Green link type 1 and type 2, Pedestrian elevated footpath
Water supply	Rainwater Harvesting – PF level
Solid Waste management	Door-to-door collection, and Micro sorting and collection points

Lighting	Solar PV lighting poles
Open spaces	Paved squares, Sports fields, Playgrounds, Pond open public spaces, Shading shelters, Benches, and Green areas
Markets	Local market

Figure E-1; Zanzibar Urban upgrading and drainage system location areas

The areas and communities involved in this project are Meya-Magomeni and Sebleni-Kwa Wazee, Tomondo-Mombasa and System C drain which covers Amani, Kilimahewa Juu na Kilimahewa Bondeni, Mapinduzi, Mkele na Shauri Moyo Shehias (Table E-2). The identified activities include: The Improvement of local/secondary drainage system, water supply system, road network, paving foot-path, public lighting, solid waste collection point and improvements of open space.

Table E- 2: Final selection of areas and names of Shehias for urban upgrading intervention

S/No.	Area	Shehias involved
1.	Sebleni Kwa Wazee	Sebleni, Kwa Wazee
2.	Meya – Magomeni	Meya, Magomeni, Mpendae
3.	Tomondo-Uzi	Tomondo, Uzi
4.	System C	Amani, Kilimahewa Juu na Kilimahewa Bondeni, Mapinduzi, Mkele na Shauri Moyo

- **Approach to urban upgrading**

i. Focus on improving the liveability of unplanned, underserved and low-income communities.

ii. Comprehensive area-based strategy.

iii. Long-term urban development framework, mid-term program and short-term priority actions.

iv. Participation of the local inhabitants in decision making in all stages of the project.

v. Incremental approach based on local capacities.

vi. Minimum displacement and resettlement impacts.

- DRAINAGE SYSTEMS PROPOSED IN THE SELECTED AREAS

Seven secondary drainage interventions of various entities were identified and proposed for the study and three communities which have been studied for urban upgrading. Four of the proposed drainage systems are located within these Shehias; the others are located outside the urban upgrading areas. Table E-3 consists of drainage interventions located within the project areas (Shehias). All the drainage interventions aim at reducing flooding problems in Zanzibar urban.

Table E- 3;General drainage interventions

Location	Category	Length (m)
North Meya	Secondary Drain	122
Meya-Magomeni	Secondary Drain	147

The principles guiding the design of the secondary drainage intervention for local service, have been defined following the structures of the general drainage scheme of Zanzibar City. Each local drainage network has been drafted for intercepting the runoff of the catchment area and discharging it into the closest main drainage where possible or into foreseen lamination ponds.

The identified and proposed drainage has been designed in different shape and size based on peak flow, safety and technical considerations. The Main Channels is designed to consist of Reno mattresses and gabions channel to have low flow channel providing habitat for aquatic organisms and a grassed high flow channel which is hydraulically efficient for flood protection purposes. This will be used in the open channels as well as in the outlets of the underground channels towards the sea

Underground concrete channels are necessary. The pre-cast or cast in situ culverts have been proposed in order to guarantee the inspection and the simple maintenance of the structures. In this project, box culvert has been designed to be used in most of underground drainage.

The Secondary Drainage Channels consist of Rectangular channel with cover slabs and side openings for allowing water to be collected from the road surface. This solution of covering has the aim of integrating the drains in the urban design of the city and to minimize risk in falling.

An alternative to covered secondary channel is the trapezoidal or rectangular open concrete channel. This solution is easier to make and less expensive. Each option has been technically analysed, and every suitable typology was identified to be used in proposed drainage system.

PROJECT ENVIRONMENT DESCRIPTION

Zanzibar is the major urban centre of the Zanzibar Island, located in the Indian Ocean. It is a well-known tourist hub in East Africa that arise from its rich history and culture and magnificent tourist attractions.

- **PHYSICAL ENVIRONMENT**
  - Climatic condition

The climate is tropical and the area receives relatively high rainfall as such low-lying areas experience frequent flooding. The rainfall pattern is bimodal in nature. The annually average rainfall of Unguja is approximately to 1600mm. There are also permanent ponds or lakes within Zanzibar which act as flood receptors. The hot and humid season is between December to March while the cool and dry season is between June to September. Temperatures range between 25 degrees Celsius to 35 degrees Celsius. But, with higher humidity levels, temperatures can be felt to range above 40 degrees Celsius in some occasions.

  - Air quality, noise level condition

The ambient air quality around the ZMC areas and the whole Unguja Island appears to be deteriorating rapidly. According to the study on Economic Impacts of Climate Change in Zanzibar (2012), the total CO_2 emissions for Zanzibar in 2010 was 763 Gq CO_2 equivalent or 0.6 tCO2 Emissions per Capita Equivalent. According to ESMP of BIG Z, the analysis of noise levels indicate that ambient noise levels exceed human threshold during day time

especially around the municipal zone and arterial roads exceeding 90 to 120 db. While the current condition of the site areas, the air quality and noise level does not exceed the available standards both national and international standards. The field investigation measurements revealed that; air quality and noise levels comply with both local (ZBS: 2005) and international (IFC-WBG: 2007) standards although the condition is predicted to change during the project implementation, especially during the project mobilization and construction phase.

- Water sources and wastewater condition

Environmental pollution is an issue in the project areas as most of surface water is polluted from sewage and solid wastes. The boreholes water analysis showed a concentration of organic and chemical pollution lower than the guidance standard of both WHO and Tanzania Bureau of standards (TBS). Analysis shows that bore hole water collected around Ziwa Maboga and Sebleni ponds are contaminated with Nitrate concentration of; 4.70mg/l and 1.1mg/l respectively.

- Pond sediments condition

The ponds sediments analysis showed that a concentration of heavy metal is higher than the guidance standard of both WHO and (TBS). If the sediments are found to have significant heavy metals levels, then they should be excavated out of the pond and should be properly disposed to prevent environmental pollution. Lead (Pb) concentration in the sediments were observed to be 9.99mg/Kg and 34.65mg/Kg at Ziwa Maboga and Sebleni Kwa Wazee respectively. Zinc concentration in the sediments analysed were 120.00mg/Kg and 123.21mg/Kg while Cadmium concentration is 3.10 and 4.55mg/Kg at Ziwa Maboga and Sebleni Kwa Wazee respectively.

- Topography and geological condition

Zanzibar urban topography varies between 0-100 m above mean sea level (Johnson, 1983 and USGS, 2006). The project areas are generally flat with little/gentle slope towards the sea and few depressed areas at Tomondo-Mombasa, Meya Magomeni, and Sebleni Kwa Wazee. The project area occurs generally in geological sequences of sedimentary rocks and Quaternary sequence.

- Soil condition

The Geotechnical survey carried out in the three-unit areas observed that; the top soil is composed of darkish clay silt sand. Loose to medium dense, greyish to darkish to reddish moist silty sand with occasional clayey layers. Loose to medium dense, moisty clayey sand has been recognized along all boreholes and trial pits below Top Soil, with occasional clayey layers.

- **BIOLOGICAL ENVIRONMENTAL**
- Vegetation cover

Zanzibar Urban area is rich of different plant species. Among the plants found in Zanzibar urban upgrading areas and in the area of drainage interventions include mangroves at the outlet of system C near Sabatini Shehia and at Mbweni beach. Other plants species area; coconut palm, Neem trees, Bread Fruit Tree, Mango Tree, Flamboyant Tree, Lipstick Tree, Zanzibar Palm, Indian Almond, Seaweed and other vegetation in the beach area and sea cliffs

- **HUMAN ENVIRONMENT**
- Socio-economic and cultural condition

According to the 2012 National census, Zanzibar urban population was 593,678. Most of the population is Islam while approximately 1% is Christians. Customs and traditions of people along the project areas is a mixture of Arab and African customs and an emerged Swahili culture. The culture and attitudes of Zanzibar residents are being influenced by its economic and political processes.

❖ **PUBLIC CONSULTATION**

Public consultation formed an integral part of the ESIA as it provided for interested and affected parties to share their views on the proposed project throughout the project phases. The approach that was used to conduct these meetings included PowerPoint Presentations, plenary discussions, interviews. After each presentation the community had to visit project sites to verify projects which were not clear during discussion.

The following were the stakeholders' engaged for consultations:

- Zanzibar Environmental Management Authority (ZEMA)
- Department of Environment, Zanzibar.
- Department of Forestry and Non-Renewable Natural Resources, Zanzibar.
- Department of Lands and Registration
- Department of Rural and Urban Planning
- Department for Roads Construction, Zanzibar
- Department of Health and Health Education
- Zanzibar Water Authority (ZAWA)
- Zanzibar Electricity Corporation (ZECO)
- Zanzibar Municipal Council
- West B municipalities
- Central District Administrative Office
- Communities from Meya-Magomeni and Sebleni Kwa Wazee, and Tomondo-Mombasa Shehias who form boundaries with the proposed site.
- People whose lands, houses, plots, crops, trees, etc. are directly affected by the project like fishermen, and boat making guys

The followings were the issues and concerns raised by stakeholders

i. There should be well designed collection point in every street to avoid waste scattering,
ii. The implementation of Local Governmental Authorities by-law concerning solid waste management and environmental protection
iii. Street road expansion for the solid waste collection trucks can access and collect solid waste and transport it to disposing site
iv. There should a restriction on disposing of solid waste in the open spaces and open drainage channels
v. ZMC shall make sure that there is adequate solid waste management for the city beautification and attraction of the tourists
vi. All drainage should be covered with concrete slabs to prevent solid waste disposing
vii. ZMC should ensure regular cleaning of the drainage to make them free from Solid wastes and sediments (Sands)
viii. Small number of drainage systems, and the existing drainage channel are overloaded because are small and full of sediments and solid waste, hence they should be developed and expanded to accommodate the amount of storm water which increases due to climatic changes
ix. Poor urban planning and unplanned settlements have obstructed the top of drainage;
x. Poorly designed channels not deep or wide enough;
xi. Lack of maintenance and regular cleaning of drainage channels;
xii. Farming in river courses, which blocks water flow and divert it to the residential areas;

PUBLIC AND LEGAL INSTITUTION FRAMEWORK

Environmental management is not a Union matter (between Tanganyika and Zanzibar) and therefore is handled by the Revolutionary Government of Zanzibar (RGoZ). Regulation on environmental management in the Zanzibar is mainly vested on the Department of Environment (DoE) in the Office of the First Vice President. The DoE undertakes enforcement, compliance, scoping and review of environmental impact statements as well as to provide the policy formulations and technical back-up and executes the overall mandate for environmental management in Zanzibar. The ESIA has been developed by considering the available Zanzibar Environmental management policies, laws and WB safeguard policies. According to the World Bank Guidelines the Urban upgrading and Integrated drainage Project in Zanzibar will trigger the following specific policies; Environmental Assessment (OP/BP 4.01); Physical Cultural Resources (OP/BP 4.11); and Involuntary Resettlement (OP/BP 4.12) Natural Habitats (OP/BP 4.04); Environmental Health and Safety guidelines, as well as other International Environmental and social safeguards guidelines

IDENTIFIED POTENTIAL IMPACTS

Implementation of Zanzibar urban upgrading and drainage integration will create a wide range of environmental and social impacts on a number of receptors. The impacts are of both positive and negative nature and vary in severity and impact duration. The significant environmental and social impacts identified include the following:

Table E- 4; Predicted impacts of the proposed projects

<table>
<tr><th>Positive Impacts</th><th>Predicted potential negative Impacts</th></tr>
<tr><td rowspan="2">• Job creation and increased income to local communities;
• Increase of social interaction and tourism attraction;
• Environmental improvement;
• Reducing of flooding problems;
• Improved transport infrastructure and economic development of the area;
• Improved community life and services;
• Improved storm water drainage system and reduced soil erosion;
• Reduction of water sources pollution;
• Reduce traffic congestion;
• Increase of land value and,
• Increase of agricultural productivity.</td><td>Mobilization phase impacts
➢ Potential Environmental impacts
i. Environmental pollution impact (Air, Noise and Vibration pollutions)
ii. Loss of trees and biodiversity
➢ Potential Social impacts
i. Land expropriation, loss of property and resettlement
ii. Road Traffic Accidents</td></tr>
<tr><td>Construction Phase Impacts
➢ Potential Environmental impacts
i. Degradation of resources and management
ii. Water resources pollution
iii. Soil degradation and depletion
iv. Environmental pollution impact (Air, Noise and Vibration pollutions)
v. Pollution due to waste generated
vi. Interference with Local Hydrology
vii. Loss of Vegetation and Natural Habitats/ biodiversity
viii. Destruction of sensitive areas
➢ Potential Social impacts
i. Destruction of Public Utilities, infrastructure/services and access
ii. Increased Immigration and labour influx</td></tr>
</table>

	iii. Resources Use Conflict *iv. Gender Based Violation (GBV) impact* ➢ **Occupation Health and safety impacts.** *i. Potential threats from spread of STDs and communicable diseases* *ii. Health and Safety risk* *iii. Increased Road Accident and community Health and safety risk*
	Operational Phase Impacts ➢ **Potential Environmental Impacts** *i. Increased Environmental pollution* *ii. Pollution due to waste generated* ➢ **Potential Social impacts** *i. Induced developments and settlements* ➢ **Occupation Health and safety impacts.** *i. Risk of Health and Safety* *ii. Community Health and Safety risk*

Decommissioning phase

Decommissioning is the final phase in the life cycle of the project. It is the demise of the project. It is a process involving dismantling and demolition of the used structures and management of resulting debris. However, the process will be associated with environmental and social impacts, which should be managed as required by the Zanzibar Environmental Management Act and other related guidelines

IMPACTS MITIGATION MEASURES

Many of the mitigation measures put forward are nothing more than good engineering practices that shall be adhered to during the design and construction phases. Among the proposed mitigation measures include;

- Consultation shall be done by contractor with special permission from ZEMA and ZUMC for disposal of excavated materials so as to avoid water source pollution. Consultation with Shehas and Mosque leaders shall be done to arrange for the procedures to relocate the Mosque.
- Compensation shall be done according to Zanzibar laws
- The ZUMC, ZAWA and ZECO shall be involved from the early stages of this project so as to have an integrated planning to prevent destruction of public utilities and infrastructures.
- Avoidance strategies such as sidestepping settled areas, sensitive / important natural or social/ cultural or economic features in order to avoid /minimize extensive resettlement
- An independent groundwater modelling study around the ponds shall be conducted
- Design will be done as not to drain all logging water from the ponds by considering the spillway/ embarkment to the drainage for the maximum flow control
- Good housekeeping shall be practiced within material storage compounds or vehicle maintenance yards where the possibility of spillage is great.
- Proper planning and designing of waste disposal facilities. Proposed management actions for Zanzibar urban upgrading project are requirement and instructions to designers of facilities such as waste treatment facilities to incorporate proper collection and recovery systems;

- Water sprinkling should be practiced regularly at all active work sections along the roads and at all quarries, borrow sites and any place assumed to emit dusts for the protection of workers
- The contractor shall deploy locally available labour to reduce risk of spreading of communicable diseases (especially STD/HIV and COVID19).
- A safety, health and environment induction course shall be conducted to all workers,
- Traffic management plan shall be incorporated in the designs to include for example details of signs, markings, intersection layouts, access restrictions, bus stops, crossings, footpaths etc.
- The contractor shall consult ZAWA before any abstraction of water in the project area. The amount of water given to the contractor shall consider the local community around the project road and downstream of the water course.
- The drainage design and expansion shall try as practicable to offset the route so as to minimize the destruction of mangroves, and other vegetation

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) AND MONITORING PLAN (ESMOP)

Implementation of the recommended mitigation measures have been organized into an ESMP, which shall be part of the contract documents for the contractor. Monitoring of the anticipated environmental and social impacts is essential so as to determine the implementation of ESMP and also tracking the effectiveness of the mitigation measures. The estimated cost for implementing ESMP and ESMoP are T. Shs. 332Million and T. Shs. 219 Million respectively.

The ESMP presents mitigation measures that can be applied by contractors and the PMT broadly to mitigate environment, Social and health and safety impacts of the types of urban upgrading activities (e.g. road development, drainage systems, street lighting, water supply, and solid waste collection points) and drainage interventions that would be undertaken by the PMT, ZUMC and PTCs. ESMPs and ESMoP will be tailored to each subproject, which can draw from the proposed mitigation measures.

RESETTLEMENT ACTION PLAN ASSOCIATED WITH ESIA

A key impact of the BIG-Z is the potential involuntary resettlement and disruption of project affected people (PAPs), as well as potential damage to property. A key mitigation measure is the development and implementation of a Resettlement Action Plan (RAP). The RAP has already investigated in detail these potential impacts and build an action plan to provide compensation for PAPs. The RAP has included the following:

- Identification of project Impacts and affected population (through mapping, censuses, asset inventories, socioeconomic studies and consultation);
- An outline of the legal and compensation framework;
- Resettlement assistance programs;
- Budget and implementation schedule;
- Organizational responsibilities;
- Grievance redress; and Monitoring and evaluation mechanisms

SUMMARY AND CONCLUSION

The ESIA study results show limited negative environmental implications of the project; however, the Zanzibar Urban Upgrading and drainage integration will have high socio-economic benefits to the people of Zanzibar. The major one being reduction of flooding that will improve living conditions and wellbeing of the communities. The

associated negative impacts, to a large extent have been minimized through good engineering design and envisaged construction practices. Specific mitigation measures have been suggested in to offset some of the inherent adverse impacts. Implementing these mitigation measures would increase environmental soundness of the urban upgraded areas and developed drainage systems. Environmental and Social Management Plan (ESMP) and Environmental and Social Monitoring Programme (ESMoP) provide the detailed mitigation measures and impacts management.

It is therefore concluded that, the implementation of the proposed Integrated Drainage and Resilient Urban Upgrading in Zanzibar will entail limited adverse impacts provided that the recommended mitigation measures are adequately and timely put in place. The identified adverse impacts shall be managed through the proposed mitigation measures and implementation regime laid down in this ESIA. BIG-Z and PMT are committed in implementing all the recommendations given in the EIS and further carrying out the environmental auditing and monitoring schedules. Capacity building supported by integration of best practices local by-laws and public awareness Programme shall be given first priority.

UFUPISHO

Serikali ya Mapinduzi ya Zanzibar (SMZ) ilitekeleza na kukamilisha Mradi wa Huduma za Mjini Zanzibar "Zanzibar Urban Services Project (ZUSP)", ambao ulianza mwaka 2011 chini ya ufadhili wa Benki ya Dunia. Mradi wa ZUSP ulizingatia uendelezaji wa miundombinu katika maeneo muhimu ya miji na kusaidia kujenga uwezo kwa Baraza la Manispaa Zanzibar (ZMC) na Mabaraza ya Miji ya Pemba katika usimamizi wa maendeleo ya miji. Mradi wa ZUSP ulisaidia huduma za msingi za miundombinu (usafi wa mazingira, udhibiti wa mafuriko, na maeneo ya wazi ya umma) na urithi wa kitamaduni. Fedha za ziada za utekelezaji wa Mradi kutoka Benki ya Dunia chini ya dirisha la fedha la ziada " Additional Finances (ZUSP-AF)", ambazo zilijumuisha kufanya kazi ya ushauri elekezi kuhusu Uendelezaji wa Miundombinu ya Mitaro Jumuishi na Uhimilivu wa Mji wa Zanzibar "Intergrated Drainage and Resilient Urban Upgrading in Zanzibar Town. Serikali ya Mapinduzi ya Zanzibar imeziajiri kampuni za A.R.S Progetti Pamoja na Sering Ingegneria Srlza Italia, ili kusanifu kupitia mradi wa wa *Huduma za Ushauri wa Upangaji miji, Utaftaji wa Marekebisho, Ubunifu wa Kina wa Uhandisi na Hati za Zabuni za Urekebishaji na Uimarishaji wa mitaro ya maji kwa Mji wa Zanzibar*. Pia Mradi huo umejumuisha kufanya tathmini ya athari za mazingira na kijamii (ESIA) kwa maeneo yaliyopendekezwa kutekelezwa mradi huo ambapo kazi hiyo ilikamilishwa na mshauri elekezi Disemba 2020 na kufanyiwa mapitio na Serikali ya Mapinduzi ya Zanzibar Juni, 2022 ili kuendana na mazingira ya yaliopo.

Kufuatia kukamilika kwa mradi wa ZUSP, imepelekea kuanzishwa kwa mradi wa Ukuzaji wa Uchumi Jumuishi Zanzibar "Boosting Inclussive Growth for Zanzibar (BIG-Z)" unaofadhiliwa na Benk ya Dunia ambao ulianza rasmi kutekelezwa Disemba, 2021

Katika kuhakikisha utekelezaji wa mradi huu unazingatia usalama wa mazingira ni muhimu kwa ajili ya kufikia mradi wa BIG-Z ni endelevu, ilipelekea kufanyika ufuatilaji wa karibu wa usalama wa kimazingira na wa kijamii unaenda sambamaba na Sera ya Mazingira ya Serikali ya Mapinduzi ya Zanzibar na Benki ya Dunia ni muhimu. Kwa kuzingatia matakwa ya Serikali ilipelekea kufanyika tathmini ya athari za kimazingira na kijamii ili kuonesha athari za kimazingira na za kijamii zinazoweza kujitokeza katika utekelezaji wa mradi na kupendekeza njia stahiki za utatuzi wa atahari hizo kwa kipindi cha utekelezaji wa mradi huo. Katika kufanya kazi hiyo inazingatia kufata miongozo na viwango vya kimazingira na kijamii vya Serikali ya Mapinduzi ya Zanzibar na Benki ya Dunia.

MAELEZO YA MRADI

- Kuendeleza maeneo ya miji na miundombinu iliyopendekezwa

Mradi huu unatekelezwa katika Manispaa za Zanzibar, ukiwa na lengo la kuimarisha maeneo yaliyohatarini kuathirika zaidi na mafuriko ikiwemo makaazi ya watu. Mradi uanahusiana na uendelezaji wamji kupitia uimarishaji wa miundombinu ili kuimarisha maisha na mazingira ya jamii. Maeneo ya mradi yalichaguliwa kupitia tafiti zilizofanywa kwa kushirikiana na Manispaa ya Mjini, Magharibi "B", wanajamii (Shehias) na wadau wengine. Upembuzi yakinifu uliofanywa kwa mradi huu ulionesha huduma mbali mbali zinazohitaji kutekelezwa kupitia mpango wa uimarishaji miji wa Zanzibar ikihusisha miundombinu kama ilivyoelezwa kwa ufupi kwenye jedwali E-1.

Jedwali E- 1: Miundombinu iliyopendekezwa Kuboresha mji wa Zanzibar

Miundombinu inayopendekezwa	Vipengele
Mitaro ya maji	Mitaro midogo
Miundombinu ya barabara	Daraja la I (lami, mita 9), Daraja la II A (lami mita 6), Daraja la II B (udongo mita 6), Daraja la III (mita 3-4), Njia Daraja la IV, *Green link type 1 and type 2*, njia ya waenda kwa miguu

Miundombinu inayopendekezwa	Vipengele
Usambazaji wa maji	Uvunaji wa maji ya mvua - kiwango cha PF
Usimamizi wa taka ngumu	Ukusanyaji wa nyumba kwa nyumba, utenganishaji wa taka na maeneo ya kukusanya taka
Taa	Nguzo za taa za jua za PV
Maeneo wazi	Viwanja vilivyosafishwa, Viwanja vya michezo, Sehemu za wazi za umma, Makao ya kivuli, Benchi, na maeneo ya bustani
Masoko	Soko la mtaa

Mchoro E- 1: Ramani ya maeneo ya uboreshaji wa mji Zanzibar

Maeneo na jamii zinazohusika katika mradi huu ni Meya-Magomeni Sebleni-Kwa Wazee. na Tomondo-Mombasa (Jedwali E -2). Shughuli zilizoainishwa ni pamoja na: Uimarishaji wa mfumo wa mitaro ya maji ya ndani / midogo midogoi, mfumo wa usambazaji wa maji, mtandao wa barabara, njia ya watembea kwa miguu, taa za umma, vituo vya ukusanyaji wa taka na uimarishaji wa maeneo ya wazi.

Jedwali E- 2: Maeneo na shehia zilizohaguliwa kuingia kwenye Mradi

S / N.	Eneo la mradi	No.	Shehias iliyohusika	Eneo (Ha)
1.	Sebleni Kwa Wazee	2	Sebleni, Kwa Wazee	75.3
2.	Meya - Magomeni	2	Meya, Magomeni, Mpendae	72.1
3.	Tomondo-Uzi	3	Tomondo, Uzi	1.02
4.	System C		Amani, Kilimahewa Juu na Kilimahewa Bondeni, Mapinduzi, Mkele na Shauri Moyo	0.40

- **Mwelekeo wa kuimarisha mji**
  - i. Mradi unalenga kuimarisha maisha ya jamii zenye makazi duni na kipato cha chini katika maeneo yasiofata mipango miji.
  - ii. Kuwepo kwa mkakati wa kina kulingana na maeneo

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  - iii. Kuwepo kwa Mfumo wa maendeleo ya miji wa muda mrefu, programu za muda wa kati na vipaumbele vya muda mfupi.
  - iv. Ushiriki wa wenyeji katika kufanya maamuzi katika hatua zote za mradi.

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  - v. Kutumia mbinu za kujengea uwezo kwa jamii
  - vi. Athari ndogo za uhamishaji wa makazi.

- Mifumo ya mitaro iliyopendekezwa katika maeneo yaliyochaguliwa

Mitaro saba katika maeneo tofauti iliainishwa na kupendekezwa kwa kufanyiwa utafiti pamoja na jamii katika maeno matatu ya uimarishaji wa miji. Mifumo minne ya mitaro ya maji iliyopendekezwa iko ndani ya Shehias hizi; zingine ziko nje ya maeneo ya uimarishaji miji. Hatua zote za uimarishaji wa mitaro zinalenga kupunguza tatizo la mafuriko katika miji ya Zanzibar.

Jedwali E- 3; Jumla ya mitaro iliyopendekezwa

Mahali	Daraja	Urefu (m)
Meya (Kaskazini)	Mtaro mdogo	122
Meya-Magomeni	Mtaro mdogo	147

Kanuni zinazoongoza muundo wa usanifu wa mitaro midogo kwa huduma za mitaa, zimefafanuliwa kufuatia muundo wa mpango wa jumla wa mfumo wa mitaro ya Mji wa Zanzibar. mifumo yote yote ya mitaro ambayo imeandaliwa na kuelekezwa katika eneo la mkusanyiko wa maji na kuyaingiza ndani ya mtaro mkubwa uliopo karibu pale inapowezekana au kuyaelekeza ndani ya mabwawa ya maji.

Mitaro iliyopendekezwa imesanifiwa kwa ukubwa na miundo tofauti kwa kuzingatia kilele cha juu cha maji, usalama na kiufundi. Mitaro mikubwa imesanifiwa kwa kutumia "Reno mattresses" na mawe "gabion channel" ili kuwa na kasi ndogo ya mtiririko na kulinda makazi ya viumbe vya majini na mtiririko wa nyasi ambacho kina ufanisi wa majimaji kwa madhumuni ya kupunguzai wa mafuriko. Hii itatumika katika mitaro ya wazi na katika mwisho wa mitaro inyopita chini ya ardhi na kumwaga maji kuelekea baharini.

Mabomba ya madaraja yamependekezwa kutengezwa ndani au nje ya eneo la ujenzi ili kuhakikisha na kuwepesisha ukaguzi na ukarabati wa wa miundo mbinu wa mabomba. Katika mradi huu, madaraja ya boksi yamesanifiwa ili kutumiwa katika mitaro ya maji chini ya ardhi.

Mitaro midogo inayojumuisha mitaro ya pembe nne yenye mifuniko na uwazi pembeni ilikuruhusu maji kuingia kutoka barabarani. Suluhisho hili la kufunika mitaro lina kusudia kupunguza hatari ya kuteleza na kuanguka.

Njia mbadala ya kufunika mitaro midogo ni njia ya wazi ya trapeza au mstatili. Suluhisho hili ni rahisi kutengeneza na linagharama kidogo. Kila chaguo limechambuliwa kitaalam, na kila aina inayofaa iliyobainika kutumika katika mfumo wa mitaro uliyopendekezwa

MAELEZO YA MAZINGIRA YA MRADI

Mji wa Zanzibar ndio kitovu cha Kisiwa cha Zanzibar, katika Bahari ya Hindi. Ni sehemu inayojulikana katika utalii kwa Afrika Mashariki hii ni kutokana na historia na utamaduni wake wa utajiri na vivutio vya kitalii vya kupendeza.

- **MAZINGIRA YA KIFIZIKIA**
  - hali ya hewa

Hali ya hewa Zanzibar ni ya kitropiki na mvua nyingi kiasi, kwa upande wa maeneo ya chini huwa na mafuriko ya mara kwa mara. Kawaida mvua hunyesha mara mbili kwa msimu. Mvua ya wastani ya mwaka ya Unguja ni takriban 1600mm. Zanzibar kuna mabwawa na maziwa ya kudumu ambayo huwa kama mapokezi ya mafuriko. Msimu wa joto na unyevu unyevu ni kati ya Desemba hadi Machi wakati msimu wa kiangazi na msimu wa baridi na ni kati ya Juni hadi Septemba. Jotohufikia kati ya nyuzi 25 Celsius hadi digrii 35 Celsius. Lakini, pamoja na viwango vya juu vya unyevu unyevu, joto huengezeka hadi nyuzi joto 40 Celsius kwa baadhi ya wakati

- Hali ya Ubora wa hewa, kiwango cha kelele

Ubora wa hewa uliyopo karibu na maeneo ya ZMC na Kisiwa chote cha Unguja unaonekana kudhoofika kwa kasi. Kulingana na utafiti wa Athari za Uchumi za Mabadiliko ya Tabianchi Zanzibar (2012), jumla ya uzalishaji wa hewa ukaa (CO_2) kwa Zanzibar mnamo 2010 ulikuwa 763 Gq CO_2 sawa au Uzalishaji wa 0.6 tCO2 kwa kila mtu.

Kulingana na ESMP ya BIG Z, uchambuzi wa viwango vya kelele unaonesha kuwa viwango vya kelele vya kawaida vinazidi kizingiti cha binadamu wakati wa mchana haswa eneo la manispaa na barabara za mitaa zinazozidi 90 hadi 120 db. Hata hivyo, hali ya sasa ya maeneo ya mradi, kiwango cha hewa na kiwango cha kelele havijazidi viwango vya kitaifa na kimataifa. Vipimo vya uchunguzi kwenye maeneo ya mradi vimeonesha kuwa; viwango vya ubora wa hewa na kelele havijavuka viwango vya kitaifa (ZBS: 2005) na kimataifa (IFC-WBG: 2007) ingawa hali hiyo inatabiriwa kubadilika wakati wa utekelezaji wa mradi, haswa wakati wa uhamasishaji wa mradi na ujenzi.

- Vyanzo vya maji na hali ya maji taka

Uchafuzi wa mazingira ni suala la kuzingatia katika maeneo ya mradi kwani maji mengi yamechafuliwa kutokana na maji taka na taka ngumu. Uchunguzi wa maji wa visima ulionesha mkusanyiko wa uchafuzi wa oganiki na kemikali chini ya kiwango cha mwongozo wa viwango vya WHO na Ofisi ya ubora wa viwango Tanzania (TBS). Uchambuzi unaonyesha kuwa maji ya visima yaliyokusanywa karibu na mabwawa ya Ziwa Maboga na Sebleni yamechafuliwa na Nitrate kwa kiwango cha; 4.70mg / l na 1.1mg / l mtawalia.

- Hali ya mchanga katika mabwawa

Uchambuzi wa mchanga katika mabwawa ulionesha kuwa mkusanyiko wa madini sumu ni mkubwa kuliko kiwango cha mwongozo wa WHO na (TBS). Mkusanyiko wa risasi (Pb) kwenye mchanga ulionekana kuwa 9.99mg / Kg na 34.65mg / Kg kwa Ziwa Maboga na Sebleni. Mkusanyiko wa *Zinc* katika mchanga ni 120.00mg / Kg na 123.21mg / Kg wakati mkusanyiko wa *Cadmium* ni 3.10 na 4.55mg / Kg huko Ziwa Maboga na Sebleni Kwa Wazee.

- Hali ya kitopografia na hali ya kijiolojia

Hali ya kitopografia ya mji wa Zanzibar inatofautiana kati ya 0 - 100 m kutoka usawa wa bahari (Johnson, 1983 na USGS, 2006). Maeneo ya mradi kwa ujumla ni tambarare na mteremko mdogo kuelekea baharini na baadhi ya maeneo machache yamabonde ya Tomondo-Mombasa, Meya Magomeni, na Sebleni Kwa Wazee . Eneo la mradi lipo katika ukanda wa kijiolojia wa miamba ya *sedimentary* na ukanda wa *Quaternary*.

- Hali ya udongo

Utafiti wa taaluma ya udongo uliofanywa katika maeneo matatu ya mradi uligundua kuwa; tabaka la juu la udongo linaundwa na udongo mweusi wa ufinyazi pamoja na tifutifu uliochanganyika na mchanga. Loose Tabaka la kati, lina rangi ya hudhurungi wenye mchanga mwepesi wenye unyevu na tabaka za kawaida za rangi. Mchanga wenye unyevu wa unyevu umetambuliwa kwenye mashimo yote na mashimo ya majaribio chini ya Udongo wa Juu, na tabaka za kawaida za udongo wa ufinyanzi

- **MAZINGIRA YA BIOLOJIA**
- Mimea

Sehemu ya Unguja Mjini ina aina ya mimea tofauti. Kati ya mimea inayopatikana katika maeneo ya kuboresha miji na katika eneo la mitaro ya maji ni pamoja na mikoko kwenye kituo cha mfumo C karibu na Shehia ya Sateni. Sehemu zingine za mimea; mitende na minazi, miarobaini, Mishelisheli, Mimbe, Flamboyant, Mzingifuri , mikungu, magugu maji na mimea mingine katika eneo la pwani na miamba ya bahari.

- **MAZINGIRA YA KIBINADAMU**
- Hali ya kijamii, kiuchumi na kiutamaduni

Kulingana na sensa ya kitaifa ya mwaka 2012, wakazi wa mijini Zanzibar walikuwa 593,678. Idadi kubwa ya watu ni waislamu wakati takriban 1% ni Wakristo. Mila na tamaduni za watu kwenye maeneo ya mradi huu ni mchanganyiko wa mila za Kiarabu na Kiafrika na tamaduni iliyoibuka ya Kiswahili. Utamaduni na mitazamo ya wakazi wa Zanzibar inashawishiwa na michakato yake ya kiuchumi na kisiasa.

MASHAURIANO YA UMMA

Mashauriano ya umma yalitengeneza sehemu muhimu ya ESIA kwani yalihusisha pande zinazovutia na zinazoathirika na mradi ili kutoa maoni yao juu ya mradi uliopendekezwa katika awamu zote. Njia ambayo ilitumika kuendesha mikutano hii ni pamoja na Maonesho ya picha na maelezo, majadiliano ya jumla, na mahojiano. Baada ya kila uwasilishaji jamii ililazimika kutembelea maeneo ya mradi ili kuhakikisha miradi ambayo haikueleweka wakati wa majadiliano.

Ifuatayo ni orodha ya wadau walioshiriki kwa mashauriano:

- Mamlaka ya Usimamizi wa Mazingira Zanzibar (ZEMA)
- Idara ya Mazingira, Zanzibar.
- Idara ya Misitu na Mali asili zisizorejesheka, Zanzibar.
- Idara ya Ardhi na Usajili
- Idara ya Mipango Miji na Vijiji
- Idara ya Ujenzi wa Barabara, Zanzibar
- Idara ya Afya
- Mamlaka ya Maji Zanzibar (ZAWA)
- Shirika la Umeme la Zanzibar (ZECO)
- Baraza la Manispaa ya Zanzibar
- Manispaa ya Magharibi B
- Ofisi ya Tawala za Wilaya ya Kati
- Jamii kutoka Meya-Magomeni, Sebleni Kwa Wazee, na Tomondo-Mombasa Shehias ambazo zinaunda mipaka ya miradi iliyopendekezwa.
- Watu ambao ardhi zao, nyumba, viwanja, mazao, miti, n.k zinaathiriwa moja kwa moja na mradi kama wavuvi, na waundaji wa mashua

Yafuatayo yalikuwa maswala yaliyoibuliwa na wadau

i. Lazima kuwe na eneo la ukusanyaji taka lililotengwa vizuri katika kila mitaa ili kuzuia kutawanyika kwa taka,
ii. Utekelezaji wa sheria ndogo ndogo za Serikali za Mitaa kuhusu Usimamizi wa taka ngumu na kulinda mazingira
iii. Upanuzi wa barabara za ndani ili magari ya kukusanya taka kuweza kupita na kukusanya taka ngumu na kuzisafirisha kwenda eneo la kutupia taka
iv. Lazima kuwe na kizuizi cha utupaji wa taka ngumu katika maeneo ya wazi na mitaro
v. Manispaa zihakikishe kwamba kuna usimamizi kamili wa taka ngumu kwa kuweka mji safi na kuvutia watalii
vi. Mitaro yote inapaswa kufunikwa kwa mifuniko ya zege ili kuzuia utupaji wa taka
vii. Manispaa zinapaswa kuhakikisha kusafisha mara kwa mara ili kuepuka kuziba kutokana na taka na mchanga
viii. Idadi ndogo ya mitaro iliyopo imejaa kwa sababu ni midogo na imejaa mchanga na taka ngumu, kwa hivyo inapaswa kuendelezwa na kupanuliwa ili kuweza kuchukua maji mengi ya mvua kutokana na mabadiliko ya tabianchi.
ix. Upangaji duni wa miji na makazi yasiyopangwa yameziba mitaro;
x. Muundo mbovu wa mitaro iliopo hauridhishi kwani mitaro mingi ina kina kifupi na upana mdogo;
xi. Kuna Ukosefu wa matengenezo na usafishaji wa mara kwa mara wa mitaro;
xii. Kulima katika kingo za mto, huzuia mtiririko wa maji na kupelekea maji kufurika kwenye maeneo ya makazi;

MFUMO WA UMMA NA TAASISI WA KISHERIA

Usimamizi wa mazingira sio jambo la Muungano (kati ya Tanganyika na Zanzibar) na kwa hivyo usimamizi huu unashughulikiwa na Serikali ya Mapinduzi ya Zanzibar (RGoZ). Kanuni juu ya usimamizi wa mazingira visiwani Zanzibar ni zinatungwa na Idara ya Mazingira (DoE) katika Ofisi ya Makamu wa Kwanza wa Rais.ZEMA

inatekeleza, kufuata, kuongeza na kukagua taarifa za athari za mazingira na pia kutoa sera na uungwaji mkono wa kitaalamu na kutekeleza jukumu la jumla la usimamizi wa mazingira Zanzibar. Tathmini ya Athari za Mazingira na Jamii (ESIA) imeandaliwa kwa kuzingatia sera zilizopo za usimamizi wa Mazingira ya Zanzibar , sheria na sera salama za Benki ya Dunia. Kulingana na Mwongozo wa Benki ya Dunia, Mradi wa kuboresha mijini na Mradi uliowekwa Unguja utasababisha sera maalum zifuatazo; Tathmini ya Mazingira (OP / BP 4.01); Rasilimali ya Tamaduni (OP / BP 4.11); na Makaazi ya hiari (OP / BP 4.12) Makazi ya Asili (OP / BP 4.04); Afya na Usalama wa Mazingira (EHS) na miongozo mingine ya kimataifa ya usalama wa Mazingira na kijamii

ATHARI ZINAZOWEZA KUJITOKEZAUtekelezaji wa Mradi wa Uboreshaji Miji na uboreshaji wa mitaro Zanzibar utaweza kusababisha athari mbali mbali za mazingira na kijamii . Mabadiliko yanayotarajiwa kuwa chanya na hasi na madhara yanatofautiana katika ukubwa na muda. Athari za mazingira na kijamii zilizoainishwa ni pamoja na zifuatazo;

Jedwali E- 4; Athari zilizotabiriwa za miradi iliyopendekezwa

Faida za mradi	**Athari zinazotarajiwa**
• Uzalishaji wa kazi na ajira na mapato kuongezeka kwa jamii; • Kuongezeka kwa mwingiliano wa kijamii na vivutio vya utalii; • Uboreshaji wa mazingira; • Kupunguza shida za mafuriko; • Kuboresha miundombinu ya USAFIRI na maendeleo ya kiuchumi ya maeneo; • Kuboresha maisha ya jamii na huduma; • Kuboresha mfumo wa maji ya mvua na kupunguza mmomonyoko wa ardhi; • Kupunguza uchafuzi wa vyanzo vya maji; • Kupunguza msongamano wa magari barabarani; • Kuongezeka kwa thamani ya ardhi na, • Kuongezeka kwa tija ya kilimo.	**Athari wakati wa maandalizi ya mradi** ➢ **Athari za kimazingira zinazoweza kujitokeza** *i. Athari za uchafuzi wa mazingira (uchafuzi wa Hewa, Kelele na mitetemo)* *ii. Kupoteza miti na viumbehai* ➢ **Athari za kijamii zinazoweza kujitokeza** *i. Kupoteza ardhi, mali na makazi* *ii. Ajali za barabarani*
	Athari za kipindi cha ujenzi ➢ **Athari za Mazingira zinazoweza kujitokeza** *i. Kuharibiwa kwa rasilimali na usimamizi* *ii. Uchafuzi wa rasilimali za maji* *iii. Mmomonyoko/Mmong'onyoko wa udongo na kudhoofika kwa udongo* *iv. Athari za uchafuzi wa mazingira (Hewa, Kelele na mitetemo)* *v. Uchafuzi kutokana na uzalishaji wa taka* *vi. Kuingiliana na hydrolojia asilia* *vii. Kupoteza mimea na makazi ya asili / viumbe hai* *viii. Uharibifu wa maeneo nyeti* ➢ **Athari za kijamii zinazoweza kujitokeza** *i. Uharibifu wa Huduma za Umma, miundombinu / huduma na ufikiaji* *ii. Kuongezeka kwa Uhamiaji na wimbi la wafanyikazi* *iii. Migogoro juu ya utumiaji Rasilimali* *iv. Athari za Udhalilishajii wa Kijinsia (GBV)* ➢ **Athari za kazini na usalama zinazoweza kujitokeza .** *i. Matishio yanayowezekana kutokana na kuenea kwa magonjwa ya zinaa na magonjwa yanayoambukiza* *ii. Hatari ya Afya na Usalama* *iii. Kuongezeka kwa Ajali za Barabara na hatari kwa Jamii na usalama*

	Athari kipindi cha Uendeshaji wa miundombinu ➢ **Athari za Mazingira zinazoweza kujitokeza** *i.Kuongezeka kwa uchafuzi wa Mazingira* *ii.Uchafuzi kwa sababu ya taka zinazozalishwa* ➢ **Athari za kijamii zinazoweza kujitokeza** *1 Ongezeko la maendeleo na makazi* ➢ **Athari za afya na usalama kazini zinazoweza kujitokeza .** *ii.Hatari ya Afya na Usalama kazini* *iii.Hatari ya Afya na Usalama wa Jamii*

Kipindi cha mwisho wa mradi

Muda wa mwisho wa matumizi ya miundo mbinu ni sehemu ya mwisho wa mradi. . Ni mchakato unaohusisha kubomolewa na kuvunjwa kwa miundombinu iliyotumika kuondoa uchafu. Lakini, mchakato huo utahusishwa na athari za kimazingira na kijamii, ambazo zinapaswa kusimamiwa kama inavyotakiwa na Sheria ya Usimamizi wa Mazingira ya Zanzibar na miongozo mingine inayohusika.

NJIA ZA KUPUNGUZA ATHARI ZINAZOWEZA KUJITOKEZA

Hatua nyingi za kupunguza athari zinazoweza kujitokeza zinahitaji ubunifu mzuri wa uhandisi tokea hatua ya awali hadi kipindi cha ujenzi. Miongoni mwa hatua zilizopendekezwa kupunguza ni pamoja na;

- Mashauriano yatafanywa na mkandarasi kwa ruhusa maalum kutoka ZEMA, Manispaa ya Magharibi “B” na ZUMC kwa utupaji wa udongo ili kuepusha uchafuzi wa vyanzo vya maji. Kutafanyika mashauriano na masheha na viongozi wa dini ili kupanga taratibu za kusogeza msikiti ikibidi.
- Malipo ya fidia yatafanyika kulingana na sheria za Zanzibar na Mpango Kazi wa Makazi (RAP)
- ZUMC, ZAWA, Manispaa ya Magharibi “B” na ZECO watahusishwa kuanzia hatua za awali za mradi huu ili kuwa na mpango bora wa kuzuia uharibifu wa huduma za umma na miundombinu.
- Mikakati ya uzuiaji wa athari zinazoweza kujitokeza, kama vile; kukiuka maeneo ya makazi, sehemu za huduma muhimu za asili au za kijamii , kitamaduni na kiuchumi ili kuzuia au kupunguza kuhamisha makazi mapya.
-
- Kufanyika kwa utafiti wa kujitegemea wa maji ya chini ya ardhi karibu na maeneo ya mabwawa
- Kufanyika usanifu wa mitaro ambayo haitaruhusu kuondosha maji yote kutoka katika mabwawa.
- Utunzaji mzuri unatakiwa kufanywa ndani ya maeneo ya magarage na yadi ambapo kuna uwezekano mkubwa wa mtiririko wa uchafu.
- Upangaji sahihi na muundo wa vifaa vya utupaji taka. Hatua za usimamizi zilizopendekezwa kwa mradi wa uboreshaji wa miji ya Zanzibar ni mahitaji na maagizo kwa wabunifu wa miundombinu ya kutunzia taka na kubuni mifumo sahihi ya ukusanyaji na uokotaji wa taka;
- Kunyunyizia maji kunapaswa kufanywa mara kwa mara katika sehemu zote za kazi kando ya barabara na katika uwanja wowote, maeneo yanayochimbwa na mahali popote panapodhaniwa kutoa vumbi kwa ulinzi wa wafanyikazi.
- Mkandarasi ataajiri wafanyakazi wazawa ili kupunguza hatari ya kuenea kwa magonjwa ya kuambukiza (ikiwemo maradhi ya zinaa(STD / VVU) na Uviko 19).
- Kutolewa kwa mafunzo elekezi ya usalama, afya na mazingira kwa wafanyakazi wote.
- Kuwepo kwa mpango wa usimamizi wa miundombinu ya barabara ikiwemo maelezo ya ishara, alama za barabarani, mpangilio wa makutano, vizuizi vya barabarani, vituo vya mabasi, njia za barabara, njia za wanaoenda kwa miguu nk.

- Mkandarasi tshauriana na ZAWA kabla ya kutumia maji katika eneo la mradi. Kiwango cha maji aliyopewa kutumia mkandarasi lazima atazingatie mahitaji ya jamii ya karibu na mradi na chini ya maeneo yenye vyanzo maji.
- Ubunifu na upanuzi wa mitaro ya maji uweze kupunguza uharibifu wa mikoko, na mimea mingine.

MPANGO WA USIMAMIZI WA MAZINGIRA NA JAMII (ESMP) NA MPANGO WA UFUATILIAJI (ESMoP)

Utekelezaji wa hatua za kupunguza zilizopendekezwa zimeandaliwa kwenye Mpango wa usimamizi wa mazingira na usimamizi wa jamii (ESMP), ambao utakuwa sehemu ya hati za mkataba kwa mkandarasi. Ufuatiliaji wa athari za mazingira na jamii ambazo ni muhimu kuamua utekelezaji wa ESMP na pia kufuatilia ufanisi wa hatua za kukabiliana na athari hizo. Gharama inayokadiriwa ya utekelezaji wa ESMP ni Milioni 332T.Sh na ESMoP ni Milioni 219 T.Sh.

ESMP inawasilisha njia za kupunguza athari ambazo zinaweza kutumika na wakandarasi na PMT kwa upana kupunguza athari za mazingira, kijamii na kiafya na usalama kutokana na aina ya shughuli za uboreshaji wa miji (kwa mfano, ujenzi wa barabara, mifumo ya mitaro ya maji, taa za barabarani, usambazaji wa maji, na vituo vya ukusanyaji taka ngumu) na uangalizi wa mitaro utafanywa na PMT, ZUMC, Manispaa ya Magharibi "B" naPTC. ESMPs na ESMoP zitalengwa kutumika katika utekelezaji wa mradi, ambapo zinaweza kutumia njia zilizopendekezwa za kukabiliana na changamoto.

UHUSIANO WA MPANGO KAZI WA MAKAZI (RAP) NA TATHIMINI YA ATHARI ZA MAZINGIRA NA JAMII (ESIA)

Changamoto kuu ya BIG Z ni makazi ya hiari na usumbufu wa watu walioathirika wa mradi (PAPs), na pia uharibifu wa mali. Hatua muhimu ya kupunguza ni kukuza na utekelezaji wa Mpango Kazi wa makazi (RAP). RAP tayari imechunguza kwa undani athari hizi zinazowezekana na inaunda mpango wa hatua kutoa fidia kwa watakaoathiriwa na mradi. RAP imejumuisha yafuatayo:

- Utambuzi wa Athari za mradi na idadi ya watu walioathirika (kupitia ramani, sensa, hesabu za mali, tafiti ya uchumi na mashauriano);
- Muhtasari wa mfumo wa kisheria na fidia;
- Programu za usaidizi wa makazi;
- Bajeti na ratiba ya utekelezaji;
- Majukumu ya kitaasisi;
- Utatuzi wa malalamiko na mifumo ya Ufuatiliaji na tathmini

MUHTASARI NA HITIMISHO

Matokeo ya Tathimini Ya Athari Za Mazingira na Jamii (ESIA) yanaonesha kuwepo kwa uchache wa athari mbaya za mazingira kwa mradi; hata hivyo, uboreshaji wa mji wa Zanzibar na uboreshaji wa mitaro ya maji utakuwa na faida kubwa za kijamii na kiuchumi kwa watu wa Zanzibar. Moja ya jambo kubwa la kuzingatia ni kupunguza athari za mafuriko ambapo itapelekea kuboresha hali ya maisha na ustawi wa jamii. Athari hasi mbaya, zimepunguzwa kwa kiwango kikubwa kupitia muundo mzuri wa uhandisi na ushauri mzuri wa ujenzi unaokusudiwa. Hatua maalum za kupunguza zimependekezwa ili kumaliza baadhi uwepo wa athari mbaya. Utekelezaji wa hatua hizi za kupunguza athari na utaongeza ubora wa mazingira kwa maeneo yaliyoboreshwa na mifumo ya mitaro ya maji. Mpango wa Usimamizi wa Mazingira na Jamii (ESMP) na Mpango wa Ufuatiliaji wa Mazingira na Jamii (ESMoP) umetoa mpango kamili za usimamizi na kukabiliana na athari.

Kwa hivyo imehitimishwa kuwa, mradi wa utekelezaji wa mitaro iliyoboreshwa na Uimarishaji na uboreshaji wa Mji Zanzibar utakuwa na athari kidogo ikiwa tu njia zilizopendekezwa za kupunguza athari zitafanyiwa kazi kwa wakati unaofaa. Athari zilizoainishwa zitasimamiwa kupitia njia zilizopendekezwa za kupunguza na mamlaka ya utekelezaji uliowekwa katika waraka huu wa athari za mazingira (ESIA). BIG Z na PMT wamependekezwa kutekeleza mapendekezo yote yaliyopewa katika ESIA na zaidi kutekeleza ukaguzi wa mazingira na ratiba ya ufuatiliaji. Ujengaji wa uwezo unaungwa mkono na ujumuishaji wa sheria bora za mitaa na Mpango wa uhamasishaji wa umma utapewa kipaumbele cha kwanza.

1 INTRODUCTION

1.1 Background

The Revolutionary Government of Zanzibar (RGoZ) has executed and subsequently closed a project known as "The Zanzibar Urban Services Project (ZUSP)", which started in 2011 under funding from the World Bank. The ZUSP focused on infrastructure in key urban areas of the Zanzibar Municipal Council (ZMC) and Pemba Towns and supports management capacity for urban development and management. The ZUSP project supported basic infrastructure services (sanitation, flood control, and public green space) and cultural heritage. Additional finances were obtained from the World Bank under "additional financing window" (ZUSP-AF), which covers the studies and implementation of this consultancy for Integrated Drainage and Resilient Urban Upgrading in Zanzibar Town. The Revolutionary Government of Zanzibar retained ARS Progetti JV Sering Ingegneria S.r.l both, of Italy, to undertake the designs under a project titled, "*Consulting Services for Planning, Feasibility Study, Detailed Engineering Design and Bidding Documents for Integrated Drainage and Resilient Urban Upgrading in Zanzibar Town*". The project also included undertaking environmental and social impact assessment (ESIA) study of the proposed investments, whereas the project was registered with ZEMA in September 2019, ToR issued in February 2020 and a draft was completed by the consultants in December 2020 and updated by the RGoZ in July 2022.

Following closure of ZUSP, the Boosting Inclusive Growth for Zanzibar – Integrated Development Project (BIG-Z) became effective in December 2021 as a follow-on operation also financed by the World Bank. Ensuring adherence to environmental safeguards is a key element for attaining sustainability of ZUSP and now BIG-Z. High-quality-due diligence on environmental and social impacts and compliance with RGoZ and World Bank policy on environment is essential. In order to comply with the client's requirement, an Environmental and Social Impact Assessment (ESIA) was conducted to address the potential environmental and social impacts and risks of the project and provide means to manage and monitor them throughout the project life. Both RGoZ and World Bank Safeguard Standards and Guidelines were followed.

1.2 Justification and Objectives of the Project

As for many developing countries there are a growing number of environmental and social challenges facing Zanzibar. Zanzibar finds itself in the midst of emerging environmental and social challenges of the current times, mostly caused by the increase of urban population with less urban infrastructure development. These environmental challenges compelled the Government to institute a new policy of 2015, towards an environmental governance framework focused on environmental and social protection. Among the key issues include:

- Frequent flooding events in many places like Tomondo, Sebleni Kwa Wazee, Meya-Magomeni and along system C drain covering several shehias.
- Loss of biodiversity and destruction of habitat both from terrestrial and marine environment
- Problem of water borne diseases like Bilharzia, Malaria and Cholera
- Other people living near Ziwa Maboga and Sebleni who are fishing usually suffer from skin diseases
- Mismanagement of solid waste and It has been a habit to the people to disposal of solid waste into drainage channels, open space, street paths, and water ponds

- Poor waste water management in the community as many people use pit latrines/septic tanks and discharge sewage into drainage channels
- Many people are living low standard housing and low life and surface water pollution due to poor waste water management
- Loss of properties and house during the flooding and loss of life of children and youth in water ponds around Tomondo and Sebleni Kwa Wazee
- Improper settlement as people have been constructing their houses near the existing drainages
- Lack of storm water drainage channel and the few which are existing are overloaded and suffering problem of sedimentation, solid wastes, Wastewater discharge and constricted due improper settlement
- Risk of ground water pollution as some people have constructed local wells along the drainage channels with polluted water by sewage

With this background there is a justification for the "Integrated Drainage and Resilient Urban Upgrading in Zanzibar Town" that lies in the fact that floods are probably the most serious problem of the Zanzibar Town urban areas and that the answer requires an integrated approach based on the local conditions and needs of the local communities along drainage line. The objectives of this assignment are to reduce flooding, expand basic service delivery and improve living conditions in Zanzibar Town through integrated urban upgrading and storm water management in some priority drainage areas. The assignment includes identification of damage and potential impacts due to climate change, interventions or adaptive responses such as plans or measures to counteract climate change threats, and actions to adapt to climate change in the short, medium and long term (Source: Inception Report ARS Progetti, September, 2019).

1.3 Study Rationale

In Zanzibar, it is a legal requirement to undertake environmental impact assessment of any proposed development projects. This is provided for in the Zanzibar Environmental Policy (2013) and the Zanzibar Environmental Management Act (2015). The level of assessment is determined by the Zanzibar Environment Management Authority (ZEMA), after receiving project registration form and project concept note from the developer. The project screening is guided by the provisions in the same law.

In addition, the World Bank, as the development partner for financing the BIG-Z project, has environmental and social safeguard policies for which projects to be financed must abide to. The Environmental and Social safeguards policies set out the standards for Borrowers for assessment of environmental and social risks and impacts associated with projects supported by the Bank through Investment Project Financing. The Bank believes that the application of these policies, by focusing on the identification and management of environmental and social risks, will support Borrowers in their goal to reduce poverty and increase prosperity in a sustainable manner for the benefit of the environment and their citizens.

Environmental and Social Management Framework (ESMF) of the Boosting Inclusive Growth for Zanzibar project (BIG-Z) includes practical, operational set of guidelines and procedures to guide ESIA and ESMP preparation. The ESMF strives to conform to relevant RGoZ policies and legislations and consistent with the World Bank Safeguard Policies, including consultation and disclosure practices for Category B project. According to the World Bank policies, Integrated Drainage and Resilient Urban Upgrading project fall under Category B, hence shall follow national and World Bank environmental and social assessment procedures and guidelines.

The ESMF and RPF are being used as tools for environmental and social due diligence. In addition, an Environmental, Health and Safety Management Plan (EHSMP) for the project investments have been developed and included in developing this ESIA Report.

1.4 Nature of the Project and level of impact assessment

The proposed activities for BIG – Z fall under EIA mandatory projects in accordance with the Zanzibar Environment Impact Assessment (Procedures) Regulations, 2002, because they are likely to cause potential significant environmental and social impacts. Similarly, the overall BIG-Z project is categorized as Category B in accordance with the World Bank classification as stipulated in the OP/BP 4.01. Considering the project environments, this project will trigger WB safeguard policies on Environmental Assessment (OP/BP 4.01), Physical Cultural Resources (OP/BP 4.11), Involuntary Resettlement (OP 4.12) and Natural resources (OP/BP 4.04) and Environmental Health and Safety guidelines. The same safeguard policies were triggered by the other on-going BIG-Z subprojects.

1.5 ESIA Study Objectives

The objective of this ESIA study was to assess the environmental and social impacts of the proposed upgrading of the Integrated Drainage and Resilient Urban Upgrading in Zanzibar Town and recommend mitigation measures to address the negative impacts and enhance positive impacts. Specifically, this ESIA study foresees all environmental, social and economic effects of the proposed project design before the project is implemented. The study therefore has addressed the social, economic, and environmental issues associated with the project and provided relevant mitigation plan to prevent or minimize adverse impacts and enhance the positive ones.

1.6 Scope of Work

The scope of this work is to carry out a comprehensive Environmental and Social Impact Assessment (ESIA) study, prepare and submit a detailed Environmental and Social Impact Assessment Report in a format outlined in the approved Terms of Reference (ToR). The detailed ToR (Appendix I) was approved by the Zanzibar Environmental Management Authority (ZEMA) and includes among others;

To provide a brief description of the relevant parts of the project roads using maps of appropriate scale where necessary:

- Assembling, evaluating, and presenting baseline data on the relevant physical, environmental and social characteristics of the study area.
- Making consultation with Government agencies, local communities and the private sector operating in the villages affected by the project road.
- Reviewing of policies, legislation, standards and regulations governing environment at international, regional and local levels
- Assessing the potential environmental impacts and risks resulting from the project development
- Describing alternatives that were examined in the course of developing the proposed project and identify other alternatives, which would achieve the same objectives
- Developing an Environmental Management Plan (EMP) detailing actions and responsibilities for impacts mitigation and monitoring.

- Identifying the key stakeholders and reviewing on the adequacy of participatory approaches suggested.

1.7 Methodology

Study Team

In order to properly address the environmental issues, a team of experts participated in undertaking the ESIA study. The experts were Environmentalist, Land Valuer expert, Sociologists and Engineers (Environmental and hydraulic) and Urban planners. The names of experts and their respective responsibilities are provided in the fore pages of this report.

Literature Review

Broader literatures were reviewed to understand the environmental and socio-cultural characteristics of Zanzibar and the project area (Zanzibar Municipality). Supplementary reports were obtained from ZUSP on previous projects such as the Environmental and Social Impact Assessment of the proposed Zanzibar Urban Services Project conducted in 2010. Other literatures were collected from government offices and others accessed via the internet.

Field Studies and Stakeholders Consultations

The fieldworks for this study were carried out intermittently from September 2019 to February 2020. The fieldwork involved reconnaissance site visits of proposed drainage channels and communities to be upgraded. The field work involved consultations with governmental officials, meeting communities in the project areas (Chapter 5 discusses more on public consultations), collecting baseline data (described in details in Chapter 4), making physical observations and collecting water and sediment samples for analysis. The field visits were essential to fully realize the scope of the project, the biophysical environment specific to the location and the socio-economic conditions in the project area. Site visits to appreciate the project environment. Site visited were Ziwa Maboga, Sebleni Kwa Wazee, Meya-Magomeni and Tomondo-Mombasa. Other areas visited were drainage systems including; system Cc, Cd and outlet of system C, system C32-12, and Jang'ombe road.

Information and data collected include land use, ecosystems and human habitat, rural production, forestry, wildlife, demography, hydrology, and other indicators related to environmental and socio-economic trends of the project area. Other information was appraised through key informants' interviews and experts' observations. The names of participants in the discussions are attached in Appendix VI.

Consultative meetings

Consultative meetings were held with various stakeholders at Municipals, District, and Shehia levels in order to introduce the proposed project, plan for interviews and booking appointments for meetings. This provided an opportunity to learn and share the salient information about the proposed project. In addition, the team obtained important socio-economic secondary data about the project area. Consultative meetings were conducted in Shehas along the selected communities for upgrading with the purpose of introducing proposed project. Through this technique information on attitude of the people towards the project as well as knowledge and their perceptions and concerns were obtained. The output of the meetings and interviews was identification of major issues and impacts.

Institutions visited and obtained information included;

- Department of Environment, Zanzibar and ZEMA
- Department of Forestry and Non-Renewable Natural Resources
- Zanzibar Water Authority (ZAWA)
- Zanzibar Urban Municipal Council (ZUMC)
- Zanzibar Electrical Corporation (ZECO)
- Department of Roads
- Ministry of Agriculture and Natural Resources
- Department of Urban and Rural Planning (DoURP)
- Department of Health and health education
- West B Municipal Council

In addition, one-on-one interviews with key informants and representatives of the people were used to extract issues regarding to management, development programs, participations and role played by various institutions in the communities. The interviewees were encouraged to give their opinions and perceptions regarding possible positive and negative impacts of the proposed project. Structured questionnaires were used to collect information about socio-economic issues at Shehia levels. Survey interviews were conducted into Tomondo-Mombasa, Meya-Magomeni, and Sebleni-Kwa Wazee Shehas. Public consultation meetings were held in all Shehas that are earmarked to receive drainage improvements and urban upgrading to solve flooding problems.

Direct observations

Some facts were observed directly by the ESIA team. The information obtained from this technique assisted the study team to have the starting point during subsequent one-to-one interviews with stakeholders. Observations were made along the proposed project area to get an impression of the physical features; vegetation; proposed discharge points of storm water; condition of the existing drainage infrastructures; housing type land use, community development activities, etc.

1.8 Project Impact Assessment

- **ESIA Process and Approach to the Assessment**

The assessment for the urban upgrading and drainage integrated Project has been undertaken in accordance with the guidelines and procedures noted above. It has followed a systematic process of predicting and evaluating the impacts the Project is expected to have on the physical, natural, cultural, social and socio-economic environment, and identifying measures that the developer is able take to avoid, reduce, remedy, offset or compensate for adverse impacts, and to provide benefits.

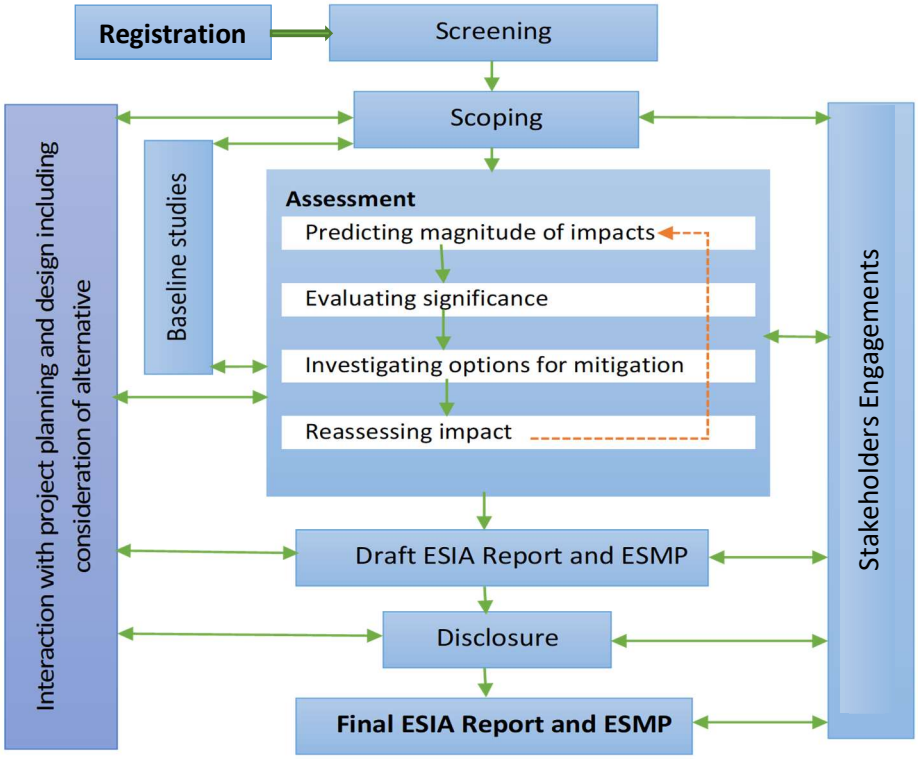

Figure 1.1: ESIA process and assessment approach

- **Impact Identification and Evaluation**

The checklist method has been used to identify the impacts and to recommend mitigation measures. Further, the environmental impact matrix method has been adopted to identify impacts of major concern. A key guiding assumption in this study is that the project will be designed, constructed, operated, and maintained with due care for safety and environmental matters using current and practical engineering practice and/or Best Available Technology Not Entailing Excess Cost (BATNEEC). The implementation schedule of the mitigation measures is summarized in the Environmental, Health and Safety Management Plan (EHSMP).

The environmental assessment has been undertaken in close interaction with the engineering and planning team. In this process environmental impacts have been evaluated for various alternatives. Several project alternatives were considered including that of not implementing the project. The fundamental environmental protection strategy and environmental considerations influencing engineering design were incorporated. However, reasonable regard to technological feasibility and economic capability were considered.

Impact significance and evaluation

Potential project impacts were evaluated during mobilization, construction, operation and decommission phases. Impact significance were dtermined using both project and environment factors (Table 1.1).

Table 1. 1: Factors considered in ascertaining significance of impacts

General	Ecological	Social
- Magnitude - Extent - Non-conformity with environmental standards - Level of public concern - Social impacts resulting from environmental change - Scientific and professional evidence concerning: - resource loss/ecological damage - negative social impacts - foreclosure of land and resource use options - Environmental loss and deterioration - Probability and acceptability of risk - Environmental sensitivity	- Reduction in species diversity - Habitat loss, degradation or fragmentation - Affecting threatened, rare and endangered species - Impairment of ecological functions	- Displacement of people - Human health and safety - Decline in important local resource - Loss/gain of valued area - Disruption of community livelihoods - Demands on services and infrastructure - Public concern - Political concern

The above factors were used to create six criteria which were used to determine the significance of the identified impacts, which are;

- **Spatial Scale-** The spatial dimension encompasses the geographical spread of the impacts regardless of whether they are short term or long term. Table 1.2 describes the ratings used in the simple matrix as far as spatial scale is concerned.

Table 1. 2: Spatial Rating

International (I)	Trans-boundary
National (N)	Within country
Regional (R)	Within Region
Local (L)	On and adjacent to site

(Source: UNEP EIA Manuals, 2002)

Temporal Scale- Temporal boundaries refer to the lifespan of impacts. Table 1.3 describes the ratings used in the Simple Matrix.

Table 1. 3: Temporal Rating

Short-Term (ST)	During construction
Medium-Term (MT)	Life of project
Long –Term (LT)	Residual impacts beyond life of project

(Source: UNEP EIA Manuals, 2002)

- **Reversibility of the impact-** Every impact was checked if its effect can be reversed or not. Letter R was used to denote reversible impacts while IR was used to denote Irreversible impacts.
- **Residual Impacts-** These are long term impacts which go beyond the lifetime of the project in other words Residual impacts refer to those environmental effects predicted to remain after the application of mitigation suggested by the ESIA i.e. they are non-mitigable.
- **Timing-** During which phase of the construction is the impact likely to occur. The phases included Mobilization, Construction, Demobilization and Operation.
- **Cumulative Impacts-** These are Impacts that cause changes to the environment that are caused by an action in combination with other past, present and future human actions. Table 1.4 show types of cummulative impacts;

Table 1. 4: Types and Characteristics of Cumulative Impacts

Type	Characteristic	Example
Time crowding	Frequent and repetitive effects	Forest harvesting exceeds rate of re-growth
Time lags	Delayed effects	Bioaccumulation of mercury
Space crowding	High spatial density of effects	Numerous small mining enterprises on river
Cross-boundary	Effects occur away from the source	Atmospheric pollution and acid rain
Fragmentation	Change in landscape pattern	Fragmentation of habitat by agriculture
Compounding effects	Effects arising from a multiple sources or pathways	Synergistic effect of POPS in humans and rivers
Indirect effects	Secondary effects	Forest areas opened up as a result of new highway
Triggers and thresholds	Fundamental changes in system functioning	Climate change

(Source: UNEP EIA Manuals, 2002)

However, in deciding on the level of significance the team used “best estimate” professional judgment of the experts and case studies as analogous or references. The environmental and social impacts were identified and their potential size and nature were predicted. The prediction of impacts specified the impact’s causes and effects and its secondary and tertiary consequences on the environment and the social aspects.

Identifying Mitigation and Management Options

The options for dealing with identified and predicted impacts were considered. This enabled the study team to analyze proposed mitigation measures. A wide range of measures have been proposed to prevent, reduce, remedy or compensate for each of the adverse impacts evaluated as being significant. Analysis of the implications of adopting different alternatives was done to assist in clear decision-making.

1.9 Outline of the Report

The approved ToRs from ZEMA specify the reporting structure to be followed. This report adopted the same format containing 12 Chapters as follows;

- Non-Technical Executive Summary (in both English and Kiswahili)

- Chapter 1: Introduction
- Chapter 2: Project Description
- Chapter 3: Baseline Environmental and social Conditions
- Chapter 4: Public Consultation
- Chapter 5: Policies, legal and Institutional Framework
- Chapter 6: Analysis of Project Alternatives
- Chapter 7: Identification, Assessment and Analysis of Potential Impacts
- Chapter 8: Impact Mitigation measures
- Chapter 9: Environmental and Social Management Plan
- Chapter 10: Environmental and Social Monitoring Plan
- Chapter 11: Decommissioning or Closure plan
- Chapter 12: Summary and Conclusion

The appendices, containing some key primary information collected during the study are attached at the end of this report as Annexes.

2 PROJECT DESCRIPTION

2.1 Project Location

The project lies in the island of Unguja. The Revolutionary Government of Zanzibar consists of two main islands, Unguja and Pemba. The Unguja Island is separated from the Tanzania Mainland by a channel which at its narrowest part is 36 km (22 1/2 miles) across. Unguja lies between latitudes 5° 40' and 6° 30' south; and longitude 39° east. It is about 85 km (53 miles) in length and 39 km (24 miles) in breadth at its broadest point. Its area is about 1 660 square km (640 square miles). It is the largest island on the east coast of Africa. Figure 2.1 shows the geographical location Zanzibar.

Figure 2.1; Map Showing the Zanzibar Island

The project is located in Zanzibar Municipality, which is the capital and main urban center on Unguja Island. The project covers critical areas prone to floods in Zanzibar municipality. The areas have been selected through rigorous studies conducted under this consultancy. The flooding areas necessitated drainage interventions, of which have been conceptualized and presented in this report. The project also dealt with urban upgrading, with the aim of improving living standards of people.

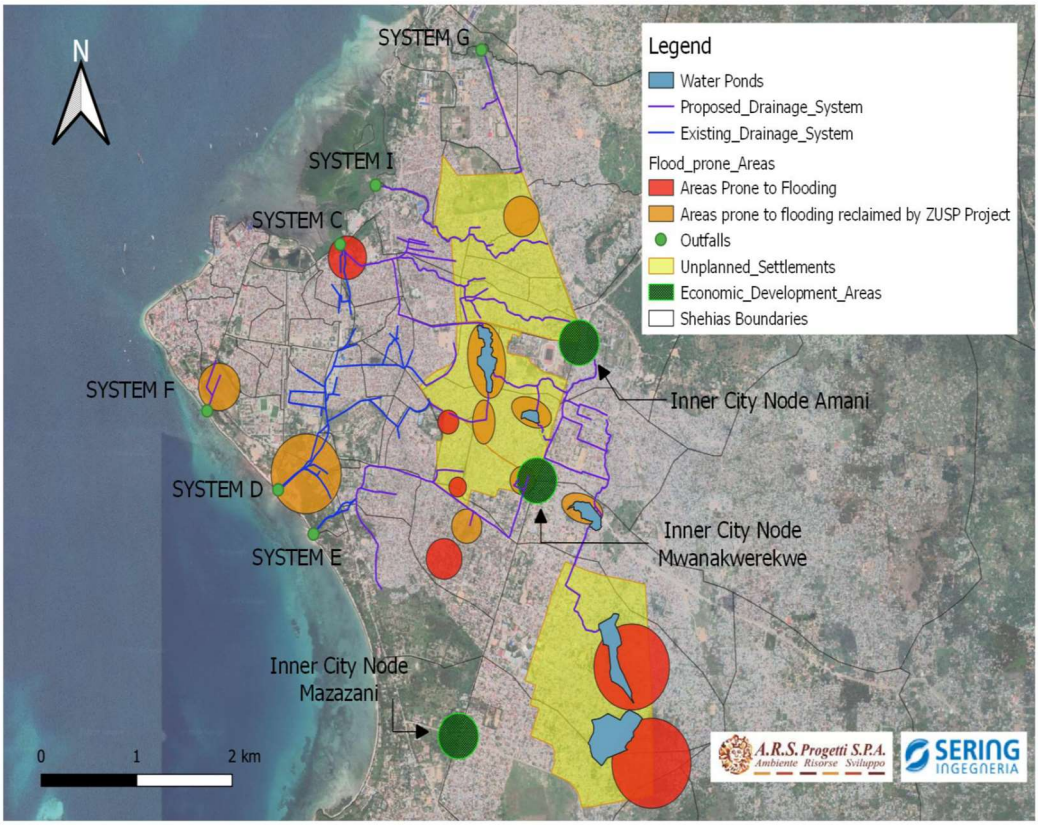

Figure 2. 2: Preliminary findings for the study areas (Source: Inception Report for this Consultancy, September 2019)

- **Sebleni-Kwa Wazee project area**;

It is planning area located to the west of the city centre, approximately 3km from Stone Town. It is located within the so-called inner-city boundary of the city. It includes the areas of the Shehias of Sebleni and Kwa Wazee. It is bonded by the activity corridors of Amani Road to the north and Mombasa Road to the east. Local secondary roads define its western and southern border. It has an approximate gross area of 75ha and a total estimated population of 10,218 inhabitants. The area was previously farmland, owned and rented by the government, used to grow crops and fruits. Land use began to shift starting from the mid-1960s, when development of the area of Sebleni began and the Old People Home was constructed on the land to be later designated as Shehia Kwa Wazee.

- **Meya-Magomeni project area:**

The planning area is located to the southwest of the city centre at an approximate distance of 2,7km from the Stone Town. This area embraces the shehias of Meya and Magomeni, plus the open space of Binti Amrani part of the Shehia of Mpendae. It is bounded to the north by Makunduchi Road, to the east by Mombasa Road and to the west by a local street that runs north-south direction connecting Makunduchi Road and Magomeni Wandarasi Road. The area has an extension of approximately 72ha and an estimated population of 11,942 inhabitants. Development in Meya dates to the 1970s, following its establishment in 1966, whereas the northern section of Magomeni was established in 1978 and developed between 1985 and 1989. The southern section of Magomeni and most of Mpendae was planned and developed in the late 80s and 90s.

- **Tomondo-Uzi project area:**

The planning area is located beyond the boundaries of the "inner-city" perimeter. It is located to the southeast of the city centre approximately 9 km from Stone Town. It embraces part of the Shehias of Tomondo and Mombasa. It is bounded to the west by a north-south road that connects Mwanakwerekwe swamp with Mombasa Shehia. Some sections of this road, when crossing Tomondo Shehia are inaccessible by cars due to the encroaching of housing units. To the south lies the main arterial road to access Zanzibar City from Fumba. The northern boundary is delimited by a local road to the south of Francis Maria Liebermann school. The area has an extension of approximately 125ha and an estimated population of 19,112 inhabitants. The settlement was created in the early 1980s from previously used farmland.

- **System C project areas:**

This drain runs through various shehias namels Amani, Kilimahewa Juu na Kilimahewa Bondeni, Mapinduzi, Mkele and Shauri Moyo which have varying populations and geormological structures. All shehias along system C drain have urban features characterized by dumping of waste and discharging sludge water into the drain. The drain was constructed under ZUSP but population increase and houses densification in Shehias along the drain has caused frequent floods along the drain. The drain size has deteriorated and experienced overflow causing floods.

2.2 Project Components

The proposed project is composed of mainly two subprojects, that is;

i. Zanzibar urban upgrading interventions and;

ii. Drainage systems integration

Both of these sections intend to reduce flooding impacts to the Zanzibar Urban and improve community livelihood and infrastructure improvement.

2.2.1 Zanzibar Urban upgrading component

- **General Urban Upgrading**

The project areas which have been identified and selected for urban upgrading are in three units that is; Meya-Magomeni, Sebleni-Kwa Wazee and Tomondo-Mombasa (Figure 2.3). The main aim of the urban upgrading exercise is to improve the living and environment conditions of local communities in the project areas. The three selected areas are:

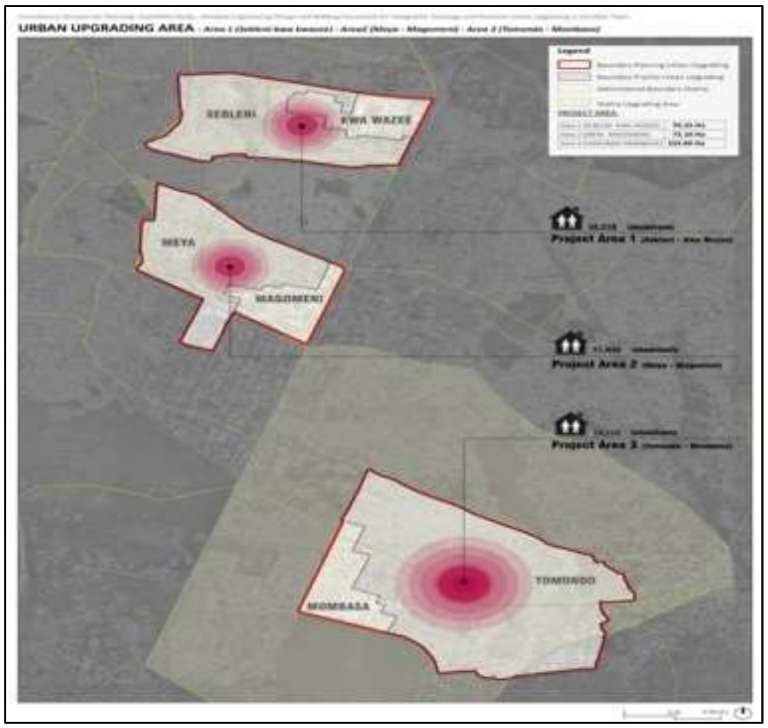

Figure 2. 3; Urban upgrading location areas

Table 2. 1; List of identified and selected areas for urban upgrading

Area nº	Area name	Shehias to be involved
1	Sebleni – Kwa wazee	Sebleni - Kwa wazee
2	Meya – Magomeni	Meya – Magomeni -Mpendae
3	Tomondo – Uzi	Tomondo, Uzi

In the three (3) selected-areas, basic infrastructure and services are insufficient, therefore; a package of tertiary infrastructure has been identified. This includes the following infrastructures:

Table 2. 2: Service categories and components in three-unit areas for upgrading

S/No.	Proposed infrastructure	Infrastructure component
1.	**Drainage**	Secondary drainage
2.	**Streets infrastructure**	Category I (bitumen street 9 m) Category II A (bitumen 6 m) Category II B (compacted soil 6 m) Category III (3-4 m) Category IV Footpath Green link type 1 and type 2 Pe destrian elevated footpath
3.	**Solid Waste management**	Door-to-door collection Micro sorting and collection points
4.	**Lighting**	Solar PV lighting poles

5.	**Open spaces**	Paved squares Sports fields Playgrounds Pond open public spaces Shading shelters Benches Green areas
6.	**Markets**	Local market

The aims of the proposed sub-project include the following;

- Upgrading basic tertiary infrastructure through partnerships between communities and local governments.
- Providing and or rehabilitating primary and secondary infrastructure network to connect with the tertiary infrastructure.
- Reducing the environmental impact such as minimizing impervious area and carbon emission.
- Reducing the waste problem that affects Zanzibar City
- Improving/Reducing the current flood situation of the project area
- Providing compensation to people who will be resettled at full replacement cost rate.

The resilient urban upgrading activities to be implemented will involve construction of storm water drainage systems along the flood prone area and development of identified infrastructures. The services that most directly affect the drainage system are the solid waste and the liquid waste disposal. The performance of both these services is at the same time cause and effect urban environment, which must be made livable and sustainable, with particular reference to the mobility and to the economic growth of the areas. On the other hand, an improved environment can generate the conditions and means for maintenance and correct operation of the infrastructure.

The Zanzibar Urban upgrading is targeting into the improvement of the physical, social, economic and environmental setting of unplanned low-income communities undertaken cooperatively and locally among citizens, community groups, business, government and private sector. It is undertaken in parts of the city characterized by unplanned or “spontaneous” settlements with sub-standard living conditions due to the lack of basic municipal services (such as sanitation, storm drainage, street lighting, paved footpaths, roads for emergency access), low housing quality conditions, and the areas which suffer from the frequency and periodic flooding calamities.

Potential impacts individuated at this stage are mostly related to the construction phase as the interventions are localized in areas characterized by a high unplanned urbanization where environmental pressure on the local ecosystem is currently considerable.

2.2.1.1 Approach to urban upgrading

i. Focus on improving the liveability of unplanned, underserved and low-income communities.

The main objective of the AUP is to improve the liveability of low-income communities living in unplanned” and “underserved” neighbourhoods within Zanzibar Municipality and West B Municipality.

ii. Comprehensive area-based strategy.

The Urban upgrading is an integrated and comprehensive intervention with the final goal of improving the liveability of the local population. In this sense, the AUP combines a variety of objectives, strategies and actions with the aim to; improve the built environment, preserve the natural environment and strengthen local ecosystems, and promote economic development.

iii. Short-term urban development framework priority actions.

The proposed Short-term planning frameworks developed for the three areas consider the vision and desired city development objectives as per the key planning documents, in particular the Zanzibar Plan. The short-term interventions have been strategically concentrated on urgent problems and activities identified in conjunction with the local community during different participatory exercises undertaken in previous project phases and based on agreed objectives to achieve liveability.

iv. Participation of the local inhabitants in decision making in all stages of the project.

The AUPs have been developed jointly with the local communities since the initial stages of the project. Local communities have identified the priorities, the level of services they can afford, reviewed the proposals and prioritization, and defined how they want to contribute to its implementation and maintenance.

v. Incremental approach based on local capacities.

Urban upgrading projects aim to incrementally improve the area as opposed to a redevelopment intervention. An incremental approach to urban upgrading has a higher chance of improving living conditions as it does not disrupt social networks or livelihoods strategies. Engineering and other technical solutions have been designed and improved with a level of service and standards that are adequate for the local context and capacities.

vi. Minimum displacement and resettlement impacts.

Plots where new buildings can be developed to accommodate the households impacted by the investment proposals have been identified and costed on all areas. A key principle of the intervention has been that all impacted households can be compensated at full replacement rate.

2.2.1.2 Identified interventions in three-unit areas

The study has identified the interventions which were observed, and they require urgent implementation. The considered interventions include the following infrastructure investments as elaborated in the following section.

2.2.1.2.1 The identified and proposed interventions at Sebleni Kwa Wazee

Neighbourhood infrastructure investment include; the upgrade and widening of the two main local streets (Kwa Wazee Magazeti) comprehensive of drainage, public lighting and sidewalk; the upgrading of the waste collection points along these routes; the upgrade of Nemo street (which is the main commercial route within Sebleni); and the upgrade of the existing unbuilt spaces that have remained after the completion of the construction of secondary drainages part of the ZUSP project into a ¨green link¨ and adjacent public open spaces of Machicha and Mbarawa grounds. In addition to the selected list of projects, the neighbourhood infrastructure investment component includes additional investments in drainage interventions to ensure the hydraulic functioning of the area in the short term.

These investments are complemented by a group of soft projects which include first and foremost the land tenure regularization program, as well as the capacity building of the existing community to ensure the sustainability of the interventions.

Table 2. 3; Identified interventions in Sebleni Kwa Wazee Project Area

Neighbourhood infrastructure investment	Type
Upgrade of Gongo Store - Kwa Wazee street (Kwa Wazee to Magomeni street) into local street (category I).	Street
Pedestrian elevated path on Sebleni detention pond	elevated path
Street Category III	Street
Street Category III	Street
Upgrade of Magazeti to Kwaboko street into local street (category I)	Street
Development of "green link project" along drainage line within Kwa Wazee (from Mombasa street to Sebleni pond)	green link
Upgrade Nemo street (part A) into category III street	Street
Upgrade of Machicha ground (adjacent to Msikiti Kwa Wazee) with sitting shading area and play area	open space
Upgrading of Mbarawa ground football pitch	open space
Upgrade the solid collection point along Kwa Mabata	Solid Collection point
Upgrade the solid collection point on Machicha ground	Solid Collection point
Road category III in Sebleni	Street
Additional Local Drainage	Drainage
Additional Local Drainage	Drainage

2.2.1.2.2 The identified and proposed interventions at Meya-Magomeni

Neighbourhood infrastructure investment include; the upgrade and widening of the two main local streets (Magomeni Najim -Sogea Branch) comprehensive of drainage, public lighting and sidewalk; the upgrading of the key open spaces of Mzalendo and Vijibwa pond; the construction of a small market structure and new waste collection point adjacent to Vijibwa pond; the improvement of the west to east connection between the shehias and access to the new market structure; the upgrading of Wandarasi street, and the construction of new secondary and local drainages to address the problem of flood events in some critical area (Table 2.4). In addition to the selected list of projects, the neighbourhood infrastructure investment component includes additional investments in drainage interventions to ensure the hydraulic functioning of the area in the short term. The project is considering the additional of upgrading of Jang'ombe road corridor.

Table 2. 4; identified interventions in Meya-Magomeni Project Area

Neighborhood infrastructure investment	Type
Development of secondary drainage and green link from Magomeni Wandarasi to Vijibwa Pond (drain EB)	Drainage
Upgrade and extension of Magomeni Najim street into "local street" category I up to Magomeni Wandarasi public open space and up to Jang'ombe street.	Street
Upgrade of Vijibwa pond	Open Space
Upgrade of Magomeni Mzalendo	Open Space
Development of secondary drainage from Jitini street to Nyerere football pitch (drain CD) to drain Shimo la Nguruwe	Drainage
Construction of 700 mq of market space for small traders in Vijibwa pond	Facilities
Upgrade of Sogea Branch street up to Denja into neighborhood street (category IIA).	Street
Upgrade Wawi Bekari street as category III	Street
New solid point in Vijibwa pond (Meya) into micro-sorting and transfer areas	Solid Waste
Upgrade Wandarasi street into category II B street	Street
Upgrade "Moss street" into a neighborhood street (category IIB + III street)	Street
Local Drainage in Concrete lining	Drainage
Upgrading of Jang'ombe green corridor	Street
Added local Drain Meya	Drainage
Added local Drain Meya	Drainage

2.2.1.2.3 The identified and proposed interventions at Tomondo-Mombasa

Neighbourhood infrastructure investment include: the upgrading of the main local and neighbourhood streets within the area, comprehensive of drainage, public lighting and sidewalks, in order to improve the connection of the area with the city. Among the main streets to upgrade highlight, the reinstatement of the main feeder roads and previous public transport route of Francis Maria street, which has been currently encroached by buildings; the upgrade of Changu street which will improve the connection of the area with Mombasa market, and the upgrade of the main commercial route within Tomondo which is Royal street (Table 2.5).

These investments are complemented by a group of soft projects which include first and foremost the land tenure regularization program, as well as the capacity building of the existing community to ensure the sustainability of the interventions.

Table 2. 5; Identified interventions for Tomondo Project Area

Neighborhood infrastructure investment	Typology
Upgrade Francis Maria street into local street (category IIA street) from Mombasa to Maduka Saba including constructing new bridge	Street
Upgrade Mpigabodi street into neighborhood street (category IIA)	Street
Upgrade and extend Changu street between Kwerekwe street and Royal street into local street (category I)	Street
Upgrade Royal street - Ziwa Maboga street into neighborhood street (category IIA street)	Street
Linear meters of road category III	Street
Added Local Drain Tomondo	Drainage
Added Local Drain Tomondo	Drainage
Added Local Drain Tomondo	Drainage

2.2.1.3 Description of Infrastructure and development interventions

This project of urban upgrading and drainage interventions has several development activities which includes:

Street infrastructure

Street categories for feeder streets in urban upgrading interventions in high density settings. Three main street categories are proposed for the urban upgrading intervention. Highlight that these categories only refer to "feeder" streets within the settlement area and do not embrace urban streets or arterial roads. Additional details on materials and design are included in the "Technical assessment" chapter 4. These revised standards for streets for upgrading interventions, will minimize resettlement impacts to the implementation of the local streets (Category I) for the development of macro blocks and in punctual locations for the realignment of streets.

- ***Local Street (category I):***

This category is composed by the main "feeder roads" which constitute the main accesses to the neighbourhood. These streets will have a section of approximate 8-9 meters and include a carriage way of 5.5 meters and incorporate a mixed cycle and pedestrian sidewalk. This section has been based on the current practice being developed by the Ministry of Local Government, Feeder roads department, and is also aligned with the "Local streets" category as per the "Infrastructure guide use of roads and streets of Zanzibar". It involves pervious standard bitumen pavements

These streets will be located every 500 meters (approximately) creating "macro blocks" which will divide the areas. In most cases, the development of these roads will entail the demolition and rebuilt of one line of plots to fit the enlarged street width. Higher building densities, with recommended building height of 3 to maximum 4 stories have been proposed along this street category. Commercial uses are proposed to be located on the ground floor units. Pilot projects to build mixed use typologies with higher densities on reorganized plots are proposed. This street will support public transport routes (Figure 2.7).

Figure 2. 4; Local street section

- ***Neighbourhood Street (category II)***.

These streets are existing vehicular routes that connect two locations within the neighbourhood. The intervention will consist in the upgrade of the existing street section with limited resettlement in order to ensure a continuous street width. Category IIa consists of 8-9meters width and involves pervious standard bitumen pavement. The other selected category is category IIb which includes of 5-6m width and involves Earth stabilized pavement. These streets have a section of approximate 6 meters, with a one-way carriage way of 2.85 meters, made in compacted soil or asphalt concrete. Commercial uses are proposed along these routes (Figure 2.8).

Figure 2. 5; Neighborhood street section

- ***Pedestrian and bicycle street (category III):***

These streets are local access streets to the dwellings. They are organized in the settlement creating an interconnected network of streets and blocks of a maximum side length of 150 m. These streets will enable the access of emergency vehicles and service trucks closer to each dwelling (Figure 2.9).

Figure 2. 6; Pedestrian and cycle street section

There are number of identified roads for improved and development of the roads. In order to implement this project, resettlement of dwellings along some of the roads is planned, especially for category I.

The importance of this project is relying on improving the security and for transit of emergency vehicles and wanted the widening of the road to allow for two-way traffic. They consist of 3-4meters width and involve the Earth stabilized pavement

Green Link

It has been found the case where drainage interventions were needed within the urban upgrading areas in alignment not related to road trunks construction. For these cases, with the aim of providing integrated solutions and urban livability enhancement in all areas of intervention, the Consultant has defined the category "Green Link" which is a combined solution integrating the drainage intervention and walking path (Figure 2.10).

Figure 2. 7. Green Link cross section

The solution mainly consists of trapezoidal open channels further covered with suitable concrete slab placed on intermitted curbs.

Street Lighting

"Resilience Urban Upgrading in Zanzibar" will also carry out lighting to the roads and provide security services to the area which are scared to pass during the night. It will involve solar power supply or traditional poles.
The lighting requirements for each road category under this project follow the British Standards guidelines. The solution proposed is to adopt photovoltaic LED luminaries provided with energy accumulators and grid connected (Figure 2.11). The system can work in a stand-alone mode in the case of no power from public network and as a standard grid connected system when power is supplied from the public grid. Power produced during the light hours is furnished to the public grid when connected. This solution ensures high durability of the system and reduced power consumption.

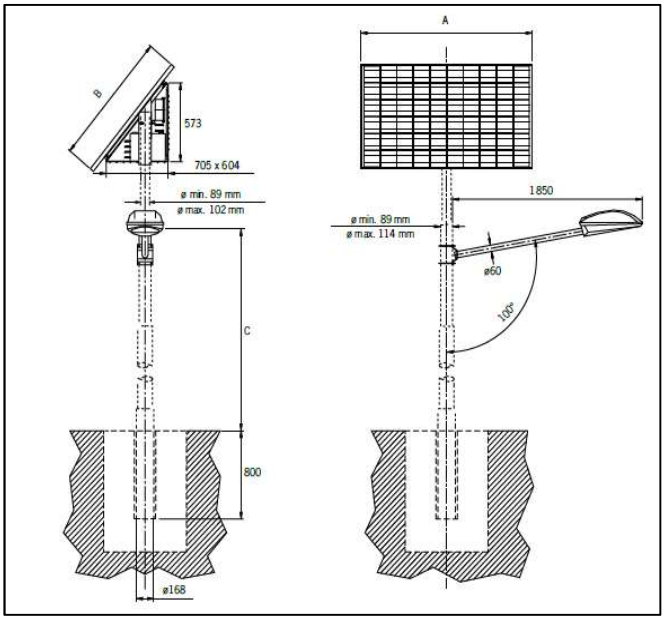

Figure 2. 8. An example for the proposed street lighting

Solid waste management

Waste collection has been highlighted by the local communities as one of the key priorities and least efficient services provided. The capacity of the skip containers located in the area is not sufficient for the current volumes produced within the neighborhood (Figure 2.12).

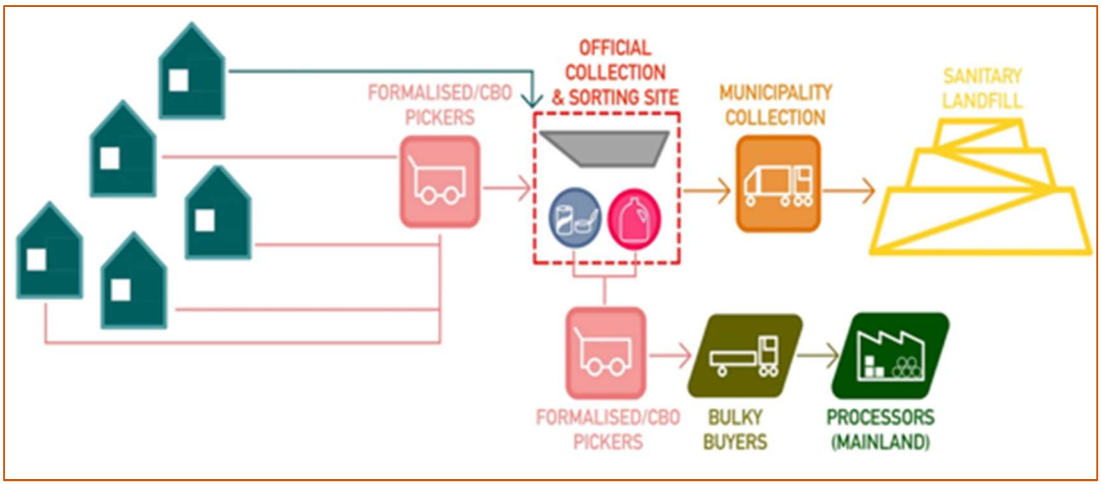

Figure 2. 9. Solid Waste Management Flow diagram

The project will entail the installation on each of the agreed spots of a new waste collection point including the installation of an additional skip container, implementation of a wall and shelter for the collection point as well as sorting area (Figure 2.13).

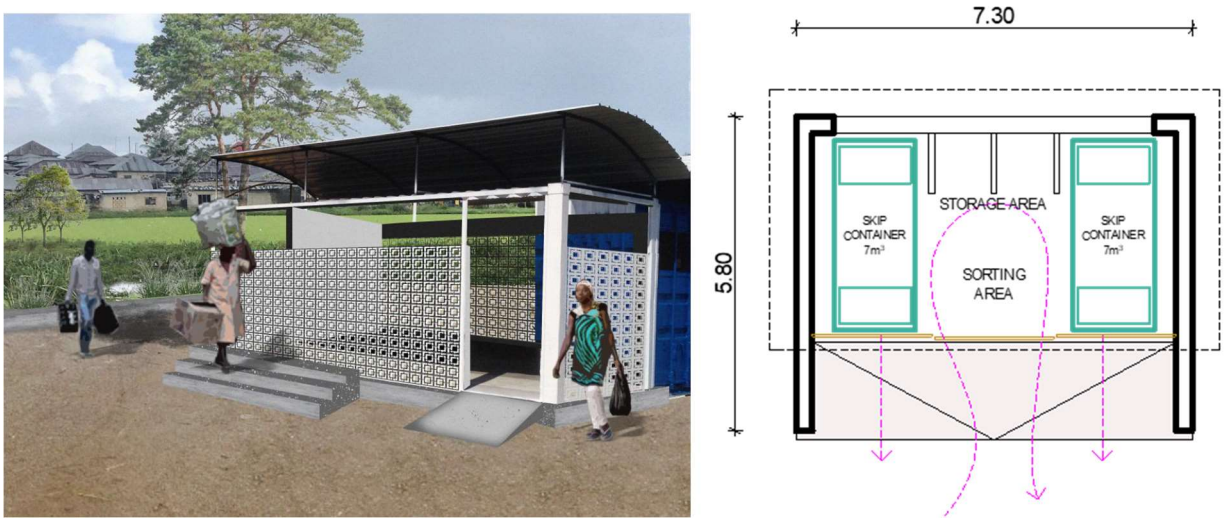

Figure 2. 10; Micro Sorting and Collection Spots

Public open space

In public open space, the project is proposing many interesting activities which are accounted as one of the issues into the community. Among the proposed projects are; improvement of surface materials, shading, benches, sport fields, playgrounds, embankment walls ponds, vegetation and gardens, urban agriculture and market places (Figure 2.14).

Figure 2. 11; existing open spaces at Sebleni Kwa Wazee (right) and example of upgraded open space

Pond open public spaces

Following the implementation of secondary and main drainages, the area at present flooded during rainy seasons will be kept to detain a certain volume of runoff, improve and enhance the natural water drainage of water. The pond will become infiltration basins landscaped to provide spaces for amenities and recreation during dry season.

The concept idea is to contribute to the initial design of flooding park by providing:

- reinforcing and greening of pond banks
- securing accesses to pond bed
- executing crossing paths

The upgrading will become an opportunity to mark the limit of the pond through urban design and landscaping. Punctual accesses to cross the pond are designed and a continuous tall and short dense vegetation strip is planted along the upper shoreline to prevent uncontrolled access and construction on flood prone hazardous areas (Figure 2.15).

Plants used for the stabilisation and construction of ponds embankments become an important removal mechanism for pollutants and metals and they might create a range of habitat type. Design and maintenance shall be optimized to deter breeding of mosquitoes.

Figure 2.12. Typological scheme to show areas and services complementarity in Pond

Markets

The markets have been proposed in a specific need assessed in each upgrading area. In general market have been located, upon consultation of the Community, on empty plots located along Cat I or CAT II streets (Figure 2.16). Market are meant to be reachable by motorized vehicles to facilitate pick-in and drop-off operations and cleaning. The site is located along streets which will be subjected to a prevalent mixed-use development on ground floors. Market structure will be kept as simple as possible. It will be provided with appropriate water supply, toilets and electricity.

Figure 2.13. Examples of markets: paving and vertical partitions finishes (left image) and roofing metal structure (right image)

The market areas consist of: a ground reinforced concrete slab polish finished; vertical low rising partitions in HB blocks or wood to create organized spaces for vendors and to guide the movement framework; a metal frame roofing structure to provide a protective shelter from sun radiation and rain; corrugated metal sheets for roofing. To execute vertical and horizontal non-structural partitions, where necessary, is suggested the use of locally made vegetal panels (raffia mats, interwoven leaf mattresses, palm branches,). The use of vegetal panels

locally produced is highly recommended and to be preferred over the use of cement-based materials. Production, maintenance and repairs of the vegetal panels might become a sustainable income generating opportunity for a locally based production. Existing trees and vegetation are kept, maintained and integrated into the design

2.2.2 Drainage system interventions component

2.2.2.1 General overview of drainage systems of Zanzibar municipality

The drainage interventions under this project are divided into two categories:

- local drainage interventions that are included in the urban upgrading projects and for which they are lying along the road section's
- drainage interventions outside the project areas, which shall be considered as urgent drainage needs.

Local drainage implementation will follow the development of the urban upgrading projects with some exception due to technical constrains.

The general drainage of Zanzibar municipality is shown in Figure 2.17 that provide main drainage basins. Among of the proposed drainage interventions being selected are; Cc, Cd, C32-12, Eb, and system C outlet (appendix ix).

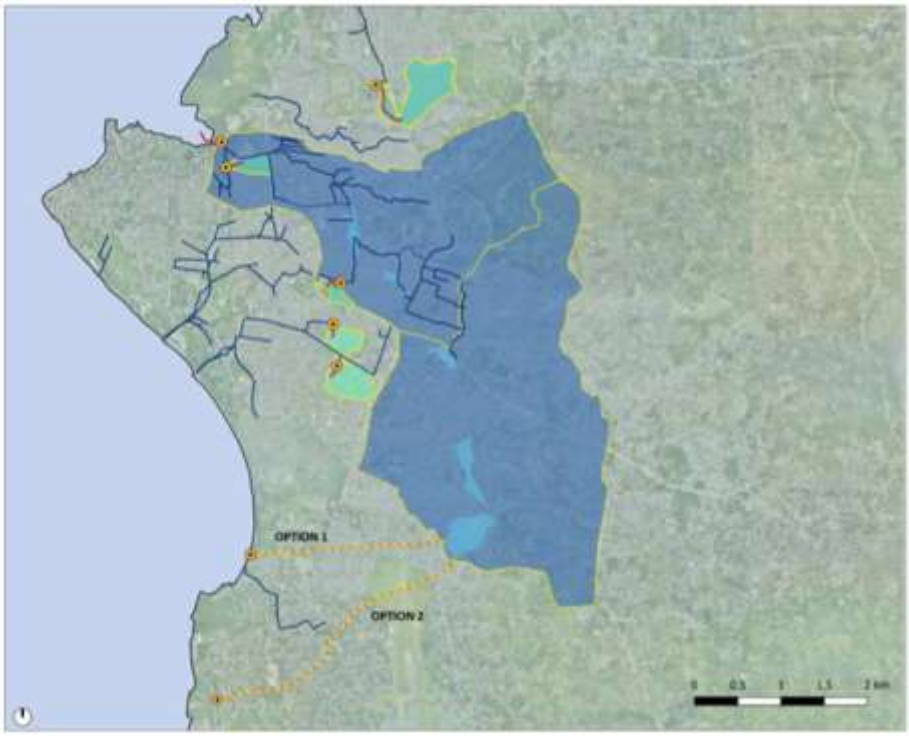

Figure 2. 14: The general main drainage network of Zanzibar Municipality

2.2.3 Proposed drainage systems localization, layout and their specified lengths

In the project area, the drainage interventions have been selected and analysed. The drainage interventions have been identified after field surveys and interviews carried out during the assessment of the flood risk in the project area and the localized drainage of different length were assessed and the areas where are found. Among

the identified drainage; two of them are located outside of the three units; the location of the drains and their length are shown in Table 2.6.

Table 2. 6:Proposed drainage systems and their location

Location	Length (m)
North Meya	122
Saateni	120
Meya-Magomeni	147

2.2.3.1 Layout Drainage system Cc and Outlet System C

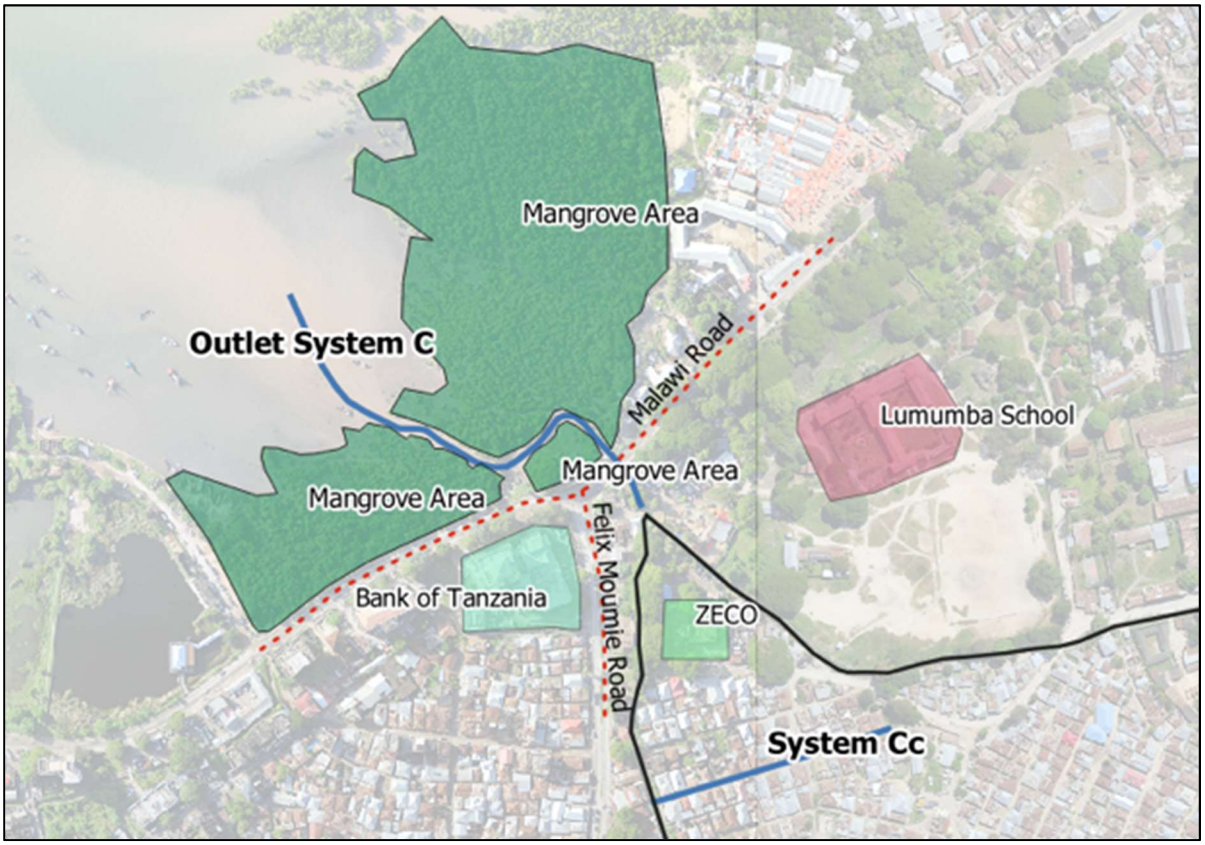

Figure 2. 15. Project Area Assessment

- **Layout Drainage System Cc**

The System Cc is proposed to be surface Rectangular Channel with Slabs which is connecting from Makadara School 200m to the existing open channel, and flows to the proposed outlet of system C. It is located outside the three project unit areas. The sub basin drained by the proposed CC channel covers an area of 8.3 ha which determine a peak flow for 15 years Return Period of 2.38 M^3/s. The proposed drain provides outlet for its sub – basin to the existing drainage trunk named C4.2/C4-1. It runs for 210 meters with a cross section of 1.5 wide and 0.7me-ters high (Figure 2.19).

Figure 2. 16: Proposed drainage Cc layout

- **Layout of Outlet System C**

The outlet drainage of system C is 120m crossing three bridges in the Malawi road at Sateni Shehia and being close to Malawi road, the Bank of Tanzania and the state office ZECO. Schools, petrol stations and other services are also present in the area, flowing along the Mangrove area to the sea. It is proposed to be open trapezoidal channel. The system C outlet rehabilitation consists of a number of interventions to be put in place in the last trunk of the system C from the junction named MHC-4, upstream Malawi road, to the mangrove areas. The area is currently prone to flood due to the poor condition of the existing stream, hydraulic insufficiency of some of the existing structures and interferences placed on the riverbed (Figure 2.20). The intervention will involve the following bridges;

The box culvert bridge, the first met by the flow from upstream, is a well condition reinforced concrete structure with dimensions of 4.4 x 1.7 meters (WxD) that appears immediately inadequate for allowing the transit of the design flow.

The second bridge on the stream, which belongs to Malawi road, is an old reinforced concrete structure placed on a concrete basement on the river bed currently partially destroyed.

The third bridge, the oldest one, is a reinforced concrete bridge as well as the second one. It appears in all its visible part in good conditions.

Figure 2. 17. Third Bridge and Bridge 1, Box culvert Bridge

A number of interferences are also present of which the main one is a sewer pipe crossing the stream nearby the second bridge, placed on a number of concrete piles on the riverbed.

Several hypotheses have been put in place for solving the critical issues and minimizing the structural interventions. The following have been considered and verified:

- Demolition and reconstruction of the box culvert bridge with the following dimensions: W=9 meters; H=2.5 meters;
- Excavation of the riverbed and regularization of the slope to i=0.2%;
- Riverbed reshaping and lining of reno mattress from the section downstream the bridge 1 to downstream of the bridge 3;
- Removal of the sewer pipe support pile ad replacement with a support beam;
- Regularization of the cross sections of the entire length of the river between the three bridges (Figure 2.21)

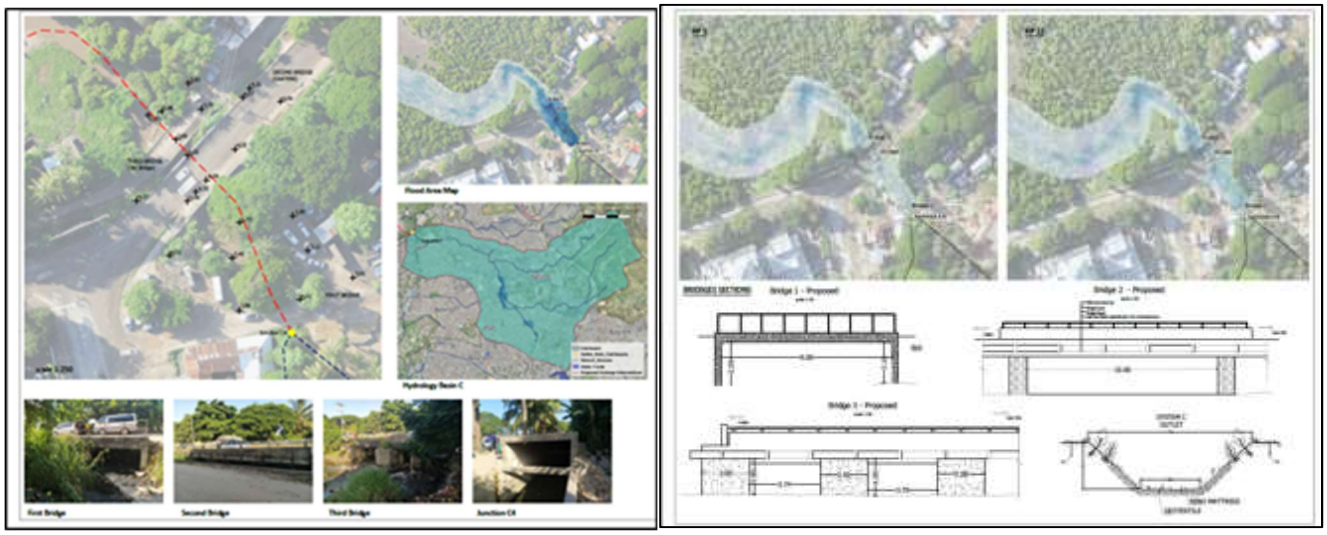

Figure 2. 18: Layout of the drainage Cc and outlet of drainage system C with beneficiaries' area

2.2.3.2 Layout Drain Cd

The proposed drainage system Cd has length of 245m and it is rectangular Channel underground with MH. It is located along flood prone area called Magae and expected to drain storm water from this flooded area to the existing

underground drainage system C. It involves development of secondary drainage from Jitini road to Nyerere football pitch to solve the flooding problem at Shimo la Nguruwe most of the residential houses have been frequently flooded. As the discharge point of the intervention is an existing drain (MH C21.3.6), the hydraulic capacity of the existing has also been verified by using all the available information, including design and as built drawings. A third sub basin discharging into the foreseen connection point has been individuated for this purpose (Figure 2.22).

Figure 2. 19: Proposed system C and beneficiaries' area

2.2.4 Proposed drainage System C

The proposed drainage system C of Zanzibar town and proposal for engineering solution for insufficient or critical trunks. The project area is comprised between Amani, on the Eastern part, and Mkele on the Western part, starting from the stretch C32-C21 of an existing natural drainage stream on which several arrangements interventions had been carried out during the years. The project area is characterized by a highly urbanization rate and unplanned settlements in the eastern part (along the alignment of the C32-C13 drain) and a decent level of urbanization in the western part, nearby the junction C12. In the proposed C drain area, a low urbanization rate with easy possibility of intervention has been found.

A total of 8 Catchments have been identified. The main geographical features of the watersheds are summarized in the following tables. The catchment area covers an extension of 545 Ha. The mean elevation is of 30.7 meters

above sea level while the minimum elevation is 3.00 meters and the maximum are 58 meters. The mean slope is of 4.16%. The return period analysed for this project is 15 years.

Particular attention was paid to the following:

- Rehabilitation of about 1.4 km of existing lined channel (part of C32- C12)
- Diversion of the catchment of the C32-C12 to the outlet of the system I by constructing 600 meters of underground culvert 3.0 x 2.2 meters and then discharging through 200 meters of open natural channel
- reshaping of about 75 meters of existing drain. in the trunk C4.1- C4 (Figure 2.26).

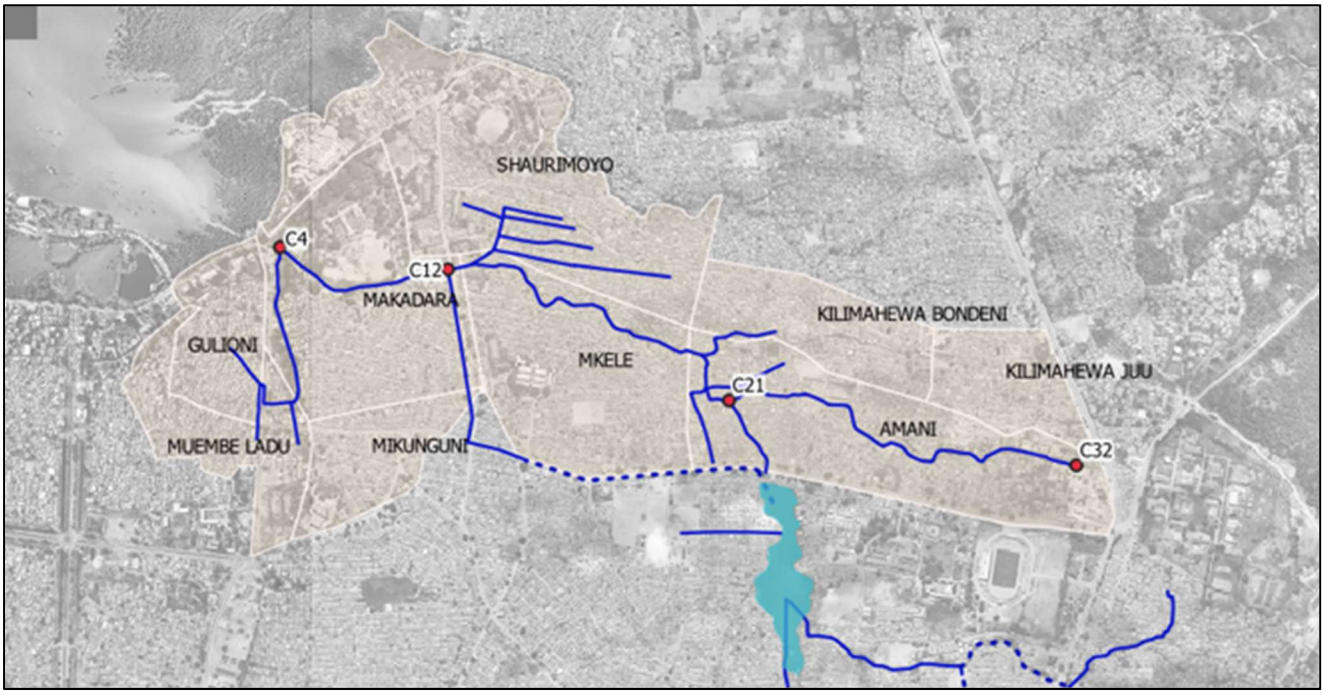

Figure 2. 20: Drainage system C general layout details

2.2.4.1 Drain C32-C21 at Amani Area

The C32-C21 drainage trunk, is part of a natural stream running from east to west of Amani Shehia, naturally discharging into the system C outlet that has been modified and rehabilitated several times over the years. As above stated, the area is densely urbanized with typical Swahili households and is not endowed with a sufficient roads service and of a wastewater system (Figure 2.27).

Figure 2. 21A: Trunk C32-C21 view, the drain running from East to West of Amani Shehia *(Source: Detailed Feasibility study)*

- **Design Scenario of Trunk C32- C12: the drain running from East to West of Amani Shehias**

For the trunk C32-C12, the main constrains to the design is the lack of available space for enlarging the hydraulic section or even to reach the work area with construction equipment. A solution has been found by maintaining the boundary of the channel reshaping the river bed and imposing a wider geometrical section. For the drain from East to West of Amani a simple reshaping of the cross section and cover with a concrete slab for safety reason applying standard procedures is foreseen.

2.2.4.2 Junction C12

The Junction C12 is located in Makadara Shehia, where the new constructed drainage culvert from Sebleni pond running to the Outlet of the system C meets the natural river named C31 – C12. The junction is basically composed by a confluence pit where the open trapezoidal C-3 -C12 trunk discharge into the main culvert going to the outlet of the C system. In this area, the availability of space allows for interventions aimed at solving the critical hydraulic surcharge due to the discharge of the eastern catchment (flowing in the C32-C12 river) into the insufficient main culvert. Due to the combined effects of the two flows, a critical situation is expected for the last 200 m upstream point C12 due to the elevation of the recipient culvert arriving from Sebleni (Figure 2.27B).

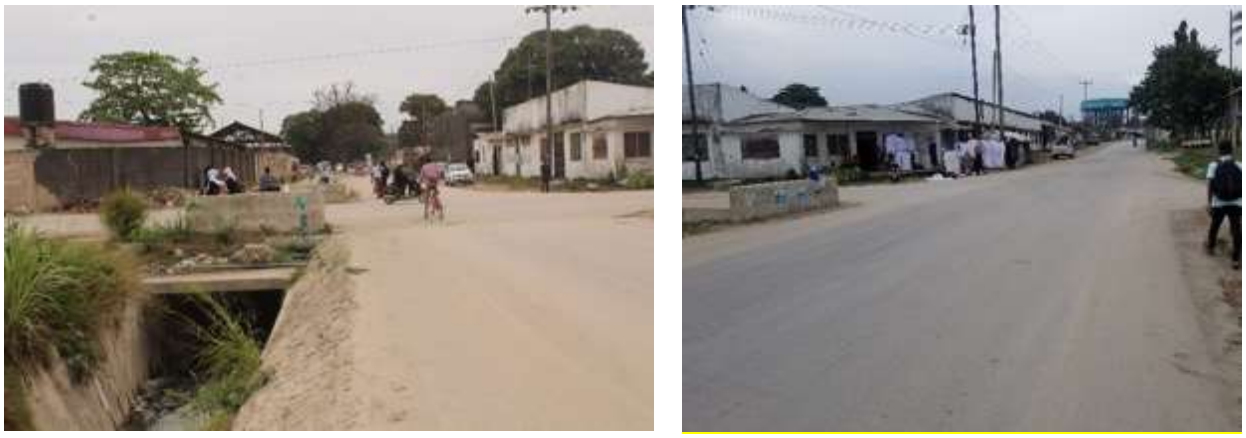

Figure 2.27B: Junction C12 view, (Source: Detailed Feasibility study)

- **Design Scenario For Junction C12**

The surcharge of the junction C12 is strictly connected to the hydraulic insufficiency of the downstream trunk to the system C outlet. In consideration of the lack of space, elevation constrains and the fact that the main culvert has been recently constructed, the only feasible option has been found to be a diversion of the entire catchment of the drain C32-C12 to the outlet of the system I.
The diversion consists of the disconnection of the trunk C13-C12 from the main culvert and connection to a new culvert line running beneath the road towards the system I outlet. This solution will completely solve the hydraulic problems of the C32 – C12 stretch and will strongly contribute reducing the surcharge on the culvert line to the system C outlet (Figure 2.28).

The proposed culvert from point C12a to the outlet of the system I is foreseen to be an underground rectangular culvert 3 meters wide and 2.2 meters high. The alignment of the culvert passes beneath an existing road with a maximum depth at the invert of about 6 meters. For this reason, in order to avoid the inconveniences related to the open trench excavation, a precast culvert placed with box shoring system is proposed.

Figure 2. 22: Box Shoring System, *(Source: Detailed Feasibility study)*

- **Design Scenario for C 4.2 – C4 Drain**

The most suitable solutions have been defined and modelled after verifying the topographic conditions of the area. A small trunk of about 75 meters downstream the Cc discharge point was found to be affected by surcharge for the RP 15 years. A reshaping of the existing cross section of this stretch has been assessed and it is proposed in order to remove every critical section in this open channel. It must be highlighted that this intervention will solve the elevation criticism of the Cc outlet as well (Figure 2.30).

Due to the availability of space, no specific recommendations are needed for this intervention. The proposed section shall be excavated from the centerline of the existing channel and reshaped as indicated in the design drawings.

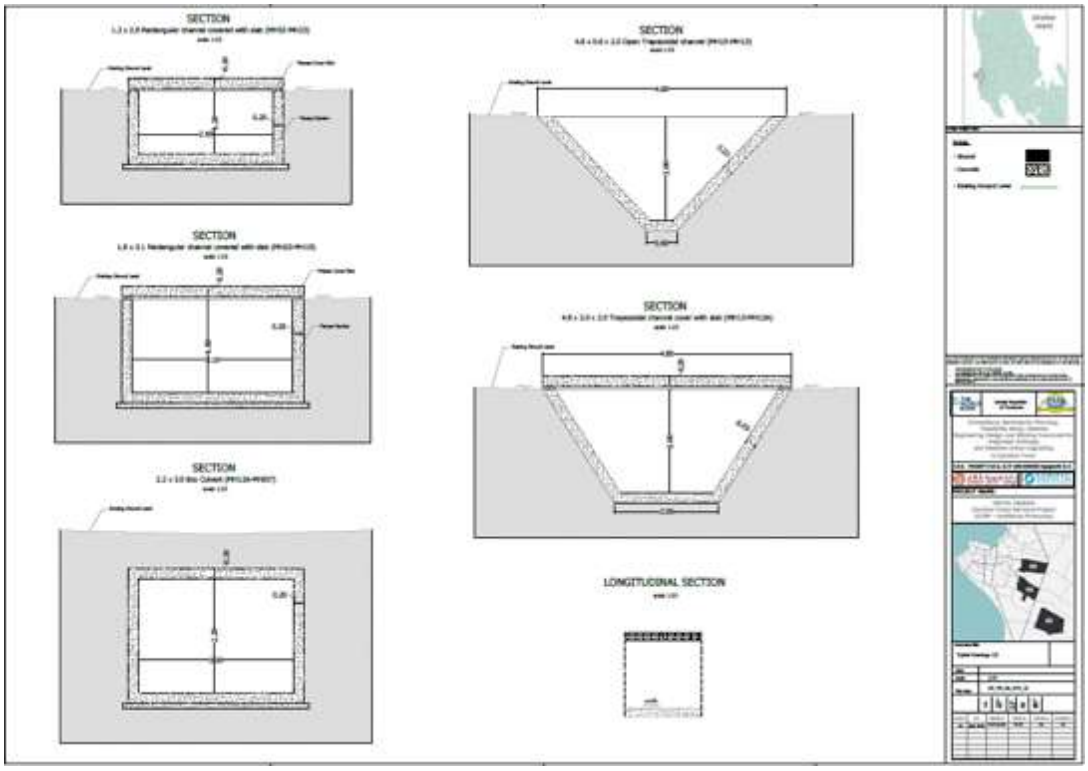

Figure 2. 23; drainage sections for proposed drainage system.

Generally, the actual condition of the existing streams for rehabilitation are not adequate due to several erosions sometimes affecting also the neighboring buildings and to the presence of many obstructions for garbage, vegetation, sewage and mud, also provoked by the inappropriate shaping of the channel. It is presumed that the rehabilitations of drainage systems will change vertical and horizontal profile in order to meet the relevant geometric standards for each class of proposed drainage. For instance, the construction of the new drainage will leave the low laying areas with limited flooding events. There is the potential to transform existing ponds into a smaller pond and the surrounding areas into a green park for locals and visitors from other areas of the city. This project involves the resettlement of those units that are still at risk of flooding.

2.2.5 Proposed Jang'ombe road corridor

The project area is comprised between Kwa Mchina, south east of Meya Magomeni and Jang'ombe prison. The area is densely urbanized and the existing road has a considerable traffic volume. The upgrading corridor is running along Jang'ombe tarmac road which have no surface drainage system for storm water management.

The existing Jang'ombe road is characterized by an irregular cross section spanning from 6.5 to 7.5 meters of carriage way and absence of shoulders. The proposed cross section will enlarge of a maximum of 1.0 meter the existing carriage way, including the shoulders, Road drainage is not present and safety conditions of the road itself is not adequate as the existing conditions of the intersections does not satisfy the international standards requirements. According to the Tanzanian roads' classification, this road is considered as a "feeder roads" category road.

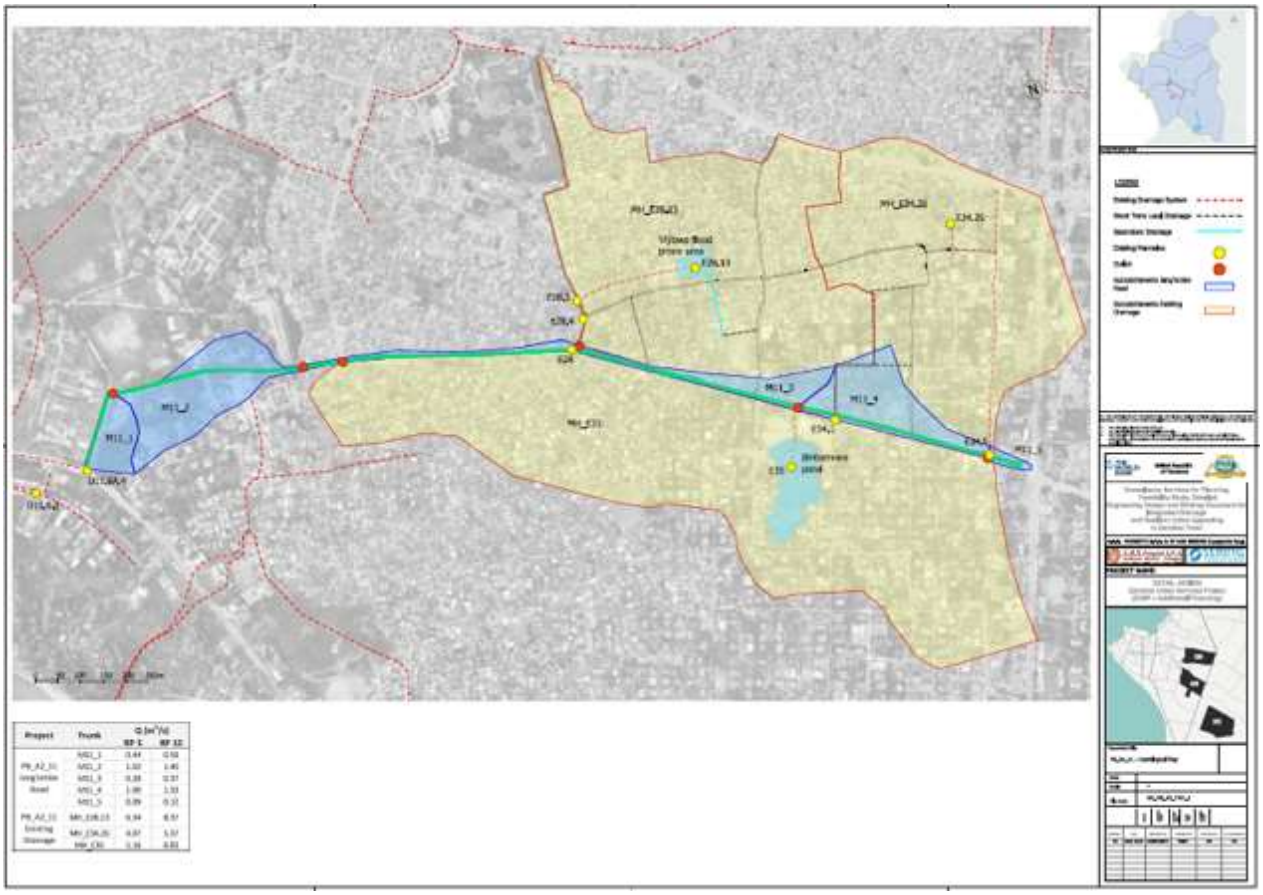

Figure 2. 24; Proposed Jang'ombe road corridor

The upgrading area is comprising of underground drainage system (Trunk A and B drainage system) with manholes for servicing, and culverts. The area is bounded with the commercial buildings/shops along the road, houses, Jang'ombe Schools, Binti Amrani Open Space, Jang'ombe primary school playground, police station and prison premises. Also, the proposed area is used as the parking in front of the shops, and some places are used as part of the garage.

Figure 2. 25: View of Jang'ombe road proposed corridor (Source: Detailed Feasibility study)

- **Proposed project components**

2.2.5.1 Jang'ombe Road rehabilitation corridor

The proposed landscaping plan for Jang'ombe Road has been developed to transforming Jang'ombe in a 2km long commercial promenade and of creating a continuous public open space integrated with the neighboring residential areas. In consideration of the future development of the project corridor, the upgrading of the corridor itself as well as the close Meya Magomeni area, is selected along the available space. The following are the proposed components

2.2.5.2 Drainage system

- **Proposed drainage system**

The proposed drainage system is composed by two rectangular channels covered with a perforated slab, on both side of the project road with size equal to 0.3x0.3m and 0.5x0.5m. The drainage system provided from section 1 to section 18 is composed by two 0.5 x 0.5 m closed rectangular channel on each side of the project road discharging into an underground box culvert, 0.7x1.0m. Both of drainage trunks are then connected to an additional drain that discharge into a system D manhole.

2.2.5.3 Landscaping and urban furnishing

The landscaping plan consists of a variety of interlock blocks pavers to form the walk free zone, a bicycle lane in compacted soil, a continuous green belt of trees and low rising plants siding the two lanes road. The promenade is an active civic space, and an integral part of the growing residential areas that flanks on both sides of the road. The promenade functions as a pedestrian (Benches and seating areas, Bicycle stand, Lighting poles, Litter bin) and cycle route, that complement the vehicular connecting road to the city center and offers a variety of commercial services and uses.

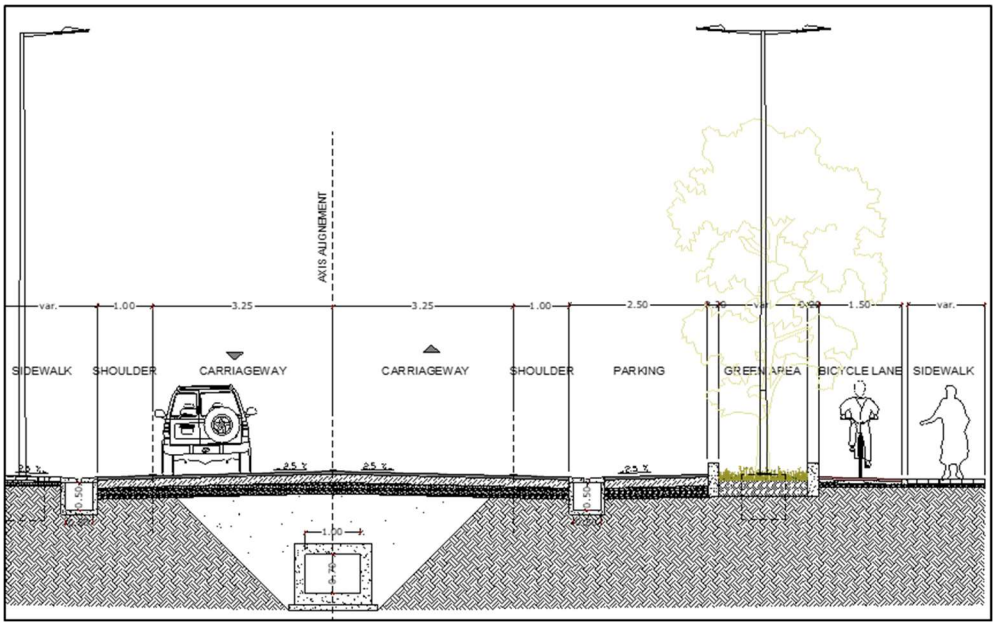

Figure 2. 26; Jang'ombe road typical section

The main components of the landscaping and urban furnishing design for Jang'ombe road corridor will be:

- Side walks
- On-street parking
- Public transport stops
- Bicycle lane
- Seating and resting areas
- Children playground
- Green belt and lightings

2.2.6 Project Activities for proposed project

Mobilization phase

This phase entails mobilization of labour force, equipment and construction of offices/camps as well as acquisition of various permits as required by the law. The decision for the location of the camp will be decided after tendering process, and it will be the duty of the contractor, who shall consult PMT and local communities (Shehia). Other activities during this phase include;

- Topographical Survey,
- Geotechnical Investigation,
- Soils and Materials Investigation,
- Land acquisition,
- Material storage and material preparation,
- Identification of borrow pits, quarry sites and source of water

Construction phase

The construction works will consist mainly of:

- Construction of campsites and other temporary facilities
- Exploitation of material sources for construction
- Excavation and widening of channels
- Construction of longitudinal and cross drainage structures and systems

- Provision of temporary crossings and traffic diversions;
- Disposal of excavated materials
- Demolition and proper handling of sludge from affected latrines and septic tanks

Demobilization phase

Demobilization of temporary structures will be done for proper restoration of the construction sites, restoration of borrow pits to required grades, and removing all temporary structures. Other activities include;

- Rehabilitation of the workshop and stockpile yard;
- Rehabilitation of campsite at least to the original condition;
- Clearance of all sorts of wastes including used oil, sewage, solid wastes (plastics, wood, metal, papers, etc.);
- deposit all wastes to the authorized dumpsite and;
- restoration of water ponds and temporary quarry sites to a natural and useable condition, termination of temporary employment

Operation phase

The actual operation of the drainage interventions will be complimented with a continuous monitoring and maintenance like regular removal of sand and debris and attention to tear and wear.

Decommissioning Phase

Decommissioning is not anticipated in the foreseeable future. However, if this will happen, it may entail change of use (functional changes) or demolition triggered by change of land use or malfunctioning of infrastructure.

2.2.7 Quantification of Resources to be used

The main construction materials for the drainage structures include sand, gravel, hard stones (aggregates), reinforcement iron bars and water. Almost all of the materials shall be obtained locally within Zanzibar and may be sources from Tanzania Mainland. Water will be sourced from ZAWA boreboles though evaluation of the water quality of the project lakes shall be done to determine whether its quality fits usage in construction works. In both cases prior permission from ZAWA shall be sought. Moreover, there are local suppliers who can bring sufficient quantities of construction materials for the project.

For the purposes of constructuion of roads and drainage systems for urban "Resilience Urban Upgrading in Zanzibar", hardstones quarying facilities and borrow pits shall be established. In some road sections borrow materials may be transported from a distant if the existing soil found to have poor strengths. There are various areas in Zanzibar where construction materials such as gravels, aggregates and Sand can be sourced as shown in Table 2.10. Ministry of Minerals will provide guidance on where to source construction materials upo request from the contractors.

Table 2. 7; Types, and sources of project requirements

Requirements							
Raw Materials	**Source / Borrow pits**	**Power**	**Source**	**Manpower**	**Source**	**Equipment**	**Source**
Aggregates	Zanzibar (Kibele, Tunguu)	Electricity	ZECO/ Generators	Skilled (20 – 30)	Contractor	Excavator	Contractor
Gravel	Zanzibar (Kibuteni)	Fuel	Zanzibar vending stations	Unskilled (80 -100)	Local People along the project area	TBM	Contractor

Sand	Zanzibar (Donge, Pwani Mchangani and Kazole)					Wheel loader	Contractor
Water	ZAWA					Water Bowser	Contractor
Cement	Dar es Salaam					Bull Dozer	Contractor
Reinforce-ment bars	Dar es Salaam					Motor grader	Contractor
Bitumen/ Asphalt	South Af-rica/Saudi Arabia					Roller/ Com-pactor	Contractor
Timber	Zanzibar (Local Vendors)					Plate compactor	Contractor
						Tippers	Contractor
						Bitumen Distrib-uter	Contractor
						Concrete Mixer	Contractor
						Rock Drill	Contractor
						Road Marking Machine	Contractor
						Pugmill Mixing Plant	Contractor
						Generators	Contractor

Table 2. 8; Estimated materials for the project areas

PACKAGE B			37.02.b G25	37.02.a G45	37.01.b G60	37.03.b GW	3702 G80 open	filling (open)			
	street								structures		
	EXCAVATION(M^3)	BACKFILLING(M^3)							EXCAVATION(M^3)	BACKFILLING(M^3)	Vol. to be reused (M^3)
SEBLENI											
	8,084.42	***3,792.02***		***946.15***	***439.44***	***659.16***	***42.24***	***74.76***	2,422.46	1,220.34	**1,202.12**
MEYA											
	17,810.40	***6,310.47***	***426.85***	***6,409.72***	***639.13***	***888.98***	***312.42***	***226.08***	6,082.79	2,845.31	**3,237.48**
TOMONDO											
	10,244.00	***5,981.06***	***1,998.12***	***230.38***	***39.99***	***59.99***	***609.98***	***93.60***	10,981.83	5,043.32	**5,938.50**

LEGEND		M^3
	volume to be disposed	**54,723.15**
	needed gravel material for roads subgrade construction	**21,836.45**
	volume to be reused from drainage excavations	**30,926.64**
	Material Balance 1 (to be disposed)	**9,090.20**
	Needed gravel material for roads pavement layers construction split by CBR value from borrow area	14,096.99

2.2.8 General Existing conditions of the project areas

A synopsis of the existing condition of the drainage areas presented as appendix II in which the current existing conditions have been elaborated, taken as example of the others; along the system C32-12 located along Amani; the existing drainage are overloaded in size, capacity and accumulated with sediments and solid wastes which have contributed to flooding effects during the high rainfall. On the other hand; the risk of ground and surface water pollution is significant for areas like Sebleni as the stagnated storm water are covered with water hyacinth which is sign of eutrophication due to sewage discharge.

2.2.9 Emissions and wastes generation

2.2.9.1 Gaseous and dust emission

The proposed project will lead to various types of emissions and wastes mainly depending on the type of activities and phase of the project. The main emissions will be vehicle exhaust and plant machinery emissions containing greenhouse gases like CO_2, CH_4 and SO_x, NO_x, and other gases. Emissions will come from construction vehicles and plants that use fossil fuels during drainage trench excavations, roads constructions and materials trasnportations. In addition,there will be apprent production of dust during construction earth works and stone aggregates production.

2.2.9.2 Wastes generation

Both solid and liquid wastes will be generated during construction, operation and decommissioning phases of the project. Huge spoil materials shall be generated from drainage trenches and road works. There will be also construction debris from houses demolitions and other construction works. Other types of solid wastes will include domestic refuse generated by construction workforce (especially in the campsite), scrap metals, plastics etc. Liquid wastes will also be generated from campsites during construction phase. Significant amounts of excavated materials from excavation activities shall be generated from Sebleni pond that will need special disposal methods. Table 2.12 provides estimates of some of the waste quantities that will be generated.

Table 2.9: Types, amounts and treatment/disposal of wastes during the operational phase

	Types	Amount	Treatment/ Disposal
Solid Waste (Degradable)	Domestic refuse (food remains, papers, etc)	About 2.1 tonnes per month (assuming a camp with 200 people @0.35kg per day.	Collected to landfill
Solid Waste (Non-Degradable)	Scrap metals	1-3kg per month	Collected by designated collector
	drums plastics Tins, glasses	1-2kg per month	Taken to the landfill
Liquid waste	Domestic sewage	About 20m^3 per day (assuming a camp of 200 people each using 120 liters of water per day for which sewage is 80%).	Disposed of to septic tanks
Liquid waste	Oils and greases	Non	Car maintenance will be done at designated garages
Semi liquid waste	Slurry	Approximately total volume of 20,000 m^3	Collected by designated collectors

(Source: Consultant's Evaluation)

3 BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

3.1 Introduction

This section presents the existing environmental and socioeconomic baseline conditions of the proposed Zanzibar urban upgrading and drainage integration areas. The information was collected through secondary sources, direct discussions with stakeholders and physical observations.

3.2 Physical Environment conditions

3.2.1 Geology and Morphology conditions

The geological structure of Zanzibar is characterized by sedimentary rocks. The island is underlain by Miocene sandy clay marl. The main deltaic sediments were Miocene sandy clays and slightly cemented clay sands. These sediments are resistant to erosion and form the beds and banks of the river channels. Alluvial deposits and laterites are found on the northwest part of the island up to 130m above sea level.

The project area occurs generally in geological sequences consisting of the Quaternary sequence: (Q1: Quaternary soils, laterites, alluvial and colluvial. Limited distribution as top-soil and Q2: Quaternary coralline limestone and coral rag. Forms the low broad coastal plains and overlays the Miocene deposits in the corridor zones), The Miocene sequence: (M1: Miocene limestone as inter stratified lenses and continuous horizons are found as subordinate strata in the M3 deposits on the north - western part of the island. The limestone with subordinate sandstones constitutes the main rocks on the eastern side of the island east of their main boundary to the M3 rocks. M3: Miocene clays, shale's, marls and clayey sands constitute the main deltaic deposits.

Figure 3. 1; rocks' bed along the beach to the proposed drainage outlet

3.2.2 Hydrogeological Conditions

As a preliminary assessment, the Consultant has elaborated a number of laboratory tests results, carried out for previous studies within the project area. This has been carried out for obtaining a preliminary characterization of the soil and determining the most suitable Control Number value (Figure 3.2).

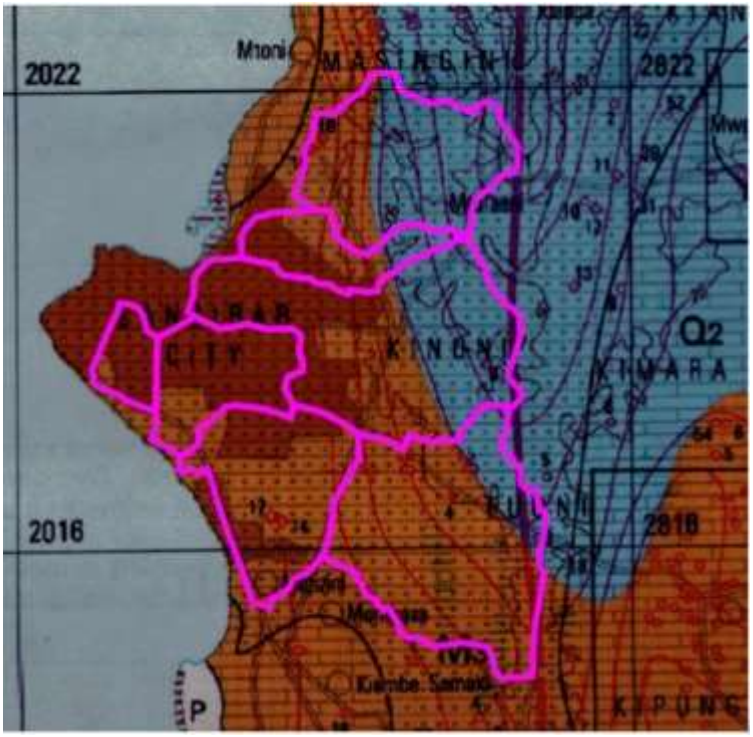

Figure 3. 2: Geological map in Zanzibar Urban area

3.2.2.1 Soils

The soils of Zanzibar fall under three main groups depending on the geological feature of parent rocks; 1) sandy soils, 2) calcareous red soils, 3) clay soils. The sand soil group derived from non-calcareous sediments, the sandy group varies from very deep sandy to rather heavy reddish through brown, yellowish grey, to grey shallower types. The calcareous red soils are the free draining soils derived from limestone. The clay soils derived from clays and mudstone. There are five main soil categories called Kichanga, Kinongo, Uwanda, Maweni and Kinamo in Unguja. Maweni soil is located in the coral rag limestone that forms the extensive eastern and southern portion of the island. This soil covers more than 40% of arable land and supports traditional shifting cultivation. Sandy soil is found on the western part of the island covering 20% of land area. This soil is suitable for both tree and annual crops. Uwanda soil forms the interface between the plantation area and coral rag zones covering 17% of the area. This soil is generally open grass area for unimproved grazing. Kinongo soil is the most fertile in the island and provides high potential for food crop production. Kinamo soil covers only 5% of the land area and is found in the north and small patches in central and south zones. This soil is suitable for rice cultivation.

Soils observed in the project area spots have been grouped into two classes, as described below and the observation was done during geotechnical survey as shown in the figure 3.3

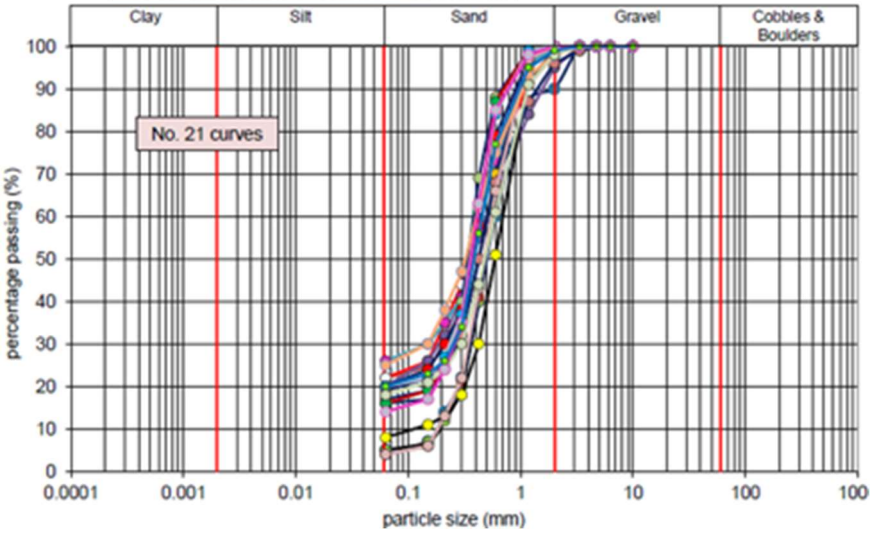

Figure 3.3; The trial pits Grain Size Distribution of Clayey Silty Sand of the site areas taken during geotechnical survey

- **Topsoil**: that is composed of darkish dry to moisty clay silty sand with on average of about 0.7 m.
- **Clayey Sand (S):** Loose to medium dense, moist clay sand S has been recognized along all boreholes and trial pits below Top Soil, with occasional clayey layers.
- **Density;** generally increasing with depth. Soil colour varies from grayish to darkish to reddish. Values of the geotechnical parameters of foundation soils and fine-grained construction materials are summarized in the following table 3.1

Table 3. 1; Geotechnical parameters

Soil/Material	Unit weight (kN/m³)	Cohesion c'(kPa)	Friction angle ϕ' (°)	Young modulus
Clayey Silty Sand	19-20	0	24-27	7-10

3.2.2.2 Topography

Topographical surveys are necessary for evaluation and to proceed to the next phase of detailed hydraulic sizing and further structure design.

Generally, the main topographic feature of Zanzibar is a series of flat low "corridors" bounded by a number of parallel ridges running in North-south direction. Prominent amongst them are the three topographic zones identified as follows:

- The undulating and elevated central and western area, incised on the western coast.
- The channel or corridor zones in the central area which form valleys with gentle slopes.
- The flat coastal periphery or 'coral rag' country.

The topography varies between 0 – 100 m above mean sea level (Johnson, 1983 and USGS, 2006). The project areas are generally flat with little/gentle slope towards the sea and few depressed areas at Tomondo-Mombasa, Meya Magomeni, and Sebleni Kwa Wazee

3.2.3 Climate

The islands of Zanzibar are characterized by an equatorial Monsoon system (Hot and Wet seasons). The long Masika rains from March to May come before the onset of the South-West Monsoons also known as the Kusi (which blow from April to November) while the short Vuli Rains (September to November) come before the onset of Northeast Monsoon winds known as the Kaskazi blow from November to April. The rainfall pattern is bimodal in nature. During Masika contributes to 50% of the annual rainfall rain while Vuli contributes between 25% and 30%. On annually average, Unguja receives rainfall of (1600mm) (Table 3.2).

The hot and humid season is between December to March while the cool and dry season is between June to September. Temperatures range between 25 degrees Celsius to 35 degrees Celsius. But, with higher humidity levels, temperatures can be felt to range above 40 degrees Celsius in some occasions. The relative humidity is high, with a monthly average ranging between 75% and 85%.

Table 3. 2: Annual climate patterns on Unguja Island (ZUSP EMF, 2016)

Items	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Precipitation(㎜)	1,561	87	86	127	403	249	54	48	37	33	105	187	145
Mean. Temp(℃)	26.0	27.2	27.8	27.5	26.9	26.1	25.3	24.4	24.3	24.5	25.2	25.8	26.8
Max. Temp(℃)	30.2	31.4	31.9	31.9	30.3	29.4	28.3	28.3	28.9	29.9	30.4	30.4	31.2
Min. Temp(℃)	21.8	23.0	23.7	23.1	23.5	22.8	21.7	20.6	19.7	19.2	20.1	21.3	22.5
Humidity (%)	79	78	76	81	83	81	76	75	75	76	77	83	81
Wind(m/s)	2.0	1.9	1.8	1.8	1.6	2.2	2.3	2.3	2.2	2.2	2.0	1.6	2.0
Sunshine(%)	62	60	65	60	48	59	63	61	71	70	67	60	64
Daylength(h)	12.1	12.4	12.3	12.1	12.0	11.8	11.7	11.8	11.9	12.1	12.2	12.4	12.5

3.2.3.1 Climate Change

As per the Zanzibar climate change action plan, climate change in the area is likely to result in less frequent but more intense precipitation hence more surface runoff, erosion and less recharge of ground water; saltwater intrusion in wells near the coast due to rising sea level and over abstraction; and increased occurrence and intensity of future disease outbreaks especially water borne diseases due to flooding return interval. According to ESMP of BIG Z, Zanzibar is experiencing droughts and municipal floods which have had economic costs in terms of GDP. In this case, Zanzibar is not yet adequately adapted to the current climate change impact and the Government needs to address adaptation deficit to lead to immediate benefit as well as providing resilience to future climate change.

According to "The Economics of Climate change in Zanzibar" all the climate models show that the rainfall regime will change but the projections vary across the models and seasons. Nonetheless, there are consistent trends projected of increasing rainfall during the Mar-May wet season, as well as an increase in January and February. There is also a trend of decreasing rainfall during the dry season (June – October) (Figure 3.4). These changes

would exacerbate existing trends (i.e. increased rainfall during the rainy season, lower rainfall during the dry seasons).

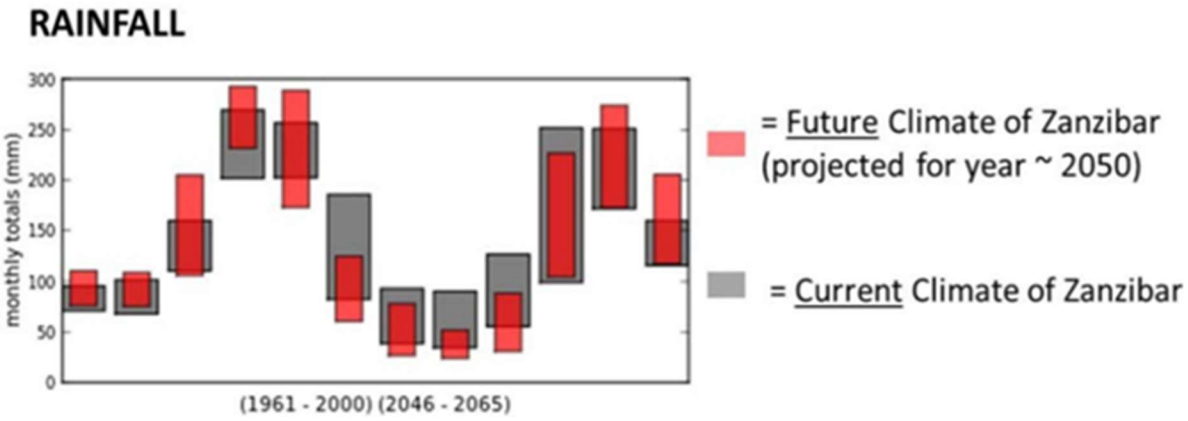

Figure 3. 4. Rainfall change for the 2040-2060 time period

As a least developed country, or part of the contracting party to the United Nations Framework Convention on Climate Change (UNFCCC) Zanzibar produces negligible carbon emissions that do not necessarily or directly impact the global effects of the carbon emissions.

According to the study on Economic Impacts of Climate Change in Zanzibar (2012), the total CO_2 emissions for Zanzibar in 2010 was 763 Gq CO_2 equivalent or 0.6 tCO2 Emissions per Capita Equivalent. Wastes take up a small share of total CO_2 emissions (4%). Energy sector is the leading source of CO2 emissions (39%) followed by Agriculture (28%), and LULUCF (29%). The projected CO_2 emissions by 2030 in Zanzibar are expected to rise to 2200 Gg CO_2 equivalent with LULUCF, Agriculture and Transport sectors leading in these emissions.

3.2.3.2 Climate Change Resilience

Currently, the Tanzania has responded to growing climate risks by adopting the National Climate Change Strategy (NCCS), which is the guiding framework for taking action on climate change. Zanzibar has also adopted its own climate change strategy, the Zanzibar Climate Change Strategy (ZCCS). The proposed projects are taking step toward integrating climate change into development planning. The investment is aiming in improving Zanzibar's resilience to climate change and to assist in leveraging and channelling climate finance more strategically, to deliver results on the ground.

In improving the impact of the Zanzibar climate change strategies, the World Bank has developed a series of policy notes complemented by targeted capacity building focused on key areas of vulnerability and financing. In relevant to this project, the strategy notes include the following:

i. *Financing Climate Resilient Growth.* Outlines Tanzania's experience and challenges to date in accessing and channeling climate finance and provides recommendations to the URT to help guide design decisions around their planned climate finance mechanism.

ii. *Toward Climate-Resilient Cities in Tanzania*. Looks at the climate risks faced by the country's larger cities based on an evaluation of recent historical flooding events and outlines key vulnerabilities and recommended responses and,

iii. *Tanzania's Coastal Zone: Vulnerability to Climate Change and Priorities for Action*. Assesses the anthropogenic and climate-related threats to the entire coastline, including both mainland and Zanzibar, and outlines the process to identify and prioritize responses to build resilience

It has to be highlighted that the adaptation is the only option to reduce the impact of climate change. Predicting future climate well ahead can help to improve decision making in a wide range of activities. More important is perhaps the widely accepted precautionary principle of 'taking measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects in the proposed project.

Table 3. 3. Peak flow of the Main catchment after Climate change consideration

	Peak discharge (m^3/s) for given PR							
Basin name	**2**	**5**	**10**	**15**	**20**	**30**	**50**	**100**
System C	27.2	40.5	49.4	54.5	58.1	63.1	69.4	78.0
System D	14.9	21.8	26.5	29.2	31.0	33.6	36.9	41.3
System E	21.3	31.5	38.4	42.3	45.1	49.0	53.8	60.4
System F	3.9	5.8	7.1	7.8	8.3	9.1	10.0	11.2
System G	36.6	55.9	69.1	76.6	81.9	89.3	98.6	111.2
System H	30.5	45.7	56.1	62.0	66.2	72.0	79.3	89.2
System I	13.0	19.2	23.4	25.8	27.5	29.8	32.8	36.8

3.2.4 Ambient Air Quality and source of emission

On the legal and at the policy level, the Zanzibar Bureau of Standards is preparing a set of air quality standards that are expected to be operational in the immediate future. The Ministry of Health is also preparing Regulations on Landfill Management that are expected to stress on compliance with the atmospheric emissions limits. The ambient air quality has been interfered and the causes of air pollution are traffic (dust and gasses) and wind, burning of woody biomass, production of charcoal, slash- and-burn practices, dust emissions from unpaved roads, and the traffic pollution which is increasing in great proportion. The existing air quality condition of the site area and the source of the emission have been elaborated in the following sections and found in Appendix VIII, Air quality and Noise level report of the three site areas in Zanzibar Municipality;

3.2.4.1 The Ambient Dust Measurement

The ambient dust baseline condition was carried out for the site area. The suspended ambient smoky dust and particle levels measurement was carried out using a potable particulate counter (make–Stark, model–CW–HAT200S). It is capable to detect the suspended particulate matters of $PM_{2.5}$ and PM_{10}/TSP diameter size in microgram per cubic meter ($\mu g/m^3$) concentrations in the air. Its sampling principle is light scattering. The sampling time done was 60 seconds per one reading with all four parameters at once. The result was as elaborated in the table 3.4;

Table 3. 4: Baseline condition for dust in the site areas

Dust parameter	**Tomondo-Mombasa**	**Meya-Magomeni**	**Sebleni-Kwa Wazee**	**Control point-Amani**	**Zanzibar (ZBS xx:2005)**	**International standard (IFC-WBG:2007)**
Pm2.5[$\mu g/m^3$]	8.0±0.6	21.0±0.95	15.0±0.73	17.0±0.95	**N.M**	**25**
PM10[$\mu g/m^3$]	16.0±1.2	43.0±2.00	30.0±1.50	34.0±2.00	**90**	**50**

TSP[µg/m^3]	32±2.6	88±4.39	63±3.11	70±4.14	**N.M**	**230**

The field measurements revealed that all measured locations (on/off site) had dust emission levels which comply with both local (ZBS: 845 2005) and international (IFC-WBG: 2007) standards.

3.2.4.2 The Ambient Gaseous Measurement

The ambient gaseous air quality assessment was done using a portable gas detector type GMI VISA model 66369BENX. The instrument complies with the European standard EN 61779; EN 50104 and EN 45544 with certification to ATEXII 1 G EEx ia IIB T3/UL913 Class I Group CD/EC. The gases condition was; oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and methane (CH_4) gases in air. The existing results for gaseous investigation on the proposed site areas were as shown in the table 3.5.

Table 3. 5: Existing gaseous condition for the three selected site area for Urban Upgrading and drainage integrated in Zanzibar.

Gaseous Parameters	Tomondo-Mombasa	Meya-Magomeni	Sebleni-Kwa Wazee	Control point- Amani	Zanzibar (ZBS xx:2005)	International standard (IFC-WBG:2007)
CO2 [%]	**0.04±0.0002**	**0.04±0.0006**	**0.04±0.0004**	**0.04±0.0002**	**N.M**	**N.M**
CO [ppm]	**0.07±0.008**	**0.07±0.13**	**0.11±0.02**	**0.12±0.03**	**9.0**	**9.0**
SO2 [ppm]	**0.05±0.006**	**0.08±0.01**	**0.04±0.006**	**0.02±0.004**	**N.M**	**0.5**
O2 [%]	**20.9±0.002**	**20.9±0.006**	**20.9±0.004**	**20.9±0.003**	**N.M**	**N.M**
CH4 [ppm]	**0.03±0.004**	**0.06±0.007**	**0.02±0.003**	**0.01±0.003**	**N.M**	**N.M**
NO2 [ppm]	**0.04±0.006**	**0.07±0.010**	**0.03±0.005**	**0.02±0.005**	**N.M**	**0.2**

As presented in Tables 3.5; all monitored locations were had ambient gaseous levels which comply with both local [Zanzibar (ZBS: 845:2005)] and international (IFC-WBG 2007) standards limits. The condition is predicted to change during the project implementation, especially during the project mobilization and construction phase. To ascertain the impacts, they might be sourced by construction machines such as earth excavators, compacters, trucks and other construction machines. Field observations and measurement earmarked that, the detected ambient gaseous emissions were assumed to be contributed by vehicles and motor cycles exhaust emissions passing nearby the project area. Also, domestic activities which involve burning of charcoal, wood and solid waste were assumed to cause such recorded levels of ambient gases.

3.2.5 Noise Emissions

In Zanzibar Municipality typically around the zone of influence, major sources of noise pollution include motor vehicles, aircraft, entertainment buildings and construction sites have proven to be a big source of noise pollution. Increasing traffic has given rise to traffic jams in congested areas where the repeated hooting of horns by impatient drivers pierces the ears of all road users. According to ESMP of BIG Z, the analysis of noise levels indicate that ambient noise levels exceed human threshold during day time especially around the municipal

zone and arterial roads exceeding 90 to 120 dB. The Zanzibar Bureau of Standards has already adopted ambient and occupational noise standards whose implementation and enforcement are yet to be activated.

Community consultations have indicated a rising scale of public nuisance caused by increased garbage trucks traffic flow through the locality. Public Address System and the use of loud speakers contributes heavily in its own way towards noise pollution while other miscellaneous sources such as automobile repair shops, construction-works, stone crushing etc. are other sources of noise pollution that are worth considering in preparing environmental monitoring protocols. Such a highly audible flow needs a regulated standard procedure in order to avoid environmental and public health challenges

3.2.5.1 The Ambient Noise Level Measurement for proposed site areas

Measurement of noise level was accomplished using a portable Class Ohlson digital sound level meter type 36-1604, model ST-805 with measurement range of 30 to 130 dB (A), A-weighted factor deciBel. The meter meets ANSI S1.4 type 2 standards and conforms to IEC 651 type 2. Its accuracy is ±1.5 dB of reading. The meter is calibrated using electrical calibration with built in oscillator (1 kHz sine wave). After the noise level investigation in the site areas, the results were as summarized in the table 3.6. All measured locations had eight hours equivalent noise levels which comply with the acceptable TBS [(TZS 845:2005)] limits of 70 dB (A), and international (IFC- WBG: 2007) standards. Further, the noise levels recorded at residential house near Maboga Lake, at Meya Magomeni and Sebleni Kwa Wazee were assumed to be caused by aircrafts, vehicles and motor cycles, passing near the project area as well as the wind blows.

Table 3. 6: Existing noise condition in the proposed three site areas in **Zanzibar.**

Noise parameter	Tomondo-Mombasa	Meya-Magomeni	Sebleni-Kwa Wazee	Offsite Control point-Amani	Zanzibar (ZBS xx:2005)	International standard (IFC-WBG:2007)
Noise levels[d(BA)]	**53.0±0.35**	**68.0±0.34**	**52±0.19**	**58±0.94**	70	70

Generally; the field investigation measurements revealed that all measured locations (on/off site) had noise levels which comply with both local (ZBS: 2005) and international (IFC-WBG: 2007) standards. The condition is predicted to change during the project implementation, especially during the project mobilization and construction phase. To ascertain the impacts, they might be sourced by construction machines such as earth excavators, compacters, trucks and other construction machines

3.2.6 Groundwater baseline conditions

According to the Zanzibar Water Authority (ZAWA) Strategic Plan 2013-2018, natural resources for drinking water in Zanzibar are restricted to groundwater, which is considered to be in abundance, whereas surface water resources are modest. It has been reported that; in the town there were many ponds which were contributing to the water table recharge, the Technicians of the water supply system responsible (ZAWA) expressed their concerns for the reduction of the infiltration due to the drainage system that transported the water directly to the sea. This concern has been considered seriously especially because the 90% of the water supplied by ZAWA in Zanzibar City comes from wells fields, some of which located close to the seaside.

So, the Consultant considered the new design the idea to maintain the ponds surface lifting the invert level of the exit channel to an elevation to protect the feet of the houses leaving the pond in the center of them. In this way the 90% of the water that infiltrated the soil in the past will continue to do it as only the exceeding water of the peak fluviometric events will be drained to the sea.

On the risk to groundwater pollution, the findings indicated that; groundwater around Ziwa Maboga/Tomondo and Sebleni has experiencing bacteriological contamination due to sewage discharge during rainfall. Other presumable cause is due to pit latrine and poor management of sewage from human settlements with ineffective pollution control measures and from human encroachment in the rainwater catchment areas is imminent. If bacteriological contamination becomes established this will raise ZAWA's cost of treatment of groundwater. This indication leads to chlorination of boreholes networks (appendix IV) and storage tanks to disinfect germs.

It was also noticed that; local wells have been drilled along drainage channels in most of existing natural drainage channel (figure 3.5). The major source of pollution for ground water is salt intrusion from the ocean and the uses of onsite sanitation especially pit latrines and infiltration of stagnated storm water already polluted

Figure 3. 5; well drilled near the drainage channel used for domestic uses

3.2.6.1 Existing Borehole water quality analysis

Water supplied to the community by ZAWA and one private borehole collected from Tomondo Mombasa, Sebleni Kwa Wazee and Meya-Magomeni have been preliminarily checked by analyzing nine (9) samples taken surrounding the ponds. The physical, biological and chemical parameters were analyzed to check the level of contamination. On 8th, February, 2020, the samples were collected, three from each pond and taken into 1litter bottles and were analyzed at Ardhi University environmental laboratory-Dar es Salaam. The analysis results were as elaborated in table 3.7.

Table 3. 7; Boreholes/Groundwater analysis from three Shehia (Tomondo-Mombasa, Meya- Magomeni, and Sebleni Kwa Wazee)

Parameters	Unit	Location											WHO	TZS
		TM1	TM2	TM3	Av.	SK1	SK2	SK3	Av.	MM1	MM2	MM3	Av	

pH	-	6.16	7.04	7.19	6.80	7.42	7.15	6.58	7.05	7.37	7.02	7.08	7.16	6.5-8.5	6.5-9.2
NO^{-}_{3}-Nitrogen	mg/l	6.40	6.10	1.60	4.70	1.70	0.90	0.70	1.1	0.70	0.50	0.60	0.6	1.0	2.0
Chloride	mg/l	67.8	40.17	29.31	45.76	7.60	21.6	117	48.72	91	58	54.29	67.76	200	800
Lead	mg/l	<0.01	0.01	0.01	0.01	0.045	0.01	0.01	0.02	0.01	0.01	0.053	0.02	0.1	0.1
Zinc	mg/l	0.01	0.01	0.01	0.01	0.014	0.011	0.01	0.01	0.021	0.02	0.021	0.02	5	5-15
Cadmium	mg/l	<0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05	0.1

Key; TM= Tomondo-Mombasa, SK= Sebleni-Kwa Wazee, MM= Meya Magomeni

The boreholes water analysis showed a concentration of organic and chemical pollution lower than the guidance standard of both WHO and Tanzania Bureau of standards (TBS) while nitrate which is also indicating organic pollution is usually up to 2.0 mg/l for portable water. Analysis shows that bore hole water collected around Ziwa Maboga (Tomondo) and Sebleni ponds are contaminated with Nitrate concentration of; 4.70mg/l and 1.1mg/l respectively. This can be presumed to be due to stagnation of storm water to these two ponds

The other analysis was done during the drilling of the boreholes Appendix III(a). ZAWA provided the borehole water quality report for few boreholes as elaborated in table 3.8

Table 3. 8; Ground water analysis from sampling boreholes (Source; ZAWA-UNGUJA)

S/No	**Parameters**	**Location**					**WHO**	**TZS**
		Units	**Tomondo (west B)**	**M/hospital k/chekundu**	**Sebleni**	**Amani kwa Boli**		
1.	**appearance**	-	**Clear**	**Clear**	**Clear**	**Clear**	-	-
2.	Odour taste	Mg Pt/l	None	None	None	None	-	-
3.	Turbidity	NTU	0.52	33	0.17	21.2	15	50
4.	Temperature	ºC	29	7.2	30	30.5	-	-
5.	pH	-	7.4	Clear	7.2	7.8	6.5-8.8	6.5-9.2
6.	Conductivity	µS/cm	670	450	712	1172	400	1500
7.	TDS	Mg/l	419	270	356	588	500	1500
8.	Total alkalinity	Mg/l CaCO3	250				-	-
9.	Hardness	Mg/l$CaCO_3$	135	90	95	102	500	600
10.	Chloride	Mg/lCl	108.7	52.5	81.53	Not	200	800
11.	Salinity	Ppt	0.196	92	0.147	0.05	-	-
12.	Phosphate	Mg/lPO_4	0.48	-	-	0.39	-	-
13.	Fluoride	Mg/l F	0.25	-	-	Not	1.5	8
14.	Iron	Mg/l Fe	0.11	0.03	-	0.01	0.3	1
15.	Manganese	Mg/l Mn	0.005	0.017	-	0.023	0.1	0.5
16.	Sulphate	Mg/l SO4	18	14	-	16	200	600
17.	Nitrate	Mg/l NO3	0.2596	0.148	-	2.17	10	75
18.	Nitrite	Mg/l NO2	0.0528	0.0693	-	0.09	0.1	-
19.	Calcium	Mg/l Ca	54	32	38	56.71	75	200
20.	Magnesium	Mg/l Mg	19.7	7	16.53	22.28	50	150
21.	Copper	Mg/l Cu	0.37		-	0.035	0.1	3
22.	Chromium	Mg/l Cr6+	-		-	Not	0.05	0.05
23.	Residual Cl	Mg/l	0		0	0	0.02	0.5
24.	Total coliform	Cnt/100ml	NIL/100ml	18/100ml	6.0/100ml	8/100ml	0-3	0-10

25.	Fecal coliform	Cnt/100ml	NIL/100ml	3/100ml	4/100ml	NIL/100ml	0	0

This water quality report indicates that; in all area taken for sampling; ground Water stated to be physically and chemically good but it is bacteriologically contaminated from both TC and FC

3.2.6.2 Surface Water baseline condition

3.2.6.2.1 Storm water ponds analysis

The water quality at Ziwa Maboga and Sebleni Kwa Wazee have been preliminarily checked and analyzed. The ponds were observed to be covered with Water hyacinth and solid waste were found surrounding the ponds

Figure 3. 6; Water hyacinth and solid wastes covering Sebleni (Amani fresh(l)) and Ziwa Maboga(r)

On 8th, February, 2020, the samples collected from each pond were taken in volume of 1litter bottles and were analyzed at Ardhi University environmental laboratory-Dar es Salaam. The Six (6) samples, the three of each pond were taken at the upstream and downstream of the ponds. The physic-chemical parameters and BOD5 were analyzed to check the level of storm ponds contamination. The analysis results were as in table 3.9

Table 3. 9; Surface water quality report from Ziwa Maboga and Sebleni ponds

S/No.	Parameters	Unit	Location								WHO	TZS
			ZM1	ZM2	ZM3	Aver.	SK1	SK 2	SK3	Aver.		
1.	pH		7.1	6.82	6.65	6.86	7.06	7.12	6.87	7.02	6.5-8.5	5.5-9.2
2.	Nitrate-Nitrogen	mg/l	16.4	14.7	16.43	15.84	16.7	15.4	12.5	14.87	10	10-20
3.	Chloride	mg/l	31.85	27.63	26.25	28.58	27.41	28.98	31.85	29.41	200	800
4.	Lead	mg/l	0.046	<0.01	<0.01	0.02	0.035	0.097	0.074	0.07	0.1	0.1
5.	Zinc	mg/l	0.013	<0.01	0.014	0.01	0.02	<0.01	0.021	0.02	5.0	5-15
6.	Cadmium	mg/l	0.53	0.069	0.058	0.22	<0.01	<0.01	<0.01	0.01	0.1	0.1
7.	BOD_5	mg/l	16	14	12	14.00	28	25	30	27.67	≤30	30

Key; ZM= Ziwa Maboga SK; Sebleni-Kwa Wazee

The ponds water analyses showed a concentration of organic and chemical pollution lower than the guidance standard of both WHO and Tanzania standards (TBS) while BOD5 which is an indicator of organic pollution is 14 mg/l and 28mg/l at Ziwa Maboga and Sebleni Kwa Wazee respectively.

On the other hand, nitrate which is an indicator of organic pollution is usually up to 20 mg/l. Analysis shows that water ponds are less contaminated and the Nitrate concentration were; 15.84 and 14.87mg/l at Ziwa Maboga and Sebleni ponds respectively. Therefore, direct discharge to the sea will be having less environmental impacts.

3.2.6.2.2 Ponds Sediments analysis

The sediments quality at Ziwa Maboga and Sebleni Kwa Wazee were preliminarily checked by analyzing some samples taken at the upstream and downstream of the ponds. The chemical parameters were analyzed to check the level of ponds' sediments contamination.

On 8th, February, 2020, six (6) sediments samples were collected using sediment sampler; three samples from each pond were taken and were analyzed at Ardhi University environmental laboratory-Dar es Salaam. The analysis results were as elaborated in table 3.10

Table 3. 10; Sediments assessment report from Ziwa Maboga and Sebleni ponds

S/N	Parameters	Unit	Location								WHO	TZS
			ZM1	ZM2	ZM3	Av.	SK1	SK 2	SK3	Av.		
1.	Lead	mg/kg	10.58	8.096	11.28	9.99	86.32	8.444	9.171	34.65	0.1	0.1
2.	Zinc	mg/kg	106.36	93.50	160.16	120.	211.83	41.88	115.91	123.21	5.0	5-15
3.	Cadmium	mg/kg	1.63	6.543	1.114	3.10	1.914	2.998	8.734	4.55	0.1	0.1

K ey; ZM= Ziwa Maboga SK; Sebleni-Kwa Wazee

The ponds sediments analysis showed that a concentration of heavy metal is higher than the guidance standard of both WHO and Tanzania standards (TBS). Lead (Pb) concentration in the sediments were observed to be 9.99mg/Kg and 34.65mg/Kg, Zinc concentration in the sediments analyzed were 120.00mg/Kg and 123.21mg/Kg while Cadmium concentration is 3.10 and 4.55mg/Kg at Ziwa Maboga and Sebleni Kwa Wazee respectively. This indication tells that, the excavated materials from these ponds should be handled as hazardous waste to prevent environmental pollution

3.2.6.3 Existing Sources of Water pollution

"Integrated Drainage and Resilience Urban Upgrading in Zanzibar" will be crossing the surface water courses. For instance; the Sebleni drainage system will be discharging storm water into the sea. The stagnated water in these areas observed to be polluted from sewage, solid wastes and other chemicals. The other sources of pollution of these water sources are, Agricultural activities (application of pesticides and fertilizers), runoff turbid water during rainy season, filling station, construction and blocks making activities, and Domestic activities (washing clothes, bathing, car washing etc.) to a small extent

Figure 3. 7; Sewage discharging to the drainage system at system C and SW dumping at Ziwa Maboga

As common behavior of many people who built up their house along the drainage; they discharge the sewage from their latrines to drainage system (figure 3.7) which is likely to cause water related diseases

3.2.7 Hydrology conditions

The surface runoff in Zanzibar Island is found to pass through three types surface water bodies: the coastal rivers, the inland rivers and springs. The flow of these rivers has some resource value contribution to the groundwater recharge. However, since most of them disappear into sink holes (*pokezi*) near to the coastal aquifer, they are also regarded to pass some of the storm water to the sea.

The project area is reported to have high groundwater levels. The surface water is found to accumulate in the depression land called ponds For example; Meya-Magomeni, Tomondo-Mombasa at Ziwa Maboga, and Sebleni-Kwa Wazee at Sebleni pond. All these contribute in one way or another in groundwater recharge.

3.2.7.1 Ziwa Maboga hydrological overview

Ziwa Maboga catchment is one of the bigger of the urban area with its 824Ha. The mean elevation of the area is of 25 meters above sea level while the minimum elevation is 8 meters and the maximum are 72 meters. The mean slope is of 2.70%. This results in a peak flow estimated for 30 yrs RP in 72 m^3/s. Here below a resume of the catchment main features is shown.

Table 3. 11. Hydrological Information

			Peak Discharge (m3/s) for given RP				
Basin name	**Area(ha)**	**Length(m)**	**2 yrs**	**5 yrs**	**10 yrs**	**15 yrs**	**30 yrs**
Ziwa Maboga Catchment	824	6180	30.50	45.74	56.11	62.02	72.00

As above stated, Ziwa Maboga is not endowed with any outlet for the water collected during rain events, resulting in an increase of the water level till an elevation that strongly affects several houses and inhabitants of the area. Due to the nature of the soil, the water is retained in the pond for several days and this, during the rainy

season, results in an augmentation of the flood effects due to the stormwater flowing into the already full basin, augmenting the extension and magnitude of the flood.

Considering the extent and importance of the drainage design for Ziwa Maboga, a RP of 30 years has been considered for the hydraulic sizing of the structures and for the assessment of the flood areas and volume required for the lamination effect.

3.2.7.2 Sebleni Hydrological overview

The portion of the entire catchment of the system C flowing into Sebleni pond is of about 300ha. A considerable part of the network of main channels of the system C, discharge into the pond, from where the outlet connecting it with the downstream of the system, has been recently open. In this arrangement, Sebleni pond has the role of a lamination basin, which is a key entity of a desirable low impact development structure (Table 3.12).

Table 3. 12. Hydrological Data of Sebleni Basin

			Peak Discharge (m3/s) for given RP			
Basin name	**Area (ha)**	**Length (m)**	**2 yrs**	**5 yrs**	**10 yrs**	**15 yrs**
Sub Basin Sebleni	305	3410	18.10	27.40	33.70	37.30

The computation has been made for a return period of 15 years and have included all the catchment discharging to the pond. The peak flow estimated was of 37.3 m^3/s. The maximum outlet flow expected, according to available information was of about 27 m3/s in the trunk C21.1-C21.1.1 and therefore, an estimate of the lamination volume required for the system has been carried out by means of the said software.

3.2.7.3 Meya-Magomeni Hydrological overview

Meya-Magomeni area, extended for 70 ha is included in the hydrological catchment named E. This area is crossed by two main trunks of the drainage system E. The process of individuating a number of sub-catchments in relevant closing sections has given direction on assessing the priorities for drainage interventions and suitable paths. The proposed drain Eb will serve as drainage channel for a sub basin of 10.4ha. It will start from the lowest point of the football ground area, draining the upstream, and will run on the proposed new alignment of the above-mentioned green link to Vijibwa pond, collecting the tributaries flow from its sub-catchment in its path.

Table 3. 13. Hydrological Data of Sub Basin Drain Eb

			Peak Discharge (m3/s) for given RP			
Basin name	**Area (ha)**	**Length (m)**	**2 yrs**	**5 yrs**	**10 yrs**	**15 yrs**
Sub Basin Drain Eb	10.4	433	1.82	2.62	3.15	3.45

It is here highlighted that considering the 15 yrs RP flow from Eb drain, the correct functioning of the connection with the existing drainage is guaranteed to the pond lamination effect.

3.3 Socio-Cultural Environment conditions

3.3.1 Human environment

3.3.1.1 Existing Population

According to the 2012 National Census the Zanzibar urban population was 593,678 which 54.0% reproductive female and 84.5% is the Population living in Urban Areas and an average annual population growth rate of 3.64%. In reference to National Population and Housing Census, 2012; the urban upgrading and drainage integration is implemented in areas of the population as elaborated in table 3.14

Table 3. 14; Populated areas of proposed project

Shehia	Population	Area (Km^2)	Density/Km^2
Mombasa	14492	1.82	7966
Tomondo	23254	2.62	8863
Kwa Wazee	5116	0.287	21442
Meya	5777	0.226	25539
Sebleni	5102	0.233	21906
Magomeni	6165	0.419	14731
Makadara	5048	0.350	14411

(Source; National Population and Housing Census, 2012)

The population within Sebleni and Kwa Wazee project area came to a total of 655 people, of which 410 (62%), were female, and 245, 37%, were male. From Meya-Magomeni project area, the population came to a total of 765 people, of which 490 (64%), were female, and 275, 35.9%, were male, while, the population within Tomondo/Mombasa project came to a total of 830 people, of which 527 were female, and 303 were male.

3.3.1.2 Community Structure

The formal community structure in the immediate impact areas along the project roads is typical of Zanzibar with some variation between the urban and rural areas. The lowest administrative structure is the Shehia with its own government under the Sheha. At the top of the Shehia are the ward, and then the district headed by the District Commissioner and a district council. Immediately above the district is the region under the Regional Commissioner.

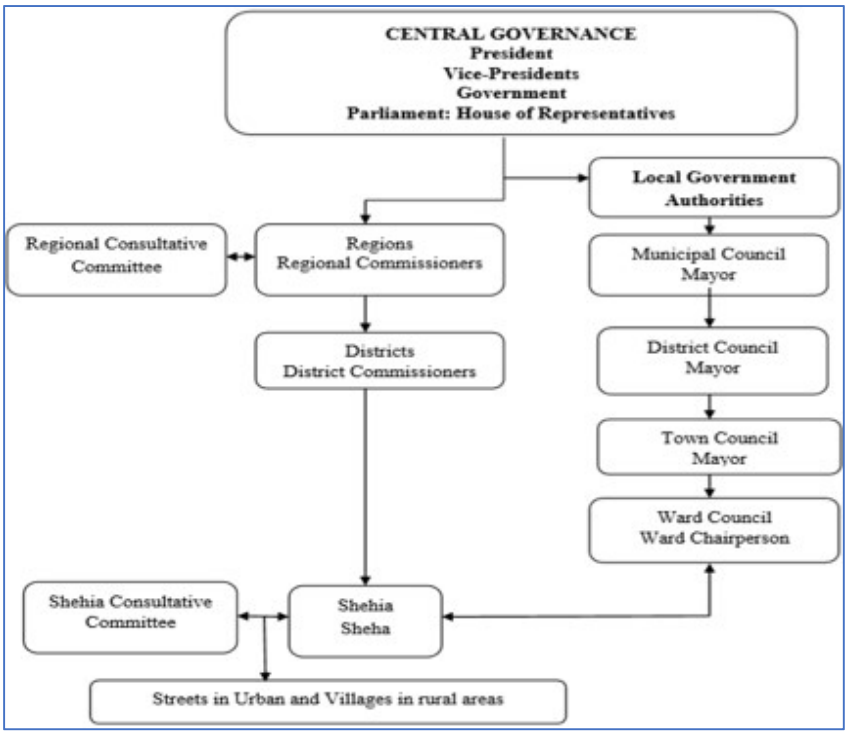

Figure 3. 8; formal community structure (Source: SWM Strategy Report)

Apart from the formal administrative structure there are other informal organizations and structures such as civil society organizations including NGOs, CBOs and FBOs, which are part and parcel of the social fabric of the communities. Although; there is no one CBO that represents the entire community, but there are different community organizations operating in the area including:

- There is a women's group that cultivate and then sells vegetables.
- There is a tailoring centre which provides training to the youth in order to help them increase their employment opportunities.

The immediate drainages system impact areas have very strong religious structures that have a direct bearing on the livelihoods of the local communities and these are reflected in the number of religious institutions.

The immediate drainage systems and urban upgrading areas have very strong religious structures that have a direct bearing on the livelihoods of the local communities and these are reflected in the number of religious institutions. 99% of all Shehas that are along the project sites have mosques. Islam is therefore the dominant factor in the lives of the individuals, families and communities the immediate drainage urban upgrading impact areas.

Customs and traditions of people along the project areas is a mixture of Arab and African customs and an emerging Swahili culture. However, values, beliefs and customs are dominated by Islamic faith and teachings and these are intertwined with these other cultures.

3.3.1.3 Culture, Attitude and Social Conditions

Zanzibar is a melting pot of cultures given the diversity of the ethnic and socio-economic composition of its residents. Currently the major cultural groupings are indigenous ethnic Zanzibar's, people of Arab descent, Asians (and predominantly the Indians). Most of these different cultural groupings are culturally united by the

use of common language which is Kiswahili. Furthermore, Zanzibar and its culture has been significantly influenced by the colonial domination of the Arabs, and British and the political and economic process and ideology since independence. The culture and attitudes of Zanzibar residents are being influenced by its economic and political processes. However, the city's culture reflects an articulation of the modern and traditional cultural patterns, belief systems and attitudes. The exposure through mass media to global cultures also has had major influence in the emerging cultural patterns, attitudes, lifestyles and values. The changing political, educational and economic systems since the 1980s also have had major impact in the psychological and psyche disposition of the Zanzibar inhabitants. While substantial degree of tolerance to racial, ethnic, religious and belief system exists but Islamic belief system is the dominant factor.

3.3.1.4 Education level and situation

In the survey done in three project areas, the majority of the sample has a secondary education, which remains true across men and women, as well as across age groups. In general, however, very few participants have a level of education higher than secondary, with 6% reporting to hold a diploma, 6.5% with a first degree, and 0.15% with a second degree. The younger generation is considerably more likely to be educated than older generations.

Table 3. 15: Number of Primary and Secondary Schools by Districts

Name of district	No. of P/S	No. of Sec. Schools
West	28	ND
Urban	20	15
Central	31	17

Source: 2011 District Reports

3.3.1.5 Public Health

Public health risk

Inadequate environmental management can lead to significant impact to human health and ultimately on the socio-economic development in Zanzibar. The project areas where the observed systems were visited lacks safe and clean water as most of the peoples depend on ground water/wells which most of them are not covered and are located near the drainage channel. The residents have constructed their latrines and discharge sewage to the natural drainage system and pollute the environment.

Health issues recorded among the communities are due, in large part, to the flooding events, with illnesses such as Cholera, infections and diarrhea, and respondents report to be ill an average of 9.4 days per year. Many people indicated that the current poor health situation can be improved if people have access to safe water, improved drainage system, and a clean environment with specified and well-designed solid waste collection and disposal site.

3.3.1.6 HIV/AIDS situation

According to the Tanzania HIV Impact Survey (THIS), 2016–2017, HIV prevalence in the general population of Zanzibar is less than 1 percent (NBS, 2017). Kaskazini Unguja and Mjini Magharibi regions have the highest HIV prevalence (0.6%), followed by Kusini Pemba (0.3%). The THIS 2017 data show significant reductions in HIV prevalence from the Tanzania HIV and AIDS and Malaria Indicator Survey (THMIS) of 2011/12, which estimated

an HIV prevalence of 1.2 percent and 0.3 percent in Unguja and Pemba islands, respectively. However, estimates from the general population mask the HIV problem in Zanzibar, which typically is classified as having a concentrated HIV epidemic, with high HIV prevalence among key populations (KPs). The key populations include people who inject drugs (PWID), men who have sex with men (MSM), and sex workers (SWs) who are also characterized as hidden and hard-to-reach population with high risk of acquiring HIV infection.

3.3.1.7 Waste Management

- **Solid waste management**

Currently, there is in-sufficient data for the entire area of Zanzibar to estimate the amount of waste generated, but it is roughly estimated that, approximately 300 metric tons and average density from household was 0.33kg/l (ZMC, 2013). Generally, the projection of population growth in the Zanzibar municipality by 2025 is 2.9 million with MSW generation per capita of 0.55kg/capita/day (World Bank, 2012. Over 60% of the total amount of solid waste generated in Zanzibar are not properly collected and therefore accumulated in drainage channels and open spaces (Table 3.17). Existing SWM infrastructures and equipment situation, as was determined in the consensus 2012 shows the following data.

Table 3. 16; Percentage by Region and Type of Refuse Disposal,

Region	Main Means of Solid Waste Handling (%)					
	Regularly Collected	**Irregularly collected**	**Burnt**	**Dumping Roadside**	**Buried**	**Other**
Mjini Magharibi*	22.9	18.1	4.4	0.7	8.3	45.6
Unguja Kaskazini	0.5	0.1	26.1	0.4	6.2	66.6
Unguja Kusini	0.03	0.8	23.1	69.9	0.2	6

(Source: SWM Strategy Report)

Currently, there is improper and less effective method of waste (solid and wastewater) disposal in Zanzibar. Disposal of municipal, biomedical and e-wastes is also a huge concern. In West B municipality, there are no specific collection points. People place the garbage at main intersection or roads where the garbage truck can access for pick up. The collection is undertaken once a week. This project aims to set 4 new micro sorting and waste collection spot in Tomondo. The community highlighted the importance of this project to improve environmental cleanliness.

According to the Zanzibar Environment Management Authority (ZEMA), meanwhile, the island generates approximately 663 tons per day (TPD) of municipal solid waste. The three main municipal councils namely, ZUMC, West A and B Municipal Councils generate almost half of the total waste generated by the island approximately 363 (TPD). “The collection efficiency of municipalities is between 40 to 50 per cent. The collected waste is sent to the landfill site at Kibele. The remaining waste is haphazardly disposed or burnt, which creates nuisance and jeopardizes the environment”,

But according to Zanzibar Urban Solid Waste management regulation, 2019; part two, section 10; it prohibits disposing of solid waste in any place where it may cause an environmental and public health problem.

Figure 3. 9; Solid waste collection point at Meya near Shimo la Nguruwe

In the socio-economic survey it was examined the behavior pertaining to solid waste management. Respondents were asked, among others: where do they dispose of their waste, why – if applicable – do they not dispose of their waste properly, distance from an official collection point, and whether or not they engage in recycling. The majority of those interviewed, however still less than half, (46.8%) dispose of their waste at an official collection point, which is an average of 411.3 meters from the respondents' homes. The second most commonly reported means of disposing waste is through at- home collection from a provider other than ZUMC, with 25.4%, followed closely behind 20.3% of respondents who have their waste collected at-home by ZUMC. As seen below, community members disposing of their waste in more improper ways, are in the minority, whereby only 2.2% bury it, 2.1% dispose of it at an unofficial dumpsite, 2% burn it, and 1.3% report using "other' means.

Solid waste strategy plan

In order to develop feasible SWM strategy for the Zanzibar archipelago, an intermediate phase was conducted, in which the various strategic options for the main SWM system components were assessed. The SW strategy gives the recommendation on how to prevent and manage solid waste in Zanzibar Urban area. These options area;

- SWM options policy and legal aspects
- SWM system main (technical) component
- Financial tools/measures (incl. PPP)
- Institutional improvement options
- Public Awareness & community involvement (Capacity building, as a cross cutting aspect)

The assessments concerning the above options are shortly summarized in table 3.18

Table 3. 17; perceptions on the improvement of SWM in Zanzibar (source; SWM Strategy Report)

SWM Component	SWM Challenges as identified	Identified System Options for SWM in Zanzibar
SWM system (technical and infrastructure)	(1) Inadequate SW equipment/ facilities (2) Inadequate SW skips- slabs (3) Inadequate collection-disposal sites (4) Existence of unplanned settlements (5) Lack of SW sorting/recycling industries (6) Delay in SW collection by councils (7) Lack of SW sorting techniques (8) Hilly topography in Pemba	(1) Provide adequate/improve SWM equipment, facilities and infrastructures (2) Scale up- ZUSP activities to other Urban districts (3) Devise/introduce inter-Municipal/District Councils cooperation/network to jointly handle of SW issues (4) Promote sorting at source, re-use and recycling (5) Prepare Broad Business Plan for SWM projects to attract funding/investors
Financial tools/measures	(1) Lack of funds to purchase SWM equipment and facilities (2) Communities unwillingness to pay for SW collection services (3) Lack of door-to door SWM services	(1) National wide financing mechanism for SWM (2) Review of SWM budget allocation (3) Review of SWM service tariffs to cover O&M costs (4) Expand/broaden the base for waste collection fee payment (pay- polluter pay principle)
Institutional/ Organization	(1) Inadequate staff for handing SW (2) Inadequate co-ordination among SWM stakeholders (3) Few NGO/CBOs dealing with SWM (4) Low involvement of PS in SWM	(1) Enforce existing regulations and bylaws (2) Review of roles and functions of institutions and actors involved in SWM (3) Create platform for coordination among SWM actors
SWM policy framework and legal aspects	(1) Existing legislation related to SWM are contradicting	(1) Enforce existing SWM regulations and bylaws (2) Identify and review/harmonize exiting SWM policies and legislations including SWM bylaws (3) Formulate specific policy for SWM
Public Awareness and community involvement	(1) Low level of awareness on issues related to SWM (2) Inadequate skills among the staff	(1) Include/Introduce SWM issues in school curricula (2) Create SWM awareness among the public through developing a SWM PA and Education Program (3) Engage Mass Media on SWM issues (4) Strengthen PPP's in SWM issues (5) Put in place communication strategy (6) Engage NGO/CBOs in SWM awareness raising

The underlying strategic principle is to apply simple, low cost SWM collection and transport technologies, and like in the ZUMC area, it is envisaged that the waste in West A and West B districts will be collected using skip container and skip trucks. Given the planned new sanitary landfill in Kibele, and the complexity and potential constraints of establishing other sanitary landfill(s) in urban areas, the selected option for disposing the collected waste from the West A and West B district, is also the Kibele landfill. This option of using the Kibele landfill also for disposing the collected waste from the West A and West B district was discussed in the consultation meetings and strongly supported by all stakeholders

Waste water management

The existing condition in according to environmental and social, most residents have onsite disposal of the domestic waste water through a leaching pit. The generated waste water commonly exceeds the capacity of the onsite disposal facilities. As a result, many people flooded with sewage effluent, contaminating drainage water as well as ground water. This habit is highly discouraged. It is estimated that, more than 50% of the diseases that affects people of Zanzibar are water and sanitation related. There is no centralized sewerage system in the Zanzibar, only Stone Town and some areas in Ng'ambo of the Zanzibar Municipality. Domestic wastewater is discharged into septic tanks, after which the overflow combines with storm water and gets finally disposed into the sea. It was reported on 2012, large quantities of sewage estimated to be more than 2,200m^3/day were discharged into the marine environment without effective treatment. It has been reported that, about 73.4% of the households use pit latrines as the means of individual sewage disposal facilities, and 22.4 % use flush toilet incorporated with septic tank and soakage pit. Zanzibar Municipal Council (sewerage, drainage and solid wastes) By-laws established on, 2006 for new tariff set-up and enforcement of revenues collection from solid wastes and sewerage services. The revenues collected from the customers services charge aiming at operating and maintaining of the waste facilities.

→Current Problems

Currently, the sewage and storm water drain into the sea through various outfalls (approximately 27 mixed outfalls in total for Stone Town and New Town).

- Treatment

As discussed earlier, the raw and partially treated (effluent from septic tanks) is discharged through these numerous sea outfalls located along the stone town coast / beach and it has been observed it is causing pollution of the seawater and beaches and the sewage discharge has found to affect the coral reefs and the marine life. It is therefore imperative that only the effluent from septic tanks is discharged into the sewers and this be adequately controlled and be treated before discharge.

- Inadequate size and network

According to the report of; Feasibility Study of Alternatives for Sanitary Sewage Collection, Treatment and Disposal for Zanzibar Town, 2010; the existing storm water and sewerage channels are inadequate in size and need to be enlarged. Urban renewal and urbanization have sewage flow increased. Also, a lot of sand, solids and debris find their way into the channels causing blockages and the overflows are unsightly and a health hazards when mixed with sewage. Solid waste management system has been improved since but sand traps and metal gratings are proposed. It has been observed that some plastic sewers (uPVC) do not have sufficient bedding and has thus collapsed under traffic loads. Certain areas are low lying basin-like areas such as Kikwajuni, Mnazi Moja play grounds, Jangwani, Uwanja wa Farasi, Government Printers, Amani, and Jang'ombe and cannot be drained easily and are therefore prone to flooding.

3.3.1.8 Flooding event Conditions

The current state in terms of sanitation practices; waste handling and disposal, hygiene behavior, flooding events, water source pollution, loss of life and low living standard contribute to the common related environmental and public health issues in Zanzibar. Apart from flooding, Water stagnated have been a source for water related diseases like bilharzia, Malaria, Cholera etc.

Figure 3. 10; flooding situation at Shimo la Nguruwe (Meya)

3.3.1.9 Impacts of storm water ponds

The existence of the ponds affects social and health environment in Tomondo and Sebleni Kwa Wazee and in many ways, both positively and negatively. The state of health of the residents has always changed from time to time. According to the response from the community, there are Water related diseases are facing them, like; skin and diarrhea diseases, typhoid, cholera, schistosomiasis or bilharzia, and malaria.

Access to primary health services is adequate although access to hospital services is problematic and the challenges and these are compounded by the distance from the hospital facility and thus vary among district. In Urban, West, Central, North "B" districts the top four causes of morbidity in 2007 were malaria, Upper Respiratory Tract Infections; Pneumonia and Diarrhea diseases. In North "A" district the four killer diseases were Upper Respiratory Tract Infections; Pneumonia, Diarrhea and eye diseases. Only Urban district has registered notable decline in Infant Mortality Rates over the years. More than 99% and 90% of the Urban and West districts residents are within 5 km of a primary health facility respectively. 90.4% and 98.4% of households in North "A" and North "B" respectively are within 5 km of a primary facility (Table 3.19).

Table 3. 18: Number of Health Facilities by Districts along the Project area

Name of District	No. of Health Centers/dispensaries	No. of hospitals	Private facilities	Parastatal facilities
West	12	0	20	4
Urban	ND	ND	ND	2

Source: 2011 Data District Council Reports

3.3.1.10 Gender violetion and social issues

The Revolutionary Government of Zanzibar recognizes that the empowerment of women and protection of children is critical to economic and social transformation and the achievement of National development goals. However, violence remains a daily reality for significant numbers of women and children in Zanzibar. Data from National Household Surveys report high levels and an increasing trend of physical, sexual and emotional violence experienced by women and children.

According to the 2015–16 Tanzania Demographic Health Survey and Malaria Indicator Survey (TDHS-MIS 2015-16), 14% of women survey respondents in Zanzibar aged 15–49 experienced physical violence since the age of 15. This represents a significant increase from 2010 when 10% of women reported physical violence. Ever-married women who have experienced physical violence since age 15 most commonly report husbands/partners as perpetrators of violence. Never married women who have ever experienced physical violence since age 15 most commonly report the perpetrator to be a teacher or a relative. Experience of physical violence declines sharply with increasing wealth and education. The TDHS-MIS 2015–16 also reported that almost 1 in 10 women (9 per cent) surveyed in Zanzibar aged 15–49 had experienced sexual violence (representing an increase from 6.5% in the previous National Survey in 2010). Sexual violence is most frequently committed by persons with whom women have a close personal relationship.

Currently, the project had made an involvement of women in decision making roles in "Integrated Drainage and Resilience Urban Upgrading in Zanzibar" this has been done in accordance with MKUZA II, through enforcing participation of women and sensitization in Shehia' planning team

3.3.1.11 Vulnerable Groups in the project areas

With reference of the conducted RAP, the PAPs within each affected Shehia, households falling under the category of "vulnerable" were identified. The criteria used to identify these households pertained to the presence of a female head of household, person with disability, and/or person over the age of 60. For those households with two or more of these factors, e.g. a female head of household and elderly person, or two members of the household with a disability, the household was labelled as "very vulnerable." It has been noted that, in Meya, 44.4% of households are vulnerable, and 11% of total households are very vulnerable. In Magomeni, 48.5% of PAP households are vulnerable, with 12% very vulnerable. In Kwa Wazee, 40% of households are vulnerable, with 5% very vulnerable. In Sebleni, half of the PAP households are vulnerable, and one-quarter are deemed very vulnerable. In Tomondo, 59.5% are considered vulnerable, with 19% very vulnerable.

3.3.1.12 Economic Activities and employment

Urban District: Main economic activities are self-employment 27.5%; paid employment- 27.5%. The mean annual income per household was T. Shs. 1,657,576 in 2004/2005 and per capita income of T. Shs 271,548. The main natural resource is fish and fishing activities are undertaken in the Indian Ocean.

In project areas, it was observed that, in Tomondo-Mombasa, the most common per household income is between 200,000 – 500,000 TZS per month, while slightly under one-third makes <200,000 TZS/month. Women are more likely to be among this category. In Sebleni Kwa Wazee and Meya-Magomeni, this trend changes among holders of a first degree, where the majority of respondents have a monthly income of 500,000-1M TZS.

In Tomondo, a large portion of the income is generated locally, with property income and self-employment being the most common, followed by commercial activities. In Sebleni, the largest sources of income generated locally include support from various organizations, property income, remittances, wage employment, commercial activity, self-employment and agricultural activities.

The top three expenditures among community members are food, electricity, and health-related items, including hospital fees and medicine. Other top expenditures include school fees and water.

3.3.1.13 Land Use/Land Cover

Notable variations were observed between districts on land use patterns. In West district: Limited use of land for farming. According to the National Land Use Plan (NLUP) The Zanzibar Vision 2020 on the other hand aims to achieve sustainable economic growth averaging 9-10% by the year 2020 by diversifying the economy with the tourism industry which will provide employment opportunities of around 50% compared to 20% in agriculture. Current land use in the project site area is; commercial, agriculture residential, public open space, public services and infrastructures.

Main food crops are roots, tubers, sweet potatoes, yams, rice, maize and bananas, beans, onions and groundnut. The two main cash crops are seaweed and cloves. However, the land that is used for farming is predominantly for temporary mono crops and permanent mixed crops while urban area is characterized by Residential, business etc. Residential uses, including local services, infrastructure and public space, account for fully 81% of the built areas with public services and limited public space (combined 9%), economic (4.7%) and infrastructural uses (>5%), accounting for the balance.

- **Land Ownership**

The family or household owned lands either distributed by governments or inherited through customary arrangements is the dominant form of land ownership. The family/household land is normally under the custodianship of the head of the family who is often a man. 95% of all Shehas along the project areas indicated that family owned land is the major type of land ownership. Government owned land that is distributed to individuals. The sector employs workers in both public and private sector mainly in schools, health services, government offices at local, district, municipal and transport sector etc.

3.4 Biological environment conditions

3.4.1 Vegetation/Plant species available in Zanzibar

Zanzibar Urban area is rich of different plant species. Some of the plants can only be found in this area of the world, thus protection efforts are made to ensure that these native species are not picked or put at risk. Among the plants found in Zanzibar urban upgrading area and in the area of intervention are; Mangroves at the outlet of system C near Saateni Shehia, *Cocos Nusifera* (coconut palm), neem trees, Bread Fruit Tree, *Mangifera Indica* (Mango Tree), Flamboyant Tree, Lipstick Tree, Zanzibar Palm, Terminalia catappa (Indian Almond), Fig trees(Mikuyu), Casuarinas species, Seaweed and other vegetation in the beach area and sea cliffs. Some of the project areas have agriculture activities taking place and crops like cassava, banana, pawpaw, wheat, potatoes were observed etc. To a small extent the project areas are covered by shrubs and bushes especial along the beach and sea cliffs.

Cultivated Lands with Settlements covers various agricultural crops such as Plantains, Cassava, Yams, Coconut, Mangoes, Oranges, Papaya, Almonds, Bread fruit, and other vegetables, etc. Restoration vegetation includes Acacia and Casuarina Trees.

The common grass species seen throughout include Heteropogon contortus, Cynodon dactylon, Dactyloctenium geminatum, Digitalia ciliaris, Eleusine corocana and Hyparrhenia filipendula. Secondary Bushland covers an assemblage of woody shrubs and dwarf trees exposed to constant clearing and pruning. Dominant small trees throughout the island include Blighia unjugata, Albizia lebbec Annona senegalensis, Ziziphus mucronata, Balanites aegyptics, Flueggea virosa, Millingtonia hortensis, Trema orientalis, Sorindeia madagascariensis, Suregada zanzibariensis, Dryopteris natalensis, Syzygium cumini, Antidesma venosum, and Mallotus oppositifolia. Dominant herb climbers include Acalypha claoxyloides and Perquetina nigrescens.

Forest Reserve/ Plantations

There is no forest reserve, national park or game reserve along the project area except Mangroves at the System C outlet. However, all trees are treated as reserved trees and anybody (including contractor) who wishes to fell/ cut down tree must seek permission from the Department of Forestry and Non-Renewable Resources

Figure 3. 11: Mangrove trees(L) and Almond trees(R)

To Conserve and manage Zanzibar's mangrove resources, is the within the framework of a program of integrated coastal area management. As elaborated Zanzibar National Forest Policy Number 4 in strategies Number 4.d; Set aside specified mangrove areas on a permanent basis as forest conservation areas to preserve biodiversity and to provide a source of plants and animals that would naturally restore adjacent areas. In strategy number 4.e it is directing to prevent damage to mangrove eco-systems from industrial pollution, discharge of domestic wastes, salt extraction and the poorly controlled development of settlements and tourist facilities.

3.4.2 Biodiversity

Biodiversity habitats are characterized by depletion of marine and terrestrial natural resources that have recently been under serious exploitation pressure. The destruction of biodiversity is due to multiple of factors including limited income generation activities for communities, demographic changes, development programs and its associated high demand for natural resources products. The urban upgrading and drainage interventions project will affect biodiversity, hence this should be carefully observed during project implementation

Zanzibar’s islands include diverse flora and fauna, which are notable to be endangered and threatened plant and animal species. These species include bird species, endangered and threatened mammal and amphibian species, and coral reefs in surrounding waters and shoreline. Protective measures for ecosystems and biodiversity include a network of Marine Protected Areas and forest reserves. Many of these assets are under

threat, for example due to deforestation to fuel charcoal consumption and poor water quality due to pollution discharges into waterways.

Relevant for the project is the Mangrove forest found at the outlet of system C. In case of locating the channel, it is seeming just small portion of mangroves will be cleared. This will have less impact during mobilization phase and construction phase.

3.4.3 Environmental Sensitive areas

On the other side; the environmental sensitive area should be well considered as with accordance with Zanzibar National Policy Number 5: concerning with Soil and waterbeds protection. Reduce soil erosion and protect critical waterbeds by promoting sound forestry practices both within government forest reserves and elsewhere. The existing outlet of drainage in the outlet of system C is suffering from erosion. During implementation of the project, this area should be taken care to prevent soil erosion and waterbed protection from pollution and erosion

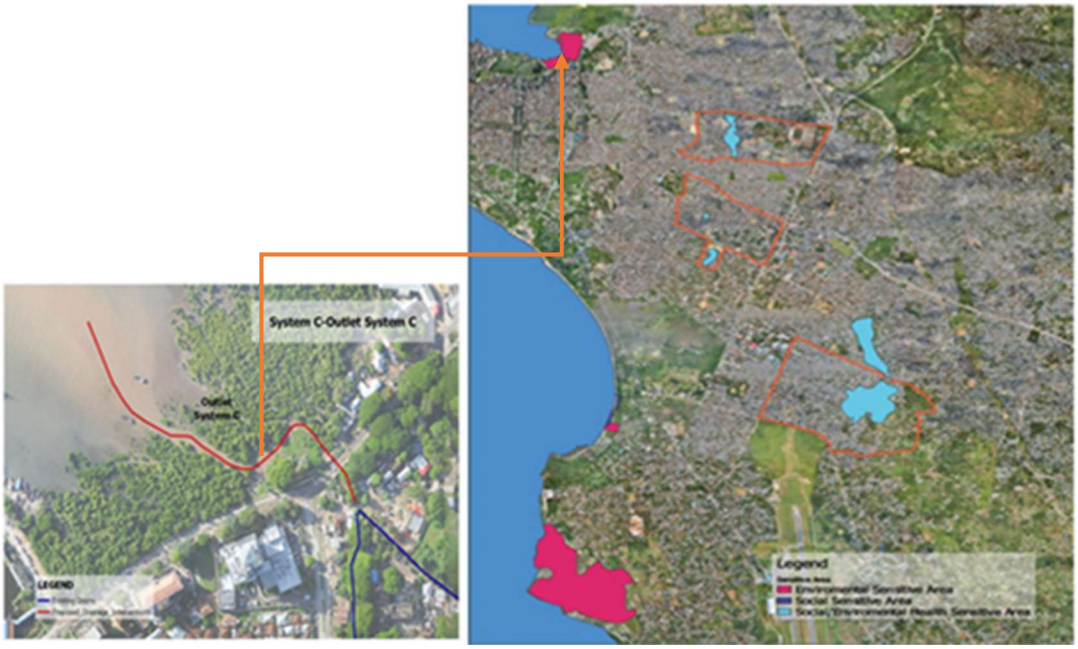

Figure 3. 12. Location maps for the sensitive areas in the site areas

3.4.3.1 Mangrove forest

During improvement of drainage channels and roads improvements, Forest Law, is one among few sector policies in Zanzibar where effective environmental concerns shall be considered and carefully observed. The overall environmental goal of this policy is to protect and conserve forest resources including wildlife, flora and fauna and enhances the role of forest resources in maintaining soil and water conservation. In accordance to Zanzibar Environment Policy (2013), “The Government will ensure sustainable management of the flora and fauna and the associated ecosystems in marine and terrestrial environment”.

Figure 3. 13; The reserved mangroves at Mbweni beach

3.4.3.2 Water ponds

Another area to be considered as it is very crucial is storm water ponds. For the case of Ziwa Maboga, storm water has been stagnating for so long and it might have an accumulation of contaminants especially heavy metals. The project involves construction of seven drainage systems with the objective to control flooding in the proposed critical areas. These structures have been designed to empty the flood water mixed with waste waters into the ocean. The marine environment is likely to be impacted if the wastewaters is discharged direct to the sea. It is thus wise to understand and know the quality of that water and sediments before draining it into the sea. Otherwise the impact will be negligible if the mixed water with detaining in the pond for some times.

3.4.3.3 Surface and Groundwater protection from pollution

Considering National policy for environmental sensitive areas, the area like Tomondo and Ziwa Maboga which seems to be temporal surface water during the rainy season and discharge during dry season. This is presumed to have direct connection with groundwater source is to be taken care during project implementation. ZAWA and ZEMA and other environmental consultation shall be attended before as it can have various impacts on groundwater. In other site areas people have been using ground water as their source for domestic uses, for instance, along system C32-12 were observed to contain boreholes along the existing drainage system

3.5 Drainage system existing conditions

Along the Zanzibar urban upgrading and drainage integration, there are fewer drainage system the problem that contributed into flooding. The drainage systems that serve part of the city were observed to be used for domestic sewage and most of these drainages are used as informal garbage disposal and other solid wastes

as well as sedimentation. This results into frequent clogging of drains and results into flooding, water body pollution and outbreak of water borne diseases

It was observed that there are crossings in system C32-12 which are in critical conditions with highly deposition of solid waste on the river bed and obstruction in downstream of the crossings. Other existing drainages were observed to be eroded, obstructed with solid wastes and sedimentation and small in size, the vegetation and building structures and unplanned settlements along the existing drainages presumed to be the source and cause of flooding in Zanzibar Urban upgrading areas.

ZTable 3. 19; Solid waste disposal and sewage discharge into the drainage channel

 The water and sewage are stagnating along the channel due to sediments and solid waste obstruction along the channel bed	Along the channel, people have been used the channel as the open sewer in which the direct sewage from the latrines to the channel Most of the toilets are located near the drainage channel 

3.6 Water supply situation

3.6.1 Water resources

Zanzibar is dependent upon groundwater for freshwater needs. Annual water abstracted is approximately 30.6 million cubic meters and serves 80% of the urban and 60% of the rural demand[25]. Fifty percent of the water abstracted is used for domestic purposes, whereas the other half is divided among commercial, institutional and industrial activities.

Zanzibar's natural groundwater quality is quite good, however over abstraction has led to increased salinity in some areas. Furthermore, surface and groundwater sources face contamination due to encroachment into water catchment areas, deforestation and wastewater. Water production for Zanzibar Town's urban water supply system is based on fifty-two boreholes, two springs and one cave. Twenty-three boreholes have been abandoned and one has been transformed into a monitoring well. Many boreholes are left uncovered or have inadequate sealing, presenting a significant risk of bacteriological contamination of groundwater.

ZAWA produces 80,000,000 L/day, or 117 L/day per 725,000 inhabitants of Zanzibar City. This is an acceptable rate, however, there are significant losses due to leaks in the distribution system and the absence of meters.

3.7 Significant natural Site

The mangroves are protected plant species in Zanzibar. The contractor shall seek permission to clear trees and mangroves for drainage improvement towards the sea. The area to be cleared is expected to be less than 0.5 Ha because the drain is a linear structure which does not take significant space. The exact size of the mangrove area to be affected will be known once the design review is concluded. According to Zanzibar law, trees are treated as reserved trees and anybody (including contractor) who wish to cut down tree must seek permission from the Department of Forestry.

According to Zanzibar Environmental Law, there is no standard for storm water quality to be discharged into the sea. According to the consultancy from ZUMC and department of Environment, all storm water drainage system discharge to the sea without consideration of storm water quality. However, substances that can harm the marine ecosystems must be restricted or sufficiently attenuated. Among the pollutants that can be introduced to coastal marine ecosystems through storm water include heavy metals, grease and oils and other toxic organic chemicals. Due to huge dilution that happens in marine ecosystems the effects of pollutants may not easily felt however, there is associated bioaccumulation potential in marine organisms that ultimate find way in higher trophic levels including human beings.

Figure 3. 14; Water hyacinth and existing almond tree species at Ziwa Maboga

The impact of ground water pollution may occur also in the site are for construction material haulage and the area where the excavated materials are disposed. The ESMP should be considered for avoidance and minimizing of the impacts which could occur

3.8 Aspiration and Attitudes towards the Proposed Project

Opinions and attitudes among Shehas and the public in general are converging on the proposed sub- projects of drainage integrations and urban upgrading as large and the need for undertaking the project. The need for

the proposed project includes: unplanned and narrow feeder roads; high rates of accidents; poor urban planning, flooding effects; poor solid waste management, lack of sewage management plan, poor state of the roads, increasing accident rates, Loss of life of the people into Sebleni pond and Ziwa Maboga. Another opinion is on solving problem of storm water at Makadara school which is in the point of the storm water flow path and the flooding in the area around Makadara especially during the heavy rainfall where the existing channel towards the underground System C tend to flow back and flood the community houses. Among positive impacts of the project as perceived by most stakeholders include: improving access to social services such as health services (only few hospitals are available within the project area), access to schools (both primary and secondary schools), creation of employment opportunities, reduction in accident rates, comfortable and efficient transport and improve communication, transport and travel between communities, flood reduction.

During discussions it was recommended that various stakeholders participate effectively in project planning and implementation for common understanding. Other recommendations are replacing indigenous trees along the drainage channels and the proposed project activities for development that might be uprooted during construction, relocation of public utilities infrastructure especially water supply lines and adequate and timely compensation for people whose properties will be affected. Design should also consider public utilities infrastructure, drainage systems, sewerage systems, solid waste collection points, reduction of sharp corners; parking areas and appropriate bus stops bumps (to reduce speed) and traffic lights on a number of road junctions, improvement of playing grounds, Markets and garden packs in the open areas

3.9 On-going Development Activities

A number of development project activities are being implemented in the immediate project areas that should be complementary to the proposed projects. Among these on-going projects are: Construction of the drainage systems to Sebleni pond to drain storm water to the system C up to the discharge point into the Ocean. Some other drainage construction has been constructed in Zanzibar urban area to serve the low laying areas from flooding problems.

4 PUBLIC CONSULTATIONS

4.1 Introduction

Public consultation formed an integral part of the ESIA as it provided for interested and affected parties to share their views on the proposed project throughout the project phases. The Zanzibar environmental law requires developers to carryout adequate stakeholder consultation and public consultation during the conduction of ESIA study.

This has been done also as in reference to the World Bank, OP4.01 and international best practices which necessitate public consultation during the ESIA and ESMP as well as RAP processing and preparation. According to ESMF for BIG-Z projects, Stakeholders should be directly involved in the whole cycle right from the design, implementation and monitoring. ESIA public consultation supports the existing participatory planning process during project identification. The displacement implications of the proposed project were part of the public consultation process. Consultation with key stakeholders for the urban upgrading and drainage integration was done to the various institutions including; ZEMA, the Forest Department, the Zanzibar Water Authority, Department of Roads, ZUMC, DoURP, Department of health, Zanzibar West B municipality, and local authorities (Shehia) and affected communities with the project and current situation of flooding areas. The purpose of all of these interviews was to understand the potential project area of influence and the potentially impacted stakeholders, to gather rich local level insights and a clear picture of the perceptions of the potential impacts of the project. Added to this, other stakeholders have been identified in the general locality that have an interest in the project. For instance, the people who are living and depending on the fishing activity at Sateni near the outlet of system C and those living at Fisheries village at Mazizini were interviewed and they raised their concerns on the proposed project and the feedbacks on the raised issues were provided as shown in table 4.1.

In reference to the Zanzibar Environmental Management for Sustainable Development Act of 1996, the following were applied to public consultation:

- Upon receipt of the environmental report, also known as an Environmental Impact Statement (EIS) the relevant authority shall distribute the report to government departments for comment;
- The public will be notified and invited to review and give written comments on the EIS;
- Written comments from the directly affected people will be solicited;
- A period of not less than 20 days and not more than 30 days will be given for public review and comment once they have been effectively notified;
- Once the public comment period is closed, the authority will have 30 days to complete their review. The outcome of this review will comprise one of three options: (1) project approval, (2) a request for more information, or (3) project disapproval; and
- Through the Director of the environmental authority, the matter will then be referred to the Minister who has 14 days to reach a decision. The Minister can approve the proposed activity (and direct the Director to issue an EIA certificate) and may attach conditions, or disapprove the application. The Minister may also invite public comments.

The individuals and Institutions consulted in form of focus group, interview and community meetings and discussions; written comments were also received by the project team. All comments, concerns and suggestions received from stakeholders are recorded in a Comment and Response Report.

4.2 Objectives of Public Consultation

The objectives of Public Consultation are to provide sufficient and accessible information to stakeholders in an objective manner which assists as follows:

- During the Announcement/Scoping Phase
  - Raise issues of concern and suggestions for enhanced benefits to the community;
  - Contribute relevant local information and knowledge to the environmental assessment;
  - Make suggestions for reasonable project alternatives; and
  - Verify that their issues, comments and suggestions have been captured and well addressed.
- During the Impact Assessment phase
  - Verify that their issues, comments and suggestions have been considered in the environmental investigations; and
  - Comments on the findings of the environmental assessments.
- During the decision-making phase
  - Be notified of government comment and decision on whether or not the project may proceed.

4.3 Methodology and Approach

The approach that was used to conduct this meeting included; PowerPoint Presentations, plenary discussions after each presentation and visiting project sites to verify projects which were not clear during discussion. Participants were given opportunities to ask questions and comment during and after each presentation and the last session participants were divided into 2 groups to discuss their contribution to the investment /planned projects in the three units.

Mainly stakeholders were consulted/involved through professional discussions (consultative meetings). Discussions were made with small groups or technical people in Zanzibar, mainly at government offices. The lists of stakeholders consulted are provided in Appendix VI.

The discussions focused on existing environmental situation in the area and the need to identify groups of people likely to be affected during the project implementation as well as the community assets and property that may be affected.

- **Community workshop:** Three community workshops were organized and realized at the end of October 2019: Tomondo (17/10), Meya / Magomeni (22/10, combined workshop) and Sebleni / Kwa Wazee (23/10, combined workshop). Each workshop counted with 40-50 participants from the communities.
- **Community focus groups:** A total of 21 Focus Group Discussions (FGD) were organized and conducted between 27 November – 3 December 2019 in the five shehias of the three target areas. The demographics targeted were Youth, Children, people with disabilities, businesspeople, women.

- **Community transect walks:** Community transect walks were organize with the Sheha of each community and members of the Community Planning team to verify and discuss on the field the outcomes of the community workshops on the first week of December.

- **Consultations with Community Planning Teams (CPT):** CPTs have been established in each area, composed by 12 community representatives (6 from each Shehia). Different consultations have been conducted with CPT in order to develop the midterm programme per each area, assessing the preliminary list of projects, prioritizing the interventions for short term investment and defining the role of the communities in the implementation and operation and maintenance phases for each category of investment.

- **Interviews:** The design Consultant consulted ZUSP PMT to discuss the implementation of the different phases of the ESIA study. Several interviews have been conducted with relevant stakeholders, including government institutions and authorities (Relevant Ministries and departments, Municipalities, DoURP, DoE, ZAWA,) and local authorities (Shehas) and individuals along the project site areas as well as affected people.

- **Technical Committee (TC)**: A TC has been established to steer the project and support the Consultant in the implementation of the assignment. Permanent members of the TC are representatives of BIG-Z PMT, ZUMC, West B, DoURP.

4.3.1 Identification of Interested and Affected Parties

Scoping report prepared by ESIA team led the consultant identified most of the stakeholders to be consulted during ESIA study. Also, preliminary review of the related literature and information on Zanzibar and the proposed development project, including legislations and national policies helped to identify gaps and areas where further information would be needed to focus on during the detailed EIA study stage. Further, the review helped to decide whom to consult (i.e. stakeholder identification).

The database includes government authorities, those who attended meetings and/or submitted comments, and people who submitted comment sheets distributed with the Background Information Document and Executive Summary of the Final ESIA Report.

I. Government officials;

- Zanzibar Environmental Management Authority (ZEMA)
- Department of Environment, Zanzibar.
- Department of Forestry and Non-Renewable Natural Resources, Zanzibar.
- Department of Lands and Registration
- Department of Rural and Urban Planning
- Department for Roads Construction, Zanzibar
- Department of Health and Health Education
- Zanzibar Water Authority (ZAWA)
- Zanzibar Electricity Corporation (ZECO)
- Zanzibar Urban Municipal Council
- West B municipality
- Central District Administrative Office

II. Project personnel

- ZUSP
- WB Group

III. Impacted communities;

- This involves Communities from Shehias forming boundaries with the proposed site and People whose lands, plots, crops, trees, etc. directly affected by the project. Table 4.1, presents the PAPs that are displaced by works implementation (fully affected) and those that could remain on site after compensation for the part of assets lost (partially affected).
- The proposed interventions will impact a total of 419 properties including structures, support structures, uncompleted buildings, housing plots and agricultural land. A breakdown of figures is shown in below.

Table4. 1; PAPs for land expropriation, loss of property and resettlement impacts

Project Intervention areas	**Shehias Involved**	**No PAPs impacted by flooding**	**No PAPs impacted by infrastructure**
Urban Upgrading Area 1	Sebleni – Kwa Wazee	1	37
Urban Upgrading Area 2	Mey-Magomeni	13	86
Urban Upgrading Area 3	Tomondo – Mombasa	2	167
System C	Shauri Moyo - Kilimahewa Bondeni - Kilimahewa Juu – Mapinduzi – Amani - Mkele	-	129

IV. Vulnerable groups

Among the PAP population within each affected Shehia, households falling under the category of "vulnerable" were identified. The criteria used to identify these households pertained to the presence of a female head of household, person with disability, and/or person over the age of 60. For those households with two or more of these factors, e.g. a female head of household and elderly person, or two members of the household with a disability, the household was labelled as "very vulnerable." In Meya, 44.4% of households are vulnerable, and 11% of total households are very vulnerable. In Magomeni, 48.5% of PAP households are vulnerable, with 12% very vulnerable. In Kwa Wazee, 40% of households are vulnerable, with 5% very vulnerable. In Sebleni, half of the PAP households are vulnerable, and one-quarter are deemed very vulnerable. In Tomondo, 59.5% are considered vulnerable, with 19% very vulnerable.

Meeting Agenda

Typically, the Agenda for these consultations included:

- Presenting the Urban upgrading and drainage interventions Project;
- Presenting the proposed upgrading activities by using maps;
- Discussing recent experience in the Region/District with respect to environment

- Obtaining from the authorities their environmental concerns and perceptions regarding the proposed project;

Community Meetings and Focus Group Discussions

The majority of comments from stakeholders were verbal during focus group meetings and community meetings. Six (6) focus group discussions in 3 community meetings were held and attended by Sheha of all selected areas and representative members.

The details of the focus group meetings held in the project areas as well as photos are shown in Public Participation Specialist report appendix VII.

The presentation of the project was done in English and/or Kiswahili, but participants were free to use their language of choice during discussions.

During these meetings, a comprehensive overview of the project and selected sub-projects for urban upgrading, as well as the motivation for the proposed project was presented. Stakeholders had the opportunity to comment, raise issues of concern and suggestions for enhanced benefits to be evaluated during the specialist studies, which were conducted as part of the impact assessment phase of the ESIA. During community meeting, the individuals visited the site after discussion for more satisfaction.

Information about the ZUSP and BIG-Z was well received by I&APs who took part enthusiastically in discussions and were very willing to share their experiences and contribute to discussions

Obtaining comments from stakeholders

The comments were both in written form and verbal explanations of the proposed project during meetings. Individuals and Affected Parts could contribute issues either in writing (by completing and returning comment sheets) or verbally by telephone which was done up to the 14, February, 2020. Comments raised are captured and used to preparation of the Final ESIA Report. The feedback and summary of the comments and deliverables from communities meeting have been indicated in the appendix V.

Public Consultation during the Impact Assessment Phase

Public Consultation during the Impact Assessment Phase of the ESIA focused on the ongoing consultation with Interested and Affected Parties; and Consultation with stakeholders around the findings of the ESIA, as presented in the executive summary

Issues Raised in Consultative Meetings

Community meetings resulted into rising of various issues related to the proposed projects. Their issues were recorded and summarise with the feedback/responses in accordance to their concerns as elaborated

Table4. 2: Key issues raised during stakeholders' engagement meetings

Institution/ Shehia	Issues and Concerns	Response and consensus
Department of Environment	Discussion was held on the DoE and proposed subprojects in water supply, storm water drainage and road sectors and suggestions were sought on	• The contractor must seek permission from the Department of Forestry before falling of any tree. • ESMF and ESIA would be shared.

Institution/ Shehia	Issues and Concerns	Response and consensus
	environmental issues to be addressed in Environmental and Social Management Framework. **→The environmental issues raised** • For drainage and roads projects, DoE suggested alignment of projects in such a way that large tree cutting and mangroves will be minimized. • Discharging of storm water to the sea is not an issue as most of drainages discharges to the sea • How is the excavated material going to be handled? • The project implementation can cause soil and beach erosion, what are to be done to minimize this impact?	• All statutory Guidelines and order to be followed • Environmental parameters in municipal areas were collected. • EMP would be shared with the Department
Department of Forestry and Non-Renewable Natural Resources	**→Environmental issues raised** • The potential environmental impacts associated with this project on forestry and non-renewable resources are loss of large trees, mangroves and extraction of definite materials (gravel and sand) • There should be Consideration on small fish and breeding site for fish under mangroves protection during project implementation • Along the project area there is no reserved forests apart from a mangrove at the outlet of system C • Due to its nature (Island), Zanzibar has got a lot of aggregates (40% of the Unguja Island is stones). However, sand is becoming a problem now which you need to consider it • All quantities of materials needed by the project should be presented to the department so that they can arrange a sustainable way of managing these resources.	• Consideration of forest regulation of 1996, section 10 on forest and mangrove conservation will be done • ESMF and ESIA would be shared. • The EMP would be available in public domain • The rates for compensation of trees are provided by the Ministry of Agriculture and Natural resources. • Importation of construction material will be done from Mainland • Department of Forestry and Non-Renewable Natural Resources should be involved during commissioning and decommissioning of the project to the contractor. • Replanting of trees that were cut down during construction will be done. • All trees must be compensated according to the law. The contractor must seek permission from the Department of Forestry before falling of any tree or mangrove clearing. • The contractor should consult Department of Non-Renewable Natural Resources before embarking to extraction of raw materials. Most of the quarry's sites are owned by the Government but Sand pits are owned privately.
Zanzibar Water Authority (ZAWA)	The meeting team appraised by Technical Engineer and his team on ZAWA to the proposed sub-projects in water supply, storm water drainage and road sectors and sought their suggestions on environmental issues	• Integrated planning should be practiced to involve all stakeholders (especially those with infrastructures along the sub-projects) in order to reduce negative effects of the project.

Institution/ Shehia	Issues and Concerns	Response and consensus
	to be addressed in Environmental and Social Management Framework. →**The Environmental issues raised** • Regarding the drainage, and road projects, technical engineer stressed that as Zanzibar is a water stress location, proper measures should be implemented to mitigate any high impacts on water quality and availability due to the project • All the project roads and drainage development have the water supply pipes; the risk of being affected is very high. • Pond draining to the sea shall be done in such a way that it won't disturb ground water	• The contractor must consult the ZAWA before any abstraction of water for construction purposes. • Replacement of the pipes must be done by ZAWA and not the lead contractor • Funds for relocation of the infrastructure should be part and parcel of the project costs. • The ESMP would be available in public domain • Design will be done as not to drain all logging water from the ponds
Zanzibar Municipal Council (ZUMC)	→**The Environmental issues raised** • The design of the roads shall take into consideration provision of Storm water drains which help to reduce floods and protect the roads. • Provisions of toilets/ urinals should be kept at labour camps during the construction activities • Trees should be planted as per national and international rule & guidelines. Survey for trees to be felled should be undertaken • Proper rehabilitation of the quarry sites and borrow pits at the end of the project →**The social issues raised** • The signage of the roads should also consider the disables • Covered open drainage to be used as pedestrian walkway and protection from solid waste disposal	• LGA and community shall be involved in maintenance and cleaning of drainage system • Enforcement of Sewage/wastewater management regulation to prevent wastewater discharge to the drainage systems • There shall be a proper management plan for sludge management • Design will be done by considering also persons who are disabled • Safety measures would be a part of EMP and BOQ. • Temporary Impacts will be a part of RAP which would be disclosed in websites and other media.
Zanzibar Electrical Corporation (ZECO)	→**The Environmental issues raised** • The electric power lines are running parallel along the project roads. This requires relocation of the lines including poles →**The social issues raised** • Resettlement of people and their properties and compensation is the major challenge of the project. The consultant and client must handle this issue with care	• Funds for relocation of the infrastructure should be part and parcel of the project costs • Consultancy shall be done in position, operating and maintenance of street lighting
Department of Roads	→**The Environmental issues raised** • The roads are being upgraded to reduce congestion problems, design period has expired and for some feeder roads. • The contractor should use the existing borrow and alternative sand material because there is inadequate of these materials to complete these projects	• All roads shall be managed and maintained by the department of Roads under MoCT-Z. • ESMF and ESIA would be shared. • The EMP would be available in public domain. • All affected persons should be compensated appropriately • The roads project will improve the community life through easy access of

Institution/ Shehia	Issues and Concerns	Response and consensus
	• There will be increased noise, and air pollution during construction, but during operation the pollution will be minimal • Development of feeder road shall be done together with installation of other utilities	services i.e. education, health, transport, electricity, water and market for agriculture products
Zanzibar Tourists Corporation (ZTC)	This department has not been consulted/ involved so far and it is one of the very important organs in planning of the towns including Zanzibar urban upgrading. **→The socio-economic issues** • The improvement of the proposed sub-project shall target in boost tourism sector as it shall be easy to take around tourist in a short period of time. • New tour routes shall be created. • The income of local people will increase since they will be employed during construction.	• The design is done to avoid demolition of any/if available tourist's attraction sites including Historical sites, Ruins, Museums etc. • If it is necessary to demolish historic sites, during their reconstruction the designers should redesign them in such a way to imitate the original structure
Ministry of Agriculture and Natural Resources	The Ministry is the organ which handles the Compensation for loss of trees. **→The Environmental issues raised** • All trees that are in the RoW but do not interfere construction activities or do not compromise the road safety should be left intact • There shall be no major negative impact on Agriculture sector as most of these roads and drainage crosses through Zanzibar urban area • All borrow pits and stone quarry are under the management of the Ministry. **→The Social issues raised** • Resettlement and Compensation is the major challenge of this project as it involves demolition of many houses, mosques, shops, etc.	• ESMF and ESIA would be shared. • The EMP would be available in public domain. • The rates for compensation of trees are provided by the Ministry of Agriculture and Natural resources
Department of Urban and Rural Planning	**→The Environmental issues raised** • The design of the project roads must comply with the Town planning regulations • Design and planning of the project activities shall consider the impact of climatic changes • Consult Department of Work for the road size standard during designing **→The social issues raised** • Do you include even the affected people from this project?	• The use of open space shall be done by consulting LGA and DoURP for common understanding and awareness • The compensation will be done with reference to the available regulations • All construction activities will be done in consideration to the available regulations and standard • The affected parts of all three units will be involved in every stage of the projects

Institution/ Shehia	Issues and Concerns	Response and consensus
	• The project shall involve a huge resettlement and compensation package; this department have to be involved as early as possible. • The plan for resettlement shall be of multi-storey buildings as is not good to move the people outside the town	
West B municipality	**→The Environmental issues raised** • During road and drainage construction will you consider other utilities? • How are the side effects of the selected materials for road pavement, for example increase of the surrounding temperature? • Sludge from demolished toilets and septic tanks shall be treated and used as fertilizer • Make sure that ZAWA is aware as their water supply systems are predicted to be interrupted **→The Social issues raised** • There should be an involvement of all key stakeholders during project mobilization for others to understand the proposed project • Provision of community awareness and capacity building as well as involvement and participation in project maintenance and operation	• Other utilities will be considered and taken into account • ESMF and ESIA would be shared. • The EMP would be available in public domain. • Consideration of water table should be highly done to avoid or prevent ground water pollution • Maintenance and operation of lighting will be frequently done by municipality • Construction material selection will be done by considering the international and local available standard
Communities (Meya-Magomeni, Sebleni-Kwa Wazee and Tomondo Mombasa)	A detailed public consultation was organized with the potential project affected persons, people's representatives. During discussion it has been observed that the benefits of the proposed project areas were acknowledged by the local people but they stressed that; **→The Environmental issues raised** • Cutting down of trees should be avoided as much as possible to avoid destruction of indigenous trees as well as habitats. The Contractor should also plant trees after construction works. **→The Social issues raised** • The Executing Agency, need to incorporate proper traffic safety measure to reduce accidents, once the road is operational. • The local people had agreed in the view of the proposed project which will solve the water logging and flooding in the area but apprehend to the pollution and traffic issues that may arise during the construction of the drainage and other infrastructures	• There should be adequate and timely compensation of the affected people who will be required to relocate to pave way for the road. • The resettlement action plan to be developed for the project will have mitigation measures to cover temporary loss of livelihood • The contractor should work closely with the local communities', local provincial administration, Shehia elders, area leaders like Shehas, and other community opinion leaders. • The Contractor should find technical solutions for preserving the available water facilities and sources especially the ones found very close to the project area. • The Contractor should preserve and/or improve accesses to any available feeder roads and drainage.

Institution/ Shehia	Issues and Concerns	Response and consensus
	• The communities expressed concerns on the possibility of destruction of their farming land, and plots during upgrading of the road and drainage. • Few affected parties informed that they used the drainage during high tide to ship their local boards to the sea	

4.4 Meeting with affected communities (PAPs)

The consultation was done in mainly three selected area (Tomondo, Meya-Magomeni and Sebleni Kwa Wazee). Residents welcome the proposed project and are positive about measures being taken to address the major problems of flooding, health impacts and solid waste management, which currently have a major negative impact on their lives. In general, there is widespread support for the BIG Z. People are anxious for the project to start as soon as possible and have high expectations that it will significantly improve the quality of their lives.

Many people however, pointed out that the sustainability of the project depends on commitment, proper planning, management and maintenance by the Municipality, as well as community involvement.

Community awareness and education emerged throughout the public consultation process as a key requirement to promote community "ownership", as a first step towards the long-term sustainability of the overall project. In terms of other benefits, some expect the road improvement and street lighting project to enhance the tourism potential of Zanzibar and improve the economy.

There are various challenges and suggestion raised by stakeholders during the ESIA public and Governmental stakeholder consultation process.

4.4.1 General issues raised by stakeholders in specific sub-projects

- **Storm water Management and drainage development**

The all three communities (Shehias) consulted during the ESIA public consultation process, raised the flooding and poor drainage problems as a major problem in Zanzibar City. This has impacted a problem of their health, safety, quality of life, livelihoods and personal property. Most people indicated that the surface water drainage component and road development to be the priority in implementing the project.

People want the current situation to change through upgrading of the drainage system to improve their lives as the upgrade of the drainage channels will completely eliminate their problems related to flooding. Stakeholders attribute the flooding problems to:

i. Poor urban planning and unplanned settlements others have constructed the top of drainage;
ii. Lack of adequate drainage systems;
iii. Poorly designed channels for example, too small, not deep or wide enough;
iv. Lack of maintenance and regular cleaning of drainage channels;
v. Farming in river courses, which blocks water flow and divert it to the residential areas;
vi. People misusing open channel drains to dispose of solid waste;
vii. People filling drains with sand in order to cross over; and
viii. Blockage of drains due to accumulation of waste.

The recommendations proposed by many focused-on design and types of drains that work well. Some people recommended wide, deep, open channel drains with pedestrian cross over points. others suggested underground drainage and closed drains from a safety point of view, as well as the fact that people would not be able to use them for waste disposal. Stakeholders noted that it is essential that once the storm water drains are in operation, the ZMC initiate a regular and effective maintenance and management program in engaging

the community. The ZUMC, tried to give out their views on drainage intervention that, the design should take care of; ventilation, sediment accumulation and blockage, Natural gas evolving protection, Kind of rock, light, velocity of the water, and solid waste control for the safety of people and environment. There should be two separate systems for storm water and waste water. There should be a consideration of LGA by-law, section 7, public health law, section 11, environmental management law, 2015 section 3, and other useful guidelines for environmental and public protection protections

- **Street improvement and developments**

On the meeting held with stakeholders from Zanzibar West B municipality on 03/02/2020, insisted that; the planned activities shall be implemented parallel to each other to avoid destruction of developed infrastructure and advised to plan and make sure there is institution coordination and involvement during implementation of the project to avoid fund misuse.

They insisted that; ZAWA, ZECO, ZRF, DoURP, ZEMA, ZUMC, BIG Z and other institutions should be highly involved for common understanding of the utilities and infrastructures to be developed like installation of water supply networks, storm water drainage systems and sewerage networks as well as roads, foot path and green link corridor on top/along of drainage systems and other modifications.

Furthermore; the municipalities addressed the issue of Community engagement, in which engagement shall be taken in consideration in creating awareness and capacity building on operation and maintenance of the developed infrastructures.

Due to the problem of high-water table in Zanzibar, choosing of construction material during road construction should be done in consideration with temperature and the water table.

- **Water supply and services**

This is including water harvesting both in public institutions and individuals/residential area including construction of storage tanks.

The community members raised the challenge facing them in water treatment, they went further saying that; they advised on proper way in monitoring the level of contamination as they normally disinfect water by using Chlorination (water guard).

They shared their experience on controlling of germs; saying that; in domestic areas people have been spaying chemical to kill germs like mosquito's lava to prevent Malaria.

Furthermore, ZAWA provided to the stakeholder the documents with some studies which have been done to identify the health problems to the community. It was observed that; ZAWA was less engaged but this was done by other institutions including; Ministry of Health and Ministry of Agriculture, Natural resource, livestock and fisheries, SUZA and CHOMAP.

- **Wastewater management**

This section is aiming in improving and control wastewater discharge into the surrounding environments especially in existing drainage systems.

DoE elaborated that; they don't allow direct discharge of untreated wastewater direct to the environment, as it referenced into ZEMA, 2015, it is restricted and prohibited the direct discharge/disposal of untreated wastewater or contaminants into ocean or any water sources.

During the meeting the department raised the issue of storm water discharge into the sea; They said that; it will cause some environment impacts to marine ecosystem;

They advised that; to reduces the impacts like; soil/beach erosion, natural trees and vegetation clearing, solid waste and sediments disposal as well as impacts to fishing activities, drainage design shall be properly done to minimize these impacts.

ZUMC and DoE raised the issue of Sewage and storm water management in Zanzibar, they said that; Sewage and storm water is not in good control as many places have been suffering the negative impacts of sewage and storm water.

ZUMC insisted that; according to Zanzibar Environmental policy (2013), "The Government will ensure prevention of contamination of water resources and protection of water catchments areas for sustainable and safe water supply".

Many community members had claimed on the sanitation issues as most of family have been using pit toilets, septic tanks and other direct discharge sewage into natural drainage. This has contributed in surface water and ground water pollution.

Meeting with ZAWA on the issue of wastewater management, they said that; ZAWA is not responsible with wastewater and solid waste management in Zanzibar rather it is a responsibility of Municipalities which deal also with Drainage at the Municipal level.

- **Solid waste management**

ZMC elaborated that waste management has been significant issue that is now taking an attention as wastes is scattered causing health risks, bad odors and blocking water drains which in any way results into the flooding problems.

Some issues raised by community members were; Lack of regular waste collection services; Inadequate provision of waste collection skips, bins and concrete slabs; few waste collection trucks; Poor waste management practices by local communities, for example dumping waste in drainage channels; and Lack of suitable waste collection and disposal sites. The stakeholders suggested that;

i. There should be well designed collection point suitable spots to avoid waste scattering,
ii. The implementation of Local Governmental Authorities by-law concerning solid waste management and environmental protection
iii. Street road expansion for the solid waste collection trucks can access and collect solid waste and transport it to disposing site
iv. There should a restriction on disposing of solid waste in the open spaces and open drainage channels
v. ZMC shall make sure that there is adequate solid waste management for the city beatification and attraction of the tourists

vi. All drainage should be covered with concrete slabs to prevent solid waste disposing
vii. ZMC should ensure regular cleaning of the drainage to make them free from Solid wastes and sediments (Sands)
viii. The existing drainage channel are overloaded because are small and full of sediments and solid waste, hence they should be developed and expanded to accommodate the amount of storm water which increases due to climatically changes

- **Lighting**

"Resilience Urban Upgrading in Zanzibar and drainage integration project" will also carry out lighting to the roads and provide security services to the area which are scared to pass during the night. It will involve solar power supply or traditional poles.

The community expressed their disappointment that street lighting for this phase of the ZUSP is restricted mostly to Stone Town as it is felt that upgrading of street lighting is needed throughout Zanzibar City. Many were positive that the upgrading of street lighting will reduce crime, enhance tourism and hence, improve the economy of Zanzibar. Others provided commitment to the municipality to ensure that street lighting is maintained during operation phase.

There were also several raised issues during the meeting with Tomondo community and West B Municipality on the investigation of solar energy for the street lighting, instead of using only electricity from the national grid and the on the street light management which community advised the municipality shall take responsibility in street lighting management.

- **Public open space**

In accordance with DoURP, people are poor and living in low life standard, the urban upgrading and drainage intervention project will improve the community life will increase their income through commercial activities and public health.

For the case of open spaces, DoURP advised that; they should be developed and expanded for recreational activities and parking. According to the DoURP regulations; all the open space should be under Municipal Council and after identification of the open spaces, then will be surveyed and handover to LGAs. DoURP has the mandatory to declare it as open space for specific purposes. For the area left due to flooding, after solving this problem if it wants to be saved as open space, compensation is required to be done in reference with the government or WB agreement.

In public open space, the project is proposing many interesting activities which are accounted as one of the issues into the community. Among the proposed projects are; improvement of surface materials, shading, benches, sport fields, playgrounds, embankment walls ponds, vegetation and gardens, urban agriculture and market places. The community suggested to use the available open spaces for developing proposed infrastructures rather than demolition the existing the existing building structures as it will involve much cost

During implementation of this project it is assumed to cause significant environmental and social impacts. The other challenges in improvement and construction of drainage system as many crosses the residential areas, the community advised elaborated that; in any case this will involve in rehabilitation and resettlement of older buildings, thus, the design improvements of footpaths are needed.

- **Environmental sensitive areas**

The consulted DoE referred to Zanzibar Environmental Management Authority (ZEMA), 2015, on the issue of environmental sensitive areas. ZEMA defines the environmental sensitive area as the protected area which reserved prevented from any anthropogenic activity. ZEMA, 2015, section 61, elaborates on protected areas.

DoE provided areas which area named to be sensitive areas; marine reserves including Mangroves, forest, special area with dangerous facilities as well as flooding area. They insisted also; Mangrove shall be careful observed as one of protected areas, it was recommended that during drainage construction it will require due discussion and special permission from the Ministry of forest to clear portion of them.

The results of consultation done with Department of the forest and natural resources, project should observe carefully the forest and mangrove conservation law of 1996, section 10. In carrying any activities which will affect the forest and marine reserve, they said; the contractor is required to get permission from ministry of forest.

Department of the forest and natural resources advised that, the required permission from the ministry to work on sensitive areas include; the permission to discharge wastewater effluent and storm water to the sea, tree and vegetation clearing and project shall consider protection of small fish and breeding site for fish under mangrove

- **Public Health and Safety**

The communities' main health and safety concerns were related to poor waste management, wastewater management and flooding and its associated impacts were including, loss of life, damage to homes; loss of livestock, personal possessions and furniture; spread of water related disease like; Skin diseases, typhoid, cholera, diarrhea, and malaria. Many people indicated that the current poor health situation can be improved if people have access to safe water, improved drainage system, installation of sewerage systems, and a clean environment with specified and well-designed solid waste collection and disposal site. Their suggestions and requests for improving the situation relate largely to the urban upgrading sub-projects and implementing the activities identified as soon as possible

- **Socio-Economic Issues**

During the public consultation as well as focus group discussions; the communities addressed several social and economic challenges and problem as elaborated here after;

i. Employment and training:

Several inhabitants indicated that communities are unable to pay for services but are able to contribute by providing e.g. labour for construction. There was strong feeling that people from the area in which the construction work is being done must be given first priority for employment opportunities and training. Local communities would also like to be trained in maintaining the upgraded storm water systems; sewerage systems and water supply networks.

ii. Awareness creation and education:

The majority of stakeholders commented those awareness creation and education programs are essential for the long-term success of the BIG - Z. This comment was endorsed by government officials, community-based organizations, community representatives and residents alike; and

iii. Compensation and resettlement:

Most of the people were worried on compensation and resettlement as; the construction activities will cause damage to their property, assets and livelihoods. Due to this; they requested that the BIG - Z should make provision for compensation in this regard and also consider resettlement should the impacts be significant. They were willing for property to property compensation not property to money compensation. This is because building the house in Zanzibar is very expensive “as some started constructed houses when they were youth but were not even able to finish until their children grown up to help”.

5 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

5.1 Environmental Management in Zanzibar

Environmental management is not a Union matter (between Tanganyika and Zanzibar) and therefore is handled by the Revolutionary Government of Zanzibar (RGoZ). Regulation on environmental management in the Zanzibar is mainly vested on the Department of Environment (DoE) in the Office of the First Vice President. The DoE undertakes enforcement, compliance, scoping and review of environmental impact statements as well as to provide the policy formulations and technical back-up and executes the overall mandate for environmental management in Zanzibar. There are policies and pieces of legislation on environmental management in Zanzibar, the relevant ones to this project are briefly discussed below.

5.2 National Policies

Environmental awareness in Zanzibar has significantly increased in recent years. The Government has been developing and reviewing national policies to address environmental management in various sectors. Among others, the objective of these policies is to regulate the development undertaken within respective sectors so that they are not undertaken at the expense of the environment. The Policies that address environmental management as far as this project is concerned and which form the corner stone of the present study include *inter alia*.

Zanzibar Environmental Policy 2013

The Policy supersedes the first policy prepared in 1992, "The National Environmental Policy". The 1992 environmental policy was the first ever blue-print document which was developed to guide the country through its national and global commitments towards the protection and conservation of environment and sustainable development. Since then, and despite the measured degree of success in environmental management and enforcement, emerging and new environmental challenges continued to affect the Zanzibar's sustainable development goals. Among the 21st Century emerging challenges facing Zanzibar included population growth, expanding tourism industry, rising energy demand, depletion of natural resources, the impacts of climate change. The new Zanzibar Environmental Policy of 2013 was developed to address such sustainable development challenges.

Fundamental issues addressed by the Zanzibar Environmental Policy 2013 include,

- Environmental and Climate Change Governance;
- Terrestrial and Marine Resources and Biodiversity;
- Forest Conservation;
- Renewable and Efficient Energy;
- Environmental Pollution;
- Waste management;
- Integrated Water Resources Management;
- Development of Environmental Quality Standards,
- Environmental and Social Impact Assessment;

- Environmental Information Systems and Awareness, Climate Change Adaptation and Mitigation, Sustainable Tourism; and
- Gender, HIV/AIDS and Public Health.

The policy focuses on;

- Ensuring the maintenance of basic ecological processes upon which all productivity and regeneration, on land and in the sea, depend.
- Promoting the sustainable and rational use of renewable and non-renewable natural resources.
- Preserving the terrestrial and marine biological diversity, cultural richness and natural beauty of Zanzibar's lands
- Ensuring that the quality of life of the people of Zanzibar, present and future, is not harmed by destruction, degradation or pollution of their environment and natural resources.
- Strengthening both institutional mechanisms for protecting the environment and the capabilities of the institution involved in the environmental management.

Zanzibar Development Vision 2050

Zanzibar Development Vision 2050 (henceforth Vision 2050) is a long-term national development plan formulated by the Revolutionary Government of Zanzibar (RGoZ) to guide Zanzibar's overall development agenda from 2021 to 2050. Among the priority areas that were addressed in the Vision is issue related to Water and Sanitation. The objectives of this issue related to solid waste management are Developing a master plan on sewerage, drainage and solid waste management, especially in municipal and town councils; Empowering municipal councils to collect and process solid waste in a sustainable and responsible manner; and Implementing the 'polluter pays' principle to punish individuals and businesses that engage in unauthorized disposal of waste. In this regard, the establishment and implementation of SW Sorting activities will support the realization of the Zanzibar Development Vision 2050.

Zanzibar Strategy for Growth and Reduction of Poverty

According to the Zanzibar Environmental Policy (2013), the Zanzibar Strategy for Growth and Reduction of Poverty (ZSGRP) focuses on the reduction of both income and non-income poverty; and ensuring the attainment of sustainable growth. The ZSGRP emphasizes environmental management issues such as sustainable and gender focused environmental management system, reduction of the environmental degradation and waste management (solid, wastewater, hospital and hazardous waste). The policy is relevant to the project as improvement of commercial centers like markets, and facilitates goods transportations for road improvement as well reducing flood through drainage improvement will prevent loss of property and life and focusing on business issues

The National Forest Policy for Zanzibar (1996)

The general goal of the National Forest Policy for Zanzibar is to protect, conserve and develop forest resources for the social, economic and environmental benefit of present and future generations in Zanzibar. This policy recognizes the dependence of the people of Zanzibar on forests for fulfilling basic needs such as fuel woods and building materials. The purpose of the National Forestry Development Policy is to establish priorities for

conservation and framework for action. The policy is directed at integrating conservation, development and the utilization of forest resources, both wood and non-wood.

The specific goals of the policy are divided into three main areas as follows:

i. The Social goal – strengthen the role of forests in alleviation of poverty, and increasing equity in resource management and utilization;
ii. The Economic goal – strengthen the role of forest resources in promoting economic development, in meeting demand for forest product, in creating income and in increasing national revenues and efficiency; and
iii. The Environmental goal – protects and conserves forest resources including wildlife and flora, and enhances the role of resources in maintaining soil and water conservation and other environmental benefits.

This policy is relevant to this project from the fact that some of the proposed storm-water drainage channels open up into mangroves areas, which are covered by the forestry policy.

The Zanzibar Tourism Policy 2012

The policy was developed to replace the Zanzibar Tourism Policy of 2003. The new policy objectives are to develop, plan, manage and promote tourism industry that emphasizes sustainability, quality and diversification, and which is culturally responsible, socially desirable, ecologically friendly, environmentally sustainable and economically viable. The policy, envisage that the image of Zanzibar abroad shall work as a promising exclusive holiday destination, basically for historical, cultural attractions and beach holidays. Strategies aiming to realization of the policy objectives include: conservation of marine environment, coral reefs, coastal zone management, and feasible management of waste disposal issues. Specifically, the National Spatial Planning Strategy should consider a systematic approach in local land use planning adjacent to the coast to avoid social and community conflicts particularly with respect to the collection, transfer and disposal sites. Urban upgrading project and drainage shall observe all existing historical features as one of attractive features for tourists; however, project development will facilitate tourists in Zanzibar urban

National water policy 2004

The Zanzibar National Water Policy was prepared in January 2004 through the Ministry of Water Construction, Energy and Lands. The objectives of Water Policy are to provide guidance to enable Zanzibar to achieve its aim of providing access to clean and safe water for all people and other water users to fulfill the needs of expanding social and economic activities while considering the nature conservation. The policy is recognizing that the ground water is the primary source of water in Unguja and Pemba. A fresh ground water lens floats above the deeper saline water and sustainable development of ground water resources must maintain the balance of fresh water flows to prevent this saline water rising up coming into the fresh water lens or flowing inland from the sea. There are no any large and adequate reserves, which can be mined at unlimited discharges indefinitely. Supplies have to depend on recharge from annual rains. The survival of this precious ground reserve will therefore depend upon the balancing of rate of extraction for human use and the rainfall recharge.

The National Water Policy addressed seven water issues, a policy statement with strategies have developed for each for future water resources management. The issues are as follows:

i. Ownership of water resources
ii. Satisfaction of basic need for water
iii. Ownership and management of water supply schemes
iv. Water funds
v. Environmental protection
vi. Water as an economic and social good
vii. Sewage and solid waste

HIV/AIDS Policy, 2006

Provides for HIV/AIDS response framework and includes HIV/AIDS educational campaign programmes. Other responses presented in the policy are integration of HIV/AIDS issues in school curriculum and prevention measures such as condom use.

Agricultural Sector Policy (2000)

The overall goal of Zanzibar Agricultural Sector Policy is to promote sustainable development of the agricultural sector for economic, social and environmental benefits for Zanzibar people. The policy in the Zanzibar context includes crops, fisheries and livestock production. More important the policy recognizes that environmental degradation is a major concern in agricultural development. The policy also recognizes the need for integrated coastal zone management. Furthermore, the policy recognizes that environmental protection is a prerequisite management tool for maximum achievement of sustainable.

Zanzibar Disaster Management Policy (2011)

The focus of this policy is on disaster risk reduction and livelihoods support. The aim is to develop the required national capacity to coordinate and collaborate on comprehensive disaster management programs among the principal players at all inter-sectoral levels. Issues discussed in the policy include erratic rainfall patterns, food shortages, marine accidents, fire outbreaks, terrestrial and marine degradation, depletion of mangrove forests, and waste management. The policy has a high relevancy to the Integrated Drainage and Resilience Urban Growth Project in Zanzibar.

Zanzibar Local Government Policy (2012)

The policy aims to establish accountable local government entities that has capacity to provide better and efficient basic services to the people and safeguard their livelihoods. The policy calls for Local Government Authorities (LGA) responsibility in establishing communications and decision-making linkages between the local communities and the project investors in a transparent and accountable manner. The policy place great emphasizes on LGAs in ensuring that land and ownership rights are upheld and that communities are compensated in accordance with laws of Zanzibar and that the right to information is disseminated to the local communities and all those who will be directly and indirectly affected by the proposed project.

Zanzibar Energy Policy (2009)

The policy promotes the need for norms, codes of practice, guidelines and standards to facilitate the creation of an enabling environment for safe use of energy efficient appliances and in particular appliances based on environmentally friendly technologies. The policy intends also to develop alternative energy; as such use of landfill gas for electricity generation may assist in realizing the objectives of this policy.

Zanzibar Information Policy (2005)

The overall objective of the policy is to inform the Zanzibar society on socio-economic changes and development trends with particular attention on the fight against poverty and in the provision of basic social services .In this case the policy has strategic significance on environmental management as it promotes effective communication on various environmental related policies and programmes as well as concerns of communities related to environment degradation, depletion of biodiversity, climate change and sustainable use and protection of natural resources.

Gender Policy (2012)

The general objective of Zanzibar Gender Policy is to provide a national framework for planning, implementation, coordination, monitoring and evaluation in a wide range of issues that impedes equality and equitable development of women and men in Zanzibar. The policy recognizes the major role women play in matters related with environment and natural resources for sustainable socio-economic development. Also, the policy is highly required as in reference to TDHS-MIS 2015–16, reported that almost 1 in 10 women (9 per cent) surveyed in Zanzibar aged 15–49 had experienced sexual violence (representing an increase from 6.5% in the previous National Survey in 2010). Sexual violence is most frequently committed by persons with whom women have a close personal relationship. The policy addressed the needs for appropriate measures to reduce social issues.

Occupational Safety and Health Policy, 2012

The main objective of the OSH Policy is to promote the right of workers to a safe and healthy working environment, in order to contribute to the improvement of workers well-being and national productivity. The policy provides for general direction for the occupational health and safety of stakeholders to adopt a management system that is effective in reducing the incidences of work-related injury and disease. The Health, Safety and Security Plans of Contractors and Operators for the implementation of this project will ensure safety of workers during the construction and operational phases.

Zanzibar Transport Policy, 2008

The National Transport Policy published in 2008 articulates a course of action for the development of aviation and land and maritime transport sector. The policy recognizes the need for Zanzibar to increase the number and distribution of waste transportation facilities with an efficient, safe and secured infrastructure. Linkage to the Project includes safety and security of waste transportation on main roads and access road leading to the disposal sites.

Zanzibar Land Tenure Related Policies

Currently, Zanzibar does not have a Land Policy as such but a draft land policy framework is in the pipeline. However, the existing policies on matters related to land recognize that critical environmental and social issues with respect to land aspects have come as a result of rapid increase of population growth, uncontrolled encroachment of urban settlements into fertile lands for agriculture, horizontal urban expansion without considering integration of environmental and social regulations and guidelines. The consequences of land mismanagement may result into land use conflicts, unsustainable land-use practices; and degradation of natural resources all of which are reiterated in other related policies. The potential land expropriation for this project shall adhere to land policy requirements.

5.3 Legal Framework

The Zanzibar Constitution (1984)

The constitution has no specific provision for environmental protection. However, Sections 13(1) states that "every person has the right to the preservation of his life" and 13(2) "every person has the right to live and to the protection of his life by the society". This can be referred to rights to a safe environment.
Moreover, Section 17 states "No person shall be deprived of his property interest or right in that property except and upon compliance with the following conditions:

a) That the acquisition and occupancy of the property is of utmost importance for defense and security of the people health requirement, town planning and any other development in the public interest;
b) That the need to acquire the property in question is absolutely important to the extent that it legalizes its acquisition even if it be to the detriment of its owner;
c) That there exists a law in respect of which acquisition or occupation of the property provides for fair and adequate compensation.

The project implementation is aiming to save peoples life from flooding, and improving environment but also this constitution is to be observed during making compensation of the community properties.

Zanzibar Environmental Management Act No. 3 of 2015

This is the principal law for managing the environment in Zanzibar. The Zanzibar Environmental Management Act (ZEMA) No. 3 of 2015 repeals the Environmental Management for Sustainable Development Act (EMCDA of 1996). The Act was established to address the environmental management priorities set in the Zanzibar Environmental Policy of 2013. The Act provides for management tools associated with permitting requirements include Pollution Prevention and Waste Management, Biodiversity Conservation, Environmental Education and Research, Integrated Coastal Zone Management, Climate Change Adaptation, Non-Renewable Natural Resources, and other matters of environmental emergency. The ZEMA is the principal Act that establishes and bestows enforcement powers and coordinating roles and responsibilities for institutions and bodies at all levels. Part IX deals with Environmental and Social Impact Assessment.

The institutional framework for environmental management in Zanzibar is provided for by the Zanzibar Environmental Management Act (2015) in particular Part III: Administration and Institutional Arrangement. As per environmental administration and management, the Act provides for;

- Establishment of Environmental Advisory Committee (EAC) with members provided for in Part III: Section 8 (a) to (i). The main function of the EAC is to advise the Minister responsible for environment on matters pertaining to implementing the Act, implementation of the environmental policy, strategy and management plan.
- Establishes the office and position of Director of Environment with mandates to develop national strategies for managing the environment among other as stipulated in Section 13.
- Establishes Zanzibar Environment Management Authority (ZEMA) as independent corporate Government Agency (Section 14) with core mandate to undertake and coordinate enforcement of the Act and others as provided for in Section 22.

The Department of Environment (DoE) based on ESIA report approval by ZEMA issues recommendations to the government for approval of the project. Director of Environment issues approval (EIA Certificates) for the project to proceed.

Occupational Safety and Health Act No.8 of 2005

The Occupational Safety and Health Act (OSHA), 2005 requires that project proponent to: Register all work place with the Occupational Safety and Health Directorate under the Labour Commission (Section 20-22); Ensure that buildings at workplace are of sound construction; supply of drinking water; sanitary convenience; washing facilities; accommodation for clothing; first aid box; seats for employees who work while standing; risk assessment by employer; removal of dusts or fumes; provision of protective equipment and protection of eyes in certain processes.

The OSHA has provisions for various Safety, Health and Welfare aspects workers including medical examination; safety of machinery; safety devices; training, supervision and research and fire preparedness. The Act has special provisions for handling materials and processes hazardous at workplace including: safety of electrical installations and apparatus; toxic materials to be used as a last resort; protection of workers from exposure to asphyxia or irritants and workers not to be exposed to ionizing, radiations, etc.

The Land Tribunal Act, No. 7, 1994; Amendment Act, No 1 of 2008

The Act establishes the Land Tribunal to deal with all matters of land disputes in Zanzibar. The Act demands that the Tribunal preside over any land that is acquired and there is a dispute or disagreement relating to any of the eighteen matters listed in the Act. The Land Tribunal (Amendment) Act, No. 1 of 2008, allows for appeal on the decision of the Land Tribunal in that any party who is aggrieved by the decision of the tribunal has the right to appeal to the High Court.

The Land Tenure Act, No. 12 of 1992 (Land Allocations Regulations 2008)

The Act sets the means through which land is allocated and way in which land is certified. According to the Land Allocations Regulations 2008 (40.b), a Right of

Occupancy holder is, in the event of his land being declared as abandoned, eligible for fair compensation for the developments made on the land prior to the date of termination of rights to occupancy and their distribution of the said portion. This provision will apply if there is any land falling under this category.

Zanzibar Standards Act of 2011

The Act establishes the Zanzibar Bureau Standards (ZBS) and vests to it functions and powers to establish, publish, promote, amend or modify a standard for the quality, quantities and units of measures to be used. Among the compulsory standards to be established is to protect the environment (section 16 (c). ZBS is required to recognize any accredited or any approved institution in Zanzibar or outside which is engaged in standardization; to cooperate with other government agencies, representatives of any industry or statutory corporation or person as well as regional and international organization in the application of standards.

Regional Administration Act No. 8 of 2014

The Act specifies powers and function of the Regional, District, and Shehia Government administrators. Section 22 (1) (d) of the Act states that Regional Development Committees established under this Act have been given a responsibility to mobilize people to participate, contribute, and if possible, assist in the use and management of natural resources, protection of environment for sustainable development and in all activities of national development. The project proponent shall ensure that during project development and operation all levels of administration are appropriately involved.

Local Government Authority Act No. 7 of 2014

The Act specifies on establishment of the Local Government Authority structures with their jurisdictional areas, powers and functions. In the context of environment, the Act has emphasized on the local powers to prevent and control public nuisance and ensure sustainable management of land and natural resources. Section 26 (1) of the Act specifies general functions of the council which include maintenance of environmental sanitation, promotion of tourism and other investment opportunities available in their areas, keeping record of land and marine transport vehicles and vessels within their jurisdictional areas, control environmental pollution and prevent private nuisance. The project proponent shall comply with all the requirements within the jurisdiction of the local government council in terms of land acquisition, necessary public works and permits, environmental clearance, prevention of public and private nuisance, and other activities that require certification and permits, etc.

Zanzibar Water Act No. 4 of 2006

The Act provides for an establishment of the water authority for Zanzibar which has the jurisdiction of all matters pertaining to management of water. The Act includes provisions on regulating, controlling, managing, and protecting all catchment areas; promoting the conservation and proper use of water resources; managing production and distribution of water on sustainable basis; specifying standards of water quality, effluent and water equipment; Advising the Government of Zanzibar in formulation of policies related to the development and conservation of water. The Act could be the basis of regulating water quality monitoring and protection of freshwater resources. This is important in avoiding any conflict between the users and maintains the health, safety and environment issues related to water management.

Other administrative units

Other administrative units that take part in the Environmental and Social Impact Assessment include,

- Government Departments

- Local Government Authorities (in this project are Zanzibar Urban Municipal Council and West "B" Municipal)
- Regional Administration- the region in which the project is implemented
- District Administration – the specific district in which the project will be executed
- Shehia – the communities where the project will be undertaken. The Shehia leadership provided key in put in the ESIA Report.

5.4 World Bank Safeguard Standards and Guidelines

Triggered Safeguard Policies

The World Bank Safeguard Policies are approved by the Board for addressing environmental and social issues within the Bank's supported development projects. According to the World Bank Safeguard policies the Integrated Drainage and Resilient Urban Upgrading projects in Zanzibar is rated Environmental Category B, and triggers the following safeguard policies,

- Environmental Assessment (OP/BP 4.01);
- Physical Cultural Resources (OP/BP 4.11);
- Involuntary Resettlement (OP/BP 4.12), and
- Natural Habitats (OP/BP 4.04).

Environmental Assessment (OP/BP 4.01)

World Bank Operational Procedure OP 4.01: Environmental Assessment stipulates the requirement that projects funded by the World Bank is subject to an environmental assessment in an effort to ensure they are environmentally sound and sustainable. To ensure there is no contravention with national legislation, in-country policies and legislation are considered before embarking on a project. According to the World Bank system, projects are categorized to determine the level of environmental study that is required. The Integrated Drainage and Resilience Urban Upgrading in Zanzibar Project has been classified as a Category B project which indicates it is less likely to have significant adverse impacts that area sensitive, diverse or unprecedented.

Physical Cultural Resources (OP/BP 4.11)

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.

In terms of the Drainage and Resilient Urban Upgrading of Zanzibar Town the implementation of the drainage interventions may infringe on historical artifacts of the culturally rich town. Hence, OP 4.11 is triggered.

Involuntary Resettlement (OP/BP 4.12)

The policy on Involuntary Resettlement is applicable for all projects that require displacement and/or resettlement of people and their individually owned and communally held assets. The overall objective of this policy is to avoid involuntary resettlement where feasible and to minimize resettlement by exploring all viable

alternative project designs. The policy further requires that displaced (project affected) persons should be meaningfully consulted and be given the opportunity to participate in planning and implementation of the resettlement programme. Displaced persons should also be assisted in their efforts to improve their standards of living or at least to restore them to pre-displacement levels. The proposed storm water drainage interventions and urban upgrading plans will cause minimal impact on people. Some affected people will be physically displaced and some temporarily losing assets. Hence this policy is triggered. A Resettlement Action Plan (RAP) has been prepared.

Natural Habitats (OP/BP 4.04)

The World Bank promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. During project design and implementation there will be solid waste produced from project area which will be disposed of at Kibele landfill located in the buffer zone of a protected forest area. Hence, Natural Habitats, OP/BP 4.04 is triggered.

5.5 International Environmental and Social Safeguard Policy

This ESIA subscribes to the International Environmental and Social Safeguard Policy especially the World Bank Environmental and Social Safeguard Policy. These policies are in line with the Equator Principle and International Finance Corporation (IFC) Policy. The related Policies as elaborated in the following sections.

National Plan of Action to End Violence Against Women and Children 2017-2022

According to National Plan of Action to End Violence Against Women and Children 2017-2022, 14% of women in Zanzibar experience physical violence and almost one in ten women experience sexual violence. One in ten males and one in twenty females report experiencing sexual violence in childhood. More than two out of three children experience physical violence before the age of eighteen years. Thus, this plan of action sets out a national framework for everyone committed to preventing and responding to violence against women and children – from Government to communities, from civil society to the private sector. This plan intensifies contractor and other project implementer to focus on the prevention and response programmes and services required to comprehensively address violence against women and children and it can be comprehensively addressed through effective prevention and response programmes and services.

IFC and World Bank Group EHS Safeguard policy

The World Bank Group requires the clients to apply the relevant levels or measures of the EHS Safeguard. This is when national regulations differ from the levels and measures presented in the EHS safeguards which generally give control on Environment, Occupational Health and Safety and Community Health and Safety, The Integrated Drainage and Resilient Urban Upgrading projects is expected to achieve this guideline as during project implementation will be some impacts on environment and social health and safety risks.

The EHS Procedures provides the performance levels and measures that are acceptable to the World Bank Group, and that are generally considered to be achievable in new facilities at reasonable costs by existing

technology. It gives specific examples of Good International Industry Practice (GIIP) which are referred to in the World Bank's Environmental and Social Framework and in IFC's Performance Standards.

United Nations Environment Programme UNEP (1993 -1994)

UNEP, in partnership with the Government of Tanzania, established a National Cleaner Production Centre/Programme in Tanzania to build local capacity to implement cleaner production and to provide core cleaner production services at the national level. This preceded after adoption of national environmental policy for Zanzibar of 1992 which identifies major environmental challenges in the country and policy actions to address them. UNEP sets the global environmental agenda, to promote the coherent implementation of the environmental dimension of sustainable development within the United Nations system, and to serve as an authoritative advocate for the global environment; from the global, regional, and to country level. In relation to this drainage integrated and Zanzibar urban upgrading project, UNEP emphasize the development of greener infrastructures, retrofitting or reconfiguring existing infrastructure systems and exploiting the potential of smart technologies which can greatly contribute to the reduction of environmental impacts and disaster risks as well as the construction of resilience and the increase of efficiency in the use of natural resources prevention in inventory emissions of greenhouse gases like CO_2, CH_4 and NO_2.

6 ANALYSIS OF PROJECT ALTERNATIVES

6.1 Consideration of Alternatives

This section analyses the project alternatives in terms of site, design, technology selection, construction techniques and phasing, and operating and maintenance procedures as well as waste management options. It also compares the alternative in term of potential environmental and social impacts, capital and operating cost, suitability under local conditions; and institutional, training and monitoring requirement.

6.2 Relocation Option

Relocation option to a different site is not an option available for the project implementation as drainage integration and urban upgrading project in Zanzibar town. For example, system C32-12 which already exists but it is faced with flooding and storm water drains by raw sewage and solid wastes which affect the resident livelihoods negatively.

6.3 Zero or No Project Alternative

The No Project option in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. This option will however, involve several losses both to people within Meya-Magomeni, Sebleni Kwa Wazee, and Tomondo-Mombasa. These areas will continue to have frequent flooding and pollution of storm water drains by raw sewage and solid waste. The No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

- The communities shall continue to be exposed to flood hazards and livelihood will be harder in future than today. This situation shall claim lives of people.
- Discouragement for investors and funders
- Development of infrastructural facilities (drainage system, solid waste collection units, roads and associated infrastructure) will not be undertaken.

From the analysis above, it becomes apparent that the No Project alternative is no alternative to the local people and the RGoZ. The detailed environmental and social analysis of the two project scenarios i.e. 'with project' and 'no project' is presented below in table 6.1 as a part of this ESIA study.

Table 6. 1; Overview of positive and negative impacts in two scenarios: (i) with project and (ii) "No-project

With Project Impacts		"No-Project" Impacts	
Positive	**Negative**	**Positive**	**Negative**

- Project implementation will improve community livelihood - Re-designed storm water drainage infrastructure will result into improved management of storm water, thereby preventing Water logging and floods - The project will result into direct and indirect creation of employment during execution of project. - The proposed drainage network is consisting of covers which avoid intervention of solid waste/garbage into the drain and prevent loss of children life in dropping into drainage - Road development will result in reducing road accidents and improve transportation and accessibility to the community	- Minor changes in soil quality pattern - Temporary Loss of houses and properties - Short term increase in Environmental pollution from dust, noise, vibration - Short term risk to community health and safety, which can be mitigated with safety features - Loss of vegetation and biodiversity - Accident during project implementation at site - Increase of contagious diseases (STD/AIDS)	- No loss of access routes - No temporary loss of houses and properties - No change of natural habitats	- Ground water contamination due to water stagnation - Absence of a proper drainage system causes water logging, thereby providing a breeding site for disease causing vectors which in turn impacts public health - Increase of flooding events which results into loss of life and properties - Currently, Zanzibar have inadequate drainage system, and Sewage treatment units so storm water mixes with untreated domestic waste water and flows into surface water bodies, thereby deteriorating the water quality - Un-aesthetic and unhygienic conditions will prevail in Zanzibar - Inadequate SW collection points and routes deteriorate the beauty of the city

From the above table 6.1, it can be concluded that the proposed project will have temporary disruptions and impacts; however, the larger environmental value of the project greatly outweighs the temporary negative social and environmental impacts that will be generated due to project activity. The temporary impacts can be managed through appropriate mitigation measures. The proposed project is expected to benefit the Zanzibar Town, as it will help in achieving better social and environmental conditions in the town.

6.4 Analysis of Alternative Construction Materials and Technology

The proposed project will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security, environmental and aesthetic requirements. The drainage, solid waste collection units, road and other construction works will be made using locally sourced materials that meet the Tanzania Standards requirements.

The alternative technologies available include the bitumen, conventional concrete roads, paved and box culverts for drainage system, or even temporary structures. These may not be desirable from a cost and durability perspective. The technology to be adopted will be the most economical and one sensitive to the environment. The use of Energy Dissipation Tanks for dissipation of the kinetic energy generated at the outlet of a culvert is essential for bringing the flow into the downstream drainage to the normal condition or to the sea in as short of a distance as possible. This is necessary, not only to protect the riverbed, banks or coasts from erosion, but also to ensure that the channel itself is not undetermined by the high velocity turbulent flow.

6.4.1 Drainage systems alternatives

- **The surface (Secondary) drainage channels**

Drainage channels are designed for collecting storm water from the portion of sub-catchment areas. The foreseen solution is the implementation of surface concrete or stone pitched trapezoidal drainage channel. Little risk of danger is associated to this type of channel, despite the fact that this configuration is open and accessible from people, being peak flows and velocity relatively small. Advantage of this solution, is the simplicity of implementation and maintenance, Velocity control is required for ensuring a minimum value for frequent events in order to guarantee a self-cleaning effect and reducing the need for cleaning. It should in any case be considered that the depths are associated with these types of channels, control of sediment and waste disposal shall be frequent. The construction of the channels shall be in precast concrete for rectangular channels till a maximum width and small depth of 1 m and cast in place concrete for bigger sections and for trapezoidal channels (stone pitching should be considered in some case). Excavation should be made paying attention to possible interferences with unknown underground utilities.

6.4.2 Road construction alternatives

The streets network implementation in the urban upgrading areas has been guided by a comprehensive approach of reshaping of the physical structure of the areas. The typical sections of each street category have been chosen according to the foreseen needs of the community with the aim of minimizing the impact on the built-up area. Some regulation has been waived for reaching this goal always taking into account the technical constrains in terms of transit capacity and safety. Category I street are intended as main connector within the urban areas. Category II streets are intended as local secondary streets and have been placed mainly on existing alignments. Category III are intended to be local access streets creating separation between blocks. Category IV are intended to be footpaths were no vehicles shall be allowed.

i. Local street roads (Category I)

Local streets (which are feeder roads) are the main access streets for the intervention areas and link with surrounding areas.

The pavement foreseen for this street category is a pervious standard bitumen pavement which includes: 50mm bituminous wearing course, 50mm bituminous binder course, 100mm crushed aggregate base course, 150mm granular sub base course, and lowest layer of compacted subgrade layer CBR>25%

The traffic load considered while drafting the pavement proposal is a medium intensity and vehicle weight. This because of the absence in Zanzibar city of any regulation for high load vehicles transit on urban roads and streets. The total thickness of the proposed pavement is of 325 mm.

ii. Neighbourhood street roads (Category IIA)

The pavement for this street type is designed for medium to low vehicle axle load. Speed bumps might be placed at regular intervals (every 30-50m) to lower speed (suggested speed max 20km/h).

The pavement foreseen for this street category is a pervious standard bitumen pavement which includes: 32mm bituminous wearing course, 50mm bituminous binder course, 100mm crushed aggregate base course, 100mm granular sub base course, and lowest layer of compacted subgrade layer CBR>25%. The total thickness of the proposed pavement is of 282 mm.

iii. Neighbourhood street roads (Category IIB) Stabilized soil

The category IIB is foreseen for a low volume of traffic and therefore a less environmental impact solution and less expensive technology has been proposed. Instead of using the standard bitumen layer, a stabilized soil pavement made by sandy clay aggregates mixed with cement has been chosen. The feasibility of this technology has been verified by assessing the nature of the soil available within the city. The pavement foreseen for this street category includes:150mm gravel wearing course with cement stabilization. 75-100mm natural gravel base course and lowest layer of natural ground level CBR>25%

iv. Pedestrian and cycle streets (Category III) Stabilized soil

The category III is foreseen for a very low volume of traffic and very low axle load. Stabilized soil technology is therefore proposed. The pavement foreseen for this street category includes: 150 mm wearing surface; and 75-100 mm compacted base

A stabilized pavement consists of supply and application of a cement and additives (dependent on the nature of the soil to be further assessed) binder material over a previously prepared street base. The seal is immediately covered with sand that is lightly rolled into the seal to form a weatherproof matrix. The application contains penetration grade component dispersed in water. Following application at ambient temperature the water in the component separates from the it and evaporates leaving the residual cement in place to adhere to the street base and sand.

This procedure may be used either to provide an additional layer of protection on a chip seal already laid, or as a single sealing to a block pavement. In some circumstances the technique can be used for maintenance reseals

6.4.3 Solid waste management alternatives

An integrated solid waste management system is recommendable as there will be solid waste generated from proposed project. First, the proponent will give priority to reduction at source of the materials. This option will demand a solid waste management awareness program in the management and the staff. Recycling and reuse options of the waste will be the second alternative in priority. This will call for a source separation program to be put in place. The third priority in the hierarchy of options is proper collection of the waste that is not recyclable to the Waste collection units. Finally, the proponent will need to establish consultation and agreement with Zanzibar Municipal Councils and Zanzibar Environmental Management Authority to ensure regular waste removal and proper disposal in an environmentally-friendly manner. This is the most practical and feasible option for solid waste management considering the delineated options.

6.5 The Proposed Project Alternative

The project alternative as proposed in this report was considered the most appropriate. Implementing the project will ensure that the project aim and development objectives are realized as summarised below. The main aim of Zanzibar Urban Upgrading and drainage integration in selected three units (Meya-Magomeni, Sebleni - Kwa Wazee, and Tomondo-Mombasa) in Zanzibar Urban is to enhance preparedness for flood disasters and improve livelihood to the community. In addition, Zanzibar Urban Upgrading and drainage integration will contribute to;

i. The goals of the Zanzibar Vision 2020 which aiming in;

- Eradication of absolute poverty and the attainment of sustainable human development.
- Conservation and protection of the environment, rational and efficient utilization of natural resources.
- Ensuring sustainable economic development accompanied by proper environmental management so that Zanzibar's natural resources and natural heritage are passed on to future generations

ii. Zanzibar Disaster Management Policy (2011) which focuses on disaster risk reduction and livelihoods support. The major aims are;

- To develop the required national capacity to coordinate and collaborate on comprehensive disaster management programs among the principal players at all inter-sectoral levels. Issues discussed in the policy include unpredictable rainfall patterns, food shortages, marine accidents, fire outbreaks, terrestrial and marine degradation, depletion of mangrove forests, and waste management.
- The policy has a high relevancy to the Integrated Drainage and Resilience Urban Growth Project in Zanzibar

7 IDENTIFICATION, ASSESSMENT AND ANALYSIS OF POTENTIAL IMPACTS AND RISKS

This chapter assesses key potential environmental impacts that are expected to occur during the project implementation. An Upgrading of Zanzibar urban area and drainage integrating can cause a wide range of environmental and social impacts on a number of receptors. Impact identification is a process designed to ensure that all potentially significant impacts are identified and taken into account in the ESIA process.

7.1 Impact Zones

The ESIA study has considered two critical impact zones, namely;

- The core impact zone – include the area immediately bordering the project areas. This depends on the type of subprojects and therefore differs from subproject to another. The core impact area for the construction of a drain and road is different from a market. For the road and drainage project the core impact zone can spin to 500m while the construction zone can be within 15m from the centreline of the road.
- The zone of influence – which includes the wider geographical areas of the subproject in this case Zanzibar Urban and West B districts. Given the extent of the proposed activities for this project there will be less to no negative social and environmental impacts on the zone of influence. For instance, draining the ponds if it impacts on the groundwater sources in its vicinity the impacts would be felt to the entire Zanzibar Municipality, that is decreased water supply capacity and salt water intrusion from the sea.

7.2 Impact Identification and Evaluation

The Environmental and \social Impact Assessments (ESIA) identifies these impacts for the purposes of mitigating the adverse ones or enhancing the benefits. In this ESIA simple checklists and expert's knowledge were used. These checklists are the simplest types that provide lists of potential impacts. These are designed to help practitioners to avoid overlooking some of the potential impacts

Table 7. 1: General impacts to all sub-projects' activities of "Drainage Integrated and Zanzibar Urban Upgrading"

Category	Pontential impacts		
	Positive	**Negative**	**Project Phase**
Environmental impacts	• Knowledge transfer on health and safety		Design / preparation Phase
		• Increased Air, Noise and Vibration pollutions • Loss of trees/biodiversity and Natural Habitat • Destruction of Public Utilities, infrastructure/services and access • Risk to Water pollution and soil degradation • Pollution due to waste generated • Interference with Local Hydrology	• Construction Phace

		•	
	• Environmental improvement	• Increased Air, Noise and Vibration pollutions • Pollution due to waste generated	• Operational phase
Social impacts	• Job Creation and Increased Income to Local Communities • Enhance technology, Socio-Cultural adoption • Increased Economic Growth and tourism attraction •		• Design / preparation Phase
	• Job Creation and Increased Income to Local Communities • Enhance technology, Socio-Cultural adoption • Flood and sewage discharge problems elimination • Improved community life and Social services • reduce the community risk like loss of life and falling of children • Reduced Traffic Congestion • Increased Economic Growth and tourism attraction • Increased Agricultural Productivity • Improved Transportation and reduce road accessibility	• Road Traffic Accidents • Degradation of resources and management • Increased Immigration • Resources Use Conflict • Gender based Violation impact • Land expropriation, loss of property and resettlement •	• Construction Phase
	• Job Creation and Increased Income to Local Communities • Enhance technology, Socio-Cultural adoption • Flood and sewage discharge problems elimination • Improved community life and Social services • reduce the community risk like loss of life and falling of children • Reduced Traffic Congestion • Increased Economic Growth and tourism attraction • Increased Agricultural Productivity • Improved Transportation and reduce road accessibility	• Road Traffic Accidents • Degradation of resources and management • Increased Immigration • Resources Use Conflict • Gender based Violation impact	• Operational phase
Health and safety impacts	• Knowledge transfer on health and safety	• Potential threats from spread of STDs and communicable diseases • Safety and Health Risks	• Design / preparation phase

	• Knowledge transfer on health and safety		• Construction phase
	• Reduce traffic accidents • Increase water safe availability to the local communities • Improved health and living conditions due to reduced risk of water related diseases		• Operational phase

7.2.1 Impacts Categorization

The potential impacts have been categorized in three phases: ►Mobilization phase ► Construction phase ► Operation phase impacts. The main receptors of impacts associated with the anticipated Zanzibar urban upgrading and drainage interventions include physical resources (hydrology, surface and groundwater quality, soils, air quality and noise); ecological resources (trees/mangroves and eco-system); material assets, public health and safety, aesthetics and landscape.

The interaction between the intended sub-project activities and the different environmental receptors are summarized in a simplified matrix presented in Table 7.2.

7.3 Impact rating

Considering the criteria for impact rating as explained in chapter one, a simple matrix with the following ratings was used to determine magnitude of the impacts:

+3=Very high positive impacts; +2=High positive impacts; +1=Minor positive impact; 0= No impacts; -1=Minor negative impact; -2=High negative impacts; -3=Very high negative impacts.

The team focused on significant positive and negative impacts that were rated +2, +3, -2, -3 and developed mitigation. In the next sections, significant impacts (positive and negative) associated with each phase of the project are discussed.

Table 7. 2: Potential Environmental and Social Impacts Matrix for the Proposed Zanzibar Urban Upgrading and drainage integration

S/No	Environmental parameters/Impacts	Impact Rating Criteria					Impact Significance Rating			
		Spatial Scale	Temporal Scale	Reversibility	Cumul. Effects	Residual Impact	Mobilization Phase	Construct. Phase	Demobilization Phase	Operation& Maintenance
1.	Job creation and increased income to local community	N	MT	IR			+2	+3	+1	+2
2.	Increased Economic Growth and tourism attraction	N	LT		✓	✓	0	0	0	+3
3.	Flood and sewage discharge problems reduction	L	LT		✓	✓	0	0	+1	+3
4.	Enhance technology, social cultural adoption	L	ST	IR		✓	+2	+3	+2	+2
5.	Improved Transportation and reduce road accessibility	R	MT				0	+1	+1	+3
6.	Improved community life and Social services	L	MT				0	+1	+1	+3
7.	Reduce water resources pollution	L	LT		✓	✓	0	0	+2	+3
8.	Reduce traffic congestion	L	LT		✓	✓	0	0	+2	+3
9.	Increased safe water availability to the local communities	L	LT		✓	✓	0	+1	+2	+2
10.	Increase of agricultural productivity	L	ST	R			0	0	0	+3
11.	Reduce traffic accidents	L	MT	IR	✓		0	0	0	+2
12.	Environmental improvement	L	LT	R	✓	✓	0	+1	+2	+3
13.	Land expropriation, loss of property and resettlement	L	ST	R			-3	-2	0	0
14.	Destruction of public utilities, infrastructure and access	L	ST	R			-2	-2	0	0
15.	Risk to Water and soil degradation	L	ST	R			-1	-2	-1	-1
16.	Environmental pollution (noise, vibration and air pollution)	L	MT	R		✓	-1	-3	-1	-2

S/No	Environmental parameters/Impacts	Impact Rating Criteria					Impact Significance Rating			
		Spatial Scale	Temporal Scale	Reversibility	Cumul. Effects	Residual Impact	Mobilization Phase	Construct. Phase	Demobilization Phase	Operation& Maintenance
17.	Potential threats from spread of STDs and communicable diseases)	L	LT	IR		✓	-1	-3	-1	-1
18.	Safety and health risks	L	ST	R			-1	-2	0	+1
19.	Road traffic accidents	L	MT	R	✓		-1	-2	-1	-2
20.	Increased water abstraction	R	ST	R	✓		-1	-2	0	-1
21.	Pollution due to waste generated	L	ST	R	✓	✓	-1	-2	-1	0
22.	reduce risk to the community life	R	LT	IR	✓	✓	-1	-3	-1	-1
23.	Loss of trees/biodiversity and Natural Habitat	R	LT	R	✓	✓	-1	-3	0	0
24.	Increased Immigration and flux	L	ST	R			-1	-2	0	-1
25.	Destruction of sensitive areas	L	LT	IR	✓	✓	-3	-2	-1	-1
26.	Degradation of resources and management	L	LT	IR		✓	-3	-2	0	0
27.	Interfere with local hydrology	R	LT	IR		✓	-2	-3	-2	-2
28.	Resource use conflict	L	ST	R	✓		-1	-1	0	-2
29.	Gender based impact	L	ST	R	✓		-2	-3	-1	-1

Key: **Spatial Scale**: Local (L), Regional (R), National (N)

Temporal Scale: Short Term (ST), Medium Term (MT), Long Term (LT)
Reversibility: Reversible (R), Irreversible (IR)
Significance: Highly Adverse (-3); Adverse (-2); Mild Adverse (-1); No impact (0); Mild Beneficial (+1); Beneficial (+2); highly Beneficial (+3);

7.4 Mobilization Phase Impacts

7.4.1 Positive impact

7.4.1.1 Job Creation and Increased Income to Local Communities

During this phase more than 40 people will be employed by the contractor to do mobilization works such as construction of camp sites, quarrying and material extraction, material transportation activities etc. This shall increase the income to the local employed people of Meya/Magomeni, Sebleni-Kwa Wazee and Tomondo/Mombasa who are to be employed by the contractor. Other people will sell food and gain the money for their family care.

7.4.2 Potential Environmental impacts

7.4.2.1 Environmental pollution impact (Air, Noise and Vibration pollutions)

Demolition of houses, site clearing, mobilization of construction materials will cause dust emission and gas emission which will pollute both air and residential houses at the specific locality. Other issue is noise pollution which will be from trucks movements and demolition activities. This will go hand to hand with vibration and other disturbances. Activities such as materials delivery, trench excavation and construction traffic will generate a lot of dust, noise and vibration.

Bush clearing, materials delivery, demolition of existing structures and construction traffic will generate a lot of dust especially during the during mobilization phase. Vehicular traffic emissions will bring about air pollution. Cleared vegetation burnt onsite would generate smoke, possibly impacting negatively on ambient air quality and human health. All these impacts are temporary and limited to construction area.

7.4.2.2 Loss of trees and biodiversity

Preparation for site areas for drainage and other identified sub-projects in Meya, Sebleni and Tomondo will cause the loss of the trees and other important biodiversity. At the outlet of upgrading drainage System C will involve tree/vegetation clearing which will disturb mangroves during the construction of stage in the beach area near the three bridges at Sateni.

7.4.3 Potential Social impacts

7.4.3.1 Land expropriation, loss of property and resettlement

The use of land for Zanzibar urban upgrading and drainage construction shall entail the voluntary sale or compulsory acquisition (expropriation) of homes, property, businesses, farms, trees and other productive resources. The impacts of expropriation are not only social and economic, but also psychological and in most cases complex or devastating.

The upgrading projects in Sebleni kwa Wazee, Meya-Magomeni and Tomondo-Mombasa are predicted to have impact on structures and physical assets. The study shows that the structures will be both fully or partially affected. For the identified interventions which are proposed in these areas for the upgrading of the area, entail land acquisition and resettlement. It is observed that, the proposed interventions will affect the structures available along the project area (i.e. on structures, ancillary structures, uncompleted buildings).

The table 7.3, shows the lists of infrastructural projects that entail land acquisition and resettlement:

Table 7. 3: Identified projects with Land acquisition and resettlement impacts

Proposed projects			
Sebleni-Kwa Wazee	**Meya-Magomeni**	**Tomondo-Mombasa**	**System C**
• Upgrading of Gongo Store-Kwa Wazee Road into Category I street • Upgrade and consolidate street network of Category III including a pedestrian elevated path on Sebleni detention pond • Upgrade and consolidate street network of Category III including a pedestrian elevated path on Sebleni detention pond • Upgrade Nemo-Mwembeni Road into Category III street • Upgrade and consolidate street network of Category III	• Upgrade and extension of Magomeni kwa Najim Road into Category I street • Upgrade of Sogea Branch road up to Denja into Category IIa street • Upgrade Wandarasi road into Category IIb street • Upgrade Moss Street into Category IIb and III street • Secondary drainage intervention (Drain Eb) from Magomeni Wandarasi to Vijibwa Pond	• Upgrade Francis Maria Road into a Category IIa street from Mombasa to Maduka Saba including construction of a new bridge • Upgrade Mpigabodi Road into Categori IIa street • Upgrade and extend Changu Road between Kwerekwe Road and Royal street into Category I street • Upgrade Royal Street-Ziwa Maboga Road into Category IIa street • Secondary drainages	• System C outlet • Channel Cc Addendum Part A (System C Additional Intervention)

The proposed urban upgrading project will cause much resettlement along proposed roads and drainage Systems like; system Eb at Meya, System C and most of identified roads in all three units. Site clearing and top soil removal for preparing of Public open spaces upgrading will lead to the loss of cultivating land. The development of open spaces leads to the loss of land right, plots and properties, for example at Sebleni where there are number of individual plots.

Figure 7. 1: Houses along the proposed system Eb (Left) and farming land at Mpendae drainage channel (Right)

- **Number of the structures to be affected in each unit area**

Sebleni Kwa Wazee: - It is observed that there will be a number of structured to be affected during project implementation in Sebleni Kwa Wazee. There are 15 partially affected properties (land, structures) and 23 fully affected properties (land, structures). There is no any Public facility/Communal Property which will be affected by the project.

Meya- Magomeni: - The upgrading projects are said to have impacts on structures and physical assets. Structures affected, both fully or partially affected. Among the interventions proposed in Meya-Magomeni for the upgrading of the area, entail land acquisition and resettlement. The proposed interventions will impact a total of 70 structures (i.e. on structures, ancillary structures, uncompleted buildings). Among these structures, there are 16 partially affected properties (land, structures) and 54 fully affected properties (land, structures).

Tomondo- Mombasa: -The upgrading projects having an impact on structures and physical assets are mapped. Structures affected are both fully or partially affected. The proposed interventions will impact a total of 111 structures (i.e. on structures, ancillary structures, uncompleted buildings). Among these, there are 56 partially affected properties (land, structures) and 55 fully affected properties (land, structures).

System C: -The construction of the drain will have impacts on structures. Upon completion of the design review a number of affected assets will be known and compensation will be arranged. Currently RAP has been prepared and assets close to the existing System C drain are included for compensation. New PAPs are expected and will be provided with the options as described in the Resettlement Policy Framework (RPF)

The project has prepared Ressetlement Action Plan (RAP) to mitigate impacts likely to occur due to resettlement. PAPs will be given options including compensation for their land, properties and crops. The RAP has been reviewed and cleared by the Bank.

7.4.3.1.1 Induced developments and resettlements impact

Indirect negative impacts relate to improvements in infrastructure which associated with social and economic services are induced settlements and increased illegal developments due to new or improved access. Development-induced displacement is a social problem affecting multiple levels of human organization, from communities to well-developed urban areas. In the project site areas, the individual land lost, residential structures, unfinished structures, permanent crops/trees and seasonal crops. PAPs loosing residential houses or business premises due to development project implementation.

7.4.3.2 Road Traffic Accidents

Project activities during mobilization phase is predicted to increase the traffic volume and movements. As most of internal and feeder roads are not wide enough for the two cars to cross. It is likely to increase accidents, especially along materials stock/ source routes to borrow pits and specifically at road crossings, especially near schools. Among the PAPs within each affected Shehia, there are persons with disability, and/or person over the age of 60. Due to this, the elderly person, or two members of the household with a disability, the household was labelled as “very vulnerable.” It was observed that, in Meya, 11% of total households are very vulnerable, 12% in Magomeni and 5% in Kwa Wazee while in Sebleni, one-quarter of the surveyed households are deemed very vulnerable as well as 19% was considered very vulnerable In Tomondo. Hence this group of people is in high risk during project implementation. The impacts due to pressure on traffic and road safety are anticipated to be direct, moderate and short term and irreversible.

7.5 Construction Phase Impacts

7.5.1 Positive impact

7.5.1.1 Job Creation and Increased Income to Local Communities

Zanzibar Urban upgrading and drainage integrations including; (drainage, feeder roads, lightings, water supply and solid waste collection point constructions) is among the strategies for poverty alleviation in Zanzibar. The project will open more opportunities for self-employment income generating activities.

Most of the casual labourers and some skilled workforce will be absorbed from within the Zanzibar Town. In addition, the women from Meya-Magomeni, Sebleni- Kwa Wazee and Tomondo-Mombasa will be selling food and other merchandise to the construction workforce. Other local workmanship will take place for the activities that do not require a high specialization, and in any case, there will be diffusion of knowhow from the more qualified personnel towards the local personnel. More than 100 people at every unit shall be engaged to both drainage and urban upgrading activities.

7.5.1.2 Enhance technology, Socio-Cultural adoption

The implementation of the project will bring many people from different cultural backgrounds. Such interactions may bring about social changes in the communities along the project areas. Interaction with technocrats will stimulate adoption of the new technologies to the all groups of people surrounding the project. Also, local people will acquire skills from the drainage construction, road workers during constructions and after implementation they will get from visitors. The skills might be sources of development in project area.

7.5.2 Potential Environmental impacts

7.5.2.1 Environmental pollution impact (Air, Noise and Vibration pollutions)

→Air pollution

- Dust pollution

Dust will arise from demolition materials, drainage and road construction work due to excavation work, movement of vehicles, stock piling of materials, operation of crusher and asphalt plants, and general earth works at the site. Dust and fumes will have major direct but short-term impacts during the project construction phase.

- Gaseous pollution

Reduced air quality and climate change may be due to fuel powered equipment including; vehicles engines and construction equipment and dust from the field area. On the other hand, odours from putrefaction of organic matter from the demolished toilets and disturbance of stagnated wastewater in water ponds

like in Ziwa Maboga, Tomondo and Sebleni during drainage interventions will also reduce air quality. Exhaust fumes will mainly come from construction plant, machinery and vehicles in operation. Fumes will also come from the processing of asphalt; all these will affect human and socio-economic environments.

→Noise and vibration pollution

Noise and vibration will be produced by construction vehicles, structure demolition, plant and machinery during delivery of materials, processing of materials, and actual construction work which affect, commercial areas/shops, worshiping areas (like at Masjid located along proposed system Eb at Meya and at Tomondo areas), Francis Maria road constructions will affect the school, the same will happen to Jang'ombe school during rehabilitation of Jang'ombe road corridor, as well as Makadara school will be disturbed during construction drainage Cc. On the other hand; Vibration may come from compaction and plants movements. If this exceeds the standards it can lead into cracking of houses near the working areas.

7.5.2.2 Degradation of resources and management

Water resources in ZMC constitute fresh surface water in natural water bodies, man-made water retention structures, Water supply systems, underground aquifers and the salt oceanic water. Draining of storm water from existing ponds can lead into ground water recharge disturbances and intrusion of salt water from the sea. Due to this; "Integrated Drainage and Resilience Urban Upgrading in Zanzibar "is likely to cause the following associated impacts;

- Obstruction of natural drainage systems causing effects on the integrity of watercourses, drainage, and sedimentation regime;
- Paving of surfaces of some types of infrastructure such parking areas/stand leads to an increase of rain water in the catchment and exacerbating of storm water management of an area;
- Construction activities requirement for water inputs e.g. for mixing, cleaning, dust dousing and water for cleaning and ablution purposes for construction crew have potential to deplete water resources if obtained from a source under water stress.
- Groundwater pollution during excavation and trenching of drainage water system
- cutting of the trees and other changing of natural resources.

7.5.2.3 Water resources pollution

Water pollution may be due to excavated materials which may reduce Water Quality as these materials are considered contaminated from heavy metals. Other cause may be due to drainage systems maintenance work.

Inadequacies in the waste management practices during construction and operation of infrastructure causing discharge of oil and lubricants from vehicle repairs and filling at car parking areas, discharges of eroded soils, seepages of leachate from the dumpsite, untreated/partially treated effluents from toilets/septic sludge treatment facilities, littering during waste collection, transportation and disposal, soils and wastes clogging drainage systems may lead to planned or accidental discharging of various types and

quantities of solid and liquid wastes, spillage / leakages of materials directly into natural habitats and inhabited areas.

Haphazardly disposed wastes may altering the physical, chemical and biological characteristics of the existing condition: i.e. changing the pH of the receiving media, increase the organic matter content (BOD, COD) and eutrophication of surface water bodies/ponds and underground water sources and contaminate and reduce quality of land areas or soils. The effects will tend to be severe if discharged wastes are hazardous and/or will contaminate water sources used for domestic purposes or arable land. Discharges in a water habitat tend to reach further due to dispersion, but severity of contamination is reduced by dilution. The effects on land will tend to be concentrated and localized, not dispersed or diluted (unless by rain).

7.5.2.4 Soil degradation and depletion

In this project, construction works will implicate some degree of land disturbance or export of soils and thus expose the soils to erosion by the elements (wind, rain) and lead to land degradation at construction sites and offsite quarry sites. Main manifestation of degradation of land and soils – is the formation of gullies and reduction of soil quality in terms of nutrients, water retention and physical properties below acceptable levels.

Construction of new drainage systems and new bridges facilities and improvement of urban roads may require more works and for longer periods. Secondary impacts at points of extraction of the construction materials may include depletion of local construction materials e.g. stones/aggregates, sand, gravel, cobblestones, and fill materials which can result into local land degradation.

Quarrying involves clearing the vegetation at the sites, excavation and transportation of the material. Thus, borrowing and quarrying activities will cause habitat change, land degradation (due to removal of fertile top soil), landscape impairment (visual intrusion) and soil erosion-which lead to siltation of waterways. Quarrying, excavation and the disposal of spoil material can destroy the economic and aesthetic value of public and/or private property including land. Some species may be affected during construction, but not to the level of extinction.

7.5.2.5 Pollution due to waste generated

It is obvious that construction activities are associated with production of wastes. These wastes can either be solid waste or liquid waste. The waste streams are Construction activities and Domestic activities of the workers at the camp and site. The solid waste includes, temporal disposal of existing road pavement layer, excavated materials from drainage and ponds (i.e. Sebleni). demolition wastes from culverts rehabilitations, Spoil, rubbles, Tree logs, metals, glasses, papers etc.; while the liquid waste include Sewage, oils etc. The quantities are provided in chapter (2) two of this report. These wastes if not well handled can change the aesthetic nature of the project area and can even lead to water and soil pollution in case of improper disposal of oils. Construction of the open channel can lead to sand intrusion to the underground channel especial when it rains. This problem was observed to the drainage nearby Kwa Mbarawa play ground

Figure 7. 2: Collection of sand for construction from underground channel near Kwa Mbarawa playing grounds

The improvement of solid collection point will require excavation and other areas were used before like dumping site like at Magae playing ground. Apart from waste increase, this can lead to the contamination from heavy metals.

7.5.2.6 Interference with Local Hydrology

The Integrated Drainage and Resilience Urban Upgrading in Zanzibar project indicate that; the hydrologic and drainage aspects of the area will be interfered. The improvement of proposed drainages of the area, especially of roadside drainage and cross drainage as well as underground channel can interrupt natural hydrological pattern. The lowering of ground water table can be a problem as a result of over drain of storm water from the existing ponds.

7.5.2.7 Loss of Vegetation and Natural Habitats/ biodiversity

This project is presumed to affect natural areas including land and water areas. Construction works may necessitate clearance of natural vegetation and storm water drainage over site loaded with wastes, oils, sediments. Others are; damage of natural vegetation; disturbance of contained fauna and direct pollution/contamination of the natural areas all subsequently causing loss or outmigration of affected species.

Land clearance to obtain the required additional area for the roads and drainage systems will involve uprooting vegetation's which falls within the area as well as displacing topsoil. Detours to provide access to traffic during construction phase will further cause loss of habitat.

As stated, before that; along the project areas and outlet of drainage System C outlet there are large trees such as Mango trees, Coconut trees, Mangroves, Almond trees, Neem trees, Casuarinas etc. This is natural habitats for various small and large animals, therefore if it happens that the construction works cut the trees to allow expansion of the drainage and other street roads or to create detour routs then there will be an impact on the flora and fauna living in.

7.5.2.8 Destruction of sensitive areas

Mangrove forest and Sebleni pond are ecological sensitive areas that need to be harmonized with the project elements. Some species may be affected during construction, but not to the level of extinction. It has been presumed that; the construction activities may affect some of the species in these areas.

Currently, there is no standard for storm water quality to be discharged into the sea thus; all storm water drainage system discharge to the sea without consideration of storm water quality. Among the pollutants that can be introduced to coastal marine ecosystems through storm water include heavy metals, grease and oils and other toxic organic chemicals. Due to huge dilution that happens in marine ecosystems the effects of pollutants may not be easily felt however, there is associated bioaccumulation potential in marine organisms that ultimate's find way in higher trophic levels including human beings.

In associated to these negative impacts, the followings are the additional of the impacts along the sensitive areas at the proposed outlets;

- Hydrological changes conditions, and the physical characteristics of the drainage system;
- Interference to the transportation as the outlet will be crossing the road towards the Fishery village
- Vegetation Removal - Trees and shrubs will be cleared.
- Altering the Channel - Straightening, widening, or smoothing out the bottom of a channel reduces the quantity, quality, and diversity of available habitat.
- Excavation can kill fish directly either by equipment, or suffocated due to sediment release, low dissolved oxygen levels, or reduced flow during excavation the pond.
- Change of marine ecosystem at the area where storm water is disposed.

7.5.3 Potential Social impacts

7.5.3.1 Destruction of Public Utilities, infrastructure/services and access

Some of the infrastructure such as pipe network and power lines are either under, near or cross the project roads and can be destructed during construction, this relocation can cause; Disruption of service to the community provided and Cost implications to the authorities managing the infrastructures, for instance cutting of the ZAWA pipe lines and other available underground cables. At Shehia of Meya, there are electric posts located within the road and available septic tanks in in the proposed roads will be destructed during project construction phase.

Connection to existing utility facilities without considerations of available resource would increase pressure on the system depending on their carrying capacity.

7.5.3.2 Increased Immigration and labour influx

The improvement of urban area and flooding free areas is usually accompanied by in-migration of job seekers and opportunistic businesses and speculators for example people at Tomondo and some part of Sebleni are shifting due to flooding, during construction and development of the roads will start to move towards the areas seeking for jobs and a place to stay. On the other hand, Considering the current HIV-AIDS level in Tanzania, increased population in Zanzibar town due to in-migration may subsequently result into increased spreading of HIV-AIDS pandemic.

The rapid migration to and settlement of workers and followers in the project area is what is called labour influx, and under certain conditions, it can affect project areas negatively in terms of public infrastructure, utilities, housing, sustainable resource management and social dynamics. This note covers temporary labour influx in contrast to longer-term or permanent migration of workers. During implementation of Zanzibar Urban Upgrading and drainage integration project the same influx is predicted, hence the contractor shall take the following initiative to minimize these impacts;

7.5.3.3 Resources Use Conflict

Presence of worker's camps is potentially a source of social and environmental problems as a result of interaction of local people and workers in the project area. Conflicts between the two groups of people may result due to sharing of social services, like water resources for domestic, and construction activities. The negative impact is expected to be indirect, short term and moderate.

Furthermore, Zanzibar Urban Upgrading and drainage construction will entail significant water abstraction from the groundwater through boreholes (tap water) in the project area to be used for domestic and construction purposes including dust mitigation in the local environment. According to ESMF for BIG-Z, the present actual abstraction is estimated to be 60 Mm3/a, while ZAWA abstraction is estimated to be 23 Mm3 /a. Thus; the implementation of project is likely to increase abstraction of water which can affect the people living nearby and interrupt with the local groundwater hydrology.

7.5.3.4 Gender Based Violation (GBV) impact

Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and act outside their normal sphere of social control. This can lead to inappropriate and criminal behaviour, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the local community. A large influx of male labour may also lead to an increase in exploitative sexual relationships and human trafficking whereby women and girls are forced into sex work. According to TAMWA and National Plan of Action to End Violence Against Women and Children 2017-2022 Women and girl's area main victims of GBV. Over 34.8% of the respondents of the conducted research in Zanzibar, admitted to commit GBV against female relations.

During construction, the vulnerable residents of the host communities, such as youth and women, may be subjected and exploitative to the social interaction between community members, casual labourers and some skilled workforce who are coming from different places during construction phase, which may

result in gender-based violence (GBV), sexual exploitation and abuse (SEA) as well as attitude and behaviour changes among local people.
It was observed that; among the PAPS within each affected Shehia, households falling under the category of "vulnerable" were identified. The presence of a female head of household, person with disability, and/or person over the age of 60. All these are to be considered among the impacts of Gender Violation issues especially during compensation for the affected properties.

7.5.4 Occupation Health and safety impacts.

7.5.4.1 Potential threats from spread of STDs and communicable diseases

The most health risk is on spread of STDs like HIV/AIDS. Considering the socio-economic as well as geographical characteristics of the project areas, there are existing number problems that either may influence high infection rate, or deter efforts to combat the epidemic. For example, the problem of low or irregular incomes among young women aged 15 – 45 years is HIV/AIDS risk factors, which can influence high infection rate in the project area. to some extent the consultant has described how construction activities can exacerbate spread of HIA/AIDS without considering other diseases. The other threat is the spread of communicable diseases such as Hepatitis B, tuberculosis and COVID-19.

To some extent the "Integrated Drainage and Resilience Urban Upgrading in Zanzibar" is expected to stimulate and attract unemployed women towards the project area. This expected to increase the infections in the project areas.

7.5.4.2 Health and Safety risk

Sub-projects implementation exposes the labourers and the general public to bronchial and other respiratory tract diseases. Also, poor use (or not using at all) of the safety gears during construction phase will result into loss of lives or injuries during construction. The people neighbouring the project site and public safety and road/facility are exposed to and likely to be affected by project activities specifically accidents during construction such as open pits filled with water and operation phases, if no preventive measures are provided and if exposed to poor sanitation and hygiene. Other risks are lack of ventilation in covered trunks of drainage during maintenance and culverts rehabilitations. For open drainage channels, lack of periodic maintenance of drains creates breeding grounds for water-borne vectors of diseases such as malaria mosquitoes and bilharzia snails and water-borne infections.

7.5.4.3 Increased Road Accidents and community Health and safety risks

Vehicular traffic to the proposed sites is expected to increase especially during delivery of raw materials. This may cause an increase in the number of accidents. It has been observed that in the project areas, there are elderly persons, and members with disability grouped as "very vulnerable." It was observed that, in Meya, 11% of total households are very vulnerable, 12% in Magomeni and 5% in Kwa Wazee while in Sebleni, one-quarter of the surveyed households are deemed very vulnerable as well as 19% was considered very vulnerable In Tomondo.

On the other side, the construction works will also expose workers to occupational risks due to handling of heavy machinery, construction noise, electromechanical works, and due to the movement of construction equipment. Construction activities of trench excavation and concrete mixing and construction traffic, will generate a lot of dust especially during the dry seasons and this may affect workers' respiratory systems.

Construction camp may be a source of both liquid and solid wastes. If these wastes are not well disposed, these sites may become breeding grounds for disease causing pests such as mosquitoes and rodents. At the concrete mixing plant, the exposure of human skin to cement may lead to damage of the skin.

7.6 Operational Phase Impacts

7.6.1 Positive Impacts

7.6.1.1 Job Creation and Increased Income to Local Communities

There would also likely be employment availability during the operation phase pertaining to drainages and other developed infrastructure maintenance such as grass cutting, cleaning drainage culverts, roads cleaning, solid wastes remove and collecting; as well as some clerical / low level supervision jobs. The built-up markets will facilitate self-employment to the local people and availability of developed road will increase rate of transportation of goods from one place to another.

7.6.1.2 Flood reduction

Completion of drainage systems will eliminate the problem of flooding to the currently affected areas like Tomondo, Shimo la Nguruwe as well as Sebleni. Moreover, for these project activities, the noise and vibration impacts will be reduced due to improved road surface and storm water flow in the drainage systems. In addition, since the vehicular density is low and drainage will be covered and others are underground, it is therefore considered that the perceived effect on noise and vibration effects will likely be greatly reduced. Solid waste collection points and other sanitation systems will help to reduce and eliminate environmental and public health problems.

7.6.1.3 Reduce water resources pollution

Development of drainage systems installation will result into water sources prevention from contaminations. There will be no more sewage discharge to the drainage system like, currently System C which is full of sewage and solid waste. Solid waste collection points will solve the issue of unauthorized solid wastes disposal of to the drainage and open spaces. All these helps to prevent both surface and ground water sources.

7.6.1.4 Improved Community Life and Services

There are several social related advantages that will accrue from the project. Improved feeder roads will enable easy delivery of drugs/medicines to health care facilities. The drainage system constructed will eradicate the flooding and most of storm water will be discharged to the sea, hence no possibility of water related diseases eruption. With urban upgrading people will enjoy the improved environment as will be involving in various commercial activities. The proposed road will facilitate patients in various areas along the road project to receive faster medical attention (especially emergency cases). Health workers will enjoy easier access to work than before. The roads will facilitate easy access to health centres, and thus lives of some patients will be saved.

Living standard of local communities along the road will be enhanced, as they will be able to easily get access to social facilities such as schools and other amenities in commercial centres.

7.6.1.5 Reduced Traffic Congestion

As a result of the improvement of the project roads in Zanzibar public transport will become efficient, fast and cost effective. This will lead to the increased use of public transport and a corresponding decrease in the use of private cars. The impact will be further reduction in traffic congestion. This also will have positive impact on reducing the level of air pollution in the urban areas because of gas emissions from vehicles. Factors such as cost of gasoline, improvement in travel time even for parts of a journey may motivate people to consider using public transport rather than use personal cars.

On the other hand, Improvement of roads and street lighting and change of geometry, including increasing in radii of curves and provision of speed restraining humps especially on accident black spots, will significantly improve the safety of the road and community at large. Construction of dual carriageways will also reduce traffic accidents involving vehicles and pedestrians.

7.6.1.6 Increased Economic Growth

Empirical findings also revealed a convergence of opinions on the potential economic benefits of improving the drainage systems, feeder roads and commercial areas. It is argued that improving project roads will increase and spark economic growth within its immediate impact areas and beyond. Drainage system will solve problem of flooding and storm water and will allow people to do their business in proper way with fear free from destructed from flooding. Business centres will attract investors both large and small and thus economic and social benefits could be felt widely and horizontally across socio-economic spectrum. The further growth of business districts will further increase the growth of the business sector and increase access.

Findings also showed that the project will increase land value in the impacted flooding area and modify its use and occupation patterns along the corridor. People will get back to the areas which were flooded and as far as no flooding this will raise the land values. The project will also, generate employment and increase employment opportunities both in the formal and informal sectors, services and recreation. The

improved travel time as already discussed will increase productivity of labour with no loss in working hours due to inefficient transport and flooding interruption.

7.6.1.7 Increased Agricultural Productivity

The urban upgrading and drainage channel construction will lead to increases in agricultural productivity in flooded area like Mpendae, Tomondo and Sebleni. The drained storm water to the sea will leave open areas to be used for the agricultural activities with little risk of flooding. On the other hand; the intensification of the use of farm input such as effluent for irrigation will increase production.

7.6.2 Potential Environmental Impacts due developed infrastructures

7.6.2.1 Increased Environmental pollution

i. Pollution will be evident during the operation life of the roads and drainage due to fuels and other chemicals associated with vehicular traffic and maintenance works. The chemical emission is likely to be washed by rainfall to water sources through the drainage and adjacent soils.

ii. Air pollution increase as there is an expectation of increase of the vehicles which produces gases like NOx, SOx Cox etc. and the dust will be emitted if roads are not cleaned.

iii. Noise is one of the most obvious negative impacts of daily road use. The discomfort caused by noise includes auditory fatigue and temporary lessening of hearing ability. However, perceived noise is related to background noise level, so that new street roads in quiet areas or noisy trucks at night are often perceived as worse than higher levels of noise in a busy area during the work day.

iv. Street sweepings and sediments accumulation into the drainage during the rainy season will be expected. However, the magnitude of the pollution is considered to be very low.

v. Accumulation of Solid waste and sand at the entrance of underground channel, this problem is expected especially to the point where open channel connects underground channel. For example, between proposed System Eb and underground channel at Meya. The same problem was observed at drainage channel near Kwa Mbarawa.

vi. High velocity of Storm water Flows results in damage to fish habitats and breeding sites and increase the risk for erosion downstream to the beach.

vii. There can be a reduction of local air quality and lead to Contamination and reduction of aesthetics at collection points /transport routes.

viii. Another impact is the increase of dangerous animals like rats and snakes which can spread plague and harm the people.

7.6.2.2 Pollution due to wastes generated

The improvement of open spaces in construction of markets can lead to both the solid and liquid wastes increase. The most expected wastes are organic waste/agricultural wastes and waste from human excretor which will cause air, water and soil pollution if not removed on time or managed properly. The increase

of solid and liquid wastes are accompanied by the increase of other dangerous animals like rats, snakes, and flies which can cause spread of diseases like diarrhoea and cholera.

7.6.3 Occupation Health and safety impacts.

7.6.3.1 Risk of Health and Safety

Project supported infrastructures will be operated by different authorities after completion of construction, for instance waste management facilities and improved public space will be under ZUMC, water supply infrastructure will be under ZAWA, while improved roads will be under department of roads. Maintenance of these infrastructures may involve closure of the roads, entering in the sewer, working at high height to repair street light etc. Such maintenance activities may increase safety risk to workers involved as well as the surrounding community. Safety risk involved with repair of street light (replacement of LED) is falling of workers and objects from working platform, collapse of the mobile elevated working platform (MEWP), contact of live cables or overhead services which may cause severe injury leading to death. On the other hand, workers involved in maintenance of drainage may be subject risk of exposure to poisonous gases/fumes/vapour, water ingress and being swept away and traffic hazards.

7.6.3.2 Community Health and Safety risk

Traffic volume in the improved roads is predicted to increase during operation phase. Improvement of these roads may prompt high speed driving, which is likely to cause accidents to pedestrians. This problem will be more severe in sections with movement of the people. The other risk in the site area is that; people and children may fall into open storm water drains constructed along the roads, which may result into injuries or fatal. This impact is considered to be negative, cumulative, long term and moderate significance.

7.7 Cumulative Impact Assessment (CIA)

7.7.1 Cumulative impact of proposed Zanzibar urban upgrading and drainage integration

The cumulative impact assessment (CIA) of the Project comprise of the potential cumulative impacts of the Project with respect to other identified significant projects being developed within or near the sphere of influence of the Project ("Project Area"). The cumulative impacts specify the risks and impacts from (i) other existing projects or conditions, and (ii) other future developments (including future stages of the project itself) that are realistically defined at the time the ESIA are undertaken and for with the sphere of influence of the various projects or developments may overlap. Cumulative impacts are thus defined for this ESIA as impacts which result from incremental changes caused by the Project together with other presently on-going, or reasonably foreseeable future planned actions/projects within the Project Area. Depending on the type/characteristics of other identified projects and their specific impacts, the main issues of concern with respect to the CIA can thus include any type of impact that is considered in the ESIA.

The CIA focuses on environmental and social components rated as "critical" by the affected communities and the scientific community (Valued Environmental and Social Components [VESCs]), which are cumulatively impacted by the project, other projects, and sources of external pressure. The development of a CIA requires the identification of VESCs on the basis of the Area of Influence (AoI) of the Project; other existing, planned, and future projects; sources of external social and environmental pressure; and the results of consultation with stakeholders.

The project area of influence is Zanzibar Municipality, where there are many on-going projects and many others are in pipeline. Among these include the water supply improvement, solid waste management, roads improvements and other infrastructure projects. There many similar potential impacts that will be caused by the stated projects, which also anticipated to occur on implementing the Drainage and Resilience urban upgrading. The severity of cumulative impacts will essentially depend on the time of implementation of the projects. Concurrent implementation of the projects may magnify some of the impacts through affecting more people in the area of influence or further depressing the environmental receptors. The proposed Zanzibar Urban upgrading and drainage integration project will take place in a predominantly brownfield setting, so no significant negative impacts of a cumulative nature are expected (if any those are likely to be quite positive in nature).

8 IMPACTS MITIGATION MEASURES

8.1 General Considerations

This section is devoted to describing measures or actions that shall be implemented so as to minimize any of the potential impacts identified in the preceding chapter. Many of the mitigation measures put forward are nothing more than good engineering practice that shall be adhered to during the design and construction phases. The developer is committed to the implementation of mitigation measures contained in this report.

8.2 Mitigation Measures for Mobilization Phase Impacts

8.2.1 Potential Environmental impacts

8.2.1.1 Environmental pollution impact (Air, Noise and Vibration pollutions)

To a large extent, the nuisance of atmospheric pollution like dust will be mitigated by adhering to the Standard Specifications for Road Works 2000 and Special Specifications. Also, it will be mitigated by:

- Use good work practices;
- Use of water to suppress dust must be practiced on all working sections including areas of cutting and filling, haul roads, in the borrow areas and quarries, and any sections of existing infrastructures by construction equipment or trucks;
- All workers exposed to the risk of dust and exhaust gas should use appropriate personal protective equipment (PPE) such dust mask;
- Contractor should consider good selection of machinery and vehicles; regular service and lubrication to reduce fumes from construction machinery and vehicles;
- Switching off the machines and vehicles when not in use will help to minimize the exhaust fumes and noise;
- All construction machinery will be maintained and serviced in accordance with the contractor's specifications;
- No equipment will be used that generates excessive black smoke;
- Routine inspection of equipment’s will be done.

8.2.1.2 Loss of trees and biodiversity

- Unnecessary removal of the vegetation especially trees should be restricted and when it is not avoidable, removed tree will be replaced by original species soon after completion of construction works.
- In order to reflect project concept of green corridor, specific tree planting activity will be included in the biding document.
- In collaboration with West B and ZUMC, all areas without trees will be planted with trees of indigenous species.

8.2.2 Potential Social impacts

8.2.2.1 Land expropriation, loss of property and resettlement

During consultations with the communities and government officials, it was very clear that compensation must be made prior to implementation of the project. Failure of implementing the compensation plan can result into social friction with local communities that can cause delay in construction schedule.

- The private area, it will require compensation of the plot and the wall surrounding the area as well as the trees within the area, this will be done with reference to BIG-Z Resettlement Policy Framework (RPF);
- Compensation shall be done according to WB and Zanzibar laws governing resettlement before commencement of the construction activities;.
- Resettlement Action Plan shall be prepared and observed. Resettlement will be avoided and where not possible will be minimized at designing stage and during implementation; pay compensation at full replacement rate or replace affected structure with improved conditions before demolition;
- Consultation with Shehas and religious leaders shall be done to arrange for the procedures to relocate the religious properties.
- The compensation shall be paid in advance (before commencement of construction) before demolition of the existing structures

8.2.2.2 Road Traffic Accidents

- The Contractor will ensure that the traffic flow is not interfered during the whole mobilization period.
- There should be no total closure of the road will be allowed. The Contractor shall provide diversions and deploy a person responsible for traffic safety.
- To prevent delay, frustration and avoidable road incidents current public transport system will be reorganized; reorganization plan will be prepared and shared with stakeholders.
- There should be clear separation of working area and traffic area by marking, barricading, fencing as well as speed restriction.
- Safety measures have been incorporated in the engineering designs to include for example details of signboards to notify the public about the potential dangers, markings, intersection layouts, access restrictions, bus stops, crossings, footpaths etc.
- The traffic management plans shall be prepared during construction and be presented both in English and Swahili.
- Working in the project area shall entail the Contractor to make special arrangement with the local government leaders (Shehas) to receive traffic police guidance during the construction works.
- Also, in considering the risks involved, it is recommended to provide adequate insurance cover to all workers. The road signs will be installed throughout the project site; particularly in the high traffic areas to direct and control car speed.

8.3 Mitigation Measures for Construction Phase Impacts

8.3.1 Potential Environmental impacts

8.3.1.1 Environmental pollution impact (Air, Noise and Vibration pollutions)

- The nuisance of noise, vibration and dust will be transient and good work practice can minimize them. In addition, these impacts are already being experienced due to the on-going projects and existing road segments.
- Contractors and facility operators to institute procedures for preventive maintenance of equipment.
- The impacts of noise and dust emissions will further be minimized by proper choice of plant and machinery (i.e. fitted with noise and dust silencers or reducers) and locating quarry areas away from human habitations (at least 500m away).
- Dust at work places within or close to human habitation should be critically minimized by periodic water sprinkling on working sections. The contractor shall advise or notify local households on dust, noise, vibration and other dangers.
- Sprinkling should be practiced regularly at all active work sections along the roads and at all quarries and borrow sites for the protection of workers. In addition, sections of roads heavily traversed by construction vehicles should also be regularly watered.

8.3.1.2 Degradation of resources and management

- Local workers will be given priority for employment;
- All workers for the project will sign code of code of conduct, among others, it will prevent illegal utilization of natural resources, prevent gender related violence.
- Breach of code of conduct my result into suspension or termination of the contract;
- Implement water use efficiency measures and Secure before abstracting water from other sources;
- In any chance; the rain water harvesting shall be done and used during construction.

8.3.1.3 Water resources pollution

- There shall be a proper disposing of excavated materials, demolition wastes from culverts, sludge from latrines and septic tanks so as to avoid water source pollution; contractor shall consult ZEMA for special permission;

- Spillage to watercourse is harmful to all living beings. In case of accidental spillage, the contractor shall exercise every effort in order to minimize the associated risks. Thus, the refueling of plant or transfer of materials should not be carried out near water bodies, and any local spillage to soil should immediately be remedied.

- In reference with type of wastes and categories of wastes the project will generate or handle (biodegradable / organic wastes; packaging materials; non-biodegradable (metallic, plastic), construction wastes, and hazardous wastes i.e. fuels, oils, lubricants, vehicle / machinery fluids and excavated materials); The contractor shall ensure there is a waste sorting before disposing of.
- Use Silt curtains to minimize sediment suspension and transport while working near water crossings.
- Use best available mechanisms, practices and technologies for waste collection, storage, transportation, treatment and final disposal.
- Consider the use secondary containment for storage of oil, fuel and other chemicals etc.
- Practice Good housekeeping within material storage compounds or vehicle maintenance yards where there is a great possibility of spillage. Thus, provide Spill tanks and Secondary containment at vehicle maintenance yards.

8.3.1.4 Soil degradation and depletion

- For disposing of excavated materials so as to avoid soil pollution; contractor shall consult ZEMA for special permission;
- Spillage of fuels and chemicals is a risk; although spillages are likely to be local and remediation is considered easy, thus, consider use of drop pan during refueling;
- The area of surface clearance will be minimised. Cleared surface will be stabilised by revegetating with natural vegetation.
- The Contractor will avoid unnecessary disturbance of soil cover. In addition, the water flow speeds, especially for side drains will be controlled by constructing erosion checks.
- Lined drainage channels at sensitive terrains shall be provided to control speed and volumes of storm-water.
- The discharge points must be carefully chosen to avoid erosion of arable land and creation of gullies. Nevertheless, all cuts in sloping grounds shall be refurbished firmly and provided with the vegetation cover to reduce the effect of soil erosion.
- For cleared land, it will be re-vegetated to slow down the movement of storm water.
- It is a requirement of the Contractor to control water during construction to minimize chances of erosion before the permanent works are completed will be part of the specifications in the bidding documents.
- Pond banksides and drainage channels sides shall be reinforced with gabions and apply vegetation to prevent erosion.

8.3.1.5 Pollution due to waste generated

- Provision of grit chamber for sediment straining and screening chamber for solid waste prevention. Screening and grit chambers will be designed to slow down the flow of stormwater so that pollutants and solids such as sand and small stones will settle out and prevent blockage.
- Disposal demolition wastes from culverts shall be done in accordance to clause 1713 of the Standard Specifications for Road Works 2000;
- A Contractor shall ensure Proper handling and treatment procedures of hazardous wastes e.g., sludge and other wastes with faecal matter from latrines and septic tanks at Kibele sludge treatment units

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- Only inert materials or readily decomposable materials shall be disposed by burial.
- No open burning of oils shall be done.
- The consultant shall make a Proper consultation from ZEMA on disposal of excavated wastes from ponds and sludge from the demolished latrines and septic tanks;
- Frequency cleaning of the drainage channels and strainers to prevent drainage blockage;
- The contractor will develop and implement an efficient waste collection and disposal system based on the principles of reduction, re-use and recycling of materials, at the camp and construction sites;
- Solid wastes produced especially from the camp sites as well as at the construction sites will be collected by municipal garbage truck or registered company and disposed of at Kibele landfill;
- Other wastes like uprooted trees will be given to the local communities for firewood;
- Introduction of waste disposal bins, warning notices;
- "DOs & Don'ts" etc. posted at strategic points, through the campsite and construction sites;
- Hazardous waste like used batteries will be recycled or collected and disposed of according to Zanzibar Environmental Management Act, 2015 and subsequent regulations.

8.3.1.6 Interference with Local Hydrology

- Good design features shall be adopted to ensure that the changes of the hydrological regimes are minimized and that any impacts are insignificant.
- The design will provide controlled and effective storm water dispersion by installation of adequate and appropriate drainage structures.
- The discharges points shall be well designed to avoid accelerate erosion downstream and beach erosion;
- The draining of ponds to the sea shall take an account of groundwater connectivity with the surface water to avoid interruption with groundwater recharge.
- This shall include hydrogeological investigation/study on the relationship of the surface water and groundwater before project implementation. The results of the hydrogeological investigation will make part of the contractor's ESMP.
- An independent groundwater modelling study around the pond shall be conducted and this will also make part of the C-ESMP.
- Design will be done as not to drain all logging water from the ponds by considering the spillway/ embarkment to the drainage for the maximum flow control.

8.3.1.7 Loss of Vegetation and Natural Habitats/ biodiversity

- The contractor shall seek permit from the Department of Forestry before falling of any Tree;
- The drainage systems design shall try as practicable to offset the route so as to avoid felling of big trees that take many years to grow or other flora of outstanding importance. The contractor shall from time to time bring to site a forester from Department of forestry to check for existence of such flora. The forester will also play key role in the review of the designs to establish their impacts to the flora of different specieis.

- Close supervision of earthworks shall be observed in order to confine land clearance within the proposed new drainage boundaries. Farmers will be notified early enough to enable them harvest the affected crops on time and/or compensated to enable them create new farms.
- Topsoil shall be stockpiled and used for reinstating flora along the road and drainage. It is assumed that displaced fauna will return once the work is over or seek another habitat locally.
- The contractor shall be instructed to give the uprooted trees/thickets in the road reserve area. Local governments or any other arrangement may seem convenient provided he does not contravene the Forest Acts 2002.
- The drainage design and expansion shall try as practicable to offset the route so as to minimize the destruction of mangroves, for instance at the outlet of system C;
- Spilled cement or concrete should be collected and disposed away from natural water ways or storm water drainage;
- Sensitize workers and enable them to properly handle concrete spillages or waste cement;
- Prevent sediment and solid waste introduction to the sea as to protect breeding sites for the fish and other marine organisms into shoreline and under mangroves;
- The budget for re planting of the trees along the project road shall be part and parcel of the project costs. Department of Forestry shall handle the replanting of trees;
- The drainage design shall try as practicable to offset the route so as to minimize the destruction of Mangroves and the proposed outlet of drainage to the sea;
- The contractor shall seek permit from the Department of Forestry before falling of any Mangrove;
- The designs should ensure that, all trees which are not in the corridor of impact remain intact even if they are located within the route of work as long as safety is guaranteed.

8.3.1.8 Destruction of sensitive areas

- The road/drainage design shall try as practicable to offset the route so as to minimize the destruction of sensitive areas like Mangroves and the proposed outlet of drainage to the sea;
- Replanting of mangrove stalks to compensate for the lost biota;
- The contractor shall seek permit from the Department of Forestry before falling of any Mangrove Tree;
- Prevent sediment and solid waste introduction to the sea as to protect breeding site for the fish and other marine organisms into shoreline and under mangroves.

8.3.2 Potential Social impacts

8.3.2.1 Destruction of Public Utilities, infrastructure/services and access

In the view of the above, the authorities managing these infrastructures ZAWA and ZECO should be involved from the early stages of this project design and implementation so as to have an integrated planning and incorporate this issue in the designs.

- The ZUMC, West “B”, ZAWA and ZECO shall be involved from the early stages of this project so as to have an integrated planning.
- Early notice shall be given to the community before any service interruption;
- The funds for the relocation of this infrastructure shall be part and parcel of the project.

- Avoidance strategies such as sidestepping settled areas, sensitive / important natural or social / cultural or economic features in order to avoid /minimize extensive resettlement;
- Use of existing undeveloped areas available in the land use plans;
- Relax the required construction standards: in some cases, expansion of diameters or extension of lengths of existing culverts/bridge and drainage channels.
- Add structures to design (e.g. walking slabs, culverts) meant to facilitate access and crossing over linear infrastructures such as drainage channels/crossings.

8.3.2.2 Increased Immigration and labour influx

- A contract shall provide a site-specific ESMP with management plans for: (i) work activities; (ii) traffic management; (iii) occupational health and safety; (IV) environmental management; (v) social management; and (VI) labour influx.
- The Contractor will implement civil works in accordance with ESMP- including all works conducted by sub-contractors under the contractor's control.
- The contractor is required to train workers on roles and responsibilities under these plans, policies and standards.
- He/she is required to submit regularly safety health reports to the Borrower on implementation.
- Proactively address any issues that arise.
- The Contactor should reduce labour influx by tapping into the local workforce and He/she is required to assess and manage labour influx risk based on risks identified in this ESIA;
- The contractor is expected to use between 70 to 100 unskilled labourers who are expected to be available within the country. The workers camp will be for skilled staff approximately 15-20 who will come from within and outside Zanzibar.
- The contractor shall Incorporate social and environmental mitigation measures into the civil works contract.

8.3.2.3 Resources Use Conflict

- The contractor shall consult ZAWA and ZECO before any abstraction of water and use of electricity in the project area.
- The amount of water given to the contractor shall consider the local community around the project road and downstream of the water course.
- Watering should be done to those places with significant dust levels and near/ along site areas to minimize water wastage.

8.3.2.4 Gender Based Violence (GBV)

- Community Based Organizations (CBOs) and other Institutions shall support and provide training on gender issues and ensure Mainstream GBV into all humanitarian response and maintain the updated comprehensive data needed to inform advocacy, planning, implementation and M&E of interventions.
- These CBOs will come from Zanzibar to ensure cultural maintenance on dealing with GBV and SEA issues

- Gender policy and guidelines on GBV shall be implemented, used and taken into account during project employment.
- Increase awareness and enhance systems for the prevention of GBV including SEA through mitigating risk factor and strengthening community protection strategies.
- Contractor shall have a policy and implement Gender Based Violence against Women and Children throughout the project implementation;
- There is need to promote gender equality in all aspects of economic development and more so in construction.
- The cost of undertaking: i) support and provide training on gender issues; ii) ensure mainstreaming of GBV issues; and iii) maintain the updated comprehensive data needed to inform advocacy, planning, implementation and M&E of interventions will be part of contractors budget.

Increase access to a comprehensive and well-coordinated GBV response services including livelihood support for survivors.

In addition, the contractor will integrate measures for prevention and handling Gender Based Violence (GBV) and Sexual Exploitation and Abuse (SEA) in the contractor's environmental and social management plan (C-ESMP). Every Gender Based Violence (GBV)-related incident should be reported and appropriate actions taken. The contractor will develop an induction programme, including a Code of Conduct, for all workers directly related to this project. A copy of the Code of Conduct should be presented to all workers and signed by each addressing various issues such as:

- respect for local residents and customs;
- zero tolerance to violence (whether physical, verbal or otherwise)
- zero tolerance of bribery or corruption;
- zero tolerance of illegal activities by construction personnel including:
  - prostitution;
  - illegal sale or purchase of alcohol;
  - sale, purchase or consumption of drugs;
  - illegal gambling or fighting;
- description of disciplinary measures for infringement of the Code and company rules.

8.3.3 Occupation Health and safety impacts.

8.3.3.1 Potential threats from spread of STDs and communicable diseases

- Since construction camps will attract many job seekers and trade mongers, the contractor shall enforce a code of conduct in the camp to encourage respect for the local community and to maintain cleanliness of the camp at all times.
- The contractor shall deploy locally available labour to reduce risk of spreading of communicable diseases (especially STDs).
- A safety, health and environment induction course shall be conducted to all workers, putting more emphasis on HIV/AIDS, which has become a national disaster.

- In order to prevent more HIV/AIDS infection, during the implementation phase, the project should include information education and communication component (IEC) in its budget. This will help to raise more awareness on HIV/AIDS and means to suppress its incidence.
- Provide Voluntary Counselling and Testing (VCT) centres for HIV/AIDs at work place,
- Enforce HIV/AIDS law and regulations and support Campaign for communicable diseases
- All measures to prevent infections and other communicable diseases like COVID 19, HIV/AIDS etc.

8.3.3.2 Risk of Health and Safety

- Appropriate working gear (such as nose, ear mask and clothing) and good camp management shall be provided.
- During construction the contractor shall ensure that the campsite and working areas are fenced and hygienically kept with adequate provision of facilities including waste disposal receptacles, sewage, firefighting and clean and safe water supply.
- The site area shall be fenced to prevent movement of unauthorized people towards the working site.
- A well-stocked First Aid kit (administered by medical personnel) shall be maintained at each camp, quarry sites and each active work section along the road.
- The medical personnel shall also be responsible for primary treatment of ailments and other minor medical cases as well as providing some health education to the workforce.

8.3.3.3 Increased Road Accidents and community Health and safety risk

- The road design shall take account of safety concerns especially at human habitation crossings e.g. installation of bus stops at settlement centres.
- Traffic management plan shall be incorporated in the designs to include for example details of signs, markings, intersection layouts, access restrictions, bus stops, crossings, footpaths etc.
- The traffic management plans shall be presented both in English and Swahili.
- The contractor will provide temporary concrete slabs to enable pedestrians as well as motorists gain access to their business and residential premises.

8.4 Mitigation Measures for Operational Phase Impacts

8.4.1 Potential Environmental Impacts

Water Pollution

This pollution will be mainly a result of use of facilities such as roads and storm water drains. Surface water is at risk of pollution due to runoff which carries along pollutants. The main pollutants include solid matters, floating and macro waste, heavy metals and organic matters. During the rainy season, the surface waters will drain the pollutants directly towards the natural discharge systems. Thus, the risk of water degradation is assessed as important, which may have an indirect impact on the water table too.

Mitigation measures

- The project will opt to develop surface water quality program and a response plan which will be used to manage and mitigate the pollution of surface and ground water on the proposed project

sites. The ESMP describes the measuring and monitoring activities and tracks actions taken to manage surface and ground water discharges;
- Septic tank and soak away shall be designed in such a way waste treatment is achieved by 100% before disposal to the authorised disposal sites;
- Minimize oil spillage;
- Discharge and treat foul drainage and sewage; and
- Pass run off through oil interceptors.

Storm Water Generation and Overflow

The proposed project components will generate a lot of storm water due to presence pavements, concrete surfaces and building roofs. The structures will tend to compromise the infiltration capacity of the land surface hence rendering water free to the environment. The storm water generated might have impacts on structures downstream as well as being a factor for soil erosion and poor water quality.

Mitigation measures
- The design of storm water drainage will be given a high priority;
- Rainwater harvesting will be used encouraged in proposed project sites; and
- The design shall consider enough greeneries in the project site.

8.4.1.1 Pollution due to waste generated

- Contractor shall ensure Capacity building to the community on proper solid waste management during operation phase
- There shall be a use of existing environmental committee at grass-root level i.e. Sheha's office for raising awareness in each Shehia regarding health and legal consequences of illegal disposal of domestic wastewater into drainage channel.
- The committee shall be dedicated in monitoring illegal disposal of wastewater and taking necessary actions according to municipal/town councils bylaws.
- ZMC and West "B" should ensure there is frequency cleanliness of the drainage channels to prevent obstruction from sand and solid wastes.
- The sands collected shall be used for other construction purposes to reduce the bulk of wastes from the drainage.
- Signage, filling pits and restoration of hazardous and disturbed areas.
- Proper drainage system design to prevent introduction of solid wastes and sediments to the sea
- Proper planning and designing of waste disposal facilities.
- Underground drainage shall be designed to contain manholes and ventilation for easy accessibility during maintenance and cleaning.
- Frequent collecting of solid wastes from collection point to be transported to the Landfill site.
- For sustainability, polluter pays principle should be applied, whereby each waste generator will provide financial contribution for waste management. Currently communities are paying for waste collection and dispaosal in various parts of Zanzibar.
- The contractor would have to produce a manual with the list and the program of the operations, the quantity and quality of chemicals to be stored, the water quality's analyses to be carried out

at the entrance and at the exit of each sector, the cleaning and removal of sludge and scum, the filters backwash.

8.4.2 Potential Social impacts

8.4.2.1 Induced developments and settlements

- Small group business, agriculture and SACCOS shall be established to assist people access loans to enable them run small businesses;
- Follow local authority and Shehia by-laws;
- Resettlement policy may be adopted by the /BIG-Z, private development companies, NGOs, large financial institutions and the WB.
- Regardless of the source of the policy, community engagement participation during all stages of the planning process is crucial to mitigating negative outcomes.
- World Bank OP/BP 4.12 – Involuntary Resetlement provide safeguards procedures for resettlement of those displaced by development, hence, shall be careful observed;
- The development project shall be implemented in less impacts to citizens against the effects of development-induced displacement.

8.4.3 Occupation Health and safety impacts.

8.4.3.1 Risk of Health and Safety

- To mitigate health and safety related impacts during operation of the infrastructures supported under this project the supervision consultant will prepare operational and maintenance manual including safety measures specific to Zanzibar.
- The manual should, at least, include the following measures:
- Working at height and in confined space should be avoided as much as possible. Where avoidance is not possible then the risk should be minimized. Procedures, plans and equipment for rescues must in place during undertaking maintenance activities.
- Workers should be provided with personal protective equipment.

8.4.3.2 Community Health and Safety risk

→ Increase of Accidents

- Mitigation of this impact will involve installing speed restraining measures at approaches to all black spots or sections with high concentration of people and school areas such as installation of safety signs (e.g. speed limit, pedestrians crossing etc) introduction of speed humps, Zebra and pelican crossings.
- The contractor must put concrete slabs or culverts on open drainage channel to allow access by residents and customers to their houses and shops/businesses respectively; in area with high concentration of people closed storm water channel should be used.
- In addition, a road safety awareness campaign will be implemented during and after construction, targeting all the local communities, including school children.
- Capacity building of district police (traffic) offices.
- Installation of proper road signs and regular inspections for their presence.
- Installation of speed control devices like humps and road safety signs.

- Installation of pedestrian lanes at human settlement crossings.
- Installation of street lighting for safety and security during the night.
- Introduction of Zebra and pelican crossings.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) presents the implementation schedule of the proposed mitigation measures to both environmental and social impacts as well as planning for long-term monitoring activities. For the proposed Zanzibar Urban upgrading and drainage integration works, the ESMP is given in Table 9.1. The ESMP also includes the associated environmental costs needed to implement the recommended mitigation measures. The engineering designs have already included some of the mitigation measures recommended in this report. Additional recommendations are provided in the ESMP to enable the drainage system construction to be more environmentally friendly.

9.1.1 Management Responsibility

The implementation steps will involve the Contractor, the Resident Engineer (Supervisor), Department of Environment, Department of Works, Department of Forestry, ZUMC, West "B" Municipal, ZEMA, DoURP, and the local communities at large. With financial and technical support from PMT, ZUMC has technical and human resources to successfully conduct supervisory oversight of ESMP implementation. The BIG-Z proponent is the RGoZ represented by the PO- Finance & Planning overseeng implementation of the project through PMT. n order to implement the ESMP the following role players are proposed:

Project Coordinator (PC)

The Developer is defined as the proponent or applicant (in this case, the POFP) and PC shall stand as developer representative. The POFP should appoint a Project Coordinator (PC) to implement the project;

- The PC will be responsible for overseeing the contract from initiation to completion of construction on the site;
- The PC will be responsible for ensuring that the development is implemented according to the requirements as set out in the ESMP;
- The PC should ensure that sufficient resources are available to the other role players to efficiently perform their tasks in terms of the ESMP; and
- The PC must appoint an independent Environmental Control Officer (ECO) to ensure strict adherence to the ESMP.

Zanzibar Environment Management Authority (ZEMA)

The responsibility of ZEMA is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Revolution Government of Zanzibar in the implementation of all policies, laws and regulations relating to the environment.

The Contractor

The persons/firms contracted to put up the proposed project infrastructure will be required to comply with the requirements of the ESMP within this report. To ensure strict compliance environmental specifications of this ESMP should form part of the contract documents. The contractor will report to the supervision consultant who represent the client on site. The client who is the RGoZ will be represented by PMT.

Consultant

The sourced consultant will have to ensure that the proposed ESMP is up to date and is being used by the contractor. Periodic audits of the ESMP will have to be done to ensure that its performance is as expected. The consultant will receive, review and approve all the progress report on the implementation of ESMP before forwarding the same to the Client who will be represented by the PMT.

Consulting Engineer (CE)

This means the engineer consulted during the construction period. The CE is not always present on site, but is part of the specialist team and responsible for designs.

Environmental and Social Coordinator (ESC)

The Environmental and social coordinator should be nominated from within the PMT before the start of the construction phase, or hired from the public. This role should be managed by the person who has the background as the Environmental and Social Safeguard Officer. The Environmental and social coordinator will be responsible for the following:

- Ensure that all contractors/subcontractors/employees are fully aware of their environmental and social responsibilities. This will take the form of an initial environmental awareness-training program in which requirements of the ESMP will be explained;
- Undertake on-going training of the workforce;
- The ESC shall monitor the developers' actions to ensure that the developers' staff and/or contractor are adhering to all the stipulations of the ESMP;
- The ESC shall be responsible for monitoring the construction activities throughout the project by means of undertaking site visits and meetings. These visits should be documented as part of the site meeting minutes;
- The ESC must sign off that the PM certifies the developer's compliance in ensuring all clean-up and rehabilitation or any remedial action required shall take place, and be completed prior to transfer of properties;
- A post construction environmental audit is to be conducted to ensure that all conditions in the ESMP have been adhered to.

Training and Capacity Development

The key appointment to ensure implementation of the ESMP is the ECO. The appointed ECO will require environmental, health and safety training for construction sites, and specific training on his/her expected roles and responsibilities, as outlined above.

The ideal candidate for the ESC would have experience on construction sites, experience of regulating Environmental, Health and Safety compliance, local knowledge and a strong interest in environmental issues. The estimated cost of training is 10,000US$.

Training of the appointed ECO would ideally involve one week of onsite training by an experienced environmental manager during the construction period. The aim of the training will be to establish good auditing procedures, identify ways in which to successfully implement the ESMP and continually improve environmental performance. The scope of the training would include;

- Weekly EHS toolbox talks;
- Environmental auditing;
- Non-conformance and emergency response procedures;
- Continual performance review and improvement; and
- Document control

Environmental Liaison Officer (ELO)

The sub-project Contractor shall designate among its staff /appoint an officer to act as Environmental Liaison Officer (ELO) and he/she will be responsible to ensure the environmental and social management mitigation measures are implemented during the contract period. The ELO will report to the EO at ZMC/PTCs/DoURP). The ELO after being provided with the required capacity shall be responsible for:

- Establishing contacts, procedures, memorandum of understanding (MOU), where applicable, for interaction with relevant authorities and communities.
- Keeping record of materials and technologies used and actions performed and reporting on the same (environmental monitoring and reporting).
- Documenting all complaints/conflicts/disagreements with details of the persons involved and the subject matter.
- Coordinating necessary studies/inspections of environmental performance (self-audits).

Community Liaison Officer (CLO)

Where necessary / required a representative of the community, as nominated by the community, will be the CLO and has the role of representing the community and managing all communication between the ECO, the Contractor and the public. The CLO shall be a member of respective Shehia and their detail shall be forwarded to the Sheha of a given Shehia. The CLO will be the contact person where all grievances or complaints are lodged by the public.

Social Specialist

This person will either be seconded from other government departments or hired from outside. This person will be knowledgable of all social issues in the construction works from spreading of HIV/AIDS, gender-based violence, poor working conditions, labour rights, community health and safety, resettlement, GRM and compensation, among others. This person will assist the project on day to day activities, including supervision of consultant's and contractors work and review of their progress reports in all social issues to ensure that the project activities are implemented smoothly.

9.2 Land Acquisition and Resettlement Officer at ZMC/PTCs/DoURP)

Overall responsible for ensuring that the ZMC/PTCs/DoURP complies with national requirements as relates to land acquisition and resettlement while attempting to influence, advise and support their efforts to comply to international best practice and requirements. The Land officer will also ensure that all relevant engagements and consultations are conducted with the affected households as relates to the subproject.

9.3 Environmental Audit

Environmental audits determine the long-term effects of adopted mitigation measures. Environmental audit is a legal requirement, there is therfore aneed to comply with the EIA & EA Regulations (2019) and ZNZ Environmental Act Section 46. Environmental audits will be carried out on the project as part of the on-going maintenance programme as per the EIA and Audit Regulations. The audits will unveil the actual performance of mitigation measures and will allow effective measures to be included in future projects based on the legislation in force. As per operative ESIA documents in Tanzania, environmental audits would be a responsibility of the developer (President's Office Finance and Planning) and the ZEMA.

9.4 Implementation of the ESMP

The environmental measures incorporated in the detailed engineering design will be attached to the Contract Documents. The Contractor shall take stock of the contents of the Environmental and Social Impact Assessment Statement of the Project.

An environmental expert should be appointed to assist the resident engineer, in order to make sure that the environmental measures recommended in this report are effectively complied with and timely adjusted whenever necessary. The expert will be familiar with the scientific measurement of environmental impacts and remedies. He/she will work on full time basis and may be selected, by the firm in-charge of supervision works. He/she will liaise with the relevant public agencies and will carry out the training scheme associated to his assignment.

During operational phase the Implementation of the ESMP shall be the responsibility of ZUMC, PMT, Department of Environment and Department of Forestry to a small extent.

In addition, the contractor shall prepare the implementation plans before commencement of the works. The plans shall be approved by the client through his consultant and they include;

- Site specific **ESMP,**
- Traffic Management Plan **(TMP),**
- Borrow Pit & Quarry Operation Plan **(BQP)**
- Landscaping Plan **(LP)**
- Biodiversity (Mangrove) Restoration Plan **(BRP)**
- HIV/AIDS Awareness Program,
- Road Safety Awareness Program,

- Occupational Health and Safety Awareness Program.
- Sexual Harassment Prevention Policy
- Hydological study

9.4.1 Personnel and Training

Upon consultation it was observed that, The BIG Z has Environmental expert who can be given the responsibilities to oversee the Implementation of the ESMP. Or else, Institution should hire/employ Environmental personnel with the minimum qualification of MSc. in the field of Environment especially environmental engineer. ZEMA also have got more than five (5) highly qualified personnel who can handle the Implementation of the ESMP

During Construction the Environmental expert of the supervision team will conduct on-job training to other Staff. This will strengthen them in participating to the implementation of the action plans (AP). The project will set a budget for this purpose. The environmental expert will design and deliver the environmental training.

9.5 Environmental costs

The principal environmental cost includes the cost of implementing the mitigation measures proposed and that of carrying out monitoring of specific environmental parameters. These costs are indicated in Table 9.1. It should be noted that most of the costs for mitigation measures are already included in the bills of quantities of the overall works. The costs of the environmental supervisor shall be included in the overall supervision cost of the works. The supervisor shall be engaged for at least 10 man-days a month over the entire construction period.

9.6 Mitigation Measures for Urban Upgrading Sub-Projects

The following table 9.1 presents mitigation measures that can be applied by contractors and the PMT broadly to mitigate environment, health and safety impacts of the types of urban upgrading activities (e.g. road development, drainage systems, street lighting, water supply, and solid waste collection points) that would be undertaken by the PMT, ZUMC, West “B” Municipal and PTCs. ESMPs will be tailored to each subproject, which can draw from the following mitigation measures.

Table 9. 1; Environmental and Social Management Plan (ESMP) for the Proposed Zanzibar urban upgrading and drainage integration

	IMPACT	MITIGATION MEASURE	RESPONSIBLE INSTITUTION	TIME FRAME	ESTIMATED COST (TSH)
Mobilization phase					
Potential Environmental impacts	**(Air, Noise and Vibration pollution)**	The contractor will implement the following measures: - No working at night especially in areas with settlements/public services like hospitals. - The construction work should not be permitted during the nights, the operations on site shall be restricted to 07.00hrs -19.00hrs. - Use protective gears like helmets and dust masks by the demolition crew - Ensure that all vehicles involved in the transport of construction material and staff, and machinery involved in the construction is properly maintained and serviced. - Noisy operations will be carried out strictly during the day time. - Where possible silenced machinery and instruments should be employed to reduce the impact of noise and vibration on the existing residents and workers. - The local residents will be kept informed of the planned works and advised in advance of noisy works.	Contractor/ Env. Supervisor, PMT	During Mobilization and before Construction	6,000,000
	Loss of trees and biodiversity	- Re-plant the indigenous vegetation as much as practical once work is completed by the original species. - Spare the vegetation that must not necessarily be removed. - The landscaping plan should seek to avoid the use of non-native and potentially invasive species.	Contractor/ Supervisor/ (Forest department)/ ZEMA, PMT, ZUMC, West "B" Municipal Council,	before Construction	4,500,000

Potential Social impacts	**Land expropriation, Loss of Property and resettlement**	- Compensation shall be done according to WB and/or Zanzibar land laws governing resettlement before commencement of the construction activities. - Resettlement Action Plan shall be prepared and observed. - The site of construction camp will be acquired by renting or buying. - The land acquired will be compensated at full replacement rate (in kind compensation is recommended) covering the properties and land to be affected. - Provision of accessible alternative site for the affected business owners - Consultation with Shehas and religious leaders, community members shall be done to arrange for the procedures to relocate the religious properties, toilets, septic tanks before demolishing the existing ones. - The compensation shall be paid in advance (before commencement of construction) to enable re construction of infrastructures before demolition of the existing buildings. - More details can be found in the Resettlement Action Plan appended to this report.	PMT/Chief governmental valuer/ Supervision Consultant/Contractor, Shehas/ religious leaders	Before construction phase	Covered in the RAP
	Road accident and traffic congestion increase	- Ensuring that the drivers and machine operators hired to work on the site are qualified. - Appropriate signs must be erected on the site to warn workers and visitors - Ensure that the traffic flow is not interfered during the whole construction period. - No total closure of the road will be allowed. - Ensure that all vehicles involved in the transport of construction material and staff, and machinery involved in the construction is properly maintained and serviced. - Project design to take into account safety concerns especially at human habitation crossings e.g. installation of bus stops at business/resettlement areas. - Appropriate road sign should be provided to direct drivers all the safety signs to avoid accidents. - The drivers shall not drive while drunk, hence, there should be an alcoholic testing program to the drivers. - There should be safety policy clearly displayed at the sites. - Public awareness raising shall be done.	Contractor, Supervising Engineer, PMT, Traffic Police, local communities	Before Construction Phase	Part of the main BOQ
Construction phase					

Potential Environmental impacts	**Air pollution (Dust and Gaseous pollution)**	- Watering road section (near human habitation) without causing erosion or runoff - Environmental and sanitation awareness raising - The Contractors and facility operators shall ensure to institute procedures for preventive maintenance of equipment. - Proper choice of equipment which offer environmental advantages - Proper planning and designing of waste collection facilities - Avoid excavation, handling and transport of erodible materials under windy conditions. - Institute traffic management and safety programme including proper signage and training of heavy machine/vehicle operators and drivers, enforcement of speed limits, maximum loading restrictions and compliance with Zanzibar transportation laws and standards especially when crossing inhabited or sensitive areas. - Vehicles carrying fine construction materials must be covered during transportation. - Ensure regular cleaning of access roads and unpaved areas to avoid dust pollution due to wind or movement of vehicles and equipment.	Contractor/ Env. Supervisor, PMT, local community	During Mobilization and Construction	12,500,000
	Noise pollution	- Provide working gear to workers - Locating quarry areas away from human habitations (at least 500 m away) and ensure Environmental and sanitation awareness raising - Proper choice of equipment which offer environmental advantages - Adopt and maintain moderate vehicle speed and traffic when crossing inhabited or sensitive areas. - Noise emissions shall comply with applicable national laws, standards and regulations. - Maintain construction equipment in good running condition, enforce vehicle/road restrictions and carry out routine inspection of construction equipment - Operate noise generating equipment for short periods or during the times they will cause less community disturbance i.e. daylight. - Stationary noise generating equipment shall be placed as far away as possible from sensitive receptors and/or shall be housed inside a shed or covered to reduce the propagation of noise	Contractor/ Env. Supervisor, PMT, local community	During Mobilization and Construction	6,000,000

	Vibration pollution	- Advance notice to local communities - Proper location of quarry sites	Contractor, PMT, local community	Construction	4,000,000
	degradation of resources management	- The contractor shall consult ZEMA, Department of Forestry and Non-Renewable Resources, and the Department of Roads before any extraction of materials - All borrow pits and quarries shall be rehabilitated and proper landscaping done after completion of the feeder roads construction. Pits shall not be left with steep or vertical side - The topsoil shall be stock piled for later use in reinstating the pit. Shallow slopes will encourage rapid re-vegetation thus preventing erosion as well as providing safety to animals - The significance to the region of the depletion of the material assets is not considered to be high as deposits throughout the remainder of the region will not be significantly affected by this project and they remain available for other projects - Obtaining sand from valleys and river sides must be well investigated to avoid accelerated land degradation and pollution of water sources and/or interfere with agricultural activities in farmland	Contractor/Consultant/Shehas/Supervisor/ PMT	During, Construction	Part of the main BOQ
Potential Environmental impacts	**Increased water pollution and soil degradation and depletion**	- Contractor shall identify erosion prone areas, identify permanent erosion control measures (applicable for a particular site) and plan construction works and sites to limit quantity of material likely to be eroded and transported from the site. - Contractor shall ensure there is an Environmental and sanitation awareness raising - The contractor must ensure that the new toilets and septic tanks are constructed before demolishing the old ones. - Spillage of fuels and chemicals is a risk, but spillages are likely to be local and remediation is considered easy. - Spillage to watercourse is harmful to all living beings. In case of accidental spillage, the contractor shall exercise every effort in order to minimize the associated risks. For instance, refueling of plant or transfer of materials should not be carried out near water bodies, and any local spillage to soil should immediately be remedied. - Good housekeeping shall be practiced within material storage compounds or vehicle maintenance yards where the possibility of spillage is great. This	Contractor, Env/ Supervisor/ZEMA, ZMC, PMT, local community	During Construction	Part of the main BOQ

		can easily be done by provision of Spill tanks and Secondary containment at vehicle maintenance yards. - The contractor should Plant vetiver grass to minimize exposed soil surface area where necessary. - Surface clearance will be minimized. Cleared surface will be stabilized by re-vegetating with natural vegetation. - Avoid unnecessary disturbance of soil cover. In addition, the water flow speeds, especially for side drains will be controlled by constructing erosion checks. - The use of silt fences, Screen and hay bales to remove suspended solids from surface water runoff. - Identify what type of solid or liquid wastes and categories of wastes the project will generate or handle (biodegradable / organic wastes; packaging materials; non-biodegradable (metallic, plastic), construction wastes, and hazardous wastes i.e. fuels, oils, lubricants, vehicle / machinery fluids and excavated materials); - Identify ways to reduce the volume of waste by reusing or recycling initiatives; - Use best available mechanisms, practices and technologies for waste collection, storage, transportation, treatment and final disposal. The management measures are coupled with implementation of monitoring plan which set targets based on standards to ensure that proposed mitigationmeasures are correctly implemented or that adjustments are made to accommodate changes.			
	Pollution due to waste generated	- Disposal wastes shall be done in accordance to clause 1713 of the Standard Specifications for Road Works 2000. - The contractor must ensure that the new toilets and septic tanks are constructed before demolishing the old ones. - The sludge/sewage from demolished septic tanks and toilets shall be disposed of into the designated area by the ZUMC and West "B" Municipal e.g. septage treatment facility at Kibele. - Small volumes of organic waste that can easily decompose must be disposed-off in environmentally friendly manner such as the use of pits. - Large volumes of wastes produced, including construction and demolition debris, slurry, must be collected by licensed private/municipal service providers for appropriate disposal e.g. in land-fills.	Contractor, Supervising Consultant, PMT, ZEMA, ZUMC, West "B" Municipal ,local communities	Construction Phase	14,000,000

		- Office waste should be sorted and storage in four different types of waste bins i.e. for paper materials; organic materials; glass wastes; and plastics; and separately disposed. - Only inert materials or readily decomposable materials shall be disposed by burial. - The burning of waste materials which produces black smoke shall be approved on its significant impacts in the environment, otherwise these materials shall be disposed of and be properly treated. Plastics shall not be burned. - No open burning of oils shall be done. - Sediments prevention from entering drainage system, hence should be a frequency cleaning of the drainage channels - Contractor shall ensure there is an Environmental and sanitation awareness raising			
	Interference to local hydrology	- The hydrological study will be conducted to understand the underground water flow system. - Good design and engineering practice shall be adopted to ensure that the changes of the hydrological regimes are minimized and that any impacts are insignificant. - Ensure the drainage designs utilize as much as possible the existing channels and drains. - Where possible, the designs shall leave some unpaved space alongside the road for water to seep into the ground. - The design will provide controlled and effective storm water dispersion by installation of adequate and appropriate drainage structures. - The discharges points shall be well designed to avoid accelerate erosion downstream and beach erosion.	Design engineer/ PMT/ZEMA/ Local communities/ ZUMC, West "B" Municipal, ZAWA	Construction Phase	17,000,000

	Loss of Vegetation and biodiversity	- The contractor shall seek permit from the Department of Forestry before falling of any Tree. - The drainage systems design shall try as practicable to offset the route so as to avoid felling of big trees that take many years to grow or other flora of outstanding importance. The contractor shall from time to time bring to site a Forester from Department of forestry to check for existence of such flora. - Close supervision of earthworks shall be observed in order to confine land clearance within the proposed new drainage boundaries. Farmers will be notified early enough to enable them harvest the affected crops on time and/or compensated to enable them create new farms. - Topsoil shall be stockpiled and used for reinstating flora along the road and drainage. It is assumed that displaced fauna will return once the work is over, or seek another habitat locally. - The contractor shall be instructed to give the uprooted trees/thickets in the road reserve area. Local governments or any other arrangement may seem convenient provided he does not contravene the Forest Act 1997. - The drainage design and expansion shall try as practicable to offset the route so as to minimize the destruction of mangroves, for instance at the outlet of system C, - Prevent sediment and solid waste introduction to the sea as to protect breeding site for the fish and other marine organisms into shoreline and under mangroves. - The budget for re planting of the trees along the project road shall be part and parcel of the project costs. Department of Forestry shall handle the replanting of trees.	Contractor/ Supervisor/ (Forestry department)/ ZEMA, PMT	During Construction	15,000,000
	Destruction of sensitive areas	- The road design shall try as practicable to offset the route so as to minimize the destruction of Mangroves. - Replanting of mangrove stalks to compensate for the lost biota - The contractor shall seek permit from the Department of forestry before falling of any Mangrove Tree.	Designers/ Contractor/ Department of forestry/ ZEMA	During Design and Construction	12,000,000
Po-ten-	**Destruction of Public Utilities, infrastructure,**	- The ZECO, TTCL ZUMC, West "B" Municipal and ZAWA shall be involved from the early stages of this project so as to have an integrated planning. - Early notice shall be given to the community before any service interruption. - Relocation of Utilities shall be done and considered.	Contractor/ supervision Consultant /PMT/	Design and Construction	Part of the main BOQ

	services and access	- The funds for the relocation of this infrastructure shall be part and parcel of the project. - Avoidance strategies such as sidestepping settled areas, sensitive / important natural or social / cultural or economic features in order to avoid /minimize extensive resettlement - Use of existing undeveloped areas available in the ZMC land use plans - Install lighting at night (where necessary), to ensure safe traffic movement. - Relax the required construction standards: in some cases, expansion of diameters or extension of lengths of existing culverts/bridge and drainage channels. - Add structures to design (e.g. walking slabs, culverts) meant to facilitate access and crossing over linear infrastructures such as drainage channels/crossings	ZECO/ZAWA, TTCL		
	Increased Immigration and labour influx impacts	- Capacity building of district police (immigration) officers and Shehia leaders - Implement awareness campaign on the impact of labour influx - Implement interventions on sexual and reproductive health including providing information regarding transmission and safer sex practices - The contractor shall employ locally available labour - The contract shall direct the contractor to observe all Zanzibar traditional norms and values. - A contract shall provide a site-specific ESMP with management plans for: (i) work activities; (ii) traffic management; (iii) occupational health and safety; (IV) environmental management; (v) social management; and (VI) labour influx. - A Contractor will implement civil works in accordance with ESMP- including all works conducted by sub-contractors under the contractor's control. - A contractor is required to train workers on roles and responsibilities under these plans, policies and standards. - He/she is required to submit regularly safety health reports to the Borrower on implementation. - Proactively address any issues that arise. - Contactor should Reduce labour influx by tapping into the local workforce and He/she is required to Assess and manage labour influx risk based on risks identified in this ESIA. - A contractor shall Incorporate social and environmental mitigation measures into the civil works contract.	PMT, Contractor, and project implementing partners Police/immigration sector	During Construction	10,500,000

	Resource use conflict	- The contractor shall consult ZAWA before any abstraction of water in the project area. - The amount of water given to the contractor shall consider the local community around the project area and downstream of the water course. - Watering should be done to those places with significant dust levels and near the villages to minimize water wastage. - All workers for the project will sign code of conduct, among other, it will prevent illegal utilization of natural resources, - Implement water use efficiency measures - Secure before abstracting water from other sources - Contractor shall consider Harvesting rainwater for use during construction	Contractor/ ZAWA technical Offices, PMT,	Construction Phase	Part of the main BOQ
	Gender Based Violation impact	- Education and awareness creation, law enforcement - Ensure equitable distribution of employment opportunities between men and women - The contractor will integrate measures for prevention and handling Gender Based Violence (GBV) and Sexual Exploitation and Abuse (SEA) in the contractor's environmental and social management plan (C-ESMP). - Every Gender Based Violence (GBV)-related incident should be recorded, reported and appropriate actions taken. - The contractor will develop an induction Programme, including a Code of Conduct, for all workers directly related to this project - Employ more community women in skilled and clerical positions. - Provide means for women workers and other community members to report abuse in the work place - All workers will sign code of conduct to prevent gender related violence. Breach of code of conduct the result into suspension or termination of the contract - Conduct monthly community leader's engagement meeting to discuss incidents related to violence against girls and women involving project workers.	PMT/ Contractor	Construction Phase	20,000,000
Occupation and Health	**Potential threats from spread of STDs and communicable diseases**	- Safety, Health and Environment (SHE) training and induction course - Provide Voluntary Counselling and Testing (VCT) centers for STDs, HIV/AIDs and other communicable diseases like COVID-19 at work place, - Enforce HIV/AIDS law and regulations - Support HIV/AIDS campaigns	Contractor/Department of health/PMT/local communities	Construction Phase	25,500,000

		- Develop an induction Programme, including a Code of Conduct, for all workers directly related to this project. A copy of the Code of Conduct should be presented to all workers and signed by each one.			
	Safety and health risks	- A well-stocked First Aid kit (administered by medical personnel) shall be maintained at each camp, quarry sites and each active work section along the drainage systems. - Comply with Zanzibar and World Bank and other international standards and regulations on health and safety requirements. - Develop and implement in-house manual/guidelines on health and safety - Keep detailed incident reports in the case of accidents. - Implement community sensitization programs on the risk for public health and safety caused by project implementation. - Attach warning signs, barriers, and other precautionary signs on all areas of potential risk. - Prepare and implement action plan to cope with risks and emergencies including having emergency first aid equipment available at construction sites. - Train workers in occupational health and safety regulations. - Provide separate passageways for pedestrians and vehicles within and outside construction areas. - Ensure that workers wear/use appropriate personal protective equipment (PPE), such as safety glasses, face shields, hard hats, safety shoes, noise protection ear muffs etc. - When working in confined spaces, such as deep excavation (trenches) use dewatering, adequate side-wall supports (shoring) and slope gradients that minimize the risks of collapse, entrapment or drowning.	Contractor/ Supervising consultant, PMT, project implementing partners	Construction Phase	20,000,000
	Increased Accidents and community safety risk	- The drainage and road design shall take account of safety concerns especially at human habitation crossings. - Access to the construction site and work areas should be confined to existing roads. - The workers shall be provided with the protected equipment to protect them from cement dusts, dust and fumes and enhancing safety. - Establishing Occupational Health and Environment induction course - Provide working gears and good camp management. - Installing well-stocked First Aid Kit at every camp site	Design team/ Traffic Police/ Contractor, Supervising Consultant, PMT, ZEMA, Directorate of Health	Construction Phase	30,000,000

		- Traffic management plan shall be incorporated in the designs to include for example details of signs, markings, intersection layouts, access restrictions, bus stops, crossings, footpaths etc. - Installation of the street lighting to avoid accident and increase safety during the night. - The traffic management plans shall be presented both in English and Swahili. - Fencing site area to prevent movement of unauthorized people.	and Safety, local communities		
Operation phase					
Potential Environmental Impacts	**Pollution due to waste generated**	- Capacity building to the community on proper solid waste management - There shall be a use of existing environmental committee at grass-root level i.e. Sheha's office for raising awareness in each Shehia regarding health and legal consequences of illegal disposal of domestic wastewater into drainage channel. - The committee shall be dedicated in monitoring illegal disposal of wastewater and taking necessary actions according to municipal/town councils bylaws. - Frequency cleanliness of the drainage channels to prevent obstruction from sand and solid wastes. - Waste should be disposed in designated sites as approved by ZEMA. - Signage, filling pits and restoration of hazardous and disturbed areas. - Proper drainage system design to prevent introduction of solid wastes and sediments to the sea. - Underground drainage shall be designed to contain manholes and ventilation for easy accessibility during maintenance and cleaning. - Frequent collecting of solid wastes from collection point to be transported to the proposed dump site - Assessment and reuse of the excavated materials to reduce bulk of wastes to the site area. - Apply for discharge permit and conduct water quality monitoring quarterly as required by law.	Designers/ Contractor/ ZUMC/ West "B" Municipal ZEMA	During operation	10,000,000
	Increased environmental pollution (Noise,	- Road design shall include measures to reduce noise. - Steep grades at critical locations shall be avoided so as to reduce noise from acceleration, braking and gear changes. - Cut sections shall be used (where appropriate) to decrease noise in nearby residences.	Vehicle Licensing Authority, ZEMA, ZUMC,	Operation phase	Part of the main BOQ

	vibration and air pollution	- Speed limit and exhaust controls shall be enforced, especially in towns. - Contractor shall ensure there is an Environmental and sanitation awareness raising.	West "B" Municipal		
Social impacts	**Increased Road accidents**	- Capacity building of district police (traffic) officers - Awareness creation to the community on proper way of using the roads - Contractor shall ensure there is an Environmental and sanitation awareness raising - Installation of proper road signs and regular inspections for their presence - Installation of speed control devices like humps and road safety signs - Installation of pedestrian lanes at human settlement crossings - Installation of street lighting for safety and security during the night	Consultant/PMT/ / Contractor, Vehicle Licensing Authority	Operation phase	10,000,000
Occupation Health and safety impacts.	**Risk to community safety**	- Prepare drainage systems maintenance manual as well as street light maintenance manual including safety measures specific to Zanzibar - Cover the open drainage - Proper maintainace and repair of broken drainage lids - Barricaded (fencing or guarding) working area to prevent workers or equipment being struck by traffic - Place road danger light at the beginning/end of barricade at night - Use clearly visible, conspicuous and easily understood signs, notices and markings - Use temporary speed control such as potable humps to reduce traffic speed	Consultant, Contractor, PMT, ZUMC, West "B" Municipal, DoR	During operation phase	**15,000,000**
Total estimated Cost					**332,000,000**

9.7 Resettlement Action Plan associated with ESIA

A key impact of the BIG-Z is the potential involuntary resettlement and disruption of project affected people (PAPs), as well as potential damage to property. A key mitigation measure is the development and implementation of a Resettlement Action Plan (RAP). The RAP has already investigated in detail these potential impacts and build an action plan to provide compensation for PAPs. The fundamental objective of this RAP is to provide an acceptable plan for the land access, compensation and resettlement of communities and individuals affected by the proposed Project in seven shehias (Mombasa, Tomondo, Kwa wazee, Meya, Sebleni, Mgomeni and Makadara) of Zanzibar Urban Municipal Council (ZUMC) and West "B" Municipal in Urban West Region in which the project will be implemented. The plan provides a guide for resolving displacement, resettlement and compensation issues including the following:

- Identification of project Impacts and affected population (through mapping, censuses, asset inventories, socioeconomic studies and consultation);
- An outline of the RGoZ legal and compensation framework and the safeguard policies of World Bank;
- Resettlement assistance programs;
- Budget and implementation schedule;
- Organizational responsibilities;
- Grievance redress; and Monitoring and evaluation mechanisms.

The proposed Project will involve land acquisition in seven shehias where roads will be upgraded and new ones built, channels will be constructed and folds will be drained. Currently, the proposed site is utilized for various uses such as residential, commercial and small-scale urban agricultural activities. Therefore, BIG-Z is preparing this RAP to ensure that land acquisition for project implementation is undertaken in compliance with various acts and regulations on land acquisitions and resettlement of RGoZ as well as WB safeguard policies and operational standards for involuntary resettlement.

Although, RAP is stand-alone document, but the linkage that will be explored by the RAP (a specific mitigation measure identified as part of the ESIA) is addressing the impact of resentment, land acquisition, and loss of properties, Degradation of local air quality and water availability due to resource use conflict impact. These measures can include compensation and proper use of resource for affected people, provision of alternative use of resources and proper waste generation management.

9.8 GRIEVANCE REDRESS MECHANISM (GRM)

A Grievance Redress Mechanism (GRM) is a set of arrangements that enable local communities, employees, out growers, and other affected stakeholders to raise grievances with the investor and seek redress when they perceive a negative impact arising from the project activities.

It also plays a critical role in preventing negative interruptions in project implementation occasioned by legal redress that are costly and time consuming. Further, the GRM have become one of key performance rating factor and requirement for World Bank-funded projects globally. It spells out avenues to mitigate grievances from stakeholders and provides a legitimate, accessible and cost-

effective avenue for receiving and addressing grievances whenever they occur. It is on this basis that it was found necessary to put in place a GRM for this project. GRMs have been operated with varying degrees of success. It outlines general grievance procedures applicable for any PAPs with concerns about broader project activities and grievances related to other social issues such as gender-based violence and sexual harassment (GBV/SH). Grievance redress mechanism specific to subproject will be prepared before commencement of construction phase.

To ensure that the GRM is giving stakeholders a voice, the meetings were held before the census and inventory and valuation of assets begun to explain to the affected people and to the community leaders and representatives the need for having in place a robust procedure for receiving and re-solving complaints and grievances that are likely to arise in the course of project implementation. Addressing grievances early is best as seemingly minor complaints can quickly become major griev-ances if left unmanaged.

9.8.1 Grievance Redress Committees – GRCs

GRMs are also an important tool for addressing employee grievances, especially as many may be first-time workers operating in an unknown business culture. A separate mechanism is set up to deal with their grievances**.**

Strong contractor management is another way to avoid grievances, as in some cases it is contractors who are interacting directly with communities. There could be confusion between an investor and its contractors. Communities may have grievances against contractors, but not realize that the con-tractors are controlled by the investor. To ensure all Environmental and social complaints are well captured, the following are the committee composed to deal with grievances:

Table 9. 2Committees for grievance redress mechanisms

Resettlement Committee	**Compensation Committee**	**Grievances Redress Committee (GRC)**
• PMT- Coordinator (Chair) • Representative of District Commissioner • Representative of subproject proponent • Representative of Ministry of Lands • Consultant • Representative of a local Administrators/Shehia • Representative of PAPs	• Principal secretary of President's Office, Finance and Planning (Chair) • Representative of District Commissioner • Representative of subproject proponent • Representative of Ministry of Lands • Consultant • Representative from the PMT • Valuer • Representative of PAPs	• District Commissioner (Chair) • Representative of subproject proponent • Representative of Ministry of Lands • Valuer and resident engineer • Representative from PMT • Representative of PAPs • Representative of a local NGO

9.8.2 Types of Grievances

Different types of grievances surface at different stages of the project cycle, e.g., during project design and planning, during project implementation or during project operation phase. Grievances are also spread over a wide range of issues and concerns. Concerning to the activities in this Project, following types of grievances could arise;

- Land related grievances and resettlement grievances
- Grievances related to the traffic congestion during construction and operation phase.
- Grievances regarding environmental and social impacts due to the contractor work (dust, sanitation and noise due to construction activities etc.).
- Delay in the salaries of labors.
- Grievances raised by contractor
- Grievance of vulnerable group including women in the construction area
- Any other issue pertinent to the engineering work like quality of work or delay in the construction work
- Grievance related to gender issues, public health and risks
- GRM system can also register any types of complaints including financial management, recruitment, procurement and GRM focal point is tasked to check out with the relevant unit to address the grievance.

9.8.3 Complaints Resolution Procedures

This GRM is referenced in the RAP of Integrated Drainage and Resilient Urban Upgrading in Zanzibar Town project. Other social grievances shall also be resolved following RAP-Grievance procedures. It is through negotiation and mediation procedures proposed by stakeholders that emulates the existing conflicts resolution process through the local government administrative structure but strengthened by some multi-stakeholders' committee formed specifically for this project. The GRM procedure involves the use of existing conflicts resolution mechanisms through local government system.

All PAPs were informed of the existence of the current GRM through their Shehas and awareness and consultation meetings during RAP preparation exercise. They were also informed about the means of accessing GRM all procedures on how they can log their grievances, namely that they can log their complaints by either reporting the matter directly to the Sheha who will record the complaints in the complaint logbook, or by reporting directly to the District grievance committee, PMT BIG-Z project office where he/she will fill special grievance forms.

Other means of reporting grievance to the Project Management Team (PMT), Shehas and District Officer are though telephone, mail, in person and complaint boxes. Public and PAPs in particular will be informed on all available means and places of logging their grievance. Anonymous grievances will also receive and dealt accordingly.

9.8.3.1 Resettlement Related Grievances

All attempts would be made to settle grievances. Those seeking redress and wishing to state grievances would do so by notifying their Sheha who is the government representative at Shehia level. For resettlement issues, the Sheha will inform and consult with the Resettlement Committee for compensation issues, to determine claims validity. If valid, the local Sheha will notify the complainant and s/he will be settled. If the complainants' claim is rejected, then the matter will be brought before the Regional Administration for settlement. The decision of the Regional Administration would be final and all such decisions must be reached within a full growing season after the complaint is lodged. If a complaint pattern emerges, the subproject proponent, regional administration and the department of lands will discuss possible remediation. The local leaders will be required to give advice concerning the need for revisions of procedures. Once they agree on

necessary and appropriate changes, then a written description of the changed process will be made. The subproject proponent, the Regional Administration and Sheha will be responsible for communicating any changes to future potential PAPs when the consultation process with them begins.

9.8.3.2 General grievances

A Grievance Redress Committee (GRC) will be responsible to register and address the grievance raised by the PAPs or by the representative of PAPs. The Grievance Redress Committee will try as much as possible to arrive at a compromise for the complaints raised. This may be obtained through series of conciliations, mediations and negotiations exercises conducted with the PAPs. If PAPs accept the recommendations made by the committee, the committee along with PAPs who are willing to take part in these proceedings may hold mediations at the appointed places. In situations where PAPs are not satisfied with the decision of Grievance Redress committee, the PAPs can approach the Tribunal/court of law. The response time for cases handled in the committee will depend on the issues addressed but it should be as short as it is possible.

9.8.3.3 GBV/SH related grievances

Grievances related to GBV/SH will be received using different approaches. The grievance redress Mechanism (GRM)for each subproject will include multiple channels through which complaints can be registered in a safe and confidential manner, specific to the nature of the investment. The complainant reporting GBV related grievance for subprojects financed under BIG-Z project will be asked, at most, the following information:

- type of complaint (explain of his/her own words without direct questioning),
- if the perpetrator was associated with the project,
- sex and age of the survivor

The grievance redress committee will ensure GBV survivors of access to service (psychological, health, security, shelter etc.), adopt survivor centered approach when resolving the grievance while maintaining confidentiality and treating survivors equally and fairly.

9.9 Time Frame and the steps taken in addressing complaints

Under negotiation and mediation procedure, the time frame for grievance resolution is as follows;

i. Complaint received in writing from affected person;
ii. Recording of grievance in standard form; this includes: 1) collecting grievances; 2) recording grievances as they come in; 3) registering them in a central place; and 4) tracking them throughout the processing cycle to reflect their status and importance
iii. Reconnaissance site visit with the complainant; the grievances will need to undergo some degree of review and investigation, depending on the type of grievance and clarity of circumstances
iv. Submission of detailed complaint to Resident Engineer for resolution by negotiation within 3days.

v. Submission of detailed complaint to the Grievance Committee for resolution by mediation within 5days.
vi. Submission of complaint to PMT for resolution.
vii. Developing Resolution Options and Preparing a Response: Once the grievance is well understood, resolution options can be developed taking into consideration Stakeholders preferences, project policy, past experience, current issues, and potential outcomes
viii. Monitoring, Reporting and Evaluating a Grievance Mechanism: Monitoring and reporting can be tools for measuring the effectiveness of the grievance mechanism and the efficient use of resources, and for determining broad trends and recurring problems so they can be resolved proactively before they become points of contention. Monitoring and reporting also create a base level of information that can be used to report back to communities.

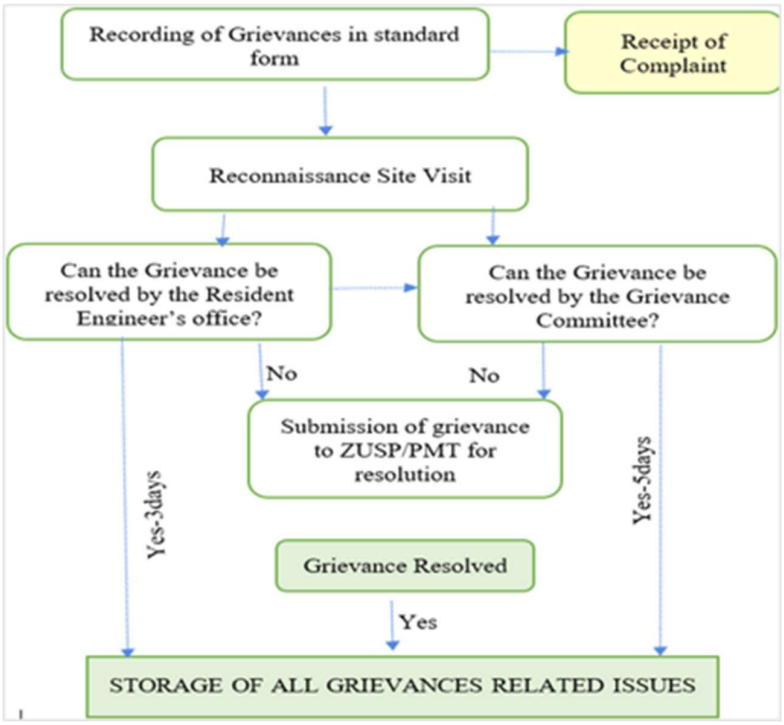


Figure 9. 1; Grievance Redress Mechanism steps

9.9.1 Recording and Processing of grievances

All submitted complaints and grievances will be entered into a database and GRM log book which will be updated regularly. Each complaint and grievance should be ranked, analyzed and monitored according to type, accessibility and degree of priority. A database will be established to track complaints and their resolution.

9.9.2 Monitoring and Reporting

To ensure smooth operation of GRM, Drainage integration and Resilient urban upgrading in Zanzibar management will conduct frequent supervisions and monitoring missions on grievances handling system to ensure the GRM is functioning and included in regular reporting mechanism. The status of grievances submitted and grievance redress will be reported by project implementation unit safeguards staff to the core team management through monthly reports

9.10 INSTITUTIONAL ARRANGEMENT AND CAPACITY BUILDING

9.10.1 GRM Institutional Arrangement

In order to implement the GRM and functionality of GRC ESM specialist (GRM focal point at PMT) has been hired who is responsible to oversee and supervise the grievances reporting and GRM database. At subproject level GRC members with the guidance of the ESM specialist will be responsible to manage

the GRM.

9.10.2 GRM Implementation Training for GRC and stakeholders

Based on the GRM, it is required to develop a GRM training manual in local languages and the Project Staff, contractors, GRC members, project stakeholders and beneficiaries should be trained accordingly.

In order to have proper implementation of GRM, first of all GRC members would be familiarized to best ways of collecting, redressing, and referring of some critical cases to referral points, reporting plus giving feedbacks in a proper way.

9.10.3 Awareness trainings of staff members

There is need to raise awareness and train the SGRP staffs specially engineers and M& E staff on procedure and mechanisms of GRM implementation within Drainage integration and Resilient urban upgrading in Zanzibar project.

10 ENVIRONMENTAL AND SOCIAL MONITORING PLAN

10.1 Environmental and Social Monitoring overview

Monitoring of the anticipated environmental and social impacts in the receiving environments is important. It helps in determining the effects of the project activities on the environments enhancing understanding of cause effect relationships between human activities and environmental changes, and verifies the accuracy of prediction about the environmental impacts. It ensures compliance with regulatory measures and understanding the degree of implementation of ESMoP and its effectiveness. The monitoring results are also used extensively during the environmental auditing.

The law requires the developer to prepare and undertake monitoring plan and regular auditing. Monitoring is needed to check if and to what extent the impacts are mitigated, benefits enhanced and new problems addressed. Recommendations for monitoring have been included in the ESMoP (Table 10.1). The ESMoP also assigns responsibilities for monitoring activities.

10.2 Environmental Audit

It is recommended that environmental audits determine the long-term effects of adopted mitigation measures. It is recommended that environmental audits be carried out on the project as part of the on-going maintenance programme. The audits will unveil the actual performance of mitigation measures and will allow effective measures to be included in future projects based on the legislation in force. Environmental audits would be a responsibility of the developer (BIG-Z) and the ZEMA. The Normal audits should be performed once a year or when one of the following happens;

10.3 Systemic noncompliance's that need a deeper analysis of root causes and/or management Plan Monitoring Responsibility

PMT in collaboration with, the Department of Urban and Rural Planning (DoURP), ZEMA and the Zanzibar Urban Municipality Council (ZUMC) and West "B" Municipal will implement the ESMoP, supervise and monitor all components of the plan and maintain detailed records of monitoring outcomes. PMT has technical capacity and human resources to successfully conduct supervisory oversight of ESMoP implementation.

10.3.1 Monitoring Parameters

The selection of the parameters to be monitored is based on the high likelihood of occurrences of the selected parameters. Monitoring of these parameters will be done in various stages of the project as follows;

→ **Mobilization stage:** Monitoring of the parameters at this stage is meant to establish the baseline information of the target parameters in the project area.
→ **Construction stage:** Monitoring at this stage is meant to establish the pollution levels that arise from the construction activities.
→ **Operation stage:** Monitoring at this stage is meant to check on the impacts that might arise as the result of normal use of the infrastructure. The responsibility for mitigation monitoring during the operation phase will lie with the Environmental Section in PMT and ZEMA

→ **Decommissioning:** Decommissioning is not anticipated in the foreseeable future. However, if this will happen, may entail change of use (functional changes) or demolition triggered by change of land use. Monitoring at this stage will be meant to establish the pollution levels that will arise from the decommissioning activities.

The results of the inspection and monitoring activities will be reported to the Client. Monitoring should check if and to what extent the impacts are mitigated, benefits have been enhanced, and new environmental, social-economic issues are adequately addressed.

Table 10. 1: Environmental and Social Monitoring Plan (ESMoP) for the Proposed Zanzibar Urban upgrading and drainage integration project

Parameters		Monitoring frequency	Monitoring Area	Measurement Units	Method	Target level/ Standard	Responsibility for monitoring	Annual costs estimate (TSH)
Mobilization stage								
Air quality	Suspended Particles/ Dust / (Carbon dioxide (CO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and methane (CH_4) gases).	Once during baseline study, and as needed for pollution control	Near the settlement area/around construction site	µg/m^3	Micro Dust Pro/ Dust level meter, Combustion Gas analyzer or dragger pump with detector tubes,	ZBS/TBS standards and international standards	Contractor/ Env. Supervisor/ECO	5,000,000
Noise Baseline	Noise level	Once during baseline study, and as needed for pollution control	Near settlements/around construction site	dBA	Noise Level Meter	Zanzibar Bureau of standards/TBS and international standards	Contractor/ Env. Supervisor/ECO, ZEMA	5,000,000
Water Quality	Turbidity/Bio-chemical (BOD)	Once before the construction starts	All drainage systems and ponds and bore holes near the	(NTU, mg/l)	Laboratory analysis	BOD-30mg/l, ZBS Standards (	Contractor/ Env. Supervisor, ZAWA, ECO	10,000,000

Parameters		Monitoring frequency	Monitoring Area	Measurement Units	Method	Target level/ Standard	Responsibility for monitoring	Annual costs estimate (TSH)
			selected areas					
Loss of trees and Biodiversity	Baseline information on biodiversity	Once before the construction work starts	All trees and mangroves along the drainage channels and roads	type and number of living organisms	Counting and Observation	-	Contractor/ Env. Supervisors, Department of Forestry, ECO	3,500,000
Land expropriation, Loss of Property and resettlement	Rate of compensation for land and properties	Once before the construction starts	All affected people around construction area	- Number of PAPs compensated gender aggregate/Amount of funds paid for compensation	Resettlement Action Plan (RAP) and file records and inquiry	All PAPs to be compensated	PMT, Ministry of Lands and Local Governments	Covered in the RAP
Construction stage								
Air pollution	suspended Particles/Dust	Once Per week	Near settlements Around construction site	µg/m^3	Visual Observation, laboratory test, Micro Dust Pro	ZBS/TBS Standards and international standards (0.01)	Contractor/ Env. Supervisor/ ZEMA/ECO	15,000,000

Parameters		Monitoring frequency	Monitoring Area	Measurement Units	Method	Target level/ Standard	Responsibility for monitoring	Annual costs estimate (TSH)
Noise pollution	Noise level caused by construction works	Once Per week	Near settlements, Health centers and schools	dBA	Noise level instrument, and interview with affected people	ZBS/TBS Standards (110) and international standard	Contractor/ Env. Supervisor/ ZEMA	10,500,000
Water pollution	Turbidity/Bio-chemical/excavated materials	Twice during the construction	All drainage systems and ponds and bore holes near the selected areas	Pollutants concentration, (NTU, mg/l)	Laboratory analysis	ZBS/TBS Standards	Contractor/ Env. Supervisor/ ZEMA	20,000,000
Storm water discharge	Water quality (physical, chemical and bacteriological characteristics)	During the rainy season	Discharging points to the sea	Pollutants concentration	Laboratory analysis	ZBS/TBS Standards	Contractor/ Env. Supervisor/ ZEMA/ECO/ ZAWA	7,000,000
Soil erosion	Visible Soil erosion along the road and drainage systems, and at storm water discharge points	Daily for excavated areas and at least weekly else where	Project areas.	Level of erosions-visible erosion	Site inspection	As minimum as possible	Env. Supervisor/ Contractor/ ECO/ZEMA	3,000,000
Natural habitat	Biomass	Once in three	Large trees, Mangroves	-	Inspection, Visual	Replacement should be twice as	Env. Supervisor/	5,000,000

Parameters		Monitoring frequency	Monitoring Area	Measurement Units	Method	Target level/ Standard	Responsibility for monitoring	Annual costs estimate (TSH)
		months of construction period	and wetland		Observation and meetings with Contractor	much as lost trees; as many as Possible / regeneration/survival of plantlings.	Contractor/ forestry Dept/ZEMA/ ECO	
Loss of trees and Biodiversity	Biodiversity/Contamination of sensitive environmental receptors	Twice during the construction	Around construction site	-	Inspection and visual observation	-	Env. Supervisor/ Contractor/ Department of forestry/ ZEMA	8,000,000
Vibration	Vibration levels caused by construction Works	Weekly during construction	Around construction site	No. per time/ m/s^2	Records	TBS/ZBS standards	Contractor/ Env. Supervisor/ ZEMA/ECO	10,000,000
Frequency of illness of construction workers	Registered sick workers (Injury /illness)	Daily and wherever there is an incident.	Work sites including campsite	Number of Illness cases/ injuries	Medical records, and site inspection	- Zero incidents and illness cases	Contractor/ PMT, Directorate of Occupational Health and Safety	36,000,000
Safety and health risks	Number and type of safety gear like; mask, helmet gloves and ear plugs. Health and sanitation facilities in camps.			Percentage of workers not using Personal Protective Equipment (PPE)	Actual injuries and illness statistics including Site inspection records	All required workers		20,000,000

Parameters		Monitoring frequency	Monitoring Area	Measurement Units	Method	Target level/ Standard	Responsibility for monitoring	Annual costs estimate (TSH)
Dust Suppression	Water sprinkling	Everyday	Project site	Frequency of water sprinkling	Inquiries and observation	Minimum dust emission	Contractor/ Environmental Supervisor	21,000,000
Child Labour	Children Employed by Contractor	Daily	Active construction sites	Observation	Rate of compliance, observations	No Child Employed	Social Expert and consultant	5,000,000
Operation stage								
Local Air pollution and contribution to climate change	Dust/odour from collection point, vehicular movements (CO, CO2, NOx, PM, SOx, VOC and Smoke)	Twice a year	Around project site	µg/m^3, ppt/mg/l	Laboratory analysis Micro Dust Pro	TBS/ZBS standards	PMT/ in collaboration Department of Environment /ZEMA	10,000,000
Noise pollution	Noise level	Twice a year	Near settlements	dBA	Laboratory analysis	TBS/ZBS standards (110)	PMT, ZEMA/ Depart. of Environment	5,000,000
Safety of human beings	Equipment maintenance reports; incidences of worker noncompliance with PPE; safety signage; water quality, Scavengers incidences reports; Road accidents roads signs and drainage maintenance	Twice a year for the project life span	Project site	Road signs and number of accidents reports	Records, inquiries and illness statistics records	Zero accident and sufficient no of road signs and drainage incidence, The Occupational Safety and Health Act, No.8/2005	Traffic police/ Municipal council, OSHA Directorate / Operator /CLO	20,000,000

Parameters	Monitoring frequency	Monitoring Area	Measurement Units	Method	Target level/ Standard	Responsibility for monitoring	Annual costs estimate (TSH)
Total monitoring costs							**219,000,000**

10.4 Institutional Arrangements and Reporting Procedures

The purpose of environmental and social monitoring is to quantitatively measure the environmental effects of the proposed projects. The environmental monitoring program will operate through the mobilization, construction, and operation phases. It will consist of a number of activities, each with a specific purpose, key indicators, and significance criteria.

Monitoring will be carried out by the project Contractor pursuant to his contractual obligations to undertake inspections, monitoring and reporting during implementation of the project. In assistance of his construction team, the monitoring of mitigation measures during design and construction will be carried out by a Contractor's Environmental manager under the supervision of Engineer's Environmental and Social Specialists. They will conduct mitigation monitoring as part of the regular works inspections.

The weekly inspections will be undertaken by the Contractor's Environmental Manager. The environmental specialist of the supervising firm will undertake checks on the inspections done by the contractor. A weekly Environmental Compliance Report will be produced following each inspection and will incorporate any actions identified during inspections. The inspection report will summarize the status of the sites; compliance, and include photographic records if appropriate.

The contractor will provide ZEMA with reports on environmental compliance during implementation as part of their annual progress reports and annual environmental monitoring reports. Depending on the implementation status of environmentally sensitive areas of the project, ZEMA will perform annual environmental re-views in which environmental concerns raised by the project will be reviewed alongside project implementation.

On a day-to-day basis, contractors should monitor their own Environmental and Social (ES) performance and that of all its subcontractors throughout mobilization, the main construction phase, operation, and demobilization. Clear responsibilities and reporting lines are essential to avoid duplication of effort and/or gaps in monitoring. Clients should agree on reporting metrics (which shall include relevant information and data from subcontractors, as applicable) and require contractors to report on ES performance at an agreed frequency. Timely reporting of E&S performance and results enables the client to identify opportunities for improvement, prevent poor performance issues, and assist contractors if remedial action needs to be taken. Regular meetings between clients and contractors, and between contractors and their subcontractors, are essential to ensure contractor performance is satisfactory and that project specifications are being met. Throughout this process, clients should ensure that contractors employ qualified ES personnel to oversee ES performance, and that contractor staffing and resources are commensurate with the magnitude and timing of work and potential ES risks. A proactive monitoring of the contractors' ES performance is key for the success of the work and service being provided, and for the overall ES performance of the project. A successful contractor will foster good client ES performance.

11 DECOMMISSIONING AND CLOSURE PLAN

11.1 Decommissioning Overview

Decommissioning is the final phase in the life cycle of the project. It is the demise of the project. It is a process involving dismantling and demolition of the used structures and management of resulting debris. However, the process is associated with environmental and social impacts, which should be managed as required by the Zanzibar Environmental Management Act.

It notable that decommissioning is not anticipated to take place in the remote future, especially where proper and timely mainteance of facilities are executed. The decomissioning activities shall take into account of the environmental health and safety requirements for the operating personnel, the general public and any implications to the environment. The lifespan of the proposed infrastructure in Zanzibar is expected to be long as already stated above. Facilities and materials such as bitumen, culverts, and bridges have a limited lifetime after which they may become worn out and need reconstruction or alternative routes constructed. At the end of its useful life, the proposed drainage, roads and associated facilities will be decommissioned so that it is 'left safe and harmless' or replaced altogether. Decommissioning will be in accordance with best practice at the time.

The associated environmental imapcts shall be properly mitigated. Moreover, the specific conditions for mitigation are generally inherently uncertain. In view of this, specific mitigation measures pertaining to environmental impacts of decommissioning works cannot be proposed at the moment with a reasonable degree of certainty. A detailed decommissioning plan that takes environmental issues into consideration shall be prepared by the developer prior to the decommissioning works. Should it be done, decommissioning may entail change of use (functional changes) or demolition triggered by change of land use. Therefore what is presented here is just a Preliminary Deccommissioning Plan which give light to what shall be done if the need for decommissioning arise. At least two years prior to the anticipated cessation of operations, a decommissioning plan for permanent closure of the project will be developed in cooperation with ZUMC, West "B" Municipal and PMT. This plan would identify specific actions and a schedule for decommissioning of the project, identify steps and procedures to restore the project area to acceptable conditions and also provide measures to minimize effects to social and biophysical environments.

11.1.1 Drainage decommissioning

The drainage systems, and other proposed structures will definitely be constructed in consideration of modern technology. As longer as nothing will work forever, it will reach the time in which drainage system will require replacement,

However, replacement will be needed only after consideration of other alternatives would indicate so. For instance, consideration of constructing other secondary or augmentative drainages to take addition runoffs can remove the idea of replacing the project drains.

Potential environmental impacts during decommissioning will be mitigated as per the provided environmental and social management plan (Table 9. 1). Some of the impacts predicted during decommissioning of drainage systems are:

Solid waste generation

Drainage decommissioning involves demolition of structural part of the system which will lead into generation of a lot of rubble. Concrete wastes, and metallic will be the mainly waste which will be produced when drainage system is dismantled. Reuse of such rubble e.g. for land reclamation should be considered

Soil pollution

This can also be a result of inadequate waste management. In case of oil spills, all the equipment and machines that will have the risk of oil spilling or leaking if not checked regularly and repaired. If oil spills/leaks and no necessary actions is taken to prevent the spill/leak from dropping onto the ground, will lead into soil pollution.

Noise level increase

Demolition of structure by using bulldozers and excavator as well as movement of trucks will result into increase of noise level which will disturb the community.

Water sources pollution

This will be due to some conducted activities during drainage demolition; the activities will lead to the turbidity increase into storm water which will pollute the final destination of the storm water. Oil leakage can also be the source for water pollution if not well monitored. Improper disposal of wastes it can cause water pollution

Dust Impacts:

Dust impact during the decommissioning of drainage systems are seems to be a result of vehicular traffic, and other soil disturbances like digging and excavating. Impacts predicted to be in deteriorating air quality and increase water turbidity

11.1.2 Roads decommissioning

The life span of roads, plastic pipes and concrete structures for manholes, drainage systems and other infra-structures is designed for 20 years or so. The demolition of the road infrastructures after useful of each one life can be thought of in terms of replacement of the defective sections of roads pavements, sewer line and drainage structures, replacement of the manholes and inspection chambers, replacement of constructed sections and parts of the structures or repairs and maintenance of the proposed infrastructures and decommissioning of water supply infrastructures. Some of the impacts predicted during decommissioning phase are:

Solid waste generation

A lot of solid waste such as asphalt waste, cement waste, and bitumen, bridges, culverts etc. will be generated during decommissioning of the project. The concrete and steel in the foundations will be broken-up and removed to appropriate depth. Shallow foundations (like that for buildings) will be removed in their entirety.

Dust Impacts:

Temporary and localized impacts from dust would occur from the decommissioning phase as a result of vehicular traffic, and other soil disturbances like digging and excavating of the tarmac surface. Impacts predicted to be in air quality changes and increase water turbidity

Noise and vibration Impacts

Local noise levels will be affected temporarily by decommissioning activities (such as equipment movement). Impacts during decommissioning are expected to be limited to workers on-site.

Risk to Public, Occupational Health and Safety

This may happen along the decommissioning zone, especially if members of the public choose to ignore posting signs or requests for them to keep some distance from the decommissioning zone.

Soil pollution from Oil Spill

In case of oil spills, all the equipment and machines that will have the potential of spilling or leaking oil if not checked regularly and repaired. If oil spills/leaks are discovered, then capping or any other necessary actions will not be taken immediately to prevent the spill/leak from dropping onto the ground, will lead into soil pollution

Interfering with transportation

During decommissioning, the transportation of goods and services as well as human transport will be interfered. The decommissioned road will be out of use unless decided otherwise.

11.1.3 Sewage treatment facilities decommissioning

Alternatively, if at any time, parts of any structure become obsolete, life threatening or unsafe to a state where demolition and replacement is necessary, may be to pave a way for improvement or construction of a new STP structures, then a new environmental impact assessment study will be required as provided for in the Zanzibar Environmental Management Act. Otherwise there are some predicted impacts which can happen during decommissioning process; these are as follows;

Noise impact

This is from dismantling activities, sewage pumping machinery, movement of trucks etc.

Air pollution/smell from the treatment units;

This will be a result of evolve gas from decomposable sewage and sludge which will be affecting the community and workers during decommissioning process

Loss of employment;

This is the impact after decommissioning as people like, security, plant operator; waste collector from the plant will be losing their job

Threat to water source and soil pollution,

This will be happening if sludge and plant structural parts is not properly handled and treated before disposing of in proposed landfill,

- Sludge handling impacts; this is considered to be hazardous wastes in which it is highly containing harmful bacterial, heavy metals and it is generally faecal matter; if not careful and proper managed can lead to water source contamination, public health threat and soil contamination
- Contaminated structural parts by faecal matters; The ABR structures are in contact with faecal matters, hence can be source to environmental pollution if not handled in proper matter as are consider to be hazardous wastes

11.1.4 Other Services

The disposal of materials from the decommissioned services under urban upgrading project is not seen as a high-risk matter. Much of the material would be recyclable (steel structures) or reused (insulators, concrete foundations, etc.). These materials would however, need to be disposed of at a formal waste disposal or recycling centre

11.2 Methodology and Schedule

BIG-Z shall fund and implement all aspects of project decommissioning, including but not limited to, all engineering, environmental assessment, permitting, decommissioning, and mitigation activities associated with the removal of the infrastructures, in accordance with this plan and mitigation of project removal impacts on site. BIG-Z shall monitor environmental impacts during and after project removal to respond to defined events during the monitoring phase.

PMT shall ensure the removal of the project structures safely and in a manner that:

- Minimizes environmental impacts e.g. dust pollution, noise pollution, disposal of any hazardous material, sludge management, water pollution etc.
- Providing protective gear to decommissioning personnel etc.;
- Satisfies BIG-Z obligations under the Zanzibar Environmental Management Act No. 3 of 2015
- Restores the site to a condition suitable for multiple use; and
- Pays all dues (workers, government, suppliers etc.)

The description is intended to demonstrate that the methods considered are practical and that they protect the health and safety of the public and decommissioning personnel. Designer(s) should ensure that the design incorporates features that will facilitate decommissioning. Considerations include:

- an estimate of manpower, materials, and costs anticipated to support decommissioning;
- a description of the anticipated final disposition and status of the non-usable facility, machinery, equipment camp and site;
- a discussion demonstrating that adequate financing will be programmed for decommissioning;
- Identification of records that should be maintained during construction and operation which might facilitate decommissioning, including a set of “as built” drawings.

11.3 Preliminary Decommissioning Plan

This Section provides a brief outline of the works required to demolish the Proposed infrastructures on the site incase it happens. This Plan will be used as a reference document that provides the framework to ensure that demolition activities on the site do not adversely affect the health, safety, traffic or the environment of the public and neighbouring properties.

A contractor will be appointed to cary out the works. The Contractor will be required to prepare a detailed Demolition Plan and Construction Management Plan to the satisfaction of the Proponent and relevant Authorities prior to the commencement of works on site as already previously stated.

Demolition Methods

It is anticipated that the Contractor will prepare a detailed Demolition Plan prior to the commencement of work on site, however, the indicative demolition methodology will be as follows:

- The strip out and removal of non-structural elements will be undertaken utilising manual labour and small plant including – bobcats, 3-5t excavators and dingo type loaders or other machinery of the tme.
- The materials will be removed from site using small to medium sized trucks.
- The structures will be demolished using larger plant and equipment including 15-40t hydraulic excavators. These machines will be equipped with rock breakers, pulverisers and the like which would be used in a sequential manner.
- During the demolition process erosion control measures will be established. These will include treatment of dust and potential discharge into stormwater systems.

Materials Handling

Materials handling will be by mechanical plant (including excavators and bobcats) loaded into trucks (bogie tippers and semi trailers). The debris will be carted offsite to an approved waste facility or recycling centre.

The contractor shall submit a Demolition Waste Management Plan to Zanzibar Municipal Council which outlines the objectives of:

- maximisation, reuse and recycling of demolition material
- minimisation of waste disposal
- evidence of implementation for specified arrangements of waste management

On-site storage of reusable materials will occur at Site. Recycling and disposal containers will also be accommodated at this location for collection vehicles. Hazardous materials will be treated separately. A hazardous materials inspection will be undertaken by an accredited consultant and a report issued. Hazardous materials will be removed in accordance with Zanzibar Environmental Management Act. A final clearance report will be provided by the hygienist which will include the provision of tip dockets from waste centres.

Proposed Sequence

The Contractor will be required to prepare the following documentation prior to the commencement of demolition and/or excavation works:

- Dilapidation Survey
- Construction Waste Management Plan
- Demolition Management Plan

Protective Measures

An A Class hoarding will be erected around the perimeter of the construction site prior to the commencement of demolition works. Additionally, wherever the risk arises of material falling into public areas, overhead

protection will be provided in the form of a B Class hoarding. Scaffolding will be erected to facades where materials could fall in excess of 4m. The scaffolding will be clad with chainwire and shadecloth to enclose debris and dust onto the site. During the demolition, dust control measures will be used to minimise the spread of dust from site. The Contractor will have a senior representative on site at all times to ensure compliance with the safety guidelines and agreed work methods.

Traffic Management

The management of construction traffic during the deccommissioning phase will be subject to the provision of a detailed traffic management plan. This plan will be prepared by the Contractor for the various stages of demolition. During demolition, all traffic will be held within the site boundaries. The site will remain closed to pedestrian traffic and will be generally manned by security.

Occupational Health and Safety

A detailed OH&S Policy will be provided by the Contractor prior to work commencement. A detailed Site Safety Plan will be prepared for the specific project.

Environmental Management Plan

A detailed Environmental Management Plan will be provided by the Contractor prior to the commencement of the work using the framework presented in this chapter.

11.4 Cost estimates for decommissioning

The cost estimates developed in the ESMP (Table 11.1) has been developed using the current prices and rates for the purpose of giving an indication of the cost implications for undertaking of decommissioning. The estimated cost amount is about TZS 54 Millions. However, the cost shall change dramatically should the decommissioning happen in the far future.

Table 11. 1: Environmental and Social Impact mitigation measures for decommissioning and closure phase of the proposed project

Parameters	Source	Mitigation measures	Responsibility	Cost estimation (TZS)
Air pollution	Dust and gaseous	• ensuring that proper notification is made prior to demolition; • water shall be sprayed during demolition to ensure dust is controlled; • Developer to find alternative sources of energy with less emission of gaseous into the environment. • Desludging shall be done in short time to avoid and in proper manner in enclosed system to avoid much smell to the surrounding • the proponent shall ensure that s/he removes all equipment and debris ready to utilize the site for other uses; and • All waste materials should be cleared and removed from the site and properly disposed of.	Contractor/ Env. Supervisor/ZEMA/ ECO	2,000,000
Noise pollution	Demolition and excavation	• Ensure Noise level complies with the Noise Prevention and Control Rules • All demolition machinery is maintained and serviced in accordance with the contractor's specifications • Exhaust mufflers and engine enclosures are in place and in good working order for all decommissioning equipment and haulage trucks. • Noise generation activities to be relegated during daytime. • Notifying the neighbour in case there would be some noisy events.	Contractor/ Env. Supervisor/ ZEMA/ECO	2,000,000
Water and soil pollution	Turbidity/ Bio-chemical/sludge, hazardous wastes,	• Prevention of accidental oil or chemical spillage, solid matters, contaminants, debris and other pollutants and wastes from entering into surface and ground water. • Awareness on environmental protection. • Contractor must dispose hazardous wastes away from the site to an approved disposal site.	Contractor/ Env. Supervisor/ZUMC and West "B" Municipal in collaboration with ZEMA and ZAWA	10,000,000

Parameters	Source	Mitigation measures	Responsibility	Cost estimation (TZS)
		• 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 • Proper handling and storage procedures for hazardous wastes e.g. fuel oil, sludge and other wastes with faecal matter should be properly handled		
Change of Scenary and loss of vegetation such as mangrove plants	Demolition of sites	• Preparation of Biodiversity (Mangrove) restoration plan • Landscaping of the demolished sites • As part of maintaining the demolished sites trees and other vegetation will be planted	Contractor/ Env. Supervisor/ZUMC and West "B" Municipal in collaboration with ZEMA and ZAWA	20,000,000
Solid waste generation	Machinery and demolished site	• Ensure that all site personnel are instructed in the proper disposal of all waste. • All solid waste shall be disposed of offsite at an approved landfill site • The Contractor shall ensure that metal refuse or equivalent plastic refuse are recycled or reused and well treated. • Where recycling of the machinery, equipment, structures, tools and related waste is not possible, the materials should be disposed of at an approved dumpsite(s). • Inert rubble and waste materials shall be disposed of in approved dumping site • The debris like concrete wastes, layer of bitumen and other wastes, generated during demolition, shall be reused (e.g. in local village roads) or can be disposed in low-lying areas for land filling.	Contractor/ Env. Supervisor/ECO/ ZEMA	5,000,000
Risk to Public, Occupational	Selected site area	• People who are working and exposed to severe dust and exhaust fumes should be provided with respirators.	Contractor/Safety officer/	5,000,000

Parameters	Source	Mitigation measures	Responsibility	Cost estimation (TZS)
Health and Safety		• Proper use of PPEs • Ensure all work procedures are undertaken without exposing workers to hazards. • Training should be provided for all staff to ensure adequate knowledge of safe sludge handling and correct use of equipment and vehicles.	Directorate of Occupational Health and Safety	
Traffic congestion increase and Interfere with transportation	Selected site	• Create a new diversion road/road • In case of road repair, the contractor shall ensure that, activities should be kept and conducted at night • There should be road sign to indicate that road is not in use, and sign to show the proper road diversion • Site conducting and director of the on-going activities	Contractor/Safety officer/police	5.,000,000
Loss Employment opportunity	Percentage of local labourers	• Ensuring that employees are well trained so that they can still be employed somewhere else • Ensuring that Social Security contributions are remitted to the applicable fund at the right time • Create a severance package in the event of abrupt closure of the facility • The safety of the workers should surpass as a priority of all other objectives in the decommissioning project - Adapt a project – completion policy: identifying key issues to be considered • Assist with re-employment and job seeking of the involved workforce • Compensate and suitably recommend the workers to help in seeking opportunities elsewhere. • Offer advice and counselling on issues such as financial matters.	Zanzibar Urban Municipal council and West "B" Municipal	5,000,000
Total estimated cost				**54,000,000**

12 SUMMARY AND CONCLUSION

The ESIA study results show limited negative environmental implications of the project; however, the Zanzibar Urban Upgrading and drainage integration will have high socio-economic benefits to the people of Zanzibar including reduction of flooding and thus improving living conditions and wellbeing.

The associated negative impacts, to a large extent have been minimized through good engineering design and envisaged construction practices. Specific mitigation measures have been suggested in this report to offset some of the inherent adverse impacts. Implementing these mitigation measures would increase environmental soundness of the urban upgraded areas and developed drainage systems.

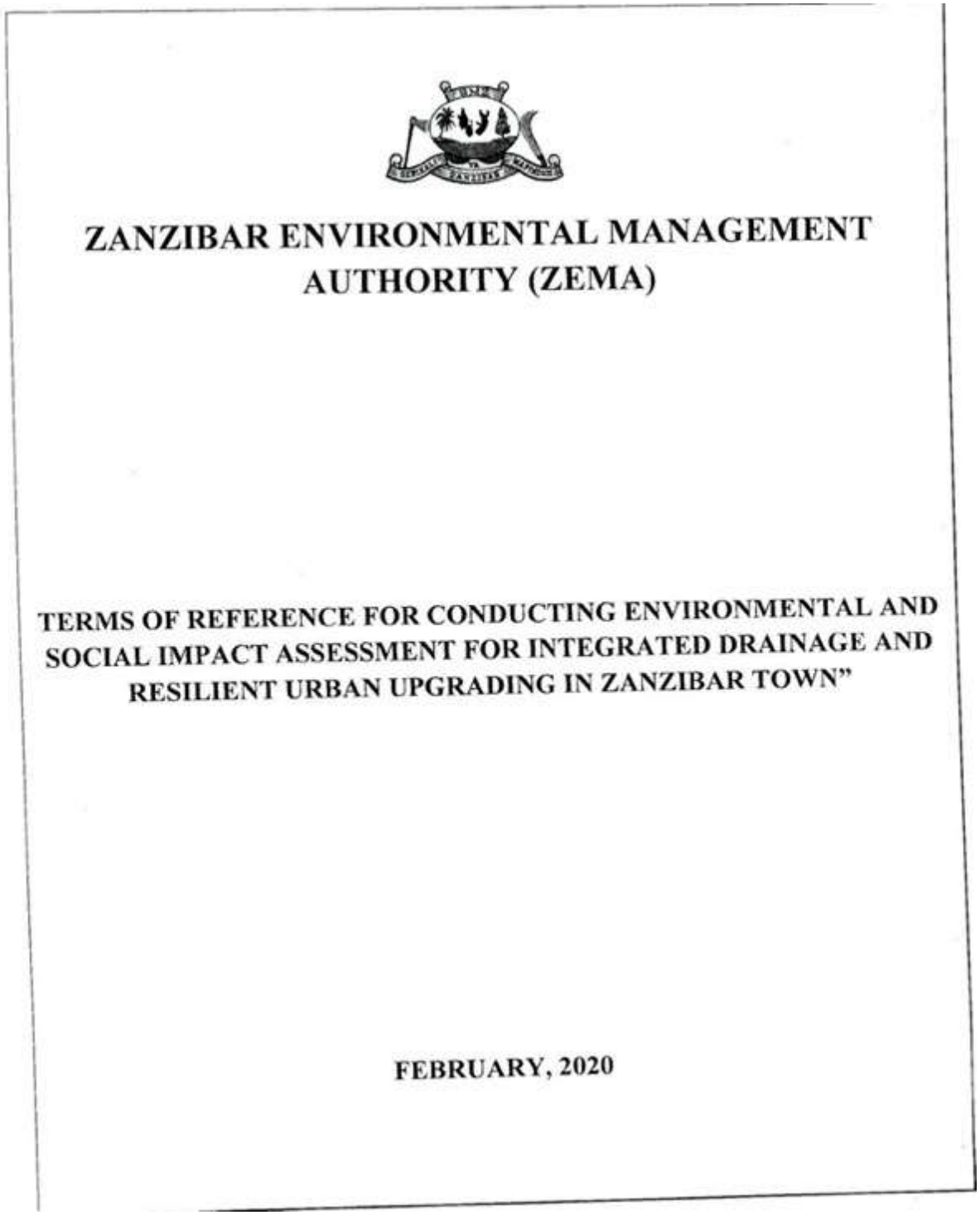
It is, therefore, concluded that, implementation of the proposed Integrated Drainage and Resilient Urban Upgrading in Zanzibar will entail limited adverse impacts provided that the recommended mitigation measures are adequately and timely put in place. The identified adverse impacts shall be managed through the proposed mitigation measures and implementation regime laid down in this ESIA. BIG-Z through PMT, ZUMC and West “B” Municipal are committed in implementing all the recommendations given in the ESIA and further carrying out the environmental auditing and monitoring schedules. Capacity building supported by integration of best practices local by-laws and public awareness programme shall be given first priority.

REFERENCES

- Draft Comparative Assessment Report – ZMC, (2010), Feasibility Study of Alternatives for Sanitary Sewage Collection, Treatment and Disposal for Zanzibar Town
- Environmental Impact Assessment Guidelines for Zanzibar, 2009
- ENVIRONMENTAL IMPACT STATEMENT (DRAFT), (2020), Environmental and Social Impact Assessment for Michenzani Area Integrated Redevelopment Project (Michenzani Green Corridor Plan), in Michenzani, Mjini District, Unguja Zanzibar
- Golder Associates Africa (Pty) Ltd, May 2010, Environmental and Social Impact Assessment of the proposed Zanzibar Urban Services Project.
- International Finance Corporation and World Bank Group (2007) Environmental, Health, and Safety (EHS) Guidelines - General EHS Guidelines: Occupational Health and Safety; World Bank Group; Page 1-17.
- International Finance Corporation and World Bank Group (2007) Environmental, Health,
- National Water Policy – July 2002
- Paul Watkiss (2012), Economic Impacts of Climate Change in Zanzibar. UK Department for International Development
- Revolutionary Government of Zanzibar Ministry of Agriculture, Livestock and Environment Department of Fisheries and Marine Resources, (2009), A Guide to Marine Conservation Areas in Zanzibar
- RGoZ Disaster Relief Committee – MAAFA.
- Safety (EHS) Guidelines - General EHS Guidelines: Occupational Health and Safety; World Bank Group; Page 1-17
- The 2012 Population and Housing Census of the United Republic of Tanzania
- The Revolutionary Government of Zanzibar – Zanzibar Investment Policy
- UN-Habitat 2014, using Global Urban Indicators, 2009 data.
- World Bank (2017), Environmental and Social Frameworks
- Zanzibar Environmental Policy, 2013
- Zanzibar Urban Service Project - Additional Financing (ZUSP-AF), (2016), Environmental and Social Management Framework (ESMF) (Draft Report)
- Zanzibar Urban Services Project (ZUSP), (2018), Environmental and Social Impact Assessment (ESIA) for the Development of ZMC Municipal Solid Waste Landfill and Septic Sludge Treatment Facilities at Kibele, Central District, Unguja, Zanzibar

Appendices

Appendix I: Terms of Reference



ZANZIBAR ENVIRONMENTAL MANAGEMENT AUTHORITY (ZEMA)

TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR INTEGRATED DRAINAGE AND RESILIENT URBAN UPGRADING IN ZANZIBAR TOWN"

FEBRUARY, 2020

1. INTRODUCTION

The Revolutionary Government of Zanzibar (RoGZ) is currently implementing a project known as "The Zanzibar Urban Services Project (ZUSP)", which effectively started in 2011 with finances obtained from the World Bank. ZUSP focuses on critical infrastructure in key urban areas of the Zanzibar Municipal Council (ZMC) and Pemba Towns and supports for improved management capacity for urban development and management. The ZUSP project supports provision of basic infrastructure services (sanitation, flood control, and public green space) and cultural heritage. Further finances were obtained from the World Bank through additional financing window (ZUSP-AF), which covers the studies and implementation of this consultancy-Integrated Drainage and Resiliency Urban Upgrading in Zanzibar Town. ZUSP is executed by the Project Management Team (PMT) under the implementing agency, the RGoZ's President's Office – Ministry of Finance.

Ensuring adherence to environmental safeguards is key element for attaining sustainability of the entire Zanzibar Urban Services Project (ZUSP), which encompasses this sub-project under the BIG-Z project. In accordance with the Terms of Reference (ToR) for this sub-project, a high-quality-due diligence on environmental and social impacts and compliance with RGoZ and World Bank policy is essential. Specifically, both of the RGoZ and World Bank, aims at consultants to undertake the environmental and social due diligence for proposed investments. In order to comply with the client's requirement, an Environmental and Social Impact Assessment (ESIA) is being conducted to address all the potential environmental and social impacts of the project and provide means to manage and monitor them throughout the project life. Therefore, this is a Terms of Reference, which has been issued by the Zanzibar Environmental Management Authority (ZEMA) for Integrated Drainage and Resiliency Urban Upgrading in Zanzibar Town.

2. OBJECTIVES OF THE PROJECT

The justification for the "Integrated Drainage and Resilient Urban Upgrading in Zanzibar Town" included in the Big-Z frame (Boosting Inclusive Growth for Zanzibar), lies in the fact that floods are probably the most serious problem of the Zanzibar Town urban areas and that the answer requires an integrated approach based on the local conditions and needs of the local communities along drainage line. The objectives of this assignment are to reduce flooding, expand basic service delivery and improve living conditions in Zanzibar Town through integrated urban upgrading and storm water management in some priority drainage areas. The assignment includes identification of damage and potential impacts due to climate change, interventions or adaptive responses such as plans or measures to counter act climate change threats, and action to adapt to climate change in the short, medium and long term.

3. SCOPE OF WORK

The scope of this work is to carry out a comprehensive Environmental and Social Impact Assessment (ESIA) study for the proposed project, prepare and submit the detailed Environmental and Social Impact Assessment Report to the Zanzibar Environmental Management Authority (ZEMA) based on the format outlined in this ToR. The ESIA Report shall be submitted to the client for final check-up before a final report in the form of soft copy on Compact Disk) and ten (10) original bound hard copies to be submitted to the Authority for a multi – stakeholders review process. All findings and issues outlined in the Scoping report of this project must be fully considered and addressed in the assessment.

4. TASK TO BE PERFORMED

Using baseline data and information, the following tasks shall be carried out by the consultant:

Tasks 1: Description of the proposed project

The Consultant shall provide a brief description of the relevant parts of the project using maps of appropriate scale where necessary and include the following information:-

- Project justification;
- Location;
- General layout, size, and capacity;
- Pre-construction activities
- Construction activities
- Schedule of project activities
- Staffing and support;
- Facilities and services
- Operation and maintenance activities
- Required offsite investments
- Life span

[Note: specify any other type of information relevant to the description of the project]

Task 2: Description of the Environment

Assemble, evaluate, and present baseline data on the relevant environmental characteristics of the study area. Include information on any changes anticipated before the project commences.

Modify the lists below to show the critical information for this project category or which is relevant to it. Environmental characteristics of the study area shall be presented on a map to facilitate the understanding of the study area:

a) ***Physical environmental:*** This shall cover geology; topography; soils; climate and meteorology; ambient air quality; surface and groundwater hydrology; existing sources of air emissions; existing water pollution discharges; and receiving water quality.

b) ***Biological environment:*** flora; fauna; rare or endangered species; ecologically important or sensitive habitats, including parks or reserves, significant natural sites; species or commercial importance; and species with potential to become nuisances, vectors, or dangerous (of project site and potential area of influence of the project).

c) ***Socio-cultural environmental:*** population land use; planned development activities community structure; employment; distribution of income, goods and services; recreation; public health; Gender issues and HIV/AIDS, Cultural/ historic properties; tribal peoples and customs, aspirations, and attitudes to the project.

Task 3: Policies, Legislative and Administration Framework

Describe the pertinent regulations and standards governing environmental quality, health and safety, protection of sensitive areas, protections of endangered species, siting, and land use control at international, national regional and local levels, The Consultant shall undertake a review of policies, legislation and administrative framework within which the environmental management of the proposed project will be carried out. Not limited to this, the following policies and Acts that shall be reviewed:-

Policies:

- Zanzibar Environmental Policy (ZEP), (2013)
- Zanzibar Vision 2020
- Zanzibar Poverty Reduction and Growth Strategy (MKUZA-II)
- Zanzibar Land Tenure Related Policies
- Zanzibar Forest Policy
- Zanzibar Water Policy
- Zanzibar Disaster Management Policy.
- Zanzibar Tourism Policy
- Zanzibar Transport Policy (2008)

- Zanzibar HIV/AIDS Policy.
- Zanzibar Information Policy.
- Zanzibar Local Government Policy.
- Occupational Safety and Health Policy.

Relevant Existing Laws:

- Environmental Management Act (2015)
- Zanzibar Land Tenure Act, 1992
- Regional Administration Act.
- Local Government Authority Act.
- Zanzibar Forest Resources and Conservation Act
- Zanzibar Water Act
- Zanzibar Land Tenure Act, 1992
- Zanzibar Fisheries Act.
- Zanzibar Maritime Act, 2009,
- Regional Administration Act.
- Local Government Authority Act.
- Zanzibar Investment Promotion and Protection Act, 2004.

Task 4: Assist in Interagency Coordination and Public/NGO Participation

Assist in coordinating the EIA & SIA with other government agencies, in obtaining the views of local NGOs and affected groups, and in keeping records of meetings and other activities, communications, and comments and their disposition. Establish the views of the public with regards to the potential impacts of the proposed project. Identify the different groups of stakeholders, and then use the most appropriate method to establish their views. Particular attention shall be paid to the disadvantage groups (e.g. children, the elderly and women) that may be affected by the proposed project.

The Consultant shall undertake an open and transparent consultation process to ensure that the views of interested and affected parties are and approximately incorporated in the project design. Minutes of the meetings conducted during this public involvement should be recorded for submission as part of the report. At least one meeting with Environmental Committee of each district council shall be held to obtain their views on the project and its implication to the environment and social aspects.

Task 5: Public Consultation and Stakeholder Analysis

Propose a thorough programme of consulting the public and other stakeholders during the study, particular emphasis should be based on the construction of proposed project. The purpose of the programme will be to assist the proponent to both inform all interested parties about the proposed project and solicit their views about it. Specifically the consultant will propose an effective, comprehensive public consultation strategy, which includes at least:

- A list of stakeholders to be consulted with their signature.
- Method of reaching them and collecting their concern
- The scheduling of consultation activities and
- How consultation efforts will be analyzed and provide a record of meetings.

Task 6: Analysis of Alternatives to the Proposed Project

Describe alternatives that were examined in the course of developing the proposed project and identify other alternatives, which would achieve the same objectives. The concept of alternatives extends to siting, design, technology selection, construction techniques and phasing, and operating and maintenance procedures. Compare alternatives in terms of potential environmental and social impacts; capital and operating costs; suitability under local conditions; and institutional, training, and monitoring requirements. When describing the impacts, indicate which are irreversible or unavoidable and which can be mitigated. To the extent possible, qualify the costs and benefits of each alternative, incorporating the estimated costs of any associated mitigating measures. Include the alternative of not constructing the project to demonstrate environmental and social conditions without the project. Various environmental and social criteria should be developed to select the best alternatives.

Task 7: Identification, Analysis and Assessment of Potential Impacts and Risks

The Consultant shall identify, analyze and assess environmental and social impacts and risks of the proposed project. The Consultant shall distinguish between positive and negative impacts, direct and indirect impacts, and immediate and long-term impacts. Identify impacts that are unavoidable or irreversible. Wherever possible, describe impacts quantitatively, in terms of environmental components affected (area, number), environmental and social costs and quality of available data, explaining significant information deficiencies and any uncertainties associated with the predicted impacts. The consultant shall describe the nature of risks and provide relevant mitigation measures to address them.

Task 8: Mitigation Measure

The Consultant shall suggest cost-effective measures for minimizing or eliminating adverse impacts of the proposed project. Measures for enhancing beneficial impacts should also be recommended. The costs of implementing these measures shall wherever possible be estimated and presented. If compensation is recommended as one form of mitigation, the Consultant shall identify all the names and physical addresses of people to be compensated.

The Consultant shall review the ongoing measures on HIV/AIDS awareness creation within the project area and proposed for the mitigation measures. The proposed shall include a plan of action, which will identify responsible key implementers, time frame and expected output. Proposed mitigation measures and cost estimates shall be grouped in a separate Bills of Quantities (BOQ) for the project and should also include cost of supervision for the implementation of mitigation measures.

Task 8: Environmental and Social Management Plan (EMP)

The Environmental Management Plan focuses on three genetic areas: implementation of mitigation measures, institutional strengthening and training, and monitoring. The Consultant shall prepare an Environmental and social Management Plan, Which will include proposed work programme, budget estimates, schedules, staffing and training requirements and other necessary support services to implement the mitigation measures. Institutional arrangements required for implementing this management plan shall be indicated. The cost of implementing the monitoring and evaluation including staffing, training and institutional arrangements must be specified. Where monitoring and evaluation will require inter-agency collaboration this should be indicated.

Identify institutional needs to implement environmental assessment recommendations. Review the authority and capability of institutions at local, regional, and national levels and recommend how to strengthen the capacity to implement the environmental and social management and monitoring plans. The recommendations may cover such diverse topics as new laws and regulations, new agencies or agency functions, inter-sectoral arrangements, management procedures and training, staffing, operation and maintenance training, budgeting, and financial support. Prepare detailed arrangements to monitor the implementations of mitigating measures and the impacts of the project during construction and operation. Include in the plan an estimate of capital and operating costs and a description of other required inputs.

In the case of land acquisition, a Resettlement Action Plan should be prepare and implemented in according to the Zanzibar land law. All properties to be affected by the project should undergo valuation for compensation. In addition, the Consultant shall develop Environmental and Social Commitment Plans (ESCP) that shall be executed by the developer to ensure that the results of the environmental and social impact assessment are implemented.

5. REPORTING

The Final ESIA Report shall be prepared in word format and submitted to Zanzibar Environmental Management Authority (ZEMA) in the form of electronic copy (on Compact Disk) and ten (10) original bound hard copies. The structure of the report should include but not limited to:

i. A non-technical executive summary, in both English and Swahili.
ii. Introduction including objectives of the study, rationale, outline of the report, description of methodologies and data sources used in the assessment;
iii. Description of the proposed activity including its location; size; components; scope of services and production; a rough quantification of resources used; emissions and wastes generated; analysis of alternatives; and decommissioning;
iv. Description of the baseline conditions at the site and affected area, including relevant socio-economic, biophysical, heritage and cultural aspects.
v. Stakeholder's engagement in the process including perceptions about the proposed activity, views, concerns and recommendations;
vi. Description of the Policies, Legal and Institutional context of the activity, including relevant environmental and socio-economic safeguards that apply and their implications for the activity;
vii. Assessment of potential impacts from socio-economic, biophysical, heritage and cultural perspective for different phases of development;
viii. Consideration of alternatives and rationale for proposing the preferred alternative;
ix. Mitigation measures considered and an evaluation of their effectiveness in addressing impacts identified and rationale for proposing measures;
x. The environmental and social management plan, including institutional arrangements, responsibilities, and budgets needed;
xi. The decommissioning or closure plan;
xii. Conclusion and recommendations.

Annexes which shall include a reference list, list of the experts involved with their Curriculum Vitae, maps, drawings, list of stakeholders consulted (including photos during consultation with public), proceedings of stakeholders meeting if any.

6. TIMING

The assessment must begin immediately after approval of ToR and will be invalid after six months from the date of approval.

7. STAFFING

The Consultant should employ an Environmental Impact Assessment Expert, Hydraulic Expert, Environmental Engineer, Sociologist, and Valuer to carry out the ESIA study. In addition, the Consultant may wish to absorb other supporting staff to facilitate efficient expedition of the work. The CV of all experts employed for this task must be attached in the ESIA Report and should sign in the document.

8. RECORDS OF MEETINGS

The consultants shall provide record of the names of organizations, government and departments and individuals whose views will be obtained. The record will also provide description of views and information that will be obtained.

11. Appendices

These shall include maps, site layouts, schematic or diagrammatic illustrations, permits, certificates, records of meetings and other miscellaneous documentation to support the main Report.

Appendix II: Existing conditions and challenges of urban upgrading areas and drainage systems

<table>
<tr><td colspan="2">Crossing and drainage blockage</td></tr>
<tr><td>High sediments and solid wastes accumulations in drainage channel near the houses. This point is located along one of drainage at (East;524275.685; North;9319293.039)
  </td><td>Beginning point of system Ca, located at Madukani street (East; 524967.707; North; 9318871.812).

It is a Metal crossing with sediment obstruction down-stream. Almost half of the section is occluded by sediments
  </td></tr>
<tr><td colspan="2">Sewage discharges into drainage system</td></tr>
<tr><td>Accumulation of sewage and other solid wastes
 
Place located at East;524919 North;9318872 downstream the drainage channel, there are sewers connected from la-trines to the channel</td><td>At system Ib, this point is found at East; 524167.764; North; 9319585.206.
 
As common behavior of many people who built up their house along the drainage; in this point people drains the sewage from their latrines to drainage system which is likely to cause water related diseases</td></tr>
<tr><td colspan="2">Solid waste accumulation in drainage system</td></tr>
</table>

<table>
<tr><td>Spot is located at Mzizima (East;524462; North;9319917). it was observed that, water and sewage is stagnating along the
 
channel due to sediments and solid waste obstruction along the channel bed</td><td>Drainage channel suffering solid wastes disposal, sedimentations and erosion
 
The is a solid wastes collection points nearby the drainage systems and open area</td></tr>
<tr><td>Box culvert located in Darajabovu-Madukani East; 524642 and North; 9319695.
 
The culvert is highly eroded downstream
Its channel base is accumulated with sediments and other solid wastes in both downstream and upstream
No obstruction inside the culvert in downstream direction</td><td>The residential houses are located near the stream (East;524554; Noth;9319737) in which the constructed walls are highly eroded
 
In this point, the wall is used as channel bank and there is accumulation of solid wastes along it.</td></tr>
<tr><td colspan="2">Lack of storm water drainage system</td></tr>
<tr><td>At system (System Eb), the point is located at Mpendae
 
The area is placed nearby an unpaved road with electric line running along it. There are Houses in both side of the road and shops. This area is prone to Flooding as no runoff of storm water is possible due to lack of drainage channels</td><td>Junction of two roads at Mpendae.
The storm water was found stagnating in the road’s junction because of absence of drainage
 
There are walls in both side of the road and the area is depressed</td></tr>
<tr><td colspan="2">Unplanned settlements and drainage blockage by buildings</td></tr>
</table>

Drainage system spot located at point, East; 524021 and North; 9319518. Drainage passes in between the houses. Block wall and concrete structure are constructed at the top of drainage channel

The drainage system crosses unplanned settlement areas from the beginning to the last point of the drainage at Madukani-
(East;524800; North;9319290)

Risk due to Storm water Stagnation

Several areas are suffering from storm and wastewater stagnation which leads to flooding and eruption of water related diseases like Malaria, bilharzia, cholera, and typhoid.

(Ziwa Maboga)

Due to likely polluted storm water as observed, there are high risk of groundwater pollution and health risk as people are using the ponds for fishing, swimming and washing

(Sebleni Kwa Wazee)

Loss of properties, like playgrounds, crops and peoples' life during the high rainy season as some area are covered by storm water and crossing in other sides, it become difficult and risky for children. For instance, in Tomondo area toward Ziwa Maboga there is no proper drainage channel and bridge for people to cross while storm water is flowing toward Ziwa Maboga

(Tomondo-Mombasa)

Presence of eutrophication in most affected areas like Ziwa Maboga, Sebleni Kwa Wazee and Tomondo is a sign of water pollution, cows are grazing as the areas are covered by grass

Solid waste disposal

It was observed that this solid waste collection point is not properly managed as spread in the surrounding which can lead to the flooding risk, water pollution and water related diseases can be observed. **(Sebleni Kwa Wazee)**

Lack of drainage network toward underground drainage at Meya Magomeni

Spot located at Meya Magomeni, in which Storm water flows together with solid wastes leading to clogging of underground channel and leads to flooding.

This point is located in a place which receives storm water from Mpendae and Meya-Mombasa.

The place is surrounded by vegetation and agricultural activities

Loss of properties and destruction of building structures due to flooding in Tomondo nearby Ziwa Maboga

Existing condition of the System Cc and the outlet of System C

At the end of system C there are three bridges where serious cracks at the pillars and upper side were observed. 	Serious erosion of drainage channel toward the roads near Bank of Tanzania 
People running activities in the area nearby the bridges such as constructing and making local boats and using the existing channel to ship their vessels to the ocean during the high tide 	Mangrove along the drainage at the end of the system C adjacent to the bridges and roads near the ocean 
Existing condition of the proposed System Eb	

 Small water path. This will require resettlement and compensation.	 Several houses will be affected, including a mosque along the path
In this point the water tend to stagnate and people have expanded their building foundation to use the path for the pedestrians and cyclist 	The path seems to be constricted at this place as there are houses and mosque in this area 
 It was observed that, the proposed area for drainage is very constricted and people are frequently affected by storm water	There is unfished building near the open space towards the existing underground drainage channel 

This is the corner in which storm water used to flow towards underground drainage channel  It is located near the open area which covered with vegetation	Along this private area, a garden for vegetables and other plants like banana trees and coconut trees has  been created. Risk for contamination is high since water flows through it. The place is located in Meya Magomeni.
This place is covered with various vegetations. People have been using this place for dumping of solids wastes from their homes 	Discharge point of system Eb in Meya Magomeni 

Appendix III: Ground water, pond water and sediments analysis reports

Appendix III (a) Groundwater quality report (Source; ZAWA)

LAB NO. 7/2[illegible]

ZANZIBAR WATER AUTHORITY

Water Laboratory

WATER ANALYSIS REPORT

Name of Site: TOMONDO Region: URBAN WEST.

Sample source: B/HOLE Climate: SUN/CLOUDY.

Water: Not treated/Filtered/Chlorinated

Physical and chemical quality

		Guidelines WHO	TZ
Appearance	CLEAR	15	50
Odor taste	None.		
Turbidity, NTU	0.52		
Temperature, °C	29.0		
Ph	7.40	6.5-8.5	6.5-9.2
Conductivity, us/cm	670	400	1500
Total dissolve solids, mg/1	419	1000	-
Total alkalinity Mg/1 CaCo₃	205		
	–		
Hardness, mg/ CaCO₃	135.0	500	600
Calcium mg/1Ca	54.0	75	200
Magnesium, mg/Mg	19.7		150
Chloride, mg/1C1	108.9	250	800
Salinity, ppt	0.196		
Nitrite, mg/1 NO_2 – N	0.0528		-
Nitrate, mg/1NO_3 – N	0.2596		75
Phosphate, mg/1 PO_4 – P	0.480		
Sulphate, mg/1 SO_4	18.00	200	600
Floride, mg/1F	0.25	1.5	8
Iron, total, mg/Fe	0.11	0.3	1
Manganese, mg/Mn	0.005	0.1	0.5
Copper, mg/1Cu	0.37	1.0	3.0
Residual chlorine	0.00	0.02	0.5

Bacteriological quality:

Total coli forms	NIL /100ml	0-3	0-10
Fecal coli forms	NIL /100ml	0	0

Bacteriological quality: Potable/Suspicious/Contaminated.

Remarks and action recommended: WATER IS SUITABLE FOR DRINKING AND OTHER HUMAN CONSUMPTION. NO HARMFUL BACTERIA WERE SEEN.

Date: 8/02/2014. Signature: [signature] LABORATORY

LAB N° 16/2[illegible]

Department of Water Development
Water Resources and Environmental Section
Laboratory.

WATER ANALYSIS REPORT.

Name: SEBLENI WATER SUPPLY. ZANZIBAR.

Sample: FROM THE WELL [illegible] 85 Date: 11/12/04

Water: Not treated/ Filtered /chlorinated

Physical and chemical quality:

		Guidelines WHO	TZ
Appearance	Clear	15	50
Odour Taste	None	5	30
Colour, mg Pt/1	–		
Turbidity, NTU	0.17		
Temperature, t°C	30.0		
Ph	7.79	6.5-8.5	6.5-9.2
Conductivity, uS/cm	712	400	1500
Dissolved solids, mg/1	356	1000	-
Carbon dioxide, mg/1	–		
Total alkalinity, Mg/1CaCO₃	–		
Phenolphthalein Alkalinity, mg/1CaCO₃	0.00		
Hardness, mg/1mg CaCO₃	95.0	500	600
Calcium, mg/1 Ca	35.0	75	200
Magnesium, mg/1 Mg	16.53	50	150
Chloride, mg/1 C1	81.53	250	800
Salinity, ppt	0.147		
Nitrite, mg /1 NO_2-N		0.1	-
Nitrate, mg/1 NO_3-N		10	75
Phosphate, mg/1 PO_4-P			
Suphate, mg/1 SO_4		200	600
Fluride, mg/1 F		1.5	8
Iron, total, mg/1 Fe		0.3	1
Manganese, mg/1 Mn		0.1	0.5
Chromium, mg/1 Cr^{6+}		0.05	0.05
Copper, mg/1 Cu		1.0	3.0
Residual chlorine	0.00	0.02	0.5

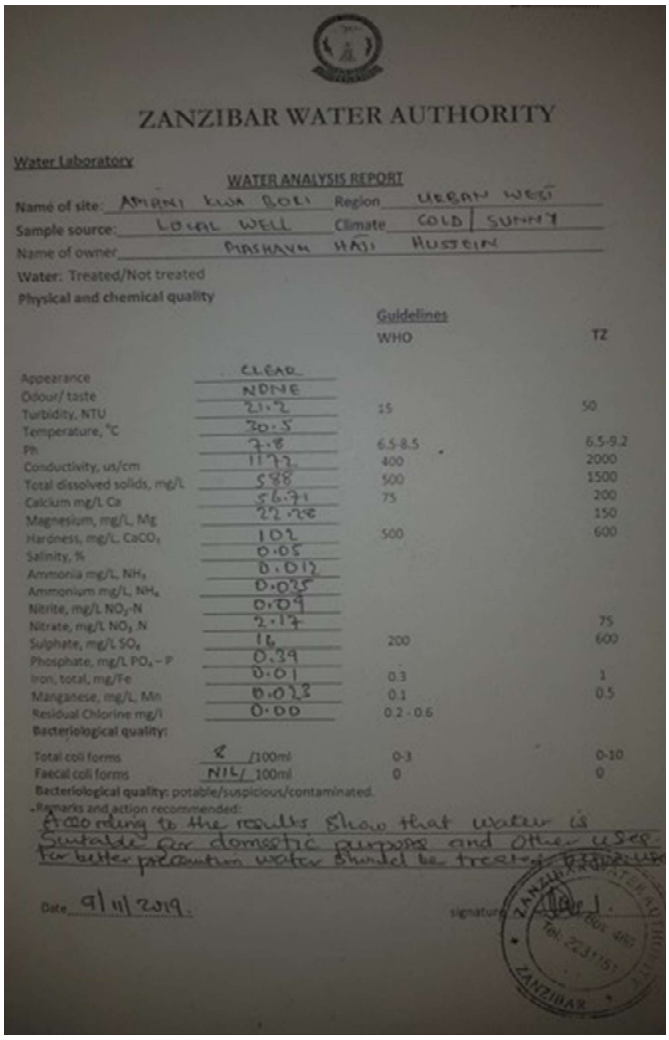
Bacteriological quality:

Total coliforms	6.0 /100 ml
Fecal coliforms	4.0 /100 ml

Bacteriological quality: Potable/Suspicious/Contaminated

Remarks and action recommended: ACCORDING TO THE RESULT OBTAINED PHYSICO/CHEMICAL QUALITY OF WATER IS GOOD BUT BACTERIOLOGICALLY IS CONTAMINATED BY FAECAL COLIFORMS ORGANISMS, TREATMENT IS RECOMMENDED FOR DOMESTIC USE

Date: 11/12/04. Signature: [signature]



ZANZIBAR WATER AUTHORITY

Water Laboratory

WATER ANALYSIS REPORT

Name of site: AMANI KWA BOLI Region URBAN WEST

Sample source: LOCAL WELL Climate COLD / SUNNY

Name of owner: MASHAVA HAJI HUSSEIN

Water: Treated/Not treated

Physical and chemical quality

		Guidelines WHO	TZ
Appearance	CLEAR		
Odour/ taste	NONE		
Turbidity, NTU	2.12	15	50
Temperature, °C	30.5		
Ph	7.8	6.5-8.5	6.5-9.2
Conductivity, us/cm	1172	400	2000
Total dissolved solids, mg/L	588	500	1500
Calcium mg/L Ca	56.71	75	200
Magnesium, mg/L, Mg	22.76		150
Hardness, mg/L. $CaCO_3$	102	500	600
Salinity, %	0.05		
Ammonia mg/L, NH_3	0.012		
Ammonium mg/L, NH_4	0.025		
Nitrite, mg/L NO_2-N	0.09		
Nitrate, mg/L NO_3 N	2.17		75
Sulphate, mg/L SO_4	16	200	600
Phosphate, mg/L PO_4 – P	0.39		
Iron, total, mg/Fe	0.01	0.3	1
Manganese, mg/L, Mn	0.023	0.1	0.5
Residual Chlorine mg/l	0.00	0.2 - 0.6	

Bacteriological quality:

Total coli forms	8 /100ml	0-3	0-10
Faecal coli forms	NIL/ 100ml	0	0

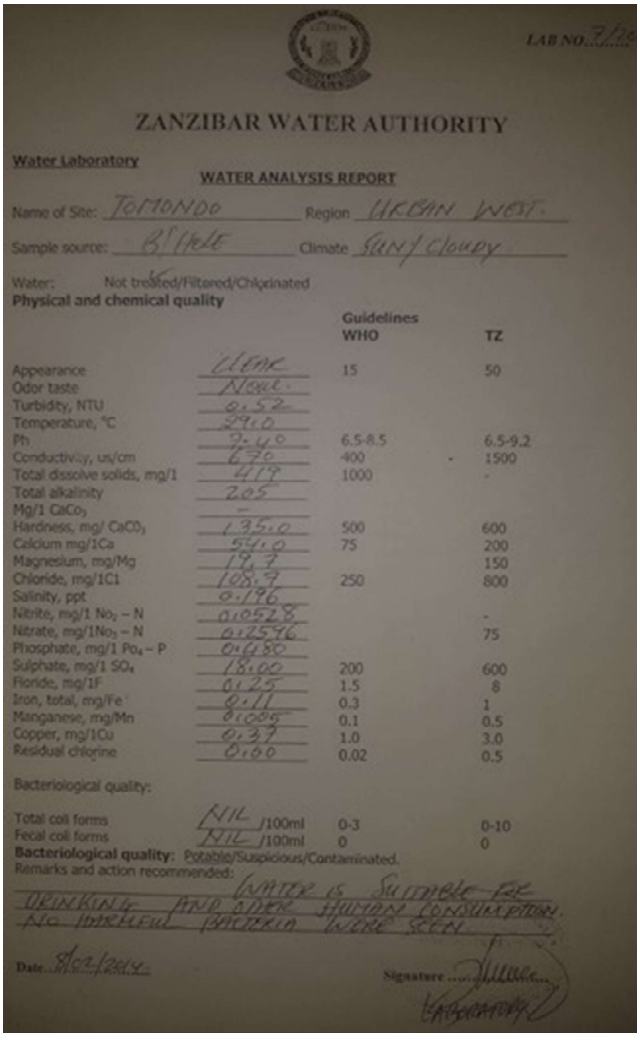
Bacteriological quality: potable/suspicious/contaminated.

Remarks and action recommended:

According to the results show that water is suitable for domestic purpose and other uses. For better precaution water should be treated

Date 9/11/2019

Signature



LAB NO. 2126

ZANZIBAR WATER AUTHORITY

Water Laboratory

WATER ANALYSIS REPORT

Name of Site: TOMONDO Region URBAN WEST.

Sample source: BOREHOLE Climate SUNNY/CLOUDY

Water: Not treated/Filtered/Chlorinated

Physical and chemical quality

		Guidelines WHO	TZ
Appearance	CLEAR	15	50
Odor taste	None.		
Turbidity, NTU	0.52		
Temperature, °C	29.0		
Ph	7.40	6.5-8.5	6.5-9.2
Conductivity, us/cm	670	400	1500
Total dissolve solids, mg/1	419	1000	-
Total alkalinity	205		
Mg/1 $CaCO_3$	-		
Hardness, mg/ $CaCO_3$	135.0	500	600
Calcium mg/1Ca	54.0	75	200
Magnesium, mg/Mg	19.7		150
Chloride, mg/1C1	105.9	250	800
Salinity, ppt	0.196		
Nitrite, mg/1 No_2 – N	0.0528		-
Nitrate, mg/1No_3 – N	0.2576		75
Phosphate, mg/1 Po_4 – P	0.480		
Sulphate, mg/1 SO_4	18.00	200	600
Floride, mg/1F	0.25	1.5	8
Iron, total, mg/Fe	0.11	0.3	1
Manganese, mg/Mn	0.005	0.1	0.5
Copper, mg/1Cu	0.37	1.0	3.0
Residual chlorine	0.00	0.02	0.5

Bacteriological quality:

Total coli forms	NIL /100ml	0-3	0-10
Fecal coli forms	NIL /100ml	0	0

Bacteriological quality: Potable/Suspicious/Contaminated.

Remarks and action recommended:

WATER IS SUITABLE FOR DRINKING AND OTHER HUMAN CONSUMPTION. NO HARMFUL BACTERIA WERE SEEN

Date 8/07/2014

Signature

Appendix III (b) Groundwater quality analysis results for (Meya- Magomeni, Sebleni Kwa Wazee and Tomondo-Mombasa,)

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GROUNDWATER SAMPLES ANALYSIS REPORT

ENVIRONMENTAL ENGINEERING LABORATORY

Client: Prof Mato RAM

Date: 18 February, 2020

Source: Groundwater/Boreholes (Meya- Magomeni, Sebleni Kwa Wazee and Tomondo-Mombasa,)

S/N	PARAMETER	Units	GWM1	GWM2	GWM3	GWS1	GWS2	GWS3	GWT1	GWT2	GWT3
1	pH		7.37	7.02	7.08	7.42	7.15	6.58	6.16	7.04	7.19
2	Nitrate-Nitrogen	mg/l	0.70	0.50	0.60	1.70	0.90	0.70	6.40	6.10	1.60
3	Chloride	mg/l	91.0	58.0	54.29	7.60	21.55	117.0	67.80	40.17	29.31
4	Lead	mg/l	<0.01	<0.01	0.053	0.045	<0.01	<0.01	<0.01	<0.01	<0.01
5	Zinc	mg/l	0.021	0.019	0.021	0.014	0.011	0.010	<0.01	<0.01	<0.01
6	Cadmium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Reporting Officer

Ndimbo A.M

Appendix III (c) pond water quality analysis results for (Sebleni Kwa Wazee and Ziwa Maboga,)

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POND WATER SAMPLES ANALYSIS REPORT

ENVIRONMENTAL ENGINEERING LABORATORY

Client: Prof Mato RAM.

Date: 18 February, 2020

Source: Wastewater/Pond water (Sebleni and Ziwa Maboga ponds)

S/N	PARAMETER	Units	Sk-1	Sk-2	Sk-3	Zm-1	Zm-2	Zm-3
1	pH		7.06	7.12	6.87	7.10	6.82	6.65
2	Nitrate-Nitrogen	mg/l	16.7	15.4	12.5	16.4	14.7	16.43
3	Chloride	mg/l	27.41	28.98	31.85	31.85	27.63	26.25
4	Lead	mg/l	0.035	0.097	0.074	0.046	<0.01	<0.01
5	Zinc	mg/l	0.020	<0.01	0.021	0.013	<0.01	0.014
6	Cadmium	mg/l	<0.01	<0.01	<0.01	0.530	0.069	0.058
7	BOD_5	mg/l	28	25	30	16	14	12

Reporting Officer

Ndimbo A.M

Appendix III (d) Sediments analysis results from (Sebleni Kwa Wazee and Ziwa Maboga ponds)

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SEDIMENT SAMPLES ANALYSIS REPORT

ENVIRONMENTAL ENGINEERING LABORATORY

Client: Prof Mato RAM

Date: **18 February, 2020**

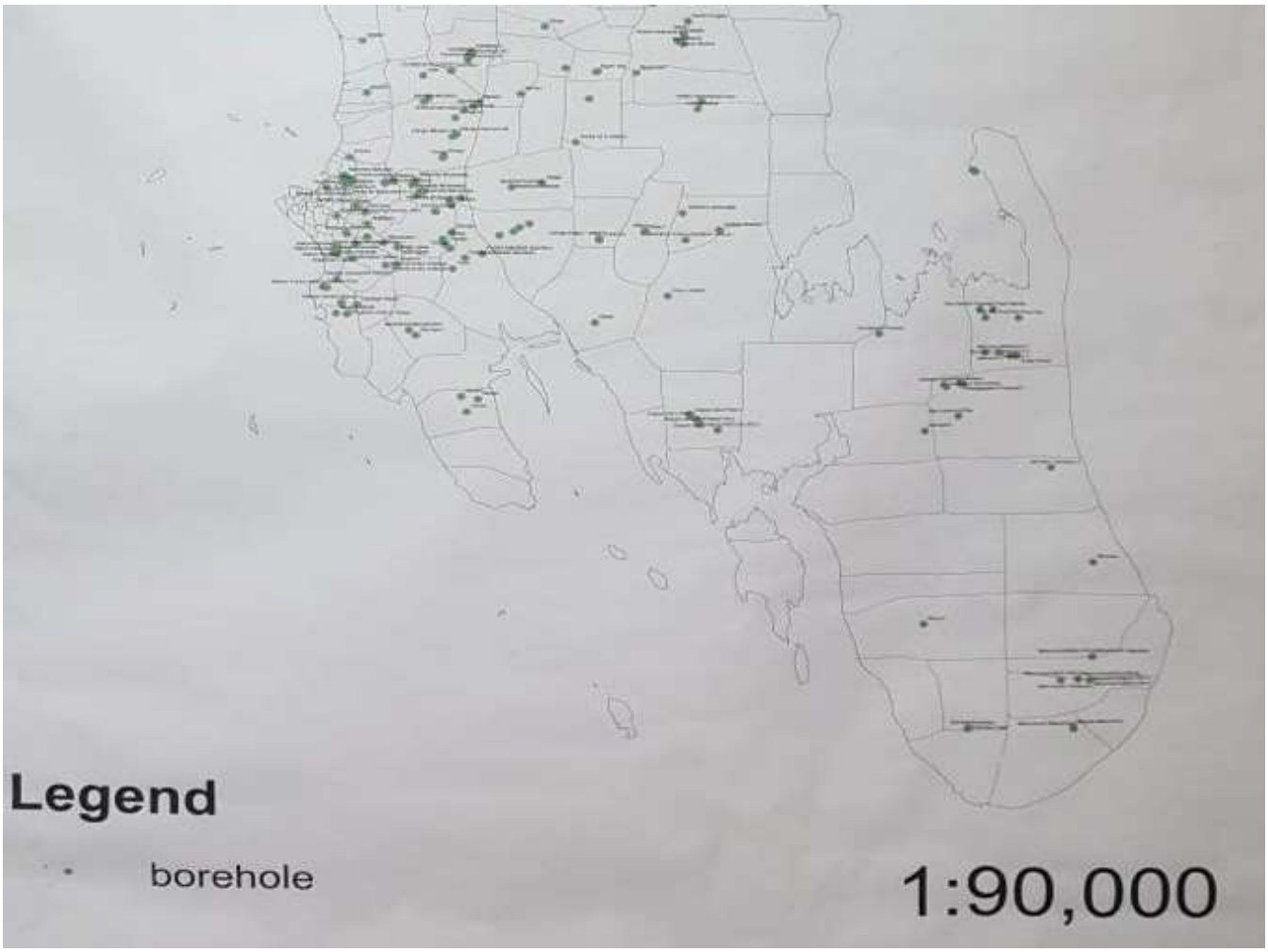
Source: Sediment (Sebleni and Ziwa Maboga ponds)

S/N	PARAMETER	Units	Lead	Zinc	Cadmium
1	**Sk-1**	mg/kg	86.320	211.834	1.914
2	**Sk-2**	mg/kg	8.444	41.876	2.998
3	**Sk-3**	mg/kg	9.171	115.909	8.734
4	**Zm-1**	mg/kg	10.583	106.357	1.633
5	**Zm-2**	mg/kg	8.096	93.501	6.543
6	**Zm-3**	mg/kg	11.280	160.155	1.114

Reporting Officer

Ndimbo A.M

Appendix IV: location of the boreholes in Zanzibar City



Appendix V; Community Meetings and workshop feedback

(Meya Magomeni, Sebleni Kwa Wazee and Tomondo-Mombasa)

Project priority key; 0 = not relevant – to be cancelled, 1 = low importance – can wait till other projects are finished, 2 = important but not urgent – to be executed, 3 = very important and urgent – to be executed immediately as shown in table

Identified sub-projects in Meya-Magomeni Shehia for urban upgrading on (31/01/2020)

Category		Rank	Reasons for the ranking and remarks
Road infrastructure		3	It is an important road used by many people. It will be a short-cut connecting to Jang'ombe road. It will ensure easy transportation of goods and services, Public buses will start operating along the road.
Housing and new commercial units		3	It will boost economic activities thus, poverty alleviation.
Road infrastructure		3	The road will influence marketing activities that will raise income of the people. Easy transportation of commodities to and from the market (Vijibwa market).
Road infrastructure		2	The roads will easy access to social services such as hospital, health centers, and schools throughout the year.
Road infrastructure		2	The roads will improve access from one street to another and help people with disabilities.
Road infrastructure		2	The roads will improve access from one street to another and help people with disabilities.
Road infrastructure		2	It will influence tourism activities; it will create employment opportunities to the local people especial youth. It will be a recreation center with good environment.
Road infrastructure		1	The footpath will improve access from one street to another and help people with disabilities.
Water supply		ZAWA	It is an important project as it will ensure supply of clean water to the community.
Water supply		2	The project in not important at the moment to community, rain water is easy to be contaminated.
Main drainage network		2	It is an important project because it will help to protect and conserve the environment, reduce flooding and source of fresh air.
Main drainage network		2	It will control floods
Waste management		2	The Project will promote environmental cleanliness and improve wellbeing of the people however, there is a challenge on ownership of the area, right now the area is owned by the ruling party (CCM), and negotiations need to be done to ensure the project is implemented.
		2	Same as above

		0	There is limited space to have this project in Magomeni
Open spaces		2	Reclaimed area after upgrading the pond will be used for agricultural activities as well as for economic and social activities.
Housing and new commercial units		1	It is an important project but can be implemented in the later. Not priority right now
Waste management		3	The project will be useful to both Shehias, it will help to control illegal dumping
Open spaces		2	Once improved it will help youth to play at a safe ground and it will be a good recreation center for other social functions
Housing and new commercial units		3	It is important project; it will boost economic activities.
Open spaces		3	Will become recreation center and other social services for the neighborhoods
Open spaces		2	Same as above
Open spaces		2	Same as above
Open spaces		2	Same as above
Public facilities		2	The market will save people from both Shehias; it will boost economic activities and easy access of commodities.

Other issues rose during the meeting

They suggested that the market should be built at Najim place

People should move out of Wawi bakery. People are flooded. How are you going to improve this area?

They proposed Drainage system to Jang'ombe road

Road construction and improvements although more than 600 houses will be affected

A list of sub-projects for urban upgrading at Tomondo-Mombasa on **(01/02/2020)**

Category		Rank	Reason for the ranking and remarks from community
Road infrastructure		3	This is the most important road in the area, the road will facilitate easy transportation of people and commodities It is a road connecting to other Shehia. At present the road is in bad shape, upgrading will easy access to many parts of the Shehia.
Road infrastructure		3	There is a school along this proposed road; it will help students to reach the school easy whole year. The road will connect to the other side of lake Maboga where there are many people and It will boost economy
Road infrastructure		3	This road is very important as it passes in the middle of Tomondo Shehia connecting to Mombasa Shehia where there is a big market. People will have access to other places to get services
Road infrastructure		3	The street is called Msheli Shelini. This is one of the reliable roads for people in the area, even public buses pass along this road.

			Also, it is an emergency road used during floods time. Members requested this road to be upgraded to category I road type.
Road infrastructure		3	It has many users, it connects to Fumba road. It is the road going into interior of Tomondo Shehia
Road infrastructure		3	Like other roads this road is very important, it will help to take sick people to the health centers and hospital. Kids will as well help to reach schools on time.
Road infrastructure		3	The footpaths will help to conserve the environment and reduce soil degradation It will improve environmental cleanliness between houses and held disabled people to access other places.
Water supply		3	The project is very important to the community because it will ensure full time supply of clean and safe water. It is likely to reduce water related diseases.
Water supply		2	The project is important but it is not priority for the community right now, it can be implemented in the long-term. Proposed public institutions are: Abdallah sharia school, Francis Maria Lieberman School, Sufa school, Royal dispensary, Neema dispensary and at madrasas schools
Main drainage network		3	This is the 1st priority project; implementation of this project will enable implementation of other proposed projects. It will also solve the problem of floods that drive some families away from their houses. Implementation of this project will significantly reduce water related diseases.
Waste management		3	It is a very important project; the CPT suggested the project to be constructed at Kwa Roja/Amour Macho area, because it is a central location and it has many residences. The project will reduce illegal dumping particularly to the lake Maboga
Open space		2	The project is very important, as it will have some roads, recreation parks, and play grounds. People will no longer going far for such services. Recommendation; the project should consider basketball pitch, a health center and a space for construction of a police post.
Open space		2	Once implemented it will reduce floods and inconvenience of people moving during rainy season. It will serve as a recreation park after the project
Open space		2	The open space once developed will allow community members to use for social, political and religious activities.
Facilities		3	The project will increase economic activities. It will reduce distance of people going to Mombasa market shopping.
Facilities		3	It is interesting project, because right now people do practice aquaculture in the area. It will as well act as a recreation center

Other Extra issues from the community

- There should be a hospital at lake Maboga if drained
- Very important to have security center in area near Ziwa Maboga area
- Back flow of water from Ziwa Maboga to the houses as the effect of heavy rain and storm water increase
- Loss of life (children) in the pond during flooding

- Sewage, grey water discharge to the drainage channels and during rainfall
- Frequent Flooding problems
- Fish: (tilapia) perege and Kambale (Catfish), maribs are found to the ponds
- Water-related diseases affect mostly children like; diarrhea, bilharzia malaria, typhoid etc.
- Sanitary used pads and children napkin disposal which causes environmental pollution
- Most use water from the wells which changes colour and odour during the rainfall
- They depend on disinfection of groundwater although they don't monitor level of pollution
- Schistosomiasis because of snails. Medications for prevention of Schistosomiasis is distributed by Sheha after sometimes in a year
- Skin diseases to children especially the ones who used to fish to the ponds

A list of proposed and prioritized sub-projects for urban upgrading at Sebleni + Kwa Wazee on **(02/02/2020)**

Category		Rank	Reason for the ranking and remarks
Road infrastructure		3	It is an important road for the community, it will increase economic activities along the road, and it will solve the problem of insecurity. The road is used as an alternative road during emergencies.
Road infrastructure		3	The same reason as above
Road infrastructure		2	The position of the road deserves to follow under category II not I It will help the public to easy transport people and commodities. It was recommended to construct this road to category II
Road infrastructure		2	The read connects the two Shehia, it will reduce insecurity in the area particularly during night and It is also an alternative road to the main road (Amani road) during crises,
Road infrastructure		2	It is the road that connects to the interior of Sebleni Shehia. However, it has less important to community for now, to be consider for the mid-term phase and It is recommended that, the road should be under category II,
Road infrastructure		2	The project is very important and accepted by the team, It will stimulate tourism activities, influence social engagement and ensure full time accessibility of the area.
Road infrastructure		3	A very important road. It is an alternative road from the main roads; it connects people of Sebleni and Magomeni, and connects many roads along the side. Should be *named Mwembeni road.*

Road infrastructure		2	Accepted as an important project but to be implemented in the mid-term phase
Road infrastructure		1	The main concern is to build a bridge across Sebleni pond which will connect Kwa Wazee and selenic Shehia, In the past there was a culvert bridge people used to cross from the other side. It is a short-cut way between the two Shehia.
Road infrastructure		3	It is very important project, it will help to protect and conserve the environ-ment, is a source of fresh air and places for people to refresh.
Road infrastructure		3	It will ensure cleanliness of the streets It will also prevent soil erosion.
Water supply		3	The project will ensure reliable water supply to the community It will reduce the use of hand dug wells whose water is not safe.
Water supply		3	The project will ensure reliable supply of clean water to the institution and the public. It Will reduce water borne diseases.
Waste management		3	The project will control illegal dumping and keep the environment clean It will help to stop dumping of solid waste into Sebleni pond. It will create employment to youth, collection of waste and separation for recycling.
		3	Same as above
		2	Same as above
Open space		2	The open space will be used for social political and religious events It will reduce accident of kids not going far from home. It will be the nearest recreation park.
Open spaces		2	It is believed that this open space belongs to football clubs. It was suggested the area remains as football pitch, for youth to exercise and fitness.
Open space		2	Same as above, if it is to be changes then consult owners with title deeds through Shehas.
Open spaces			The pitch is owned by a football club and should remain as football pitch
Open spaces		3	It was suggested to construct a market to serve both Shehas
Open spaces			Follow up on ownership of open space (football pitch) and the pitch is owned by a football club

Open spaces			Follow up on ownership of open space (football pitch) and the pitch is owned by a football club
Public facilities		2	The Community members suggested to build the small market behind Bilal Islamic school
Public facilities		2	It can be implemented as a second priority and It will maintain eco-system, It will become a recreation park, where people will sell some staff and earn income.

Other Environment and social issues included

Flooding impacts around the ponds

Diseases like malaria, Schistosomiasis, and skin diseases are commonly affecting the community

There are Fish like perege, Kambale found at Sebleni pond

They use water well and put water guard to treat water as the only treatment for drinking water

There is no monitoring of the contamination level of ground water

They use pit latrines and people used to discharge sewage to the ponds and drainage channels

They find it difficult to eat fish from the ponds as sometime the smell worse

Loss of life into the pond

Appendix VI: List of Stakeholders Consulted

List of Stakeholders Consulted

Date	Name	Institution/ Shehia	Position/occupation	Contact	Signature
30/01/20	MOHAMMED ILYASA	ZAWA	TECH-DIRECT Civil engineer.	0777479[illegible]	[illegible]
30/01/2020	ARKAM JUMA ALI	ZAWA	LABORATORY TECH	0779028556	[illegible]
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Appendix VII: Photos of Public Consultation Meetings











Report

On

Air Quality and Noise Levels Monitoring

For

ESIA Study for Consultancy Services for Planning, Feasibility Study, Detailed Engineering Design and Bidding Documents for Integrated Drainage and Resilient Urban Upgrading In Zanzibar Town

Prepared for:

A.R.S. Progeti SPA and
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July, 2020

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SYMBOLS AND ABBREVIATIONS

%	Percentage
[°C]	in Degree Centigrade
AT	Ambient/Air Temperature
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
dB (A)	Sound unit in A-weighted factor measured in decibel
EIA	Environmental Impact Assessment
EMDC	Environmental Management Divisional Standards Committee
EMR	Environmental Management Regulations
IFC–WBG	International Finance Corporation–World Bank Group
NO_2	Nitrogen dioxide
O_2	Oxygen
PM_{10}	Particles with an aerodynamic diameter equal or smaller than 10 µm size
PM2.5	Particles with an aerodynamic diameter equal or smaller than 2.5 µm size
RH	Relative Humidity
SO_2	Sulur dioxide
ZBS	Zanzinar Bureau of Standards
ZEMA	Zanzibar Environmental Management Act
ZEP	Zanzibar Environmental Policy

1.0 INTRODUCTION

1.1 Background

Sering Ingegneria has been appointed to provide Consulting Services for Planning, Feasibility Study, Detailed Engineering Design and Bidding Documents for Integrated Drainage and Resilient Urban Upgrading in Zanzibar. The project covers critical areas prone to floods in Zanzibar municipality main at three units (Meya-Magomeni, Sebleni-Kwa Wazee and Tomondo-Mombasa). These are flooding areas and have been necessitated drainage interventions and identified for being upgraded.
The project will involve; demolition of houses during mobilization phase, rehabilitation of existing drainage systems, construction vehicles and plants, that use fuels during drainage trench excavations, infrastructures constructions and materials trasnportations. All these will contribute on the Air quality changes and noise levels increase to the project areas.

Further, the project includes various sub-projects like drainage systems, road development, sewerage systems and treatment plants, Solid waste collection points, markets and other social services development. All these presumed to cause Social and environmental impacts in all phases. Among these impacts to the proposed project are various types of emissions and wastes which defer in according to the type of sub-project and in every phase of the project.

The Zanzibar Environmental Management Act (ZEMA) No.3 of 20015 provides the legal and institutional framework for sustainable management of the environment in implementation of the Zanzibar Environmental Policy (ZEP) of 2013. Section 39 (1) and (2) of the Act stipulates that an Environmental Impact Assessment study shall be carried prior to the commencement or financing of a project or undertaking, that a permit or license for the carrying out of any project or undertaking in accordance with any written law shall not entitle the proponent or developer to undertake or to cause to be undertaken a project or activity without an environmental impact assessment certificate.
Further, the Zanzibar Environmental Management (Environmental Impact Assessment and Audit) (Amendment) Regulations, 2015 and read as one with the Environment Impact Assessment and Audit Regulations, 2002 (Made under Section 47(1) (a) to (e) of ZEMA 2015) provides the legal framework on carrying out EIA. It requires the developer or proponent to conduct an assessment or evaluation of the significance of the impacts in terms of energy flow, transformation of matter, effects on sensitive ecosystems relative to the baseline state and socio-economic impacts.
While complying with the laws and legislation, Sering Ingegneria has subcontracted ENV Services Limited to carry out air quality and noise levels assessment at the project area. This report therefore, presents the finding and

recommendation of the assessment carried out to ascertain the baseline condition in terms of dust, gases and noise levels at the proposed project area.

1.2 Objectives

1.2.1 Main Objective

The main objective was to ascertain the baseline condition in terms of air quality and noise levels at the proposed project area.

1.2.2 Specific Objectives

i. To determine the ambient oxygen gas (O_2),carbon dioxide (CO_2), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and methane (CH_4),
ii. To determine the dust levels in terms of suspended particulates matters in terms of $PM_{2.5}$,PM_{10} and TSP sizes,
iii. To determine the noise level in decibel-A weighting frequency [dB(A)],
iv. To prepare, write and submitting a technical report.

2.0 METHODOLOGY

2.1 Establishing of Monitoring Locations

The monitoring locations were established based on the norms prescribed by Zanzibar Bureau of Standards (ZBS). These include predominant wind direction (leeward and windward) at the area, site workers and nearest local communities as possible receptors, size of the area to be covered, topographical condition, the areas where pollution was expected, as well as areas that pollutants from the project activities are likely to disperse to nearly identified sensitive receptors.

Four (4) measuring locations were selected, three (3) for onsite and one (1) at about 200m offsite area as control location. They were selected for taking measurement of air quality (ambient gaseous and dust emission levels) and noise levels survey. The points established for air quality and noise level measurements were:

2.1.1 Residential house near Maboga Lake

This location is near the Maboga Lake, at Tomondo-Mombasa Site where the construction of the underground drainage for discharging storm water from the lake to Indian Ocean is to be done Figure 2.1. It was assumed that the construction activities might affect the resident in terms of air quality and noise levels pollution

Figure 2.1: Measuring Location at residential house, near Maboga Lake

2.1.2 AL-MASJID NUUR LLAH

The point is at Meya-Magomeni project area. This point was selected to represent the religious institutions at the project area Figure 2.2. It is near street and Magomeni asphalt roads. These roads are among of those which will undergo upgrading kwa Najim.

Figure 2.2: Measuring Location at AL-MASJID NUUR LLAH, near asphalt road

2.1.3 Residential house, near Sebuleni pond

This location was selected due to the fact that is near the Sebuleni pond, Figure 2.3. The construction activities of roads, foot paths, upgrading of open spaces, resettlement and drainage for discharging storm water from the pond to Indian Ocean will be undertaken.

Figure 2.3: Measuring Location at rresidential house, near Sebuleni pond

2.1.4 Residential house, near Amani Stadium

This point was at 200meters from the project area Figure 2.4. The point was chosen as a control point for future benchmarking after project implementation

Figure 2.4: Measuring Location at residential house, near Amani Stadium

Further, for identification and easy access to the points, coordinates of each sampling location were recorded. The table 2.1 describes the onsite and offsite locations and coordinates in degree.

Table 2.1: coordinates of measured locations

Site Category	Measuring Location	Latitude (°)	Longitude (°)
Onsite	Residential house, near Maboga Lake	-6.194053	-39.22636
	AL-MASJID NUUR LLAH near the Magomeni asphalt road	-6.174959	-39.21992
	Residential house, near Sebuleni pond	-6.163902	-39.219314
Offsite	Residential house, near Amani Stadium	-6.164102	-39.220381

2.2 Monitoring Duration

Each location was monitored for 8 hours continuously. At every one minute, one reading was taken. The 60x8 (480) readings of that time were averaged to get a representative value of the particular location.

2.3. The Ambient Dust Measurement

The suspended ambient smoky dust and particle levels measurement was carried out by using a potable particulate counter (make–Stark, model–CW– HAT200S). It is capable to detect the suspended particulate matters of $PM_{2.5}$ and PM_{10}/TSP diameter size in microgram per cubic meter ($\mu g/m^3$) concentrations in the air. Its sampling principle is light scattering. When the dust particles are sucked in by the installed pump, the light is scattered, and amount of scattered light equal dust concentration in $\mu g/m^3$. Its sampling time is 60 seconds per one reading with all four parameters at once.

2.4 The Ambient Gaseous Measurement

The ambient gaseous air quality assessment was done using a portable gas detectors type GMI VISA model 66369BENX. The instrument complies with the European standard EN 61779; EN 50104 and EN 45544 with certification to ATEXII 1 G EEx ia IIB T3/UL913 Class I Group CD/EC. The

gas detector is capable to detect oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and methane (CH_4) gases in air.

2.5 The Ambient Noise Level Measurement

Measurement of noise level was accomplished using a portable Clas Ohlson digital sound level meter type 36-1604, model ST-805 with measurement range of 30 to 130 dB (A), A-weighted factor deciBel. The meter meets ANSI S1.4 type 2 standards and conforms to IEC 651 type 2. Its accuracy is ±1.5 dB of reading. The meter is calibrated using electrical calibration with built in oscillator (1 kHz sine wave).

2.6 Data Analysis

The data collected in all measurements were compiled and analyzed using MS Excel. The descriptive statistical data analysis tool from the MS Excel was utilized in which measures of central tendencies, standard deviation, and standard error were made at 95% confidence level.

3.0 FINDINGS AND DISCUSSION

3.1 Ambient Dust Level

As summarized in Tables 3.1 through 3.4, all measured locations had $PM_{2.5}$, PM_{10} and TSP mean value which comply with local Zanzibar (ZBS: 845:2005] and international (IFC-WBG: 2007) standards. Appendix I is the detailed findings of ambient dust emission levels measured at all locations.

Table 3.1: Summary of ambient dust levels at RH, near Maboga Lake

Item	PM2.5 [µg/m3]	PM_{10} [µg/m^3]	TSP [µg/m^3]
Mean	8.02	16.12	32.45
Standard Deviation	6.62	13.86	29.15
Minimum	3.00	5.00	7.00
Maximum	65.00	129.00	256.00
Count	480.00	480.00	480.00
Confidence Level (95.0%)	0.59	1.24	2.61
Confidence Interval (CI)	**0.59**	**1.24**	**2.61**
Mean Value	**8.0±0.59**	**16.0±1.24**	**32±2.61**
ZBS (845:2005) Standard Limit	**N.M**	**60-90**	**N.M**
IFC-WBG (2007)Standard Limit	**25**	**25**	**230**

Source: Field measurement, July, 2020

Table 3.2: Summary of ambient dust levels at AL-MASJID NUUR LLAH

Item	PM2.5 [µg/m3]	PM_{10} [µg/m^3]	TSP [µg/m^3]
Mean	21.10	43.16	88.84
Standard Deviation	10.63	22.30	49.10

Range	58.00	127.00	364.00
Minimum	4.00	7.00	12.00
Maximum	62.00	134.00	376.00
Count	480.00	480.00	480.00
Confidence Level (95.0%)	0.59	1.24	4.40
Confidence Interval (CI)	**0.95**	**2.00**	**4.39**
Mean Value	**21.0±0.95**	**43.0±2.00**	**88.0±4.39**
ZBS (845:2005) Standard Limit	**N.M**	**60-90**	**N.M**
IFC-WBG (2007)Standard Limit	**25**	**25**	**230**

Source: Field measurement, July, 2020

Table 3.3: Summary of ambient dust levels at RH, near Sebuleni pond

Item	PM2.5 [µg/m3]	PM_{10} [µg/m^3]	TSP [µg/m^3]
Mean	15.18	30.97	63.17
Standard Deviation	8.15	16.69	34.80
Minimum	2.00	3.00	5.00
Maximum	68.00	150.00	331.00
Count	480.00	480.00	480.00
Confidence Level (95.0%)	0.59	1.24	3.12
Confidence Interval (CI)	**0.73**	**1.49**	**3.11**
Mean Value	**15.0±0.73**	**31.0±1.50**	**63±3.11**
ZBS (845:2005) Standard Limit	**N.M**	**60-90**	**N.M**
IFC-WBG (2007) Standard Limit	**25**	**25**	**230**

Source: Field measurement, July, 2020

Table 3.4: Summary of ambient dust levels at RH, near Amani Stadium

Item	PM2.5 [µg/m3]	PM_{10} [µg/m^3]	TSP [µg/m^3]
Mean	17.10	34.83	70.99
Standard Deviation	10.61	22.07	46.23
Minimum	3.00	5.00	8.00
Maximum	62.00	134.00	290.00
Count	480.00	480.00	480.00
Confidence Level (95.0%)	0.59	1.24	4.15
Confidence Interval (CI)	**0.95**	**1.97**	**4.14**
Mean Value	**17.0±0.95**	**34.0±2.00**	**70.0±4.14**
ZBS (845:2005) Standard Limit	**N.M**	**60-90**	**N.M**
IFC-WBG (2007) Standard Limit	**25**	**25**	**230**

WHO Ambient Air Quality Guidelines	50 (Interim target-2) at the averaging period of 24-Hours	100 (Interim target-2) at the averaging period of 24-Hours	

Source: Field measurement, July, 2020

3.2 Ambient Gaseous Levels

As presented in Tables 3.5 through 3.8 all monitored locations were had ambient gaseous levels which comply with both local [Zanzibar (ZBS: 845:2005)] and international (IFC-WBG 2007) standards limits. Field observations and measurement earmarked that, the detected ambient gaseous emissions were assumed to be contributed by vehicles and motor cycles exhaust emissions passing nearby the project area. Also, domestic activities which involve burning of charcoal, wood and solid waste were assumed to cause such recorded levels of ambient gases. Appendix II details on findings of ambient gaseous emission levels measured in all sampling locations.

Table 3.5: Summary of ambient gaseous levels at RH, near Maboga Lake

Item	CO_2 [%]	CO [ppm]	SO_2 [ppm]	O_2 [%]	CH_4 [ppm]	NO_2 [ppm]
Mean	0.039	0.075	0.047	20.897	0.027	0.043
Standard Deviation	0.002	0.091	0.067	0.017	0.044	0.065
Minimum	0.030	0.000	0.000	20.800	0.000	0.000
Maximum	0.050	0.500	0.200	20.900	0.100	0.200
Count	480.000	480.000	480.000	480.000	480.000	480.000
Confidence Level (95.0%)	0.0002	0.008	0.006	0.002	0.004	0.006
Confidence Interval (CI)	**0.0002**	**0.008**	**0.006**	**0.002**	**0.004**	**0.006**
Mean Value	**0.04.0±0.0002**	**0.07.0±0.008**	**0.05.0±0.006**	**20.9.0±0.002**	**0.03.0±0.004**	**0.04.0±0.006**
WHO Ambient Air Quality Guidelines			50 (Interim target-2) at averaging period of 24-Hour			200 (guideline) at an averaging period of 1-Hour

Source: Field measurement, July, 2020

Table 3.6: Summary of ambient gaseous levels at AL-MASJID NUUR LLAH

Item	CO_2 [%]	CO [ppm]	SO_2 [ppm]	O_2 [%]	CH_4 [ppm]	NO_2 [ppm]
Mean	0.045	0.710	0.087	20.897	0.057	0.073
Standard Deviation	0.007	1.406	0.125	0.065	0.084	0.111
Minimum	0.040	0.000	0.000	20.600	0.000	0.000
Maximum	0.070	12.000	0.500	20.940	0.300	0.400
Count	480.000	480.000	480.000	480.000	480.000	480.000
Confidence Level (95.0%)	0.001	0.126	0.011	0.006	0.008	0.010
Confidence Interval (CI)	**0.001**	**0.126**	**0.011**	**0.006**	**0.007**	**0.010**
Mean Value	**0.04.0±0.001**	**0.07.0±0.126**	**0.08.0±0.011**	**20.9.0±0.006**	**0.06.0±0.007**	**0.07.0±0.010**

Source: Field measurement, July, 2020

Table 3.7: Summary of ambient gaseous levels at RH, near Sebuleni pond

Item	CO2 [%]	CO [ppm]	SO2 [ppm]	O2 [%]	CH4 [ppm]	NO2 [ppm]
Mean	0.041	0.106	0.043	20.89	0.017	0.03
Standard Deviation	0.004	0.272	0.068	0.041	0.038	0.061
Minimum	0.03	0	0	20.6	0	0
Maximum	0.05	3	0.2	20.9	0.1	0.2
Count	480	480	480	480	480	480
Confidence Level (95.0%)	0.0004	0.024	0.006	0.004	0.003	0.005
Confidence Interval (CI)	**0.0004**	**0.024**	**0.006**	**0.004**	**0.003**	**0.005**
Mean Value	**0.04.0±0.0004**	**0.11.0±0.024**	**0.04.0±0.006**	**20.9.0±0.004**	**0.02.0±0.003**	**0.03.0±0.005**

Source: Field measurement, July, 2020

Table 3.8: Summary of ambient gaseous levels at RH, near Amani Stadium

Item	CO_2 [%]	CO [ppm]	SO_2 [ppm]	O_2 [%]	CH_4 [ppm]	NO_2 [ppm]
Mean	0.040	0.121	0.020	20.891	0.013	0.024
Standard Deviation	0.002	0.309	0.049	0.038	0.033	0.054
Minimum	0.040	0.000	0.000	20.600	0.000	0.000
Maximum	0.060	3.000	0.200	20.900	0.100	0.200
Count	480.000	480.000	480.000	480.000	480.000	480.000
Confidence Level (95.0%)	0.0002	0.028	0.004	0.003	0.003	0.005
Confidence Interval (CI)	**0.0002**	**0.028**	**0.004**	**0.003**	**0.003**	**0.005**
Mean Value	**0.04.0±0.0002**	**0.12.0±0.028**	**0.02.0±0.004**	**20.9.0±0.003**	**0.01.0±0.003**	**0.02.0±0.005**

Source: Field measurement, July, 2020

Gas type	Unit	(ZBS: 845: 2005) Standard	(IFC-WBG 2007) Standard
Carbon dioxide (CO_2	%	**N.M**	**N.M**
Carbon monoxide (CO)	ppm	**9.0**	**9.0**
Sulfur dioxide (SO_2)	ppm	**N.M**	**0.5**
Oxygen (O_2)	%	**N.M**	**N.M**
Methane (CH_4)	ppm	**N.M**	**N.M**
Nitrogen dioxide (NO_2)	ppm	**N.M**	**0.2**

Table 3.9: Summary of air temperature (AT) and relative humidity (RH) levels

	RH, near Maboga Lake		AL-MASJID NUUR LLAH		RH, near Sebuleni pond		RH, near Amani Stadium	
Item	**AT[°C]**	**RH [%]**	**AT[°C]**	**RH [%]**	**AT[°C]**	**RH [%]**	**AT[°C]**	**RH [%]**
Mean	31.72	71.36	30.16	64.48	29.91	71.73	27.08	76.61
Standard Deviation	2.88	10.91	3.50	14.57	2.75	12.55	1.26	4.41
Minimum	26.00	53.00	26.00	48.00	25.00	54.00	25.00	72.00
Maximum	35.00	96.00	35.00	89.00	34.00	90.00	29.00	87.00
Count	480.00	480.00	480.00	480.00	480.00	480.00	480.00	480.00
Confidence Level (95.0%)	0.26	0.98	0.31	1.31	0.25	1.13	0.11	0.40
Confidence Interval (CI)	**0.26**	**0.98**	**0.31**	**1.30**	**0.25**	**1.12**	**0.11**	**0.39**
Mean Value	**31.0±0.26**	**71.0±0.98**	**30.0±0.31**	**64.0±1.13**	**29.0±0.25**	**71.0±1.12**	**27.0±0.11**	**76.0±0.39**

Source: Field measurement, July, 2020

3.3 Ambient Noise Levels

The Table 3.9 presents summary of test findings, all measured locations had eight hours equivalent noise levels which comply with the acceptable [ZBS 845:2005) [EMDC 6(1733)]] limits of 70 dB (A), and international (IFC-WBG: 2007) standards. Further, the noise levels recorded at residential house near Maboga Lake were assumed to be caused by aircrafts, vehicles and motor cycles, passing near the project area as well as the wind blows. Appendix IV is details of noise levels measured at all pre-established sampling locations.

Table 3.10: Summary of noise levels [d (BA)] for all locations

Item	RH, near Maboga Lake	AL-MASJID NUUR LLAH	RH, near Sebuleni pond	RH, near Amani Stadium
Mean	53.49	68.84	53.00	58.99
Standard Deviation	4.43	3.83	2.10	10.48
Minimum	46.40	59.70	48.10	44.70
Maximum	76.30	84.30	59.90	80.10
Count	480.00	480.00	480.00	480.00
Confidence Level (95.0%)	0.59	1.24	0.19	0.94
Confidence Interval (CI)	**0.40**	**0.34**	**0.19**	**0.94**
Mean Value	**53.0±0.35**	**68.0±0.34**	**52±0.19**	**58±0.94**

Source: Field measurement, July, 2020

Standards	**Local, [ZBS 845:2005, [EMDC 6(1733)]**	**70**	**Daytime (06:00AM-22:00PM)**
	International (IFC-WBG:2007)	**70**	**Daytime (06:00AM-22:00PM)**

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusion

i. The environmental assessment was successfully conducted covering the baseline information in terms of air quality and noise level at the project area.

ii. The field measurements revealed that all measured locations (on/off site) had air quality and noise levels which comply with both local (ZBS: 845 2005) and international (IFC-WBG: 2007) standards.

4.2 Recommendations

Based on the study findings, the following are recommended:

i. The client is advised to ensure that environmental monitoring in terms of noise and air quality is conducted during the project implementation, especially during the construction phase to ascertain the impact that might be contributed by construction machines such as earth excavators, compacters, trucks and other construction machines.

ii. Personal protective equipment (PPE) should be provided and enforced to the employees who will be involved during the construction phase to mitigate the impact that might be

contributed by construction activities such as earth excavations, compaction and loading and offloading construction materials.

iii. All construction machines and equipment shall be serviced in fine tunes in accordance with the manufacturer's specifications in order to minimize the generation of ambient gaseous emissions and smoky dust from combustion engine chamber through exhaust tailpipes to air.

Appendix IX: Detailed Description of the Main Drainage Structure

The identified drainage systems have been designed to solve flooding problems to Urban areas. The criteria used during design for each system were; flood return periods and peak flow. Table below shows the criterion for the identified drainage interventions and shapes of the proposed drainage system.

Table 1: List of the identified drainage interventions and structural typologies

Drain Code	Return Period Chosed	Peak Flow (m3/s)	Connection with Existing System	Shape
Drain Cc	15 yrs	2.4	System C	Rectangular Channel with Slabs/Closed
Drain Cd	15 yrs	0.6	System C	Rectangular Channel underground with MH
	15 yrs	1.7	System C	Rectangular Channel underground with MH

According to their aim and function different structural typologies were selected. The identified and proposed drainage has been designed of different shape and size base on peak flow, safety and technical considerations as elaborated in the following sections;

Main Channels:

Reno mattresses and gabions channel

Reno mattresses and gabions channel consist of a low flow channel providing habitat for aquatic organisms and a grassed high flow channel which is hydraulically efficient for flood protection purposes. This will be used in the open channels as well as in the outlets of the underground channels towards the sea

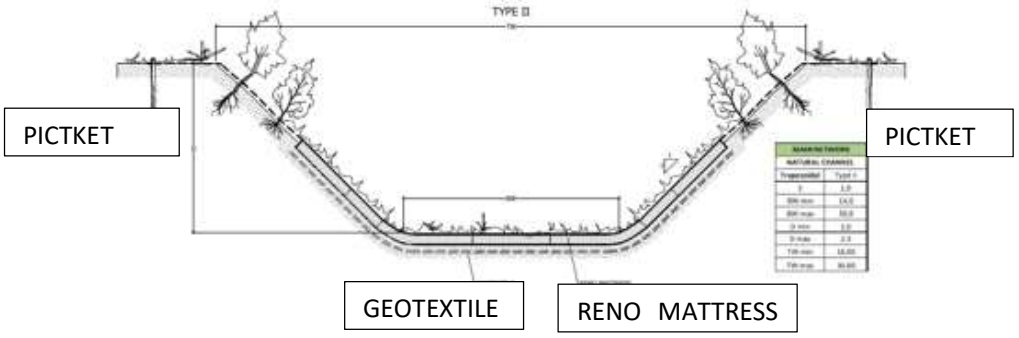

Figure 1: Typical Cross Section of a Reno mattresses and gabions channel

Precast or cast in place box culvert:

Underground concrete channels are necessary. The pre-cast or cast in situ culverts have been proposed in order to guarantee the inspection and the simple maintenance of the structures. In this project, box culvert has been designed. For Example, it has been proposed to be used in drainage system Cd.

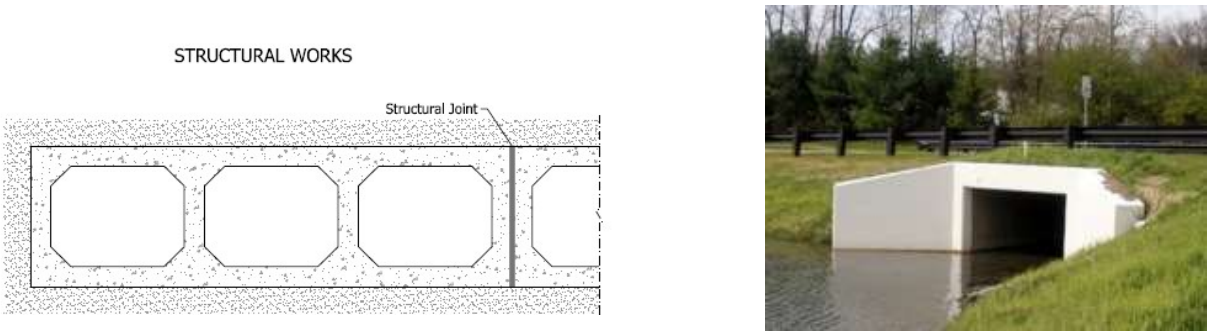

Figure 2: Example of single cell and multi-cells box culvert

Secondary/Local Channels

The principles guiding the design of the drainage intervention for local service, have been defined following the structures of the general drainage scheme of Zanzibar City. Each local drainage network has been drafted for intercepting the runoff of the catchment area and discharging it into the closest main drainage where possible or into foreseen lamination ponds.

Attention has been paid to assign, whenever possible, a drainage hierarchy following the road network hierarchy foreseen in the Urban Master Plan, this to minimize the impact of the drainage system construction. Three types of drainage category have been identified.

- **Category I**

Category I drainage has to be intended as the "backbone" of the local drainage system. Connections from all subsidiary channels of the same sub-catchment are foreseen for this drainage category that, accordingly, is designed, in cross section and depth, for allowing discharge from second order into it, providing a suitable discharge point for each sub area.

Drainage channels under this category are foreseen to be underground concrete rectangular culvert. Connectors from both sides of the carriageway are provided as per drawing below while connection to upstream drainage is made through confluence pits as per Figure

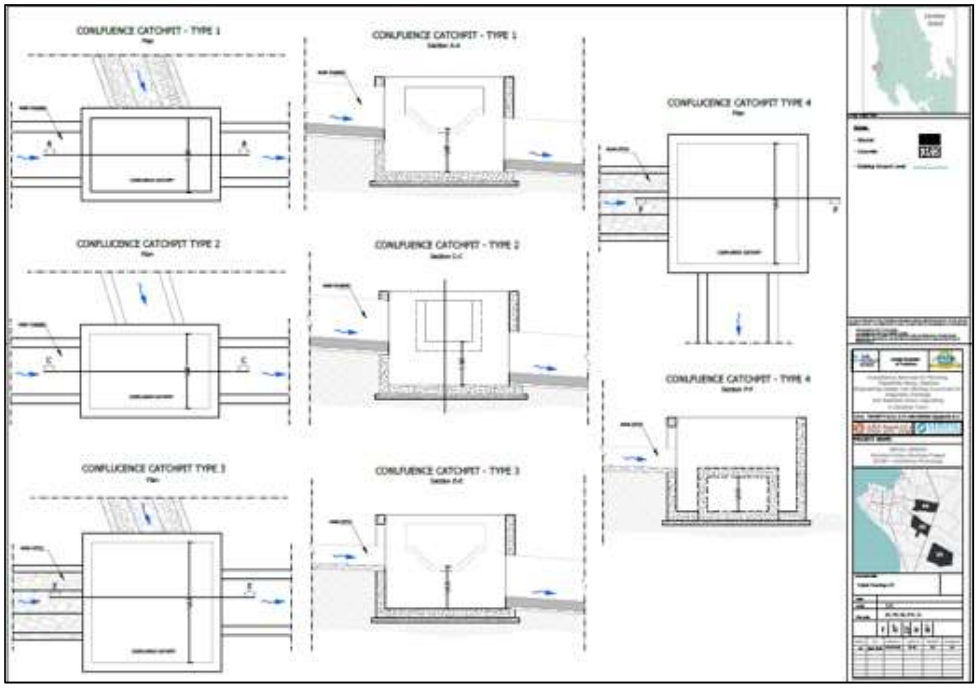

Figure 3. Confluence Cath pits Details

- **Category II**

Category II drainage are designed for collecting storm water from catchment area and category III drainage and discharging into the nearest category I drain, if a nearest direct discharge point is not available in the area. Drainage channels under this category are foreseen to be concrete rectangular channels covered with movable concrete slabs. The concrete slabs are put in place on an intermitted curb, creating curb inlets for collecting the carriageway storm water.

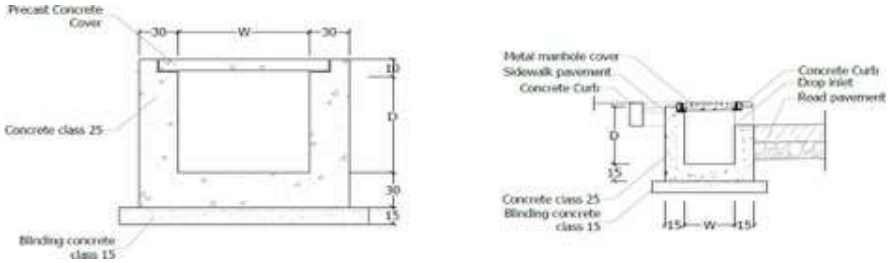

Figure 4: Category II Drainage Channel

- **Category III**

Category III drainage channels are designed for collecting storm water from the portion of sub- catchment afferent to the road trunk where it lies and discharging it into the category II drainage. The foreseen solution for this category is the implementation of surface concrete or stone pitched trapezoidal drainage channel. No risk of danger is associated to this type of channel, despite the fact that this configuration is open and accessible from people, being peak flows and velocity relatively small.

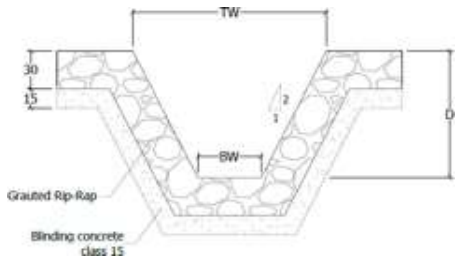

Figure 5: Category III Drainage Channel

Advantage of this solution, for minor road, and local runoff, is the simplicity of implementation and maintenance, Velocity control is required for ensuring a minimum value for frequent events in order to guarantee a self-cleaning effect and reducing the need for cleaning. It should in any case be considered that as small depths are associated with these types of channels, control of sediment and waste disposal shall be frequent.

1.4.1 Rectangular channel with cover slabs:

In this solution the drains are covered by slabs with side openings for allowing water to be collected from the road surface. This solution has the aim of integrating the drains in the urban design of the city. With respect to the proposed project, the rectangular channels with cover have been proposed to be used in drainage system Eb and Cc.

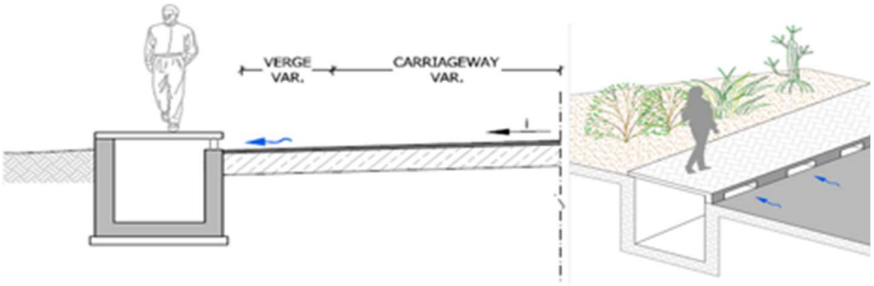

Figure 6: Precast or cast in place culvert box

- **Trapezoidal/ Rectangular open channel:**

An alternative to covered secondary channel is the trapezoidal or rectangular open concrete channel. This solution is easier to make and less expensive. The typical cross sections and some images are shown in the figure below:

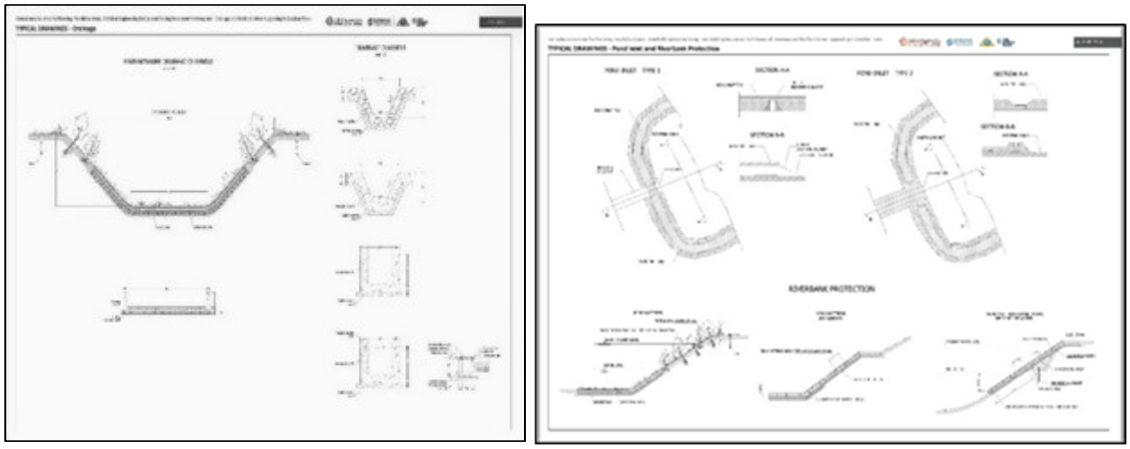

Figure 7: Typical Trapezoidal/rectangular drainage structures and protection

Hydraulic information of the selected drainage intervention

Drainage sections information

The essential hydraulic information of the selected drainage information is presented in the table below. The information includes the type of the cross section, estimated dimensions and expected excavation volume.

Table 2: Hydraulic information of the selected drainage interventions

Drain Code	**Cross Section Size**	**Length**(m)	**Excavation Volume**
Drain Cc	Rectangular Channel with Slabs/Closed	200	Minimum Volume of Excavation
Drain Cd	Rectangular Channel underground with MH	245	Minimum Volume of Excavation
Drain Eb	Rectangular Channel with slabs/closed	147	Minimum Volume of Excavation
Outlet System C	Open Trapezoidal Channel	120	Minimum Volume of Excavation

Hydrological and updated geological for the drainage interventions

The proposed interventions cover areas interested by the catchments in the table below. During the design stage the following properties and areas were achieved.

Table 3: Hydrological features for the drainage interventions

Basin Name	Area (ha)	Peak Flow (RP 15) m^3/s	Peak Flow (RP 30) m^3/s
Drain Cc	8.3	2.4	2.7
Drain Eb	10.4	3.5	4.0
Drain Cd Part I	1.5	0.6	0.7
Drain Cd Part II	5.7	1.7	2.0
Outlet System C	545.0	54.5	63.1
Outlet Ziwamaboga Pond	824.0	62.0	72.0

Storm Water Management model (SWMM)

SWMM is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of sub-catchment areas that receive precipitation and generate runoff and pollutant loads. The routing portion of SWMM transports this runoff through a system of pipes, channels, storage/treatment devices, pumps, and regulators. SWMM tracks the quantity and quality of runoff generated within each sub-catchment, and the flow rate, flow depth, and quality of water in each pipe and channel during a simulation period comprised of multiple time steps.

SWMM has been used under this study for modelling the behaviour of the system composed by catchment – lamination basin outlet. This type of dynamic study has allowed the Consultant to assess impacts of increasing of the storage area against benefits of reducing the size of the outlet works. The approach has been applied to the system of Ziwa Maboga pond for sizing of the outlet works and in Sebleni pond for assessing the impact of high RP events. The same approach has been used to assess the effects of the diversion works from Ziwa Maboga to Sebleni as well

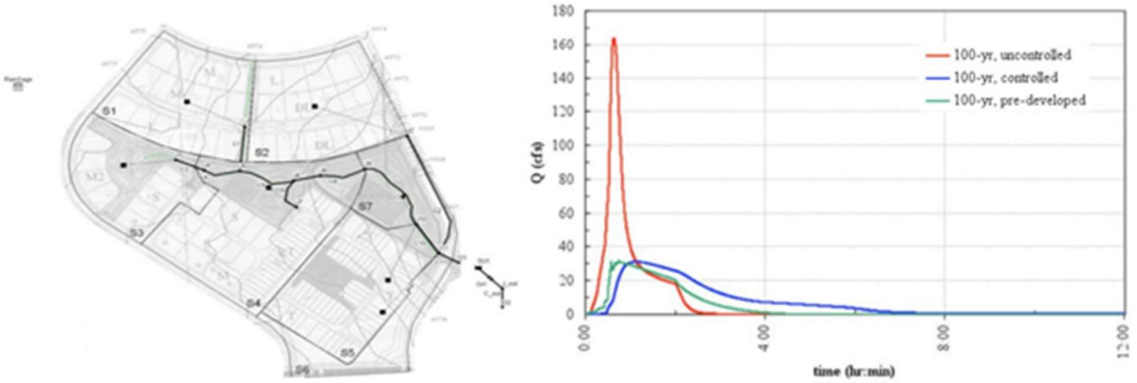

Figure 8; Example of SWMM outputs

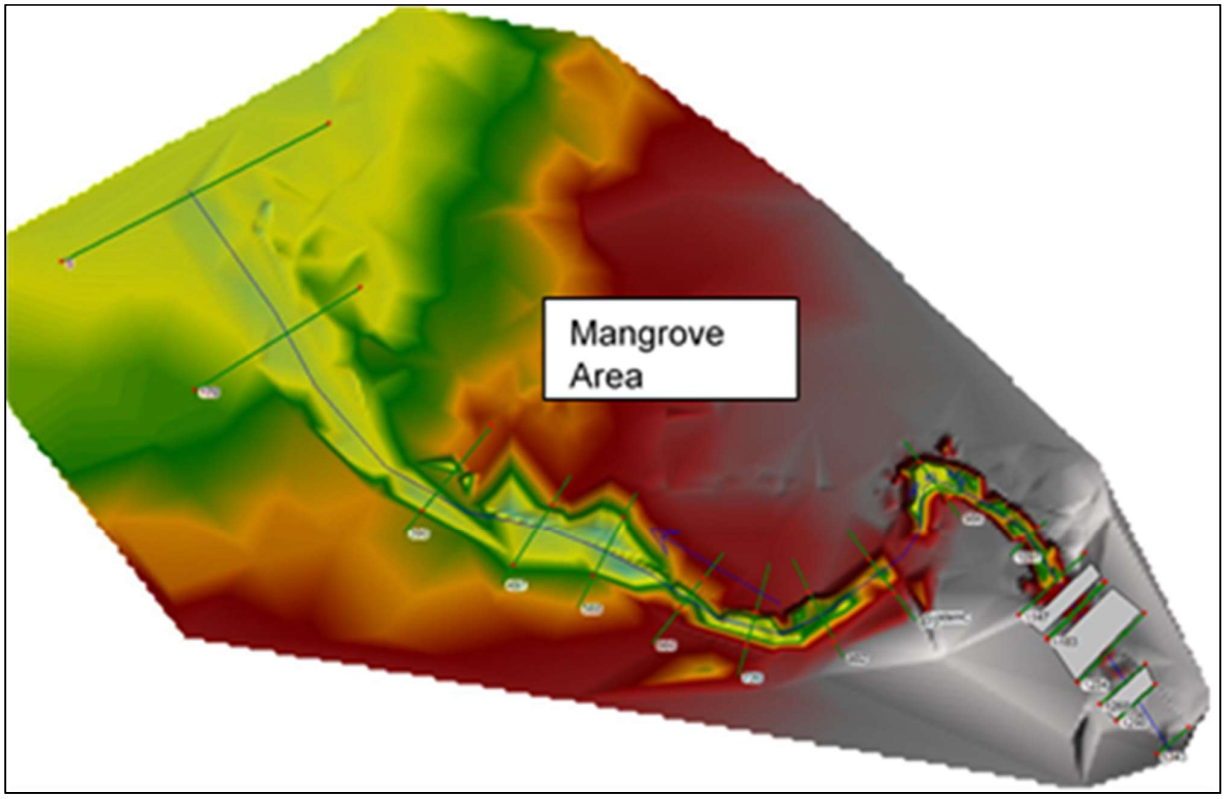

Figure 9: Geometric file of the System C outlet model in Hec Ra