

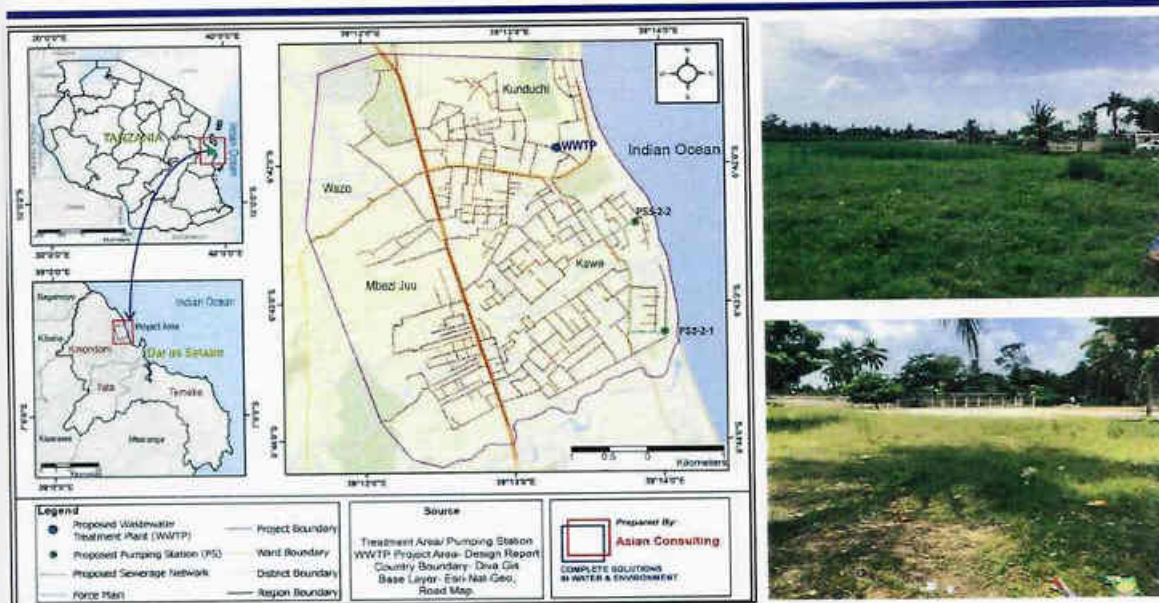


## **The Dar Es Salaam Water & Sewerage Authority (DAWASA) Dar Es Salaam, Tanzania.**

**PREPARATION OF ENVIRONMENTAL AND SOCIAL IMPACTS  
ASSESSMENT (ESIA) AND RESETTLEMENT ACTION PLAN (RAP)  
REPORTS FOR CONSTRUCTION OF WASTEWATER TREATMENT  
PLANT AND SEWERAGE NETWORKS AT MBEZI BEACH AREA.**

**CONTRACT NO.: AE/033/2017 – 2018/CS/12 – (C2-C03)**

**EXECUTIVE SUMMARY OF ESIA REPORT IN ENGLISH**



**Project Proponent**  
**The Chief Executive Officer,**  
Dar es Salaam Water and Sewerage Authority,  
P.O Box 1573  
Dar es Salaam  
Tel: +255-22-2760006/2760015  
Email: [dawasaceo@dawasa.co.tz](mailto:dawasaceo@dawasa.co.tz)

**Lead Consultant**  
Asian Consulting Enterprise Pte Limited,  
Singapore.  
Asian Consulting Engineers Private Limited,  
66 Hemkunt Colony, II Floor,  
New Delhi 110 048, India.  
Telephone: +91-11-4163 5644 / 4163 4926  
Email: [info@asianconsulting.org](mailto:info@asianconsulting.org)

**Submitted to:**  
Director General, National Environment  
Management Council (NEMC),  
Regent Estate Plot No. 29/30  
P.O. Box 63154, Dar es Salaam Tanzania  
Tel: +255-22-2774852, 22 2774889/713608930  
E-mail: [nemc@nemctan.org](mailto:nemc@nemctan.org)  
Website: [www.nemc.or.tz](http://www.nemc.or.tz)

**Executive Summary of ESIA Report  
(in English)**

**February 2022**

# ***EXECUTIVE SUMMARY***

## **1. INTRODUCTION**

Dar es Salaam Water and Sewerage Authority (DAWASA) is constructing Wastewater Treatment Plant (WWTP) and Sewerage Networks at Mbezi Beach Area. This project is an outcome of the Strategic Improvement Plan prepared by DAWASA with a 25-year horizon. The major objective of the project is to improve sanitation facilities and provide higher level of services to the people of Mbezi Juu, Mbezi Beach, Kilongawima, Kawe, Kunduchi and Wazo areas. These areas fall under Kinondoni district of Dar es Salaam.

The project falls under **Type-A**, as per the third schedule of The Environmental Management Act (EMA), 2004 and first schedule of Environmental Impact Assessment and Audit Regulations, 2005 of Tanzania.

The implementation of the project can have considerable environmental and social impacts. Therefore, it is required to identify the possible adverse impacts on bio-physical and social environment and provide suitable mitigation measures. In view of the above, DAWASA has engaged Asian Consulting Engineers Pvt. Ltd., India and its sister concern Asian Consulting Enterprises Pte Ltd, Singapore (hereinafter referred to as ACE) to carry out Environmental and Social Impact Assessment (ESIA) and to develop a Resettlement Action Plan (RAP) or Abbreviated Resettlement Action Plan (ARAP).

A major scope of the work is to prepare ESIA and ESMP report considering the potential impacts of the project on physical, biological or social components. It is also required to propose mitigation measures for the impacts as well as grievance redressal procedures.

## **2. PROJECT DESCRIPTION**

An Integrated Sewerage System consisting of a wastewater treatment plant of capacity 16,000 (m<sup>3</sup>/day), a sewerage network of 97 km and pumping stations is proposed for this project. The new system will provide sewer connection to 37,468 houses.

### **Project Boundaries**

#### ***Spatial Boundary:***

- Direct Impact Area is the area where the project is located, and that which will bear the most impacts.
- Indirect Impact Area is the surroundings of direct influence area (i.e. Kinondoni district) from where different services will be obtained for the project.

#### ***Temporal boundary:***

The impact of the construction work of sewerage may be short-lived, but the presence of the sewerage in the area may have implications that would stretch far into the future.

### **Project Design Overview**

The facilities suggested for the project along with their proposed numbers are given below in **Table 1**.



**Table1: Components of the Project**

S. No	Name of Facilities	Unit	Quantity	Remark
1.	Wastewater Treatment Plant (WWTP)	No.	1	16,000 m <sup>3</sup> /day
2.	Pumping Station (PS)	No.	2	The location of one PS has decided but another one is not yet decided.
3.	Sewer Network	km	97	Diameter between 200 to 800mm.
4.	House Connection	HH No.	37,468	
5.	Connection Pipe	m	753,620	Diameter 150mm

As mentioned above, there will be a single wastewater treatment plant (WWTP) for this project, and it will be located between 6°41'53.43"S and 39°13'18.52"E. The land selected for the same is owned by DAWASA. The major facilities recommended for WWTP is given below

**Table 2: Major Facilities in Mbezi (WWTP)**

Treatment Process	Major Facility	Type
Pretreatment	Grit Chamber	Circular
Secondary treatment	Aeration basin	Rectangular
	Secondary clarifier	Circular
Disinfection facility	disinfection facility	Rectangular

In this project, after completing the treatment, the treated wastewater will be disposed into the Indian ocean whereas the final sludge is recommended for reclamation, considering its value as an economic resource. However, it is suggested to introduce more suitable disposal methods considering both the economic and environmental point of view. Also, since odour can be produced in WWTP from various chemical compounds, it is suggested to install odour treatment plant nearby the inlet facilities.

For the sewer connection, there will be two types of pipes namely non-pressure and forced mains. The recommended material for gravity sewer pipe is profile wall HDPE and for the main force Ductile iron pipe. The pumping station will be located at Kawe ward between 6°43'12.82"S; 39°14'0.75"E. For the same, underwater grinder pump or non-closed underwater pump is recommended.

### Project Activities

The activities associated with the project at different project phases for both sewer network and WWTP are explained below in **Table 3**.

**Table 3: Project Activities**

S. No	Facilities	Project Phases	Activities
1.	<i>Wastewater Treatment Plan</i>	<b>Pre-Construction Phase</b>	<ul style="list-style-type: none"> <li>Land Acquisition</li> <li>Site Clearance</li> </ul>
		<b>Construction Phase</b>	<b>Materials and Equipment Transport</b> <b>Construction of WWTP</b> <ul style="list-style-type: none"> <li>Site surveying</li> <li>Establishment of access roads;</li> <li>Establishment of temporary fences and gates;</li> <li>Site clearance and preliminary grading;</li> <li>Establishment of construction facilities.</li> </ul>

S. No	Facilities	Project Phases	Activities
2.	<i>Sewer Network System</i>		<ul style="list-style-type: none"> <li>Site excavation;</li> <li>Connection of the facilities to the trunk sewers;</li> <li>Installation of utilities and services;</li> <li>Landscaping within the plant area.</li> </ul>
		Operation Phase	<ul style="list-style-type: none"> <li>Screening</li> <li>Grit Removal</li> <li>Disinfection</li> </ul>
		Decommissioning Phase	<ul style="list-style-type: none"> <li>Demolition of buildings and structure at the WWTP and pumping stations.</li> <li>Disconnection of sewer lines or removal.</li> <li>Re-vegetation of the sites.</li> </ul>
		Pre-Construction Phase	<ul style="list-style-type: none"> <li>Land Acquisition</li> <li>Site Clearance</li> </ul>
		Construction Phase	<ul style="list-style-type: none"> <li>Material and equipment transport</li> <li>Pipe Laying                             <ul style="list-style-type: none"> <li>Practical Temporary Works</li> <li>Temporary retaining wall</li> </ul> </li> <li>Jacking method</li> </ul>
		Operation Phase	<ul style="list-style-type: none"> <li>Pumping of sewers</li> <li>Maintenance of the network</li> </ul>
		Decommissioning Phase	<ul style="list-style-type: none"> <li>Removal of structures</li> <li>Demolition of building and structures</li> <li>Disconnection of sewer line</li> <li>Re-vegetation of sites.</li> </ul>

#### **Waste Disposal:**

A proper waste disposal plan requires to be followed to avoid any unauthorised disposal of waste. A variety of left-over materials such as excavated materials, construction/demolition waste, chemical waste, general waste etc. will be generated from the worksites during the pre-construction, construction and operation activities. These hazardous and non-hazardous wastes occurring in different forms, quantity or concentration can lead to pollution or constitute a danger to health and a safety risk.

#### **6. EXISTING REGULATORY AND INSTITUTIONAL FRAMEWORK**

For the proposed project to achieve its intended objectives, it shall operate under various national policies, legal and administrative frameworks. These include laws and policies of Tanzania, and World Bank's Environmental and Social Safeguard Policies.

#### **7. APPROACH AND METHODOLOGY**

ESIA study is carried out following various tools and methods, including collection of relevant data, review of collected data, (literature review), field assessments, consultations, and GIS mapping.

The ACE team has collected required information from different government departments, academic institutions (*universities*), public agencies, research institution, authorised websites, etc. and reviewed them for better understanding of the project area, its environment, sensitiveness, and socio-economic structures. Similarly, different GIS maps were prepared to understand the physical, biological and social components of the project area.



Likewise, the team has carried out field surveys from time to time either with DAWASA team or with other utility providers of the area to understand the project area and other associated issues. To ensure that each relevant stakeholder is involved during the study to provide a foundation for attaining and sustaining support of stakeholders, FGDs and one-to-one meetings were conducted throughout the project area. Information and perception of stakeholders related to the project were gathered with the help of a questionnaire exclusively designed for this purpose.

## 8. ALTERNATIVE

Analysis of alternatives is done based on different techniques or processes proposed for the project. This includes selection of an alternative sewer routes, raw materials for sewer pipes, types of pumps, wastewater treatment techniques, sludge disposal methods, and deodorising techniques, and also a 'No Project scenario'.

## 9. PUBLIC CONSULTATION

Stakeholders play a crucial role in project planning and management as well as in the success of the project. Stakeholders are those who can affect or may be affected by the project. They may also include regulatory and planning authorities and business people. As per the scope of work, several one-to-one meetings were conducted in the project area in order to interact with government bodies and other project affected entities. Several FGDs were also held in the project location. FGDs were conducted based on predefined questions related with the project. Details of all one-to-one meetings and FGDs together with the main issues and concerns raised by stakeholders have been enlisted below in **Table 4. Table 5** summarises FGDs conducted with different groups, government bodies etc.

**Table 4: One-to-One Meetings**

Sl No	Stakeholders	Meeting held on
1.	Kawa Dispensary	08 <sup>th</sup> January 2019
2.	Tsunny Health Center	08 <sup>th</sup> January 2019
3.	Jangwani Primary School	08 <sup>th</sup> January 2019
4.	Kawe Market	10 <sup>th</sup> January 2019
5.	Mwalimu Julius Kambarage Nyerere School	15 <sup>th</sup> January 2019.
6.	Mbezi High School	15 <sup>th</sup> January 2019.
7.	Beach Management Unit (BMU) Kawe	16 <sup>th</sup> January 2019.
8.	Watoto Kwanza	16 <sup>th</sup> January 2019.
9.	The Benjamin William Mkapa Foundation (BMF)	16 <sup>th</sup> January 2019.
10.	Wanawake Na Maendeleo Foundation (WAMA)	16 <sup>th</sup> January 2019.
11.	Mbezi Beach A street Government. (MJUMBE)	17 <sup>th</sup> Jan 2019
12.	Kunduchi Ward Office	17 <sup>th</sup> Jan 2019
13.	Kundo Street (Kunduchi Ward)	17 <sup>th</sup> Jan 2019
14.	Victoria Church	18 <sup>th</sup> Jan 2019
15.	Mbezi Street Office	18 <sup>th</sup> Jan 2019
16.	Ukwamani Village Office	21 <sup>st</sup> Jan 2019
17.	Mzimuni Village Office	21 <sup>st</sup> Jan 2019
18.	FEED The Children	22 <sup>nd</sup> Jan 2019
19.	Mtongani Village Office	22 <sup>nd</sup> Jan 2019
20.	Jogoo Village Office	23 <sup>rd</sup> Jan 2019
21.	Mbezi Kati Village Office	23 <sup>rd</sup> Jan 2019

SL No	Stakeholders	Meeting held on
22.	Tayoa	23 <sup>rd</sup> Jan 2019
23.	Ministry of Land, Dawasa.	25 <sup>th</sup> Jan 2019
24.	Dar es Salaam City Council.	25 <sup>th</sup> Jan 2019
25.	TANROADS	29 <sup>th</sup> Jan 2019
26.	Kawe Ward Office	05.02.2019
27.	Wazo Ward and Salasala Street	06.02.2019
28.	Kinondoni Municipal Council	19.02.2019
29.	Mbezi juu ward community	07.02.2019
30.	Osha HQ- Kinondoni	08.02.2019
31.	Kilongawima	04.02.2019
32.	Kunduchi	04.02.2019
33.	Mbezi Beach 'A' Street Office	03.03.2019
34.	Kinondoni Municipality Office	05.02.2019
35.	National Bureau of Statistics	08.02.2019
36.	TARURA	29.01.2019
37.	TTCL	21.02.2019

**Table 5: Schedule of FGDs in Study Area**

SL No.	Stakeholders	Meeting held on
1.	Representatives from local residents and business/shop keeper.	08 <sup>th</sup> January 2019
2.	Representatives from local residents and owners of nearby temporary structure.	08 <sup>th</sup> January 2019
3.	Local marketers and shopkeepers	10 <sup>th</sup> January 2019
4.	Marketers and Shop owners	10 <sup>th</sup> January 2019
5.	Marketers and Shop owners	15 <sup>th</sup> January 2019
6.	Beach Management Unit (BMU)	16 <sup>th</sup> January 2019.
7.	Mbezi Beach A Street Government Office	17 <sup>th</sup> Jan 2019
8.	MJI MPYA Group	18 <sup>th</sup> Jan 2019.
9.	Rainbow Bodabode Group	21 <sup>st</sup> Jan 2019.
10.	Makonde	21 <sup>st</sup> Jan 2019.
11.	Makaburin (Shopkeepers and Market Place)	21 <sup>st</sup> Jan 2019.
12.	Bola Bola Group	22 <sup>nd</sup> Jan 2019.
13.	Mtongani Villagers	22 <sup>nd</sup> Jan 2019
14.	Mbezi Juu ward Community	7 <sup>th</sup> Feb 2019
15.	Kilongawima Street Community	4 <sup>th</sup> Feb 2019

From the consultations, it can be concluded that people are positive towards the project as it will improve the health and sanitation situation of the area. Also, the project will help them overcome their need to empty the septic tanks and thereby solve the problems of wastes from septic tanks mixing with storm water during rainy season. Besides all these, the project will provide employment to the locals.

## 10. BASELINE ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS

Both primary and secondary information are used to assess the Baseline Condition of the project area. Primary information was collected during the field surveys and consultations, while secondary information was collected from the project proponent and also published journals, reports, and documents.

### ➤ Physical Environment

**Climate:** - The project area has a modified type equatorial climate that is hot and humid and occurs throughout the year. The area experiences two types of seasons, the hottest from October to March while relatively cooler between May and August. Similarly, the area has a bimodal type of rainfall. The short one is from October to December, known as the Vuli rains, while the long one is between March and May-known as the Masika rains.

**Air and Noise:** It was observed during the field visit that the major sources of air pollution are the gaseous dust and particulate emissions from motor vehicles, industrial stacks, construction and mining activities. Similarly, the major sources of noise are construction activities, entertainment centres and commercial sites.

**Topography:** The area is situated in a coastal lowland with an altitude range of 15–20 msl (mean sea level). Almost 4.5 km of the boundary is under shoreline. There is a presence of sand dunes and tidal swamps.

**Geology:** The geological formations of the project area consist mainly of Quaternary and Neogene deposits.

**Soil:** There are three types of soils in the area viz Sand, Silt and Clay. The area has sand as the top layer, up to 0.4 m of depth. From 0.4 m to 0.7 m, there is a presence of sandy layer mixed with gravels. A thin layer of silt mixed with sand is present from 0.7m to 1.4m depth. Again from 1.4 m to 5.1m, there is a presence of sand layer. Likewise, the depth of 5.1 m to 6 m comprises of sand mixed with clay. From 6.0 m to 8.0 m, there is a presence of clay layer.

**Water Resources:** There are a number of seasonal streams in the project area. These streams flow from West to East and finally meet the Indian Ocean which is intersecting the project area. These streams are polluted due to disposal of wastes from small industries, domestic and institutional sanitation systems, and solid wastes from residential areas. The quality of groundwater and surface water has been studied near the proposed project site.

**Ground Water Resource:** The residents of the area rely on groundwater for drinking, irrigation and industrial purposes. It is observed that most parts of the project location show influence of salinity because of sea water intrusion in the aquifer. In some places, the ground water has high concentration of Chloride and Sodium.

**Flood:** The project area is affected by flood every year. Over the last 50 years, 200 m of Kunduchi beach including the project area has retreated.

### ➤ Biological Environment

**Vegetation:** The project area constitutes various species of bushland and woodland and also coastal shrubs and mangrove trees. A part of the land is cultivated with different kinds of crops comprising of mixed cropping, and also tree, shade, bushy and herbaceous crops.



**Fauna:** The area is a settlement area and lacks floral diversity. The scarce vegetation cover indicates poor habitat value. Thus, animal diversity throughout the project area is low.

**Avifauna:** In the coastal side, there is a presence of invasive bird species, particularly the Indian house crow (*Corvus splendens*) and large numbers of Palearctic wading birds.

**Eco-Sensitive Area:** The eco-sensitive area includes mangrove forests, natural wetland, and marine reserve. The land proposed for the WWTP is a wetland which is visited by different species of avifauna and is a flood prone area.

#### ➤ **Socio-economic Area**

**Population Size:** The project area is falling under four wards of Kinondoni Municipality. They are Kawe, Kunduchi, Mbezi Juu, and Wazo, having a population of 73,530, 17,560, 85,658 and 95,742, respectively.

#### ➤ **Population Characteristics:**

**Age Composition:** The population of the area is characterised by a young age structure. A greater percentage of the people are in the age group of 20 -24 (13.29%), while the lowest percentage are above 75 years of age.

**Sex Composition:** The sex ratio of the area is 94 males per 100 females.

**Language:** Swahili is the commonly spoken language in the project area. The other native languages include Sukuma, Zaramo, Haya, Nyakyusa, Hehe, Nyamwezi, Wamatembo, Wagogo, Ruo, Iraq, Wazigua, Chaga, Maasai, Zanaki Kurya, Wajita, Wanyambo, Waha, Ndengereko, Wanyaturu, Wajita, Nyiha, Sonjo, Pare, Iramba, Digo, Wamakua, and Ngasa

**Ethnic Groups:** The area comprises Zaramo, haya, nyakyusa, Pare, Sukuma Nyamwezi and Chaga tribal groups.

**Literacy Rate:** Most of the people in the project area have completed primary education. Some of them have completed secondary education and very few have graduated from college.

**Educational Facilities:** There are 133 educational facilities (Table 7.5) located within the project area. They include primary public & private schools, public & private nursery schools, private & public secondary schools and colleges.

**Employment:** The people of the area depend on large and small-scale trade, small-scale livestock keeping, horticulture, tourism and small and heavy industries. The communities along the coastal areas are engaged in fisheries.

**Transportation:** The area is well connected to different modes of transportation facilities such as airport, railway and roads.

**Road and Traffic:** The road network in the proposed project area consists of both tarmac and gravel roads. The roads of the project area either fall under Tanzania National Roads Agency (TANROAD) or Tanzania Rural and Urban Road Agency (TARURA). Ally sykes road and Bagamoyo road are the roads, which come under the TANROAD while others under TARURA.



**Water Supply:** People of the area depend on the water supply pipeline of DAWASA. There are a few unplanned settlements nearby pumping stations and sewer network lines. Poor people buy water from the houses having DAWASA water pipeline as reported during FGDs conducted by ACE.

**Sanitation:** A majority of the households of the project area use pit latrines, mostly traditional unlined pits while the remaining households have either use septic tanks which are emptied from time to time and discharged at DAWASA sewage collection ponds.

**Drainage System:** The drainage system is poor in the area. There is a presence of unlined storm water drains beside the earthen roads while concrete lined storm drains are present along the tarmac roads. These drainages are not properly maintained.

**Waste Management:** The solid waste in the project area is collected by the Municipality as well as some private companies, community-based organizations and informal sectors. Apart from collection activities, the Municipality is also responsible for supervising the franchisees involved in solid waste management.

**Health Facilities:** There are several private and public health facilities in the Kinondoni Municipal Council area. The available health facilities in the project region have at least one public dispensary in each ward.

**Diseases Outbreak:** The major diseases within the project area, as learned from the interaction with local communities and ward professionals, are Malaria, Pneumonia, UTI (Urinary Tract Infection), Typhoid and skin diseases. The major reason for outbreak of these diseases is lack of personal hygiene. HIV/AIDS is one of the leading causes of mortality mostly among the working age groups. Within the project area, the highest percentage of positive HIV results were recorded in Mbezi Juu ward.

**Power Supply:** Tanzania Electric Supply Company Limited (TANESCO) is responsible for supplying power in the project area. It is a government organization.

## 11. IMPACT IDENTIFICATION AND MITIGATION MEASURES

Positive Impacts due to the construction of Sewerage Network and WWTP are explained below in Table 6.

**Table 6: Positive Impacts of the Project**

S. No	Facilities	Components	Positive Impact
1	WWTP	Water quality	<ul style="list-style-type: none"> <li>Improvement in receiving water quality due to discharge of treated sewage.</li> </ul>
		Public health	<ul style="list-style-type: none"> <li>Improved health conditions of the locals due to adequate sewage treatment.</li> <li>Reduced cases of water borne diseases.</li> </ul>
		Economy	<ul style="list-style-type: none"> <li>Job opportunities to local people.</li> </ul>
2	Sewer Network System	Soil and Ground Water Quality	<ul style="list-style-type: none"> <li>Improved sewer networks.</li> <li>Elimination of discharge of untreated sewer in undesignated areas.</li> <li>Reduced soil and groundwater pollution.</li> </ul>
		Public health	<ul style="list-style-type: none"> <li>Improved health conditions of the locals.</li> </ul>

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S. No	Facilities	Components	Positive Impact
			<ul style="list-style-type: none"> <li>• e Reduction in the spread of diseases like cholera, and diarrhoea.</li> <li>• Arrest of issues like mosquitoes breeding in stagnant water and spread of waterborne diseases.</li> </ul>
		Aesthetics:	<ul style="list-style-type: none"> <li>• Improved aesthetics of the area.</li> </ul>
		Economy	<ul style="list-style-type: none"> <li>• Provision of job opportunities to local people.</li> <li>• Possible increase in property value due to improved sewer network connection.</li> </ul>

**Table 7** explains the adverse impact of the project.

**Table 7: Negative Impact of the Project.**

SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
Pre-construction Phase					
1.	Air	i. Dust generation. ii. Emission of exhaust gases iii. Emission of Fugitive gas.	i. Water spraying ii. Proper covering of raw materials. iii. Minimizing the movement of heavy vehicles. iv. Restricting vehicle speed to 20 km/h. v. Proper maintenance of vehicles and machineries.	Same as in sewer network.	Same as in sewer network.
2.	Noise & Vibration	i. Disturbance to local population	i. Restricting the construction works between 6 am to 9 pm. ii. Maintaining the noise level below 55 dB (A) for residents and below 80 dB for workers. (A). iii. Informing nearby residents and businesses 24 hours prior to any noisy activity.	Same as in sewer network.	Same as in sewer network.
3.	Land/ Soil	i. A Loss of residential/ Commercial /agricultural/pasture/public land.	i. Alternatives need to be explored to reduce the land acquisition impacts. ii. Land acquisition process should be in line with national legislations.	The land for the proposed WWTP is presently owned by Ministry of Natural Resources and Tourism. It was agreed by the Ministry to provide the land to DAWASA as the project is a national effort to improve the sanitation. The land is to be handed over after getting the necessary statutory clearances.	
4.	Flora	Removal of present vegetation	Minimize the removal of vegetation cover.	Removal of present vegetation.	Cutting of trees as per relevant laws. Development of a Green Belt.



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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
5.	Avifauna/Fauna	---	---	Disturbances on the avifauna.	Planting of green belt around WWTP site with tall, flower and fruit bearing trees to attract birds. Preservation of remaining part of wetland that is not occupied by WWTP site.
6.	Loss of assets	Loss of commercial/residential/public property.	Compensation for property loss if any.	The empty site proposed for the setting up of WWTP is a Government land. The land is presently owned by Ministry of Natural Resources and Tourism. It was agreed by the Ministry to provide the land to DAWASA as the project is a national effort to improve the sanitation. The land is to be handed over after getting the necessary statutory clearances.	
7.	Income and Livelihood	i. Loss of commercial land and/or property ii. Effect on the source of income and livelihood of the affected person.	Compensation for the affected property and livelihood		
8.	Gender	Male may not share the compensation amount with female.	Compensation in joint account.		
9.	Occupational Health and Safety	Impact on hearing capacity of the workers.	i. Noise level limit for workers is below 80 dB (A). ii. Hearing protection to workers. iii. Installation of warning signs.	Same as in sewer network	Same as in sewer network.
10.	Community Health and Safety	Disturbance to local population, surrounding the worksites.	i. Construction works to be restricted within daytime 6 am to 9 pm. ii. Noise level for residents should not exceed 55 dB. iii. Nearby residents and businesses should be notified 24 hours before commencement of the project.	Same as in sewer network	Same as in sewer network.
11.	Child labour	Child Abuse and Exploitation	This will be a responsibility of Contractor, DAWASA, supervising	Same as in sewer network	Same as sewer in network

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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>engineer and village government to ensure that-</p> <ul style="list-style-type: none"> <li>i. Due diligence and regular monitoring to ensure the non-employment of minors in the supply chain and supporting services;</li> <li>ii. Contractor comply with the labour laws of Tanzania that prohibits employing people of the age below 18 years e.g. Employment and Labor Relations Act, 2004 Part II Sub-part A Child Labor;</li> <li>iii. The Contractor is required to prepare and sign code of conduct which has clear prohibitions on Child Abuse and Exploitation and Code of Conduct for Gender Based Violence and report on its implementation in the course of project implementation;</li> <li>iv. Contractor to develop and implement a Children Protection Strategy that will ensures minors are protected against negative impacts associated by the Project;</li> <li>v. Wherever possible, ensure that another adult is present when</li> </ul>		

SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>working in the proximity of children;</p> <p>vi. Not invite unaccompanied children to workers home, unless they are at immediate risk of injury or in physical danger; and</p> <p>vii. Refrain from hiring children for domestic or other labor, which is inappropriate given their age, or developmental stage, which interferes with their time available for education and recreational activities, or which places them at significant risk of injury.</p>		
12.	Gender Based Violence in communities neighbouring project	Gender Based Violence risk at the community level.	<p>The contractor will implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including:</p> <p>i. Effective and on-going community engagement and consultation, particularly with women and girls in villages and learning institutions in the project area,</p> <p>ii. Review and ensure that specific project components that are known to heighten GBV risk at the community level, e.g.</p>	Same as in sewer network	Same as sewer in network



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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>compensation schemes; employment schemes for women; etc. are managed and implemented in a manner that will safeguard against violence against women.</p> <p>iii. Specific plan for mitigating these known risks, e.g. sensitization around gender-equitable approaches to compensation and employment; etc.</p> <p>iv. The contractor will ensure adequate referral mechanisms are in place if a case of GBV at the community level is reported related to project implementation.</p>		
13.	Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH) Prevention and Response	<p>i. Sexual Exploitation</p> <p>ii. Abuse/Sexual Harassment</p>	To mitigate these risks the project Contractor will develop and implement a Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH) Prevention and Response Action Plan with an Accountability and Response Framework as part of the C-ESMP. The SEA/SH Action Plan will follow guidance on the World Bank's Good Practice Note for Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil	Same as in sewer network	Same as sewer in network

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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>Works (February 2020). The SEA/SH Action Plan will include how the project will ensure necessary steps are in place for:</p> <ul style="list-style-type: none"> <li>i. Prevention of SEA/SH: Integrate provisions related to sexual harassment and sexual exploitation and abuse in the employee Code of Conducts (COCs) and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance; project-level IEC materials.</li> <li>ii. Response to SEA/SH: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management.</li> <li>iii. Engagement with the community: including development of confidential community-based complaints</li> </ul>		

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SL No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>mechanisms discrete from the standard GRM; mainstreaming of Prevention SEA/SH awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their PSEA/SH-related rights.</p> <p>iv. Management and Coordination: including integration of prevention and response to SEA/SH in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA/SH, including whistle-blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA/SH focal points in the project and trained community liaison officers.</p>		



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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<ul style="list-style-type: none"> <li>v. Ensure clear human resources policy against sexual harassment that is aligned with national law.</li> <li>vi. Ensure appointed human resources, environmental, social and health and safety personnel is well trained on PSEA/SH;</li> <li>vii. Mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;</li> <li>viii. Informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted;</li> <li>ix. Introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination), and</li> <li>x. Contractor to adopt a policy to cooperate with law enforcement agencies in investigating complaints about SEA/SH.</li> </ul>		
<b>Construction Phase</b>					
1.	Air	<ul style="list-style-type: none"> <li>i. Dust generation.</li> <li>ii. Emission of exhaust gases</li> </ul>	<ul style="list-style-type: none"> <li>i. Water spraying</li> <li>ii. Proper covering of raw materials.</li> </ul>	Same as in sewer network	Same as in sewer network.

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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
		iii. Emission of Fugitive gas.	iii. Minimizing the movement of heavy vehicles iv. Restricting the vehicle speed to 20 km/h. v. Proper maintenance of vehicles and machineries.		
2.	Noise & Vibration	i. Effect to fauna ii. Disturbance to local population	i. Restricting the construction works between 6 am to 9 pm. ii. Maintaining the noise level below 55 dB (A) for residents and below 80 dB for workers. (A). iii. Informing nearby residents and businesses 24 hours prior to any noisy activity.	Same as in sewer network.	Same as in sewer network.
3.	Land & Soil	i. Loss of topsoil. ii. Soil degradation, compaction, erosion & contamination	i. Reuse of topsoil for backfilling the trenches. ii. Divert ditches during heavy rainfall. iii. Connect temporary drainage channels with the trenches and ditches. iv. Apply erosion control measures. v. Develop waste management plan. vi. Proper storage of lubricants, hazardous materials vii. Refuel in properly bounded area. viii. Provide the spill-control materials.	Same as in sewer network.	i. Reuse of topsoil. ii. Development of a green belt around the WWTP. iii. Same as in sewer network from S.no. 13 iii to ix.

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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			ix. Provide trainings on emergency spill and leakage repair.		
4.	Surface Water	i. Impact nearby water resources, especially the sea.	i. Development of a water management plan.	i. Flood in the area from River Ndumbwi. ii. Impact nearby water resources.	i. Construction of storm water drains around the site to divert local stormwater in nearby streams to avoid flooding of the site ii. Development of Waste Management Plan. iii. Proper monitoring of the area.
5.	Ground Water	i. Contamination of ground water. ii. Fall in ground water table.	i. Implementing a Waste management plan. ii. Engaging the local communities in construction works to reduce water consumption by outside workforce	Same as in sewer network.	Same as in sewer network.
6.	Natural wetland			i. The land selected for WWTP is a natural wetland which attracts avifauna. It is under flood every year during rainy season. ii. The construction of WWTP may cause mixing of flood water with wastewater. iii. The raising of the land using different engineering measures can cause flood in the adjacent area.	i. Construction retaining wall, protection wall around WWTP site to arrest flow of storm water in WWTP area ii. Construction of storm water draining all around WWTP site to diver local storm water in to near by stream iii. Planting of green belt of tall, flower and fruit



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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
					bearing trees around WWTP site to attract birds iv. Preservation of remaining part of wetland that is not occupied by WWTP
<b>Socio-economic Impacts</b>					
1.	Landscape and Aesthetics	i. Alter the landscape of the area for a time being.	i. Removal of all wastes such as debris, wreckage, temporary structures etc. after the construction work. ii. Reusable components shall be given to local community. iii. Re-plantation	i. Change in the aesthetics of the site	i. Development of a green belt.
2.	Public Utilities	i. Impact on public utilities like underground cables, water supply pipelines etc.	i. Joint inspection with project proponent and related departments. ii. Support the structures either by underpinning them from bottom or by using hangers supported from the sides if utilities cross a trench line.	-	-
3.	Traffic Movement and Public Access	i. Road blockage and traffic congestion. ii. Effect on transportation, iii. Disturbance to vehicular and pedestrian movements. iv. Disturbances to residential or commercial properties.	i. Informing local people prior to construction activities. ii. Circulation of notice prior to the commencement of construction activities. iii. Leave adequate space for traffic and pedestrian movement and vehicle crossing while excavating trenches.	-	-

**Environmental and Social Impact Assessment (ESIA) Report.**

SL No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<ul style="list-style-type: none"> <li>iv. Provide alternative access to public, both for pedestrians and drivers, through usage of signages.</li> <li>v. Backfilling the trenches as soon as possible.</li> <li>vi. Development of traffic management plan.</li> </ul>		
4.	Occupational Health and Safety	<ul style="list-style-type: none"> <li>i. Accidents at the work site.</li> <li>ii. Possibilities of occupational hazards</li> <li>iii. Sanitation and hygiene issues.</li> <li>iv. Spread of sexually transmitted diseases.</li> </ul>	<ul style="list-style-type: none"> <li>i. Informing local people about construction activities.</li> <li>ii. Providing Personal Protective Equipment (PPE).</li> <li>iii. Placing preventive tapes, warning signages and flood lights at construction sites.</li> <li>iv. Providing gender specific sanitary facilities, first aid kits, fire extinguishers etc. at the worksite.</li> <li>v. Provide drinking water to workers as per the WHO guidelines. Conduct health and safety awareness program for workers.</li> <li>vi. Regular health check-up of workers.</li> </ul>	Same as in sewer network.	Same as in sewer network.
5.	Community Health and Safety	<ul style="list-style-type: none"> <li>i. Air and noise pollution</li> <li>ii. Spread of Sexually transmitted diseases (STD).</li> </ul>	<ul style="list-style-type: none"> <li>i. Informing the local people about upcoming project and its associated safety measures.</li> <li>ii. Prohibit public access to the project site.</li> </ul>	Same as in sewer network.	Same as in sewer network.

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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			iii. Provide health education and awareness program		
6.	Child labour	i. Child Abuse and Exploitation	<p>This will be a responsibility of Contractor, DAWASA, supervising engineer and village government to ensure that-</p> <ul style="list-style-type: none"> <li>i. Due diligence and regular monitoring to ensure the non-employment of minors in the supply chain and supporting services;</li> <li>ii. Contractor comply with the labour laws of Tanzania that prohibits employing people of the age below 18 years e.g. Employment and Labor Relations Act, 2004 Part II Sub-part A Child Labor;</li> <li>iii. The Contractor is required to prepare and sign code of conduct which has clear prohibitions on Child Abuse and Exploitation and Code of Conduct for Gender Based Violence and report on its implementation in the course of project implementation;</li> <li>iv. Contractor to develop and implement a Children Protection Strategy that will ensures minors are protected against negative</li> </ul>	Same as in sewer network	Same as sewer in network

**Environmental and Social Impact Assessment (ESIA) Report.**

SL No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>impacts associated by the Project;</p> <p>v. Wherever possible, ensure that another adult is present when working in the proximity of children;</p> <p>vi. Not invite unaccompanied children to workers home, unless they are at immediate risk of injury or in physical danger; and</p> <p>vii. Refrain from hiring children for domestic or other labor, which is inappropriate given their age, or developmental stage, which interferes with their time available for education and recreational activities, or which places them at significant risk of injury.</p>		
7.	Gender Based Violence in communities neighbouring project	i. Gender Based Violence risk at the community level.	<p>The contractor will implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including:</p> <p>i. Effective and on-going community engagement and consultation, particularly with women and girls in villages and</p>	Same as in sewer network	Same as sewer in network



**Environmental and Social Impact Assessment (ESIA) Report.**

SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>learning institutions in the project area,</p> <p>ii. Review and ensure that specific project components that are known to heighten GBV risk at the community level, e.g. compensation schemes; employment schemes for women; etc. are managed and implemented in a manner that will safeguard against violence against women.</p> <p>iii. Specific plan for mitigating these known risks, e.g. sensitization around gender-equitable approaches to compensation and employment; etc.</p> <p>iv. The contractor will ensure adequate referral mechanisms are in place if a case of GBV at the community level is reported related to project implementation.</p>		
8.	Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH) Prevention and Response	<p>i. Sexual Exploitation</p> <p>ii. Abuse/Sexual Harassment</p>	To mitigate these risks the project Contractor will develop and implement a Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH) Prevention and Response	Same as in sewer network	Same as sewer in network

**Environmental and Social Impact Assessment (ESIA) Report.**

SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>Action Plan with an Accountability and Response Framework as part of the C-ESMP. The SEA/SH Action Plan will follow guidance on the World Bank's Good Practice Note for Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works (February 2020). The SEA/SH Action Plan will include how the project will ensure necessary steps are in place for:</p> <ul style="list-style-type: none"> <li>i. Prevention of SEA/SH: Integrate provisions related to sexual harassment and sexual exploitation and abuse in the employee Code of Conducts (COCs) and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance; project-level IEC materials.</li> <li>ii. Response to SEA/SH: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff reporting</li> </ul>		

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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management.</p> <p>iii. Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of Prevention SEA/SH awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their PSEA/SH-related rights.</p> <p>iv. Management and Coordination: including integration of prevention and response to SEA/SH in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA/SH.</p>		

**Environmental and Social Impact Assessment (ESIA) Report.**

SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>including whistle-blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA/SH focal points in the project and trained community liaison officers.</p> <p>v. Ensure clear human resources policy against sexual harassment that is aligned with national law.</p> <p>vi. Ensure appointed human resources, environmental, social and health and safety personnel is well trained on PSEA/SH;</p> <p>vii. Mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;</p> <p>viii. Informing workers about national laws that make sexual harassment and gender-based</p>		



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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
			<p>violence a punishable offence which is prosecuted;</p> <p>ix. Introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination), and</p> <p>x. Contractor to adopt a policy to cooperate with law enforcement agencies in investigating complaints about SEA/SH.</p>		
<b>Operation Phase</b>					
<b>Environmental</b>					
1.	Air	i. Emission of gases	<p>i. Maintaining National or WHO air quality standards.</p> <p>ii. Proper maintenance of generators.</p>	Same as in sewer network.	Same as in sewer network.
2.	Noise	i. Noise generation.	i. Operating noise generating equipment from within the acoustic enclosures.	Same as in sewer network.	<p>i. Same as in sewer network.</p> <p>ii. Development of green belt.</p>
3.	Soil	i. Soil contamination.	<p>i. Maintenance work to be implemented promptly upon leakage in sewer network and malfunction in pump stations.</p> <p>ii. Construction of temporary sewer bypass routes during maintenance period,</p>	i. Same as in sewer network.	<p>i. Construction of treatment chambers on impermeable surface</p> <p>ii. Prompt repair and regular maintenance of WWTP.</p>

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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
4.	Ground Water	i. Contamination of ground water table of the area. ii. Malfunction in pump stations.	i. Maintenance and operation upon leakage in sewer network.	i. Same as in sewer network.	i. Same as in sewer network.
5.	Surface Water	i. Contamination of surface water resources of the area.	i. Proper Monitoring.	i. Flood ii. Mixing of wastewater with flood water iii. Contamination of sea water.	i. Prompt repair upon any malfunction of the treatment plan. ii. Proper treatment of sewage. iii. Maintaining quality standards of the treated sludge. iv. Testing of treated wastewater prior to discharge.
<b>Socio-economic</b>					
1.	Odour	-	-	i. Unpleasant odour.	i. Use of closed containers to minimize odour emission. ii. Flushing the sludge with water. iii. Frequent withdrawal of sludge from tanks for gas production.
2.	Sanitation	i. Effect on sanitation facilities.	i. Construction of temporary sewer bypass routes.	-	-
3.	Occupational Health Hazards	i. Health hazards.	i. Provide the workers with appropriate PPEs.	i. Health impact of workers.	i. Provide the workers with appropriate PPEs. ii. Give appropriate vaccination to workers.

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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
					iii. Allow only trained workers for the WWTP. iv. Conduct awareness programs.
4.	Community Health	i. Health hazards to local community.	i. Covering the manholes. ii. Providing fencing and signages	-	-
<b>Decommissioning Phase</b>					
1.	Air quality	i. Air quality degradation. ii. Movement of vehicles.	i. Adoption of dust suppression measures. ii. Proper monitoring and maintenance of vehicles.	Same as in sewer network.	Same as in sewer network.
2.	Impact on aesthetics and soil erosion	i. Damages to land and water. ii. Erosion iii. Increase in sediment load in water bodies.	i. Restoration of affected sites, ii. Use of excavated earth materials to for backfilling. iii. Doing decommissioning in dry season.	-	-
3.	Impact on infrastructures and services	Interruption in existing infrastructure and services,	i. Restore the damaged utilities ii. Notify local authorities and community in timely manner. iii. Ensure minimum damage to any such public utility.		
4.	Waste	i. Generate various solid wastes ii. Affect overall sanitation in the area. iii. Clogging the local drainage channels thereby causing flooding.	i. Segregation, collection and disposal of debris and other. ii. Provision for solid waste collection facilities. iii. Sorting wastes into recyclables and non-recyclables. iv. Sensitizing construction workers on proper disposal of solid wastes.	Same as in sewer network.	Same as in sewer network.

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SL. No.	Components	Sewer network		WWTP	
		Potential Negative Impacts	Mitigation Measures	Potential Negative Impacts	Mitigation Measures
5.	Community health and safety hazards.	<ul style="list-style-type: none"> <li>i. Health and safety hazards.</li> <li>ii. Increased traffic and risk of accidents.</li> </ul>	<ul style="list-style-type: none"> <li>i. Sensitizing the community on health and safety issues.</li> <li>ii. Assigning speed limits for vehicles moving in- and out of project site.</li> <li>iii. Using signages</li> </ul>	Same as in sewer network.	Same as in sewer network.
6.	Worker's health and safety hazards.	Inherent occupational risks include muscular-skeletal injuries, falling into un-marked/ uncovered trenches and accidents from construction vehicles.	<ul style="list-style-type: none"> <li>i. Using of adequate PPEs by on-site workers.</li> <li>ii. Providing occupational health and safety training</li> <li>iii. Assigning speed limits for vehicles.</li> <li>iv. Using appropriate signages to locate trenches and uncovered pits.</li> <li>v. Sensitizing workers on health and safety issues.</li> </ul>	Same as in sewer network.	Same as in sewer network.



## **12. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN**

An Environmental and Social Management Plan (ESMP) has been developed. It documents the actions required to ensure that the mitigation measures proposed in the impact assessment study are carried out to satisfaction. This will also ascertain that the environmental and social risks are reduced to an acceptable level. The ESMP covers each stage of the project, from pre-construction to operation phases. Different management plans as listed below are also given:

- Waste Management Plan
- Traffic Management Plan
- Green Belt Development Plan
- Health and Safety Management Plan
- HIV/AIDS Prevention Strategy

## **13. ENVIRONMENTAL AND SOCIAL MONITORING PLAN**

An Environmental Monitoring Plan (EMP) outlines the monitoring parameters, frequency and monitoring locations against specific mitigation measures. The EMP clearly defines the responsibilities for mitigation and monitoring and suggests time-bound schedules. DAWASA will closely monitor the work contractor's environmental performance based on the action plans suggested in the EMP together with overall ESMP implementation. This Chapter also provides the monitoring cost of the project.

## **14. RESOURCE EVALUATION**

Resource evaluation discusses the economic cost required for the proposed sewerage project along with economic, health, non-health and indirect economic benefits of the project. The cost of the interventions includes the construction and operation whereas the benefit is associated with better access to sanitation facilities, gain in productive time (due to less time being ill), saving in health sector and patient cost due to less treatment of diarrhoeal disease, and the value of prevented deaths. Considering it as a social project as well as its health and non-economic benefits, this project is highly recommended.

## **15. GRIEVANCE REDRESS MECHANISM**

A Grievance Redress Mechanism (GRM) has also been proposed in the ESIA Report. That mechanism will be established prior to commencement of the construction activities in the project areas. The GRM will ensure that complaints of on-site workers and local communities including other relevant stakeholders will be taken care of. Complaints from the workers may include (but not limit to):

- On-site working conditions including health and safety of workers
- Issues related to wages and working hours
- Prevention and protection of child labour from hazardous work conditions
- Issue of forced labour,
- Gender discrimination

a) Complaints from local communities residing in the project areas may include:

- Risks to community, health & safety (e.g. traffic)
- Accidents (e.g. falling into open trenches)

- Unethical behavior by Work Contractor or its sub-contractors
- Noise/dust/air emissions or any other impact on environment caused by project or sub-contractors
- Issues related to cultural conflicts

## 16. CONCLUSION AND RECOMMENDATIONS:

The development of sewerage network in the Mbezi area will resolve issues related to poor waste management in the area and emptying of septic tanks by the people. It is well known that groundwater contamination is a perpetual concern due to pit latrines and improper waste management. The project will enhance public health with a reduction in the occurrences of water borne epidemics like Cholera, Dysentery, etc. and provide impetus to socio-economic development.

### Recommendations:

The land proposed for WWTP is a low-lying area. Additionally, during the rainy season, it is under flood due to the proximity of river Ndumbwi. As per consultations with the local people, each year during heavy rainfalls, the area is under flood. The recent heavy rainfall on 04.03.2019 has caused physical destructions to the structure area around the WWTP locations. Moreover, there is only one WWTP for the proposed service area and if that plant goes disconnected due to flooding, sewage cannot be routed elsewhere which makes it susceptible to disruptions due to flooding. Accordingly, mitigation measures have been recommended in the ESMP to prevent any adverse impacts due to flooding which shall be included during the design of WWTP. Some of the important mitigation measures are as follows,

- All mechanical and electrical systems should be installed above flood levels.
- Critical infrastructure should be constructed outside the high flood area.
- Construction stormwater drains should be around WWTP site to divert local stormwater in nearby streams to avoid flooding.
- Construct retaining wall / protection wall around WWTP site to avoid local stormwater entering the site.
- Plant green belt around the WWTP site to arrest aerosols arising from aeration tank and flowering trees to mask odour.