ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED 400 KV POWER TRANSMISSION LINE FROM MTWARA TO SOMANGA IN MTWARA AND LINDI REGIONS, TANZANIA

ENVIRONMENTAL IMPACT STATEMENT (EIS)

Project Registration Number: 9539

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EXECUTIVE SUMMARY

Title and Location of the Project

400kV Power Transmission Line from Mtwara to Somanga in Mtwara and Lindi Regions, Tanzania

Project Proponent

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Introduction

Tanzania's economic growth triggered by changes in economic policies has prompted the demand for commercial energy in the country in particular electricity power. In order to meet increasing energy demand and maximize recently discovered offshore gas resources in the country, the Government of Tanzania through the Tanzania Electricity Supply Company Ltd (TANESCO) is planning to install a 400kV Power Transmission Line from Mtwara to Somanga in Mtwara and Lindi Regions, Tanzania. The Project is expected to improve electricity service and coverage through the addition of new power generation, transmission and distribution capacity, as well as through much needed reinforcement of the existing network. The Project will be funded by the Japan International Cooperation Agency (JICA) and will be owned and operated by TANESCO.

The ESIA study has been undertaken in accordance with the requirements of the Environmental Management Act, Cap 191 of 2004 and the Environmental Impact Assessment and Audit Regulations of 2005, which requires mandatory EIA to all energy development projects. This Environmental and Social Impact Assessment (ESIA) report presents an assessment of the potential environmental and social impacts associated with the proposed 400kV transmission line and associated facilities. This report has been prepared for TANESCO and presents the objectives, methodology and outcomes of the ESIA study.

Project Description

The proposed Mtwara-Somanga 400kV transmission line route is located in the coastal areas of Mtwara and Lindi Regions. It will connect the proposed Mtwara 300MW power plant to the national grid by interconnecting three substations (S/S) in Mtwara S/S (new), Lindi S/S (new) and Somanga S/S (existing).

Most sections of the proposed 270km transmission line are expected to run close to the major road between Mtwara and Dar es Salaam. The required Wayleave (Right-of-Way) for the transmission line is 52m (26m for each side).

The new 400kV Mtwara substation is located within the area of the Mtwara power plant. The substation will be manned and separated from the power station for the future unbundling of TANESCO. The proposed 400kV Lindi Substation is located beside the existing Mahumbika Substation in between Mingoyo and Narunyu Wards of Lindi District. The Lindi substation is assumed to be unmanned and controlled from the 400kV New Mtwara substation. Both substations will have remote control functions at GCC (Grid Control Center).

During construction, temporary construction camps and access roads will be constructed where required. The location and extent of these components are however not known at this stage of the project. Around 100,000 workers in cumulative total number are expected during the construction. During the peak period of construction, around 100 to 200 workers on daily basis would be required. The construction will take approximately 22 months.

Environmental and Social Baseline Condition

The proposed route passes mostly on bushland, cultivated land, grassland, and woodland. The majority of the land along the transmission line route is arable and used for agriculture while the remaining constitute of forest/bush land and residential areas. Environmental quality in terms of air and noise vary significantly along the route depending on the distance to the nearest villages.

The proposed transmission line will not pass through any protected area or ecologically important area. However, an endangered bird species which has breeding sites in Lindi District Coastal Forest (recognized as an important bird area and key biodiversity area) have been identified. The Spotted Ground-thrush (EN), which is a full migratory bird, has a breeding site, approximately 7km from the proposed transmission line route.

Based on the database of IUCN Red List, the proposed transmission line will pass through an area in Kilwa District, where African elephants are possibly present The elephant corridor between Kilanjilanji village and Mtandi is the only known wildlife corridor at present. However, no signs of elephant movement were recorded during field survey.

The proposed development of power transmission line from Mtwara rural at Kisiwa village to Kilwa district at Somanga Ndumbo village traverses two regions, four districts, 15 wards and 42 villages. Agriculture is the main and important means of livelihood in all villages along the along the route. Although all districts have hospitals, health centers and dispensaries, only 60% of survey respondents have access to health services.

Archaeological sites and non-archaeological cultural heritage sites along the transmission line have been identified. These include graveyards and/ or

ritualistic sites in Mandawa and Mandangwa villages, archaeological sites in Mahumbika and Kitomanga, and archaeological site test pits (STPs).

Stakeholder Engagement

At the beginning of the ESIA process, stakeholder identification was conducted to determine exactly who the stakeholders are and understand their priorities and objectives in relation to the proposed project. Stakeholders identified include relevant government agencies (central, regional and local levels), community groups and organizations, non-governmental organizations (NGOs), vulnerable groups, and international financing agencies.

Consultation activities were undertaken by approaching the different levels of government down to villages. Meetings with relevant government agencies (e.g. Ministry of Ntural Resources and Tourism, Ministry of Land and Human Settlement Development), academic institutions (e.g. University of Dar es Salaam), and NGOs (e.g. Volunteer for Youth in Health and Development, Mtwara Society Against Poverty, Wildlife Conservation Society of Tanzania) were also conducted. Aside from these, focus group discussions were also conducted, targeting villagers and women's group. The main objectives of stakeholder engagement activities include introducing the project and its potential impacts, and gathering concerns of the different stakeholder groups. In the record, there were almost 3,600 participants who attended the stakeholder engagement activities in total.

To initiate the consultation process, prior information about the Project were shared through letters to the Mtwara and Lindi Regional Administrative (RAS) offices. The Regional administrative Secretary allowed the consultants to proceed with consultation at the district level. Letters from the District Executive Director (DED) offices were then distributed to all relevant villages to secure appointments with village government officials as well as the local communities. First phase of consultations were conducted in March 2018, while second phase of consultations were held in August 2018.

As a result of several engagement and consultation activities, it has been identified that there is overall support for the Project from various stakeholders. Different groups, particularly local communities, expressed expectations such as employment opportunities, access to stable electricity supply, and potential improvement in social services. In general, stakeholders highlighted the need for the project developer to properly implement compensation for land acquisition, pollution control and mitigation measures and to support communities that will be affected by the Project. The main concerns raised from stakeholders include following:

- Vegetation clearing and change in biodiversity
- Soil erosion
- Loss of land, properties and livelihood
- Compensation
- Influx of workers
- Risks and hazards to community health and safety

Project Alternatives

The main factors considered in the selection of alternatives include economic constraints, location, environmental and social impacts, and sensitivity of area.

"No Project" Alternative

The no project alternative entails maintaining current status of power generation sources in Tanzania and that Tanzania continues to struggle with shortage of power, quality of power supplies and stability. Implementation of the no project alternative will deny this opportunity to generate new power supply that will feed into the national grid. Therefore this alternative does not seem viable since the country need power to supply to the expanding demand as the country is implementing and industrialization scheme to middle income country by 2030.

Location alternative

Several options were considered for the transmission line route. The proposed route represents the option with less impacts on land acquisition/resettlement, cultural heritage sites and ecologically important and/or protected areas.

Impact Assessment methodology

Potential environmental and social impacts that will be caused by the Project during pre-construction, construction and operation phases, have been identified and assessed based on impact nature, type, duration, extent, scale, frequency, magnitude, and receptor sensitivity.

The environmental and social concerns related to the proposed 400kV transmission line have been identified based on the JICA environmental and social consideration guidelines (April 2010), relevant environmental legislation in Tanzania, and other applicable environmental and social conditions.

For each impact item, potential impacts in each stage of development (in planning and construction, and in the operation phase) are divided into negative impacts (−) and positive impacts (+), and the degree of impacts is classified as shown below. **Error! Reference source not found.** shows the scoping result.

A (+/ -): Major positive / negative impacts are projected
B (+/ -): A certain degree of positive / negative impacts is projected
C: Impacts are unclear (further investigation is needed. Impacts may become apparent as the survey progresses)
D: No impacts are projected

As can be observed, impacts during construction phase are expected to be more significant compared to during operation phase. During operation phase, significant impacts will be limited to impacts on an endangered bird species and risks to community safety and security due to the presence of transmission line towers and electric wires. A summary of the potential project impacts and the corresponding significance rating is listed in the Table below

Summary of Potential Project Impacts

Environmental/Social Item	Construction	Operation
Terrestrial Ecology	Minor	Moderate
Soil	Minor	Negligible
Water Resources	Minor to Moderate	Negligible
Air Quality	Minor	-
Noise and Vibration	Minor	Negligible
Wastes	Minor	Negligible
Employment and local economy	Positive	Positive
Community health, safety and security	Moderate	Minor
Occupational health and safety	Moderate	Minor
Community infrastructure and services	Minor	Negligible
Cultural heritage	Moderate	-
Land acquisition and Resettlement	Moderate	-

Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) for the Project aims to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts/risks and to propose enhancement measures. Potential impacts may be eliminated or reduced through implementation of appropriate mitigation measures. The primary role and responsibility for the implementation of the ESMP lies on TANESCO and its contractors, in collaboration with various stakeholders.

Mitigation planning involves undertaking activities during the design, implementation and operation phases of a project. Funds need to be set aside to ensure implementation of planned actions. Suggested mitigation actions include (but are not limited to) the following:

- Ensure compliance with air emissions, noise, vibration, and effluent standards set by the government
- Implement measures to reduce dust generation (e.g. watering, covering of materials)
- Ensure mechanisms in place to address accidental spills/leakages
- Develop emergency response procedures
- Conduct trainings for employees regarding health and safety, emergency response, waste management, chemical handling/storage, etc.
- Maintain equipment and vehicles regularly
- Develop Waste Management Plan, Emergency Management Plan
- Implement proper waste management (segregation, storage, and disposal)
- Provide appropriate amenities at workers' camp and power plant site
- Establish a grievance redress mechanism
- Develop a corporate social responsibility plan (social investment)
- Explore opportunities to work with local stakeholders
- Develop and implement a Resettlement Policy Framework that is compliant with laws related to land acquisition and resettlement
- Provide an income restoration program for affected population

Environmental and Social Monitoring Plan

In order to ensure proper implementation of the ESMP, it is necessary to monitor relevant biophysical and social environmental components of items identified in the ESMP. An environmental and social monitoring plan identifying biophysical and social indicators/metrics to be monitored, location, frequency, responsible entity and fund source, has been developed.

During construction, items that will be monitored include:

- General compliance
- Dust generation
- Noise
- Groundwater quality
- Waste management
- Biodiversity (endangered bird species)
- Resettlement issues
- Complaints
- Accidents/incidents

During operation, items that will be monitored include:

- General compliance
- Biodiversity (endangered bird species)
- Waste management
- Complaints
- Accidents/incidents

Cost and Benefit Analysis

The implementation of the project will involve large amount of financial resources. However, in the absence of the project, the current power shortage and supply problem are expected to continue and this can significantly affect economic performance of industries, individuals, and the country in general. Therefore, the benefits to be realized from the proposed Mtwara-Somanga transmission line project are expected to outweigh environmental and social costs.

Decommissioning

Activities to be done during decommissioning include, demolition of the facilities such as transmission towers, substations, and factories. As a result, several impacts (negative and positive) are likely to occur.

TANESCO will prepare a detailed decommissioning plan to ensure that environmental and social impacts are minimized in order to comply with environmental legislations and policy requirements. In decommissioning phase a team of experts with a representative from the relevant national, regional and local government bodies will be formed to monitor the implementation of the decommissioning plan.

Potential impacts which need to be considered during decommissioning include the following:

- Soil erosion
- Surface runoff and surface water quality
- Noise and vibration
- Waste generation

Conclusion

The potential environmental and social impacts that will be caused by the Project during pre-construction, construction and operation phases, have been identified and assessed. With the proper implementation of the Environmental and Social Management and Monitoring Plan, together with some embedded control measures in the Project design, it can be ascertained that the Project is unlikely to cause any significant environmental and social impacts since many of the impacts are localised, short-term and/or temporary in nature.

Overall, the benefits to be realized from the proposed Mtwara-Somanga transmission line project are expected to outweigh environmental and social costs. The Project presents opportunities for employment and improvement of the local economy. More importantly, it would contribute to improved stability distribution of the national power supply.

SIGNED DECLARATION OF EXPERTS

We hereby certify that the particulars given to this report are correct and true to the best of our knowledge.

S/N	Name and Title	Roles in the EIA team Area of expertise	Signature
1	Prof. Hussein Sosovele	Team Leader	
2	Prof Raphael Mwalyosi	Ecologist Expert	
3	Dr. Florian Silangwa	Socio-economics and Resettlement Expert	
4	Dr. George Sangu	Plant Ecologist	
5	Dr. Edwinus Lyaya	Archaeologist	
6	Mr. Alex Chambi	Land Use	
7	Mr. Anselm Silayo	Natural Resource Management	

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We also would like to thank the EIA team for their cooperation and contribution to complete this report. Moreover, the greatest contribution was made by the local stakeholders including local authorities, leaders and people living around the proposed project site, who provided prompt assistance, shared their concerns and expectations and actively participated in the public consultations.

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A/C	Air conditioning
AIDS	Acquired Immune Deficiency Syndrome
ASR	Air Sensitive Receptor
BDL	Below detection limit
BH	Borehole
BMU	Beach Management Unit
BOD	Biological Oxygen Demand
CBD	Convention on Biological Diversity
CBO	Community-based Organization
CI	Chief Inspector
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
COD	Chemical Oxygen Demand
DAS	District Administrative Secretaries
dB	Decibel
DO	Dissolved oxygen
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMDC	Environmental Management Divisional Standards Committee
EMP	Environmental Management Plan
EPC	Engineering, Procurement, and Construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EWURA	Energy and Water Utilities Regulatory Authority
FGD	Focus Group Discussion
FHH	Female Headed Households
GCC	Grid Control Center
GDP	Gross Domestic Product
GIS	Geographic Information System
HH	Household
HIV	Human Immunodeficiency Virus
HSE	Health, Safety, and Environmental
IBA	Important Bird Area
IBAT	Integrated Biodiversity Tool
IFC	International Finance Corporation
INDCs	Intended Nationally Determined Contributions
IPD	In patient Department
IUCN	International Union for the Conservation of Nature
JICA	Japan International Cooperation Agency
KBA	Key Biodiversity Area
MBREMP	Mnazi Bay Ruvuma Estuary Marine Park
MNRT	Ministry of Natural Resources and Tourism
MoE	Ministry of Energy
MRD	Mtwara Rural District

MSOAP	Mtwara Society Against Poverty
NEMC	National Environment Management Council
NESC	National Environmental Standards Compendium
NGO	Non-Governmental Organization
NLUPC	National Land Use Planning Commission
NOx	Nitrogen Oxides
NSGRP	National Strategy for Growth and Reduction of Poverty
NSR	Noise Sensitive Receptor
OHSA	Occupation Health and Safety Act
OP	Operational Policy
OPD	Outpatient Department
PAP	Project-Affected Person
PIU	Project Implementing Unit
PM	Particulate matter
PPE	Personal protective equipment
Ppm	Parts per million
RAS	Regional Secretary
ROW	Right of Way
RSCB	Ruvuma and Southern Coast Basin
SDGs	Sustainable Development Goals
SIDP	Sustainable Industrial Development Policy
SMEDP	Small and Medium Enterprise Development Policy
SMEDP	Small and Medium Enterprises Development Policy
SOP	Standard Operation Procedure
S/S	Substations
STD	Sexually Transmitted Disease
STP	Site test pits
TANESCO	Tanzania Electric Supply Company Ltd
TANROADS	Tanzania National Roads Agency
TARURA	Tanzania Rural and Urban Road Agency
TFS	Tanzania Forest Service Agency
TPDC	Tanzania Petroleum Development Corporation
TWA	Time Weighted Average
TZS	Tanzanian Standards
URT	United Republic of Tanzania
VOYOHEDE	Volunteer for Youth in Health and Development
WCA	Wildlife Conservation Act
WCST	Wildlife Conservation Society of Tanzania
WHO	World Health Organization
ZECO	Zanzibar Electricity Corporation

1 INTRODUCTION

1.1 BACKGROUND AND OVERVIEW

Tanzania has been experiencing rapid economic growth in the recent years. The country's average annual GDP growth rate between 2000 and 2015 was 6.6% and this is projected to increase (up to 8%) in the coming 10 years. To achieve this target economic growth, the government plans to industrialize the economy and compliment other growth sectors in order to transition to a middle income country by 2025. To fulfil this vision, a reliable power source is imperative.

According to the Five Year Development Plan-II (2016/17 to 2020/21), power system development is one of the top priorities of the Government of Tanzania. At present, Tanzania lacks reliable energy source. The country's current power generation (1,478MW in September 2017) relies on hydro power plants (40%) and thermal power plants (60%). Blackouts are commonly experienced during peak period particularly in dry season, when hydropower outputs are reduced. With the increase of population and deteriorating generation plants and transmission lines, power outages are expected to increase unless the generation is increased.

Gas-fired power plants are positioned as major new power sources. It is estimated that approximately 45 billion cubic meters of proven natural gas reserves can be found in Tanzania. Recent major offshore gas discoveries in Tanzania have created high expectations about the opportunities that might open up both for the domestic economy and for supply to international markets.

To capitalize natural gas resources and increase thermal power generation in the country, the Government of Tanzania through the Tanzania Electricity Supply Company Ltd (TANESCO) is planning to install a 300MW gas-fired thermal plant at Kisiwa village in Mtwara. Electricity generated by the power plant will be distributed via an electricity transmission system composed of two substations and 400kV transmission line that would connect to the national grid at the Somanga substation. The proposed power plant and transmission system (the "Project"), are expected to assist TANESCO in meeting current and future electricity demands in the country. The Project will be funded by the Japan International Cooperation Agency (JICA).

1.2 PROJECT JUSTIFICATION

Increase energy security and grid connectivity. As of now, Mtwara and Lindi region are the isolated grids from the national grid, hence the current capacity of power is insufficient to supply for the future development projected in these regions. This Mtwara Gas Turbine Combined Cycle (GTCC) Power Plant and the transmission line project can provide sufficient power supply and stabilize the national electricity.

Stimulate local economic development. The development of Mtwara GTCC power plant may have the potential to stimulate economic development in the Southern region by providing reliable electricity supply to industries such as agriculture and mining in Lindi and Mtwara regions.

Improve local electrification. The average of percentage of electrification in the entire Mtwara region is less than 50%. As for Lindi region, the total average of electrification in the entire Lindi region is over 50%. The main power source in Lindi and Mtwara is solar power. The coverage percentage of electrification in Lindi and Mtwara region is projected to increase with the implementation of the Mtwara GTCC project.

Contribute to Climate Change Mitigation. According to Tanzania's Intended Nationally Determined Contributions (INDCs), the country will reduce greenhouse gas emissions economy wide between 10-20% by 2030. One of the intended action in the energy sector is "expanding the use of natural gas for power production, cooking, transport and thermal services through improvement of natural gas supply systems throughout the country." Thus, this project is in line with this action plan.

1.3 PROJECT PROPONENT

Tanzania Electric Supply Company Limited (TANESCO) was incorporated as public limited company in accordance with provision of the Companies Ordinance Cap 212 (now the Companies Act) and is directed by a Board of Directors whose powers and responsibilities are in accordance with the Act.

TANESCO is a public organization under the Ministry of Energy through close supervision by the Board of Directors. Board of Directors is appointed by the Government, which exercises control through Ministry of Energy.

The Energy and Water Utilities Regulatory Authority Act, Cap 414 of the laws of Tanzania, created the Energy and Water Utilities Regulatory Authority (EWURA), which is mandated to oversee and regulate the operations of Energy and Water Utilities. In exercising its powers EWURA has granted TANESCO with the following licences:

- Electricity Generation Licence; Licence No. EGL-2013-001
- Electricity Transmission Cross Border Trading Licence
- Electricity distribution and Cross Border Trading Licence; Licence No. EDCBTL-2013 – 001
- Electricity supply Licence; Licence No. ESL- 2013 – 001

TANESCO has business licences to all regions granted by the Ministry of Industry, Trade and Marketing under the department of Revenue Collection Trade Licences.

TANESCO generates, transmits, distributes and sells electricity to Tanzania Mainland and sells bulk power to the Zanzibar Electricity Corporation (ZECO) which in turn sells it to the public in islands Unguja and Pemba. TANESCO

owns most of the electricity Generating, Transmitting and Distributing facilities in Tanzania Mainland.

1.4 SCOPE AND OBJECTIVES OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

According to the Environmental Impact Assessment and Audit Regulations of 2005, all energy development projects require a mandatory EIA. It is on this basis that the National Environment Management Council (NEMC) directed TANESCO to carry out a full EIA study after screening the detailed project brief.

Aside from fulfilling the requirements of the Environmental Impact Assessment and Audit Regulations (2005), this EIA is also aimed at meeting requirements set by the Japan International Cooperation Agency (JICA), in particular the JICA Guidelines for environmental and social considerations (JICA Guidelines). Based on these regulations and requirements, the Project will ensure that Implementation of this project may have negative and positive impacts on social, economic and environment within the project area and beyond, hence this EIA intends to address those impacts.

This EIA study seeks to establish biophysical and socio economic baseline data of the project seating and surrounding environment. The outcome of this assessment will inform TANESCO on likely socio-economic and environmental impacts and recommend mitigation measures, including Environmental and Social Management & Monitoring Plan. Thus, the main objective of the EIA is to provide to decision-makers indications of the likely consequences of the project for their actions or decisions. Therefore, an EIA must: document, in as much detail as possible, the baseline conditions prevailing before the project construction starts; assess and report on the likely magnitude and significance of impacts, both positive and negative; propose mitigation activities to reduce negative impacts and monitoring of important impacts during and after construction; The Environmental Impact Assessment and Audit Regulations of 2005 pg 5.

This EIA is in response to the proposed transmission system in Lindi and Mtwara regions. The EIA is intended to provide decision-makers with sufficient background information to: (i) assess the socio-economic, biophysical and ecological conditions of the proposed project area; (ii) predict significant impacts that could be caused by the project; (iii) consider the project alternatives, mitigation measures and prepare environmental management and monitoring plan. The specific objectives of this EIA are:

- To provide detailed description of the proposed power transmission line activities.
- To establish an environmental and socio-economic baseline analysis in the study area and identify issues of significant bio-physical, ecological/biological and socio-economic impacts that is likely to be affected by the proposed project.
- To provide an understanding of the policy, legal and institutional framework for the project including a forum and opportunity for public and stakeholder involvement.

- To identify, predict and evaluate environmental, social and economic impacts associated with the proposed project activities and provide the required alternatives for mitigation.
- To develop appropriate environmental and socio-economic management plan for implementing, monitoring, and reporting of the mitigation measures.

This Environmental Impact Assessment (EIA) report presents an assessment of the potential environmental and social impacts associated with the proposed Mtwara and Lindi substations and transmission line that traverses Mtwara and Lindi Regions in Tanzania. This report has been prepared for TANESCO and presents the objectives, methodology and outcomes of the EIA study.

1.5 APPROACH AND METHODOLOGIES IN THE EIA STUDY

The following EIA approaches and methods were used.

1.5.1 Approach for Environmental Issues

Data on environmental issues were obtained through literature review and assessment of existing environmental databases (e.g. vegetation, cultural and archaeological sites, characteristics of land, geomorphology, water resources and water quality, existing waste practices. To complement the preliminary review of available information, field visits in Mtawara and Lindi Regions where the project will be located was made. Site visit was undertaken to assess project location and layout in relation to the proposed development activities; assess the physical characteristics of the project area including the geography, water, vegetation and wildlife resources, economic activities, human population settlement and distribution in order to gauge the kind of issues and impacts that are likely to be due to the implementation of this project. In all the areas various pertinent issues related to the proposed development were identified.

1.5.2 Assessment of Land Use Issues

A preliminary understanding of the current use of the land in the proposed project area was collected through filed observation and discussion with local communities occupying and using the areas. The field observation and discussions focused on the main current uses of the land; the significance attached to their lands; the possible impact of disturbance to economic activities and wildlife during implementation.

1.5.3 Approaches for Socio-economic Issues

Literature review, public consultations and extensive stakeholder involvement constituted the main approach for collecting socio-economic data and issues. On the basis of this approach, existing social-economic databases along the transmission line such as regional, district, and local population indicators such as demographics, migration patterns, employment, economic activities, income

levels, land use, NGO's, social organizations, education, health and development programs at regional, district and village levels were undertaken. In order to collect socio-economic issues in EIA, the following methods and tools were used:

Literature Review

To address the identified objectives, a preliminary review of the available information on the proposed development and related literature was undertaken. This included national policies, laws and regulations governing the power generation in Tanzania as well information and other types of data describing the project area.

Household Survey

In order to understand the socio-economic condition of communities around the proposed development, district socio-economic profiles were reviewed and supplemented by a household survey. In conducting a detailed household's survey, the following tools were used:

- **Household questionnaire:** A household questionnaire was prepared and used for collecting basic information from all possible affected people. In addition, the questionnaire collected household demographic information, type of residential houses, level education, economic activities, and average household's income and land related issues from the household's heads along the proposed development.

- **Checklist:** A checklist was prepared and used for collecting qualitative data on social services that are obtained in the village, main economic activities, village land use, and views of the villagers regarding the proposed transmission line development in Mtwara and Lindi.

Meetings and Stakeholders consultations

The literature review was followed by a series of meetings with the project stakeholders. First the meeting, which was conducted via teleconference, TANESCO representatives and the consultants. The meeting was intended to broaden the Consultancy Team's understanding by seeking clarification on various issues which were incorporated in the terms of reference and the execution of the assignment. Other meetings were undertaken in Mtwara region, Lindi Region and Kilwa District. Public meetings were undertaken in all villages that may be affected by the proposed transmission line project.

The first meeting, was undertaken during the scoping exercise, involved all the member of the village to briefly discuss the project, likely impacts and the fate of those who will be affected. The second meeting was undertaken during the full EIA study and it involved members of the village and details of the matters related to compensation, benefits related to project and other social economic issues were discussed. The purpose of the meeting was to raise awareness to all villagers about the proposed project.

Stakeholder's consultation was one of the methods used in the EIA exercise. Consultations were made with identified stakeholders including the local communities in the proposed project area. Stakeholders' consulted were identified based on the nature of the EIA but in some occasions the Consultancy Team was connected to some of the stakeholders either through key informants or stakeholders themselves.

1.5.4 Archaeological and Cultural Heritage Issues

Techniques used to gather information related to archaeology and cultural heritage in the field included: face-to-face interviews with regional and/ district cultural officers; telephone interviews followed up by ethno-historical interviews with Ward Executive Officers and Village Executive Officers or village chairpersons; random archaeological walkover survey in the project area, and; public archaeological talks with villagers. Site test pit (STP) diggings were undertaken in sampled areas.

Methods employed to obtain such information included ethnographic inquiries and random archaeological surface surveys. The consultant interviewed the Village Chairman and local people and conducted focused group discussion at district and village to gather information concerning cultural and heritage sites.

1.5.5 Site visit

To complement the preliminary review of available information, a field visit to the project area carry out measurements for air quality, noise and vibration, conduct ecological assessment of the site, water, and geography, economic activities, human settlement and distribution in order to gauge the kind and the magnitude of resettlement anticipated from the project area. Site visits were also undertaken to assess project location and layout in relation to the proposed development activities to gauge the impacts that are likely to be of interest in the EIA process.

1.5.6 Ecological assessment

Both systematic and opportunistic survey were done within the project area to characterize vegetation, habitat and existing flora and fauna species in the area. Similarly characterization of the marine habitat was done in order to determine suitable monitoring site.

1.5.7 Impact Identification and Assessment

This section presents the methodology used to conduct the ESIA. The ESIA has been undertaken a systematic process that evaluates the potential impacts the project could have on aspects of the physical, biological, social/ socio-economic and cultural environment; identifies preliminary measures that the Project will take to avoid, minimise/reduce, mitigate, offset or compensate for potential adverse impacts; and identifies measures to enhance potential positive impacts where practicable.

Screening

At the initial stage of the ESIA, the preliminary information was complied into the Project registration form and Project Brief to be submitted to NEMC. It was provided to determine what EIA requirements apply to the Project. This step was conducted utilising a high level description of the Project.

Scoping study

Scoping study was undertaken to delineate the potential Area of Influence for the Project, and to identify potential interactions between the Project and resources/receptors in the Area of Influence. The Scoping study was undertook as a means to ensure that there is a focus on the issues that are important for Project planning, decision-making and stakeholder interests. During the scoping study, potential interactions between the Project, environmental and human resources/receptors were identified.

Project Description

In order to set out the scope of the Project features and activities, with particular reference to the aspects which have the potential to impact the environment, a Project Description has been prepared. Details of the Project facilities' characteristics are provided in Chapter 2 of this ESIA Report.

Baseline Conditions

To provide a context within which the impacts of the Project can be assessed, a description of physical, biological, social/socio-economic and cultural conditions is presented. The baseline characterization is reported in Chapter 4 of this Report.

Stakeholder Engagement

An effective ESIA Process requires engagement with relevant stakeholders throughout the key stages. This assists in understanding stakeholder views on the Project and in identifying issues that should be taken into account in the prediction and evaluation of impacts.

Impact Assessment

The impacts of the proposed development were identified drawing from the scoping report and updating the checklist accordingly. The initial baseline condition prior to project implementation provided the basis for forecasting the future scenario with or without the project and compares the changes with existing established standards, relevant national and sectoral laws and regulations while taking cognizance of stakeholder views and concerns. The approach to impact prediction was to give ratings for each identified potential impact and producing a correlation matrix. Impact prediction or estimation of the magnitude, extent or duration of the impacts was done in comparison with the situation without the project. Details are described in Chapter 6.

1.6 STRUCTURE OF THIS REPORT

An outline of the EIA report is provided in ***Table 1-1***.

Table 1-1 EIA Report Structure

Chapter	Title	Description
	Executive Summary	Summary of entire ESIA report
1	Introduction	This Chapter outlines the development and structure of the ESIA report including the Project background, objectives, Impact Assessment scope and the report structure.
2	Project Description	This Chapter provides a concise description of the Project and its geographical and temporal context. It will include a site description, an overview of the Project Facility design and details of Project inputs and outputs.
3	Administrative Framework	The policy, legal and institutional framework in which the ESIA study has been conducted will be discussed in this Chapter. National regulations are summarized along with relevant international agreements, as well as applicable international best practice guidelines and standards.
4	Existing Biophysical and Social Environment (Baseline)	This Chapter summarizes the available baseline data on the biological resources, physical environment, socio-economic conditions and receptors within the Project Study Area. It will be based on both primary and secondary data sources and will consider changes in the baseline condition without the development in place.
5	Stakeholder engagement	This Chapter summarizes comments and concerns received from stakeholders and how these comments have been addressed.
6	Impact Assessment Alternatives Analysis	This Chapter summarizes the predicted impacts of the Project, proposed mitigation measures, and analysis of alternatives.
7	Mitigation Measures	This Chapter presents proposed mitigation measure to address identified impacts
8	Environmental and Social Management Plan (ESMP)	The ESMP draws together the possible mitigation measures; define the specific actions required, institutional roles and responsibilities for implementation;
9	Environmental and Social Monitoring Plan	This Chapter presents a monitoring program and estimate the costs of the measures.
10	Cost Benefit Analysis of the Project	This Chapter describes the cost-benefit analysis to determine whether a project will deliver net economic benefits to society.
11	Decommissioning	This Chapter describes potential environmental and social impacts that need to be considered during the decommissioning phase
12	Summary and Conclusion	This Chapter will summarizes conclusions that are made based on the assessment as well as outline any further recommendations.
	References	
	Appendix	

2 PROJECT LOCATION AND DESCRIPTION

2.1 INTRODUCTION

The project is expected to improve electricity service and coverage through the addition of new power generation, transmission and distribution capacity, as well as through much needed reinforcement of the existing network. The project also aimed at increasing investment and economic activity to businesses and communities by improving the reliability and quality of electric power. This is aligned to the Government of Tanzania's National Energy Policy (2013) and TANESCO mission.

The transmission system will transmit generated electricity from the proposed Mtwara power plant and connect to the national grid for distribution to industries, companies and households in the country. This Project will assist TANESCO to meet current and future electricity demands in the country.

2.2 LOCATION

The proposed 270km transmission line will connect the proposed Mtwara power plant to three substations (S/S) in Mtwara (new), Lindi (new) and Somanga (existing). The proposed transmission line route is located in the coastal area of Tanzania. The locations of the transmission line and the two new substations (the "Project Site") are presented in **Error! Reference source not found.**. The Project Site is located in both Mtwara and Lindi Regions.

Alternatives of the transmission line route and the analysis of those alternatives are discussed in Section 6.6 and presented in **Error! Reference source not found.** and ***Table 6-32***.

Mtwara substation is located within the boundaries of the proposed Mtwara power plant. Most sections of the proposed transmission line are expected to run close to the major road between Mtwara and Dar es Salaam with some variations in areas where alternative alignments have been developed.

Figure 2-1 Location of the Project Components

Source: JICA Study Team, 2018

2.3 PROJECT COMPONENTS

The project components for the proposed electricity transmission system include two new substations in Mtawara and Lindi and 270km transmission line, which connects Mtwara, Lindi, and Somanga substations.

The schematic diagram of the transmission system is provided in **Error! Reference source not found.**. The 400kV Mtwara substation will be connected to the Mtwara GTCC power plant and transmit electricity to 400kV Lindi Substation. Within this, transmission towers will carry both 400kV and 132kV lines for an approximate length of 8km. Also, new 132kV transmission lines from 400kV Mtwara substation will connect with existing 132kV Mtwara and 132kV Mahumbika substations. From 400kV Lindi Substation, 400kV electricity lines will be connected to the existing Somanga substation.

In the future, there are plans to develop a 400kV cross border transmission line to Mozambique. This line will be connected to the 400kV Mtawara substation.

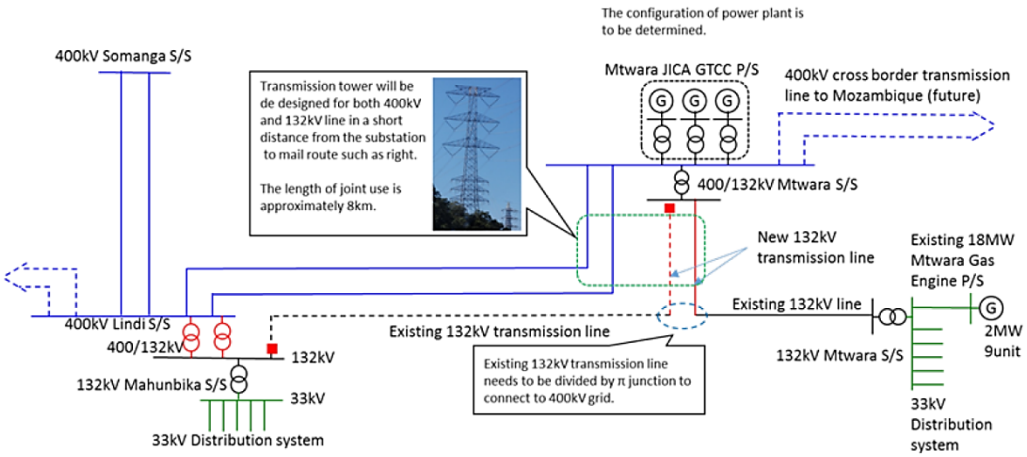


Figure 2-2 Schematic Diagram of the Proposed Transmission System

Source: JICA Study Team, 2018

2.3.1 Transmission Line

The proposed design details of the basic components of the transmission line, are summarized in ***Table 2-1***. In terms of electrical system, ***Table 2-2*** shows the minimum design requirements of the transmission line.

Table 2-1 Details of the Proposed Transmission Line

Transmission Line Components		Details
400 kV Circuit		2
Conductors per phase		4
Route length	Transmission Line (Mtawara to Lindi)	59 km
	Transmission Line (Lindi to Somanga)	209 km
	Total	268 km
Conductor Type		ACSR Bluejay
Earthwire		GSW 110 mm² or AS 110 mm²
OPGW		OPGW 110 mm²
Transmission Tower (type)		Self-supportive steel lattice structures
Foundation (type)		In-situ reinforced concrete

Source: JICA Study Team, 2018

Table 2-2 Basic Design Data

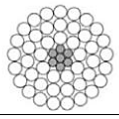
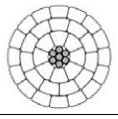
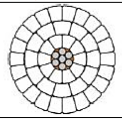
Description	Unit	Data
Nominal voltage	kV	400
Maximum operating voltage	kV	420
Power frequency	Hz	50
Basic Insulation Level Design BIL (lightning impulse)	kV_{peak}	1,425
Switching impulse withstand voltage phase - earth	kV_{peak}	1,050
Ratio of switching overvoltage phase-to-phase and phase to ground		1.5
System highest 3-phase short-circuit current level (1s)	kA	40
Short circuit current (1s) for thermal stability check of the earthwires	kA	10
Design creepage distance for medium pollution as per IEC 60815	mm/kV	31

Source: JICA Study Team, 2018

Conductor

The specifications of candidate conductors are presented in ***Table 2-3***. Bluejay is a popular conductor in Tanzania. The other candidates are two kinds of low loss conductors (hereinafter called as Low Loss). Low loss conductor have various specifications, but the ones with the same outside diameter as Bluejay were considered for easy comparison. Wind pressure loads applied to conductors are equal for all cases and tower design conditions for both are almost same.

Table 2-3 Conductor Type

Description		Unit	Bluejay	Low loss A	Low loss B
Nominal Diameter		mm	32.0	32.0	32.0
Cross sectional area	Al	mm^2	564.0	719.2	697.5
	Core		39.3	22.0	29.1
	Total		603.3	741.2	726.6
Nominal weight	Total		1,868	2,154	2,165
DC Resistance at 20 deg. C		Ohm/km	0.051	0.040	0.0416
Sag of 350 m span*1		m	13.96 m at 90 deg. C	13.96 m at 81.4 deg. C 14.25 m at 90 deg.C	12.53 m at 82.3 deg. C 12.82 m at 90 deg.C
Current capacity at 90 deg. C*2		A	964 A at 90 deg. C	964 A at 81.4 deg.C 1082 A at 90 deg.C	967 A at 82.3 deg.C 1069 A at 90 deg.C
Cross sectional view					

Note

*1Conditions
Every tension: Not exceeding 20% RTS
Every temperature: 25 degree C

*2Conditions
Ambient temperature: 40 deg. C
Wind velocity: 0.5 m/s
Wind direction: 45 dgrees
Solar radiation: 0.1 W/cm^2
Emissibity of conductor surface: 0.5
Acsorptivity of conductor surface: 0.5
Calculation method: In accordance with JCS 0374

Source: JICA Study Team, 2018

Earth wires

For earth wires, two options are being considered. The selection of earth wire has to consider following:

- The sag of the earth wire must be the same as that of the conductor or slightly less.
- To increase the effective shielding of the phase conductors from lightning, the earth wire sags will be approximately 20 ~ 25% less than conductor sags at everyday temperatures.
- Earth wire should be able withstand the expected fault and lightning currents.
- Regarding pollution and corrosion, as the area is not polluted, a proper Ground Wire should be selected.

Taking the above into account in conjunction with the earth wire presently being used in the current transmission system, the earth wire (GSW 110mm^2) will be applied with a stranding of 7/4.5 mm. The properties of earth wire GSW 110 mm^2 are shown as follows.

Table 2-4 Properties of the Earth wire GSW 110 m^2

Earth wire		GSW 110mm^2
Stranding and Wire diameter	Galvanized Steel Wire	7/4.5 mm
Calculated Area of GSW		111.30 mm^2
Approximate Overall Diameter		13.50 mm
Calculated DC Resistance at 20°C per km		2.4423 ohm/km
Total weight per km		882 kg
Ultimate Breaking Strength		more than 126.0 kN

Source: JICA Study Team, 2018

As the alternative ground wire, Aluminum Clad Steel Wire of 110 mm^2 is considered. The properties of the alternative ground wire AS 110 mm^2 are shown as follows:

Table 2-5 Properties of the Earth wire AS 110 mm^2

Ground Wire		AS 110mm^2
Stranding and Wire diameter	Aluminum-Clad Steel Wire	7/4.5 mm
Calculated Area of AS		111.3 mm^2
Approximate Overall Diameter		13.5 mm
Calculated DC Resistance at 20°C per km		less than 0.8603 ohm/km
Approximate mass per km		704.8 kg
Ultimate Breaking Strength		more than 123.2 kN

Source: JICA Study Team, 2018

Except for the properties shown in the ***Table 2-5***, the conductors shall comply with ASTM B-415 and B-416 or equivalent standard. Two overhead ground

wires make the shielding effect to protect from direct lightning strikes to conductors.

Insulator

The porcelain type insulator is suitable for the trunk power system because of its reliability. It can achieve very low failure rate not exceeding one (1) per one hundred thousand (100,000) per year, thus reducing cost and frequency of power failure work due to replacement and maintenance works. The insulator set and fittings that may be adopted by the Project depend on the tower type. These are shown in ***Figure 2-3*** and ***Figure 2-4***.

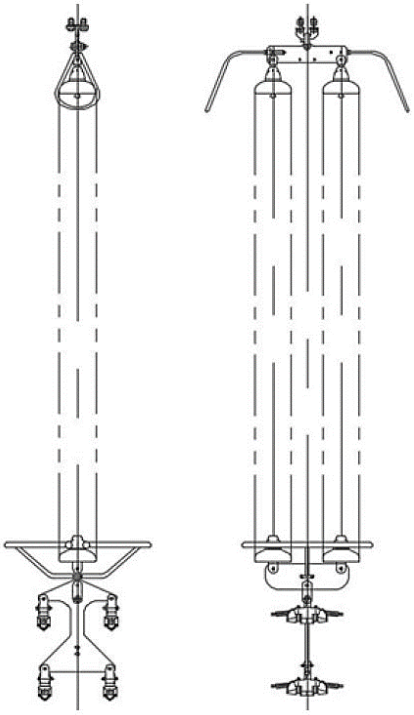


Figure 2-3 Insulators Set and Fittings (Suspension Type)

Source: JICA Study Team, 2018

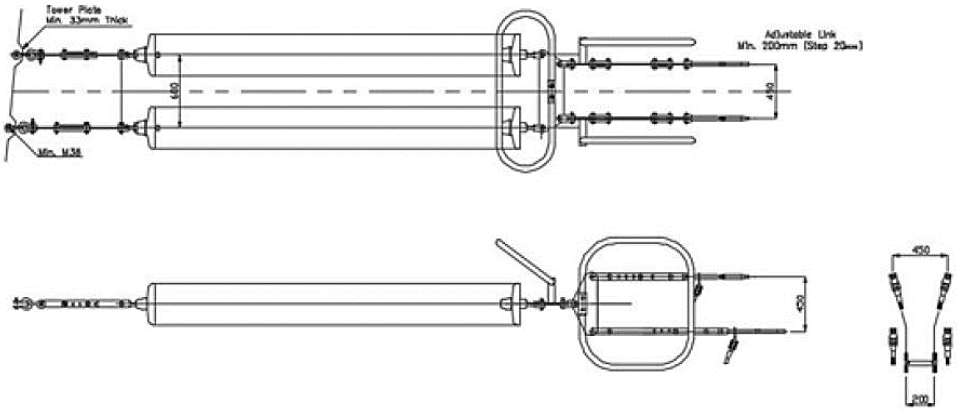


Figure 2-4 Insulators Set and Fittings (Tension Type)

Source: JICA Study Team, 2018

The proposed transmission line is located close to the coast, which increases the risk of insulators to be contaminated with salt blown from the sea (refer to ***Figure 2-5***). Salts that tend to coat insulators may increase the leakage currents by increasing conductivity at the surface of the insulator. This phenomenon may affect overall performance of the electrical system. In order to reduce risk to salt contamination, the number of insulator units necessary in the polluted region has been determined (refer to **Error! Reference source not found.**).

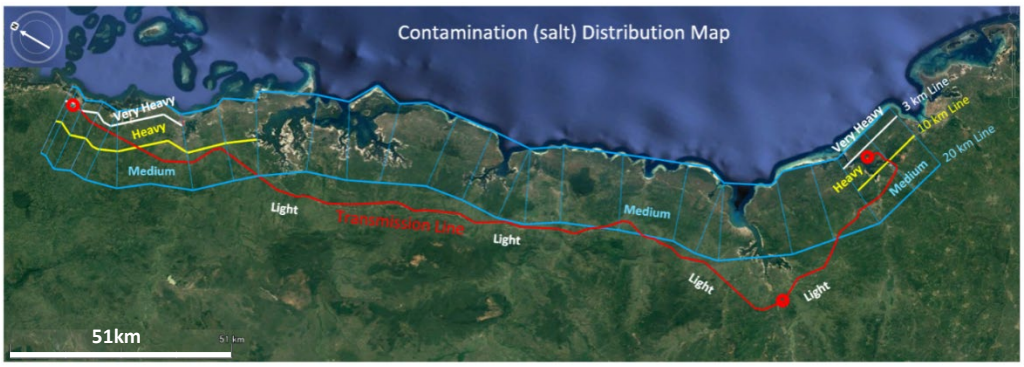


Figure 2-5 Salt Contaminated Area

Source: JICA Study Team, 2018

Table 2-6 Required Insulator Units in Salt-Contaminated Area

Pollution level	Min.nominal specific creepage distance	distance from the coastline	Tension	Suspension	
			300kN Normal	Span 300 m	Span 400 m or more
				160kN Fog	210kN Fog
			Number of insulators	Number of insulators	Number of insulators
Light	16 mm/kV	20 km over	16 × 2	19 × 1	19 × 2
Medium	20 mm/kV	10-20 km	18 × 2	19 × 1	19 × 2
Heavy	25 mm/kV	3-10 km	22 × 2	20 × 1	19 × 2
Very Heavy	31 mm/kV	0-3 km	27 × 2	24 × 1	24 × 2

Note

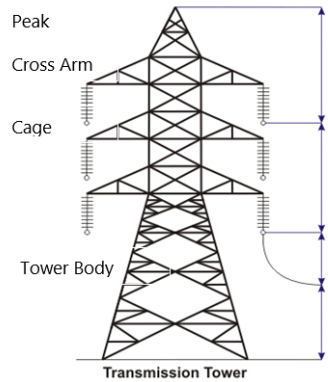
IEC60815-2-2008 compliant

Source: JICA Study Team, 2018

Transmission Tower

Typical components of a transmission tower include peak, cross arm, cage and tower body. The description of each part is provided in ***Table 2-7***.

Table 2-7 Main Components of a Transmission Tower



Part	Description
Peak	The portion above the top cross arm; Generally earth shield wire connected to the tip of this peak.
Cross Arm	Cross arms hold the transmission conductor.
Cage	The portion between tower body and peak; Holds the cross arms.
Tower Body	The portion from bottom cross arms up to the ground level; Maintains required ground clearance of the bottom conductor of the transmission line.

Source: JICA Study Team, 2018

The supporting structures will be two-circuit steel angle towers with concrete foundations. These towers should withstand the severest conditions including the breakage of two wires, that is, either 1 ground wire + 1 line conductor or 2 line conductors.

The proposed 400 kV transmission line between Mtwara and Somanga will be approximately 270 km long. The estimated number of transmission line towers is approximately 700. In view of the topography of the line routes of this project, it will be most economical to design tower of the basic types as shown in ***Table 2-8***.

Table 2-8 Tower Type

Tower Type	Insulator String	Horizontal Angle of Line	Nominal span	Wind Span	Weight Span	Phase Span
NS Tower Normal Suspention	Suspension I-string	0° – 2 °	400 m	440 m reduced i)	max 700 m min 200 m	650 m ii)
HS Tower Heavy Suspention	Suspension I-string	0° – 2 ° long span	400 m	800 m reduced i)	max 1100 m min 300 m	950 m ii)
LA Tower Light Angle	Tension string	0° – 15 °	400 m	440 m	max 700 m min -350 m	650 m ii)
MA Tower Medium Angle	Tension string	0° – 30 °	400 m	440 m	max 700 m min -350 m	650 m ii)
HA/DE Tower Heavy Angle/ Terminal	Tension string	30° – 70 ° 0° – 90 ° iii)	400 m	440 m	max 700 m min -350 m	650 m ii)
TP Tower Transposition	Tension string	2°	400 m	440 m	max 700 m min -350 m	650 m

Notes:
i) Wind span values for the line angle of 0°; For line angles >0°, the wind span has to be decreased accordingly.
ii) These are minimum values for the mid-span criterion; Actual maximum spans may be higher in case mid-span phase-to-phase spacing will be determined by phase-to-tower steelwork clearances.
iii) Considering the slack span between terminal tower and S/S gantry.

Source: JICA Study Team, 2018

Foundation

Foundation type should be designed according to soil condition, which is determined by soil type, the N-value corresponding to soil hardness measured by the standard penetration test and water level.

Fundamental foundation types are shown in ***Table 2-9*****Error! Reference source not found.** and ***Figure 2-6***.

Table 2-9 Types of Foundation

Foundation types		I	II	III	III-w	IV	V	V-w1	V-w2	VI
		Concrete Pad & chimney				Rock anchor	Raft enlarge	Raft enlarge (Swamp)	Raft enlarge (Swamp / High Water)	Pile
Approximate soil description		Stiff Clay / Dense Sand	Firm Clay / Medium Dense Sand	Soft Clay / Silt / Loose Sand	Soft Clay / Silt / Loose Sand with Water	Homogeneous Rock	Bad Soil condition with Water	Bad Soil condition with Water	Bad Soil condition with High Water	Very Bad Soil condition with High Water
N-value	Sandy soil	More than 30	30 - 10	10 - 4	10 - 4	More than 50	Less than 4	Less than 4	Less than 4	Less than 4
	Clayey soil	More than 8	8 - 4	4 - 2	4 - 2		Less than 2	Less than 2	Less than 2	Less than 2
Design uplift frustum angle		20 deg.	15 deg.	10 deg.	0 deg.	30 deg.	0 deg.	0 deg.	0 deg.	0 deg.
Concrete unit weight (kg/m^3)		2,400	2,400	2,400	1,400*	2,400	1,400*	1400*	1,400*	1,400*
Soil/Rock unit weight (kg/m^3)		1,600	1,500	1,400	950*	1,950	950*	950*	950*	950*

*Submerged unit weight

Source: JICA Study Team, 2018

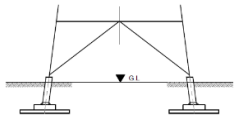
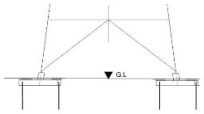
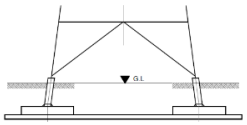
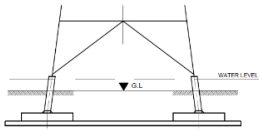
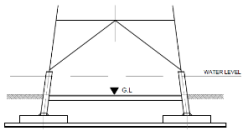
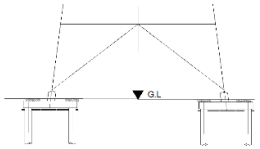
I, II, III & III-w	IV	V	V-w1	V-w2	VI
Concrete Pad & chimney	Rock anchor	Raft enlarge	Raft enlarge (Swamp)	Raft enlarge (Swamp / high water)	Pile
					

Figure 2-6 Images of Foundation Types

Source: JICA Study Team, 2018

Based on soil type, appropriate foundation types have been identified and concrete pad and chimney have been identified as the appropriate foundation type.

Access Road

Access roads required for the construction are estimated to be about 110 (6m width, 300m length on average) of which about 40 existing roads could be utilized. The EPC contractor will rent those new roads during construction. TANESCO will decide how many access roads will be necessary for maintenance during construction.

2.3.2 *Substations*

400kV Mtwara Substation

The new 400kV Mtwara substation is located within the area of the Mtwara power plant.It is located at the southeast area of the planned Mtwara power plant No. 2 (Phase II). It covers an area of approximately 3ha andis represented by the yellow plot in ***Figure 2-7***. The area will be fenced. Also, a guard house and gate will be constructed.

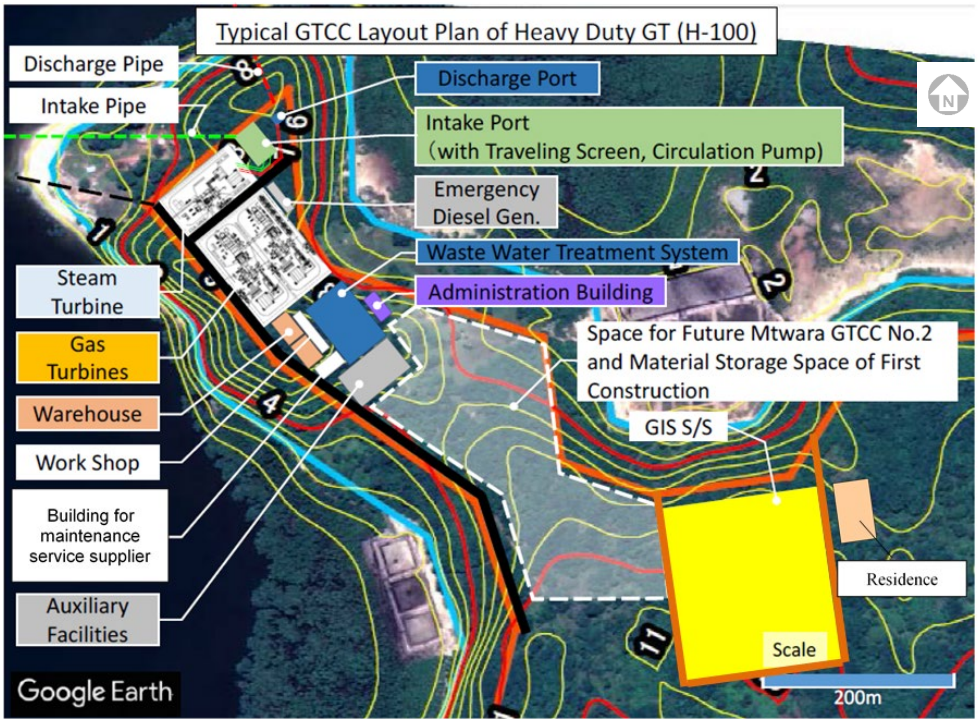


Figure 2-7 Location of Mtwara Substation

Source: JICA Study Team, 2018

400/132 kV transformers

Two 100MVA transformers will be installed in the Mtwara substation. The required capacity was identified based on demand forecast. The estimated demand is 43 MW in 2022, however it is assumed to be 89 MW for a few years until 2025. The required capacity until 2025 will be 105 MVA (89/0.85), if the

power factor is set to 0.85. After that, demand is expected to increase to 126 MVA (107/0.85) in 2030 and 167MVA (142/0.85) in 2040.

Switchgear

The 400kV New Mtwara substation will employ GIS for the following reasons.

- Uncertain power system configuration for the future expansion of power station
- Pollution due to its location near Sea Side
- Importance as Mozambique interconnection point

However, 132 kV facilities will be designed with AIS and 1CB scheme, because it requires flexibility in terms of expansion and connection rather than reliability.

Layout

The layout of the new 400kV Mtwara substation was developed whilst considering the following factors:

- Construction schedule including future plans to avoid idle equipment;
- Crossing of Cables;
- CBF (Circuit Breaker Failure) in 1.5CB scheme to avoid tripping of transmission lines and generators at the same time;
- Adjacent areas of the transmission line to avoid operational mistake; and
- Flexibility for expansion and connection of 132 kV feeders.

The proposed layout is presented in ***Figure 2-8*****Error! Reference source not found.**. The location of the 400kV New Mtwara substation, the power station near it or transmission line towers, are determined by the number (total length) of 400kV cables including future plans (e.g. PhaseII and Mozambique interconnection).

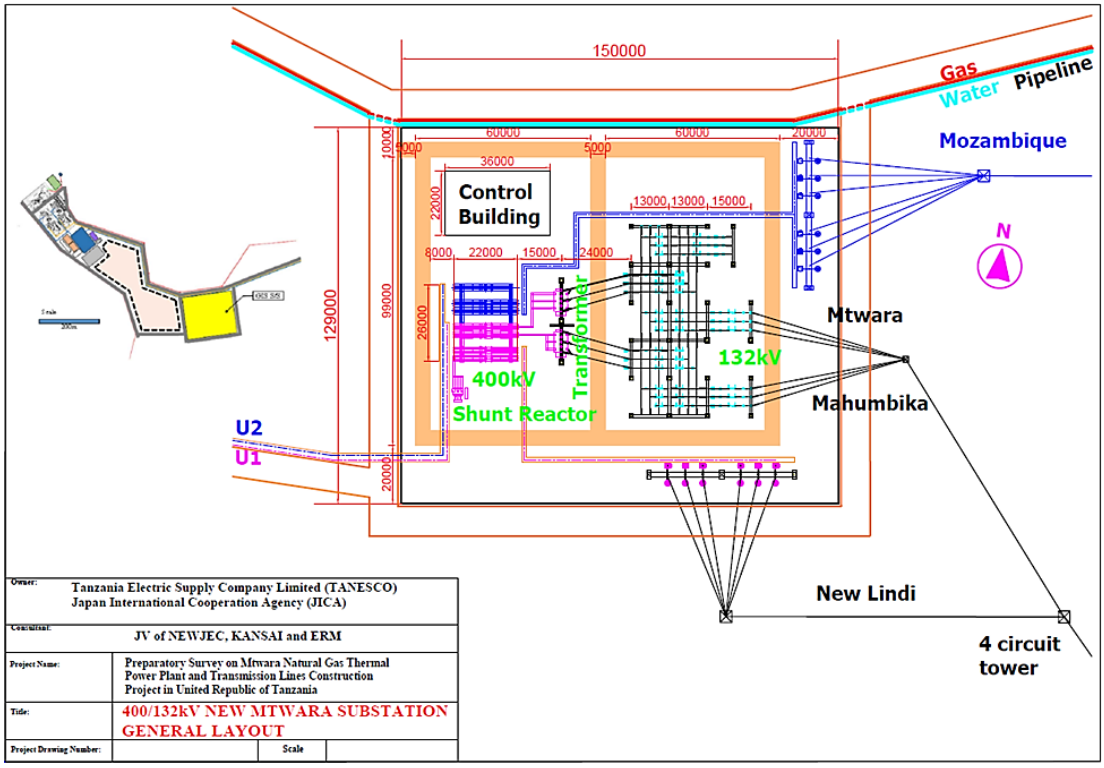


Figure 2-8 General Layout of Mtwara Substation

Source: JICA Study Team, 2018

The 400kV New Mtwara substation will not be changed, if a new transmission line is planned. The 400kV cables of the transmission line will be used to connect to the new substation, in case the 400kV transmission lines of this project are used in Phase II. The new substation will be constructed near the transmission line towers in Phase II. However, the location may be changed to a place near transmission line towers if there is a need to consider easy access to the substation's 132kV feeders.

Main Building

The new Mtwara substation will be manned and separated from the power station for the future unbundling of TANESCO. 400kV Lindi substation is assumed to be unmanned and controlled from the 400kV New Mtwara substation. Both substations will have remote control functions at GCC (Grid Control Center).

The proposed layout for the main building is presented in ***Figure 2-9***. Since the substation has 33kV cables and many control cables underground, the main building was designed as a two-floor building. The ground floor will serve as the cable room.

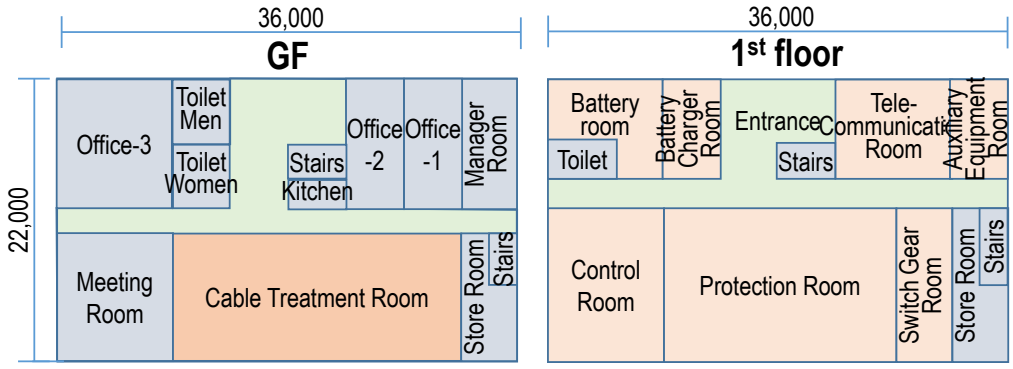


Figure 2-9 Proposed Main Building Layout

Source: JICA Study Team, 2018

Summary of Substation Facilities

A summary of the substation facilities that will be installed in the new Mtwara substation is listed in ***Table 2-10***. It should be noted that both GIS and AIS will be installed in the substation. GIS will be used for 400kV facilities, while AIS will be used for 132kV facilities.

Table 2-10 Components of Mtwara Substation

	Components	Units
1	400/132 kV 100MVA three phase transformers	2 sets
2	400kV three phase 30Mvar shunt reactors	1 set
3	400kV Gas Insulated Switchgears (GIS) with 1.5 CB scheme for 2 transmission lines, 2 transformers, and 3 generators.	4 diameters
4	132kV AIS for bus with double bus single breaker scheme (1CB)	2 sets
5	132kV AIS for bus couplers	1 set
6	132kV AIS for transformer feeders	2 sets
7	132kV AIS for transmission line feeders	1 set
8	33kV equipment	1 lot
9	Steel structure and supporting facilities	1 lot
10	Bus facilities including insulators, strings, and fittings	1 lot
11	Control system and SCADA system	1 lot
12	Protection system	1 lot
13	Communication system	1 lot
14	Earthing system	1 lot
15	Outdoor lightning protection system	1 lot
16	400V AC station service facilities including Diesel generators	1 lot
17	DC230V and 48V station service facilities	1 lot
18	MV power cables and accessories	1 lot
19	LV power and control cables and accessories	1 lot
20	Miscellaneous materials	1 lot
21	Spare parts and O&M tools	1 lot
22	Civil work	1 lot
23	Building work	1 lot

Source: JICA Study Team, 2018

400kV Lindi Substation

The proposed 400kV Lindi Substation is located beside the existing Mahumbika Substation in between Mingoyo and Narunyu Wards of Lindi District. The surroundings of the proposed project site are presented in ***Figure 2-10***.

Figure 2-10 Surroundings of Proposed Lindi Substation

Source: JICA Study Team, 2018

400/132kV transformers

Three 100 MVA transformers will be installed in the 400kV Lindi substation. The required capacity was identified based on demand forecast. The estimated demand is 125 MW in 2022, however it is assumed to be 188 MW for a few years until 2025. The required capacity until 2025 will be 221 MVA (188/0.85), if the power factor is set to 0.85. This will be decreased after the completion of 400kV Masasi substation.

Switchgear

Although the 400kV Lindi substation has enough area for AIS, H-GIS (Hybrid GIS) will be employed for the 400kV Lindi substation for the following reasons.

- Reliability as 400kV bulk system
  Against lightning, rain, strong wind, and earthquake resistance
- Severe pollution requirement
  AIS is not so cheap because the standard creepage distance for severe cases is set at 31 mm/kV throughout Tanzania.
- Shortening of project schedule
  Since included in the same package with 400kV new Mtwara substation, design and construction of an AIS will require more time.

Layout

The proposed layout of the 400kV Lindi substation is presented in ***Figure 2-11***. The layout design was developed whilst considering the following factors:

- Six 400kV Feeders for Somanga, New Mtwara, and Masasi (Another future plan is possible to be included.) with H-GIS and 1.5CB scheme
- Two 400kV Reactors
- Three 400/132kV Transformers
- One 132kV bus coupler and Six 132kV Feeders including the existing Mahumbika and Mtwara lines with AIS and 1CB scheme.

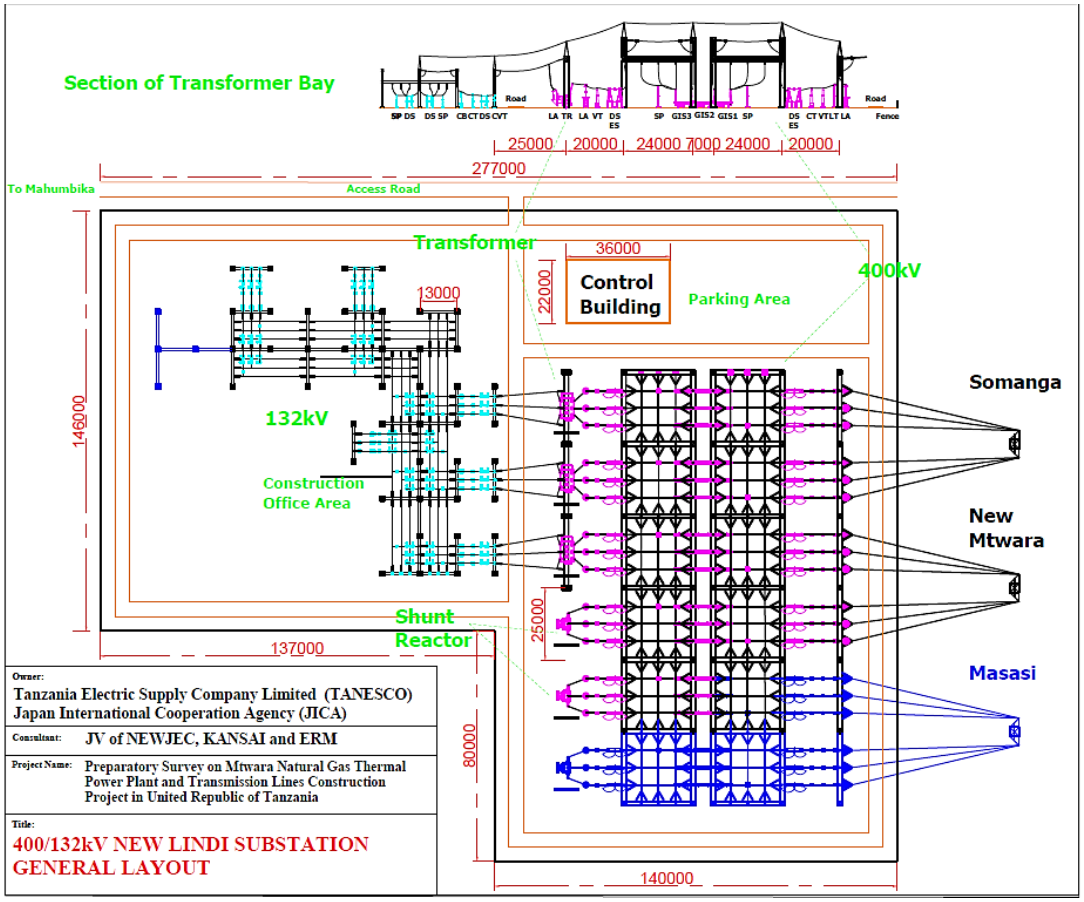


Figure 2-11 Layout of New Lindi Substation

Source: JICA Study Team, 2018

The number of feeders is subject to change. 132kV feeders may be arranged in the direction opposite to the gas pipeline, if it is difficult to set all transmission lines in the direction of the gas pipeline.

Summary of Substation Facilities

A summary of the substation facilities that will be installed in the new Lindi Substation is listed in ***Table 2-11***.

Table 2-11 Components of the New Lindi Substation

	Components	Units
1	400/132 kV 100MVA three phase transformers	3 sets
2	400kV three phase 70Mvar shunt reactors	2 sets
3	400kV H-GIS with 1.5CB scheme for 4 transmission lines, 3 transformers, and 2 shunt reactors	4 diameters
4	400kV AIS for bus	2 sets
5	400kV AIS for transformers feeders	3 sets

	Components	Units
6	400kV AIS for shunt reactors feeders	2 sets
7	132kV AIS for bus with double bus single breaker scheme (1CB)	2 sets
8	132kV AIS for bus couplers	1 set
9	132kV AIS for transformer feeders	3 sets
10	132kV AIS for transmission line feeders	6 sets
11	33kV equipment	1 lot
12	Steel structure and supporting facilities	1 lot
13	Bus facilities including insulators, strings, and fittings	1 lot
14	Control system and SCADA system	1 lot
15	Protection system	1 lot
16	Communication system	1 lot
17	Earthing system	1 lot
18	Outdoor lightning protection system	1 lot
19	400V AC station service facilities including Diesel generators	1 lot
20	DC230V and 48V station service facilities	1 lot
21	MV power cables and accessories	1 lot
22	LV power and control cables and accessories	1 lot
23	Miscellaneous materials	1 lot
24	Spare parts and O&M tools	1 lot
25	Civil work	1 lot
26	Building work	1 lot

Source: JICA Study Team, 2018

Connection with Somanga Substation

400kV Somanga substation is being planned by another project. There will be no drawings until the final report of this project. However, it may be a GIS substation, as the planned area is narrow. Only the cost of following will be considered in our project.

- Two GIS feeders including GIS bus expansion
- Protection system for the transmission line to Lindi
  Other revisions like SCADA may be included to this project by the instruction of the Employer.

The components of the proposed substation in Lindi are presented in ***Table 2-12***.

Table 2-12 Components of Somanga Substation Connection

	Components	Units
1	400 kV 100MVA three phase 55Mvar shunt reactors	2 sets
2	400kV GIS for 2 transmission lines with bus expansion	2 feeders
3	Protection system	1 lot

Source: JICA Study Team, 2018

Protection System

Protection systems are needed for main and back-up in case of unexpected system failure. In general, double group system is proposed for 400kV or extra high voltage system. For the Project, two protection groups, each connected to the main line, back-up line and reclosing line, are proposed. Details are presented in ***Table 2-13***.

Table 2-13 Protection System

Group	Line Name	Device Number
Group 1	Main	87L (Differential)
	Back-Up	21 (Distance) 67/67N (Transfer Trip) 50/51, 50N/51N
	Reclosing	25, 79
Group 2	Main	87L (Differential)
	Back-Up	21 (Distance) 67/67N (Transfer Trip) 50/51, 50N/51N
	Reclosing	25, 79

Source: JICA Study Team, 2018

Communication and SCADA System

Transmission lines between Somanga, Lindi, and New Mtwara have two ground wires. At least, single OPGW (Optical Ground Wire) will be used. Back-up for the communication system is required for following reasons.

- 400kV system will be a bulk system in Tanzania
- Communication route has a long distance.
- There is no existing route (BTIP project has 230kV communication line).

Two methods are considered for the back-up system.

- Option 1: OPGW + OPGW
- Option 2: OPGW + PLC (Power Line Carrier)

PLC is old style, and the data transfer will be restricted. OPGW will cost an additional twenty (20) US dollars per meter. That means, about 6 million US dollars for three hundreds (300) kilometers. Although Option 1 is recommended, we have to consider PLC because the plan of transmission line between Kinyerezi and Somanga is still uncertain, and it is difficult to coordinate.

Firefighting System

Normal ABC fire extinguishers are equipped around the transformers in the existing 230kV and 132kV substations. On the other hand, Kinyerezi 2 power station is equipped with an extinguishing water piping system for each transformers. The fire extinguishers are not suitable for the oil volume of 400kV transformer, as it is not possible to control/put out the fire. The fire wall can withstand only for two hours. A water system like Kinyerezi 2 will be required.

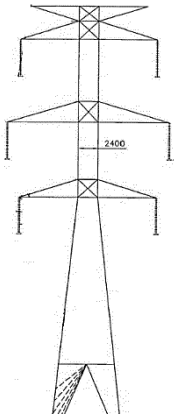
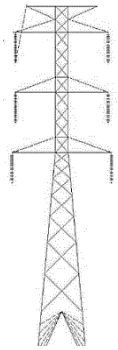
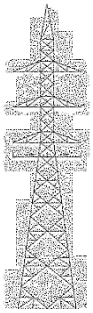
Furthermore, appropriate fire extinguishers and fire alarm will be installed in the main building in Mtwara substation.

2.4 RIGHT OF WAY, CLEARANCE, AND CROSSINGS

2.4.1 Right of Way (ROW) / Wayleave

For transmission lines, Right-of-Way (ROW) is the distance at both sides of the transmission tower that needs to be cleared/maintained to give way to the transmission towers and prevent contact with the conductors. ROW depends on various factors, which include tower height, design and transmission voltage (refer to ***Table 2-14***). Higher transmission voltage would require wider ROWs.

Table 2-14 Typical Transmission Tower Design & Right-of-Way (ROW)

	400kV	**220kV**	**132kV**
Standard width of ROW	50m	35m	27m
Typical height of tower	50m	40m	38m
Typical design example			

Source: JICA Study Team, 2018

For the Project, the ROW that will be adopted is 52m. There will be 23m allowance at each side measured from the centreline of the transmission tower.

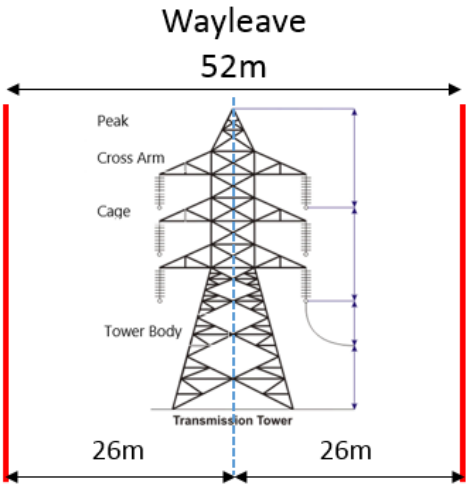


Figure 2-12 ROW for the Project

Source: JICA Study Team, 2018

2.4.2 Vertical Clearance

The details of the minimum clearance between line conductors and ground or other objects are summarized in ***Table 2-15***.

Table 2-15 Vertical Clearance

Situation	Minimum Clearance (m) for 400kV
Normal Ground	10.00
Roads – Road Level	8.60
Power Transmission and Telecommunication lines	
Lowest line conductor of upper line to highest conductor or earthwire of lower line	4.40
Lowest line conductor of upper line to support the lower line on which a person may stand	5.30
Railway crossing	
Rail level	11.0
Electrified railway crossing, building, gantries, or other structures on which a man can stay	7.20
Ground level at animal corridors crossing – Transmission line route	11.0
Ground level at roads or yards where road mobile cranes are likely to be employed	5.30
Any wall, building or other structure on which a man stand, or on which a ladder may be placed	5.30
Street lightning/ Grown trees	4.70

Note: Roads refer to any road that is normally maintained by Government and/or other recognized public authority

Source: JICA Study Team, 2018

2.4.3 Crossings

The proposed transmission line route will cross numerous rivers. Among these, three rivers (Matandu River, Manuji River and Mbwemkuru River) in Lindi

Region have constant water flow and are known to be inhabited by snakes and Nile Crocodiles, commonly found in Central Africa. Care has to be taken when going near these areas.

It will also cross major roads at nine points.

2.5 *PROJECT LIFECYCLE OVERVIEW*

Project life cycle analysis identifies the key issues and concerns that are likely to evolve over the entire lifespan of a project. In the case of the proposed project, these issues may arise during the construction, operation and maintenance, and decommissioning. The following sub-sections identify the key activities to be completed and facilities to be constructed and operated over the lifetime of the project.

2.5.1 *Construction phase*

Material Transport

The transport weight of the transformer including the trailer with a capacity of 100 to 150 MW will be 110 to 140 tons in three phases and 55 to 85 tons in a single phase. There is no problem with regard to landing at the Mtwara port. A 100 ton crane was installed in 2015 and a 300 ton crane will be added in February 2019.

An application to the Ministry of Works will be required for every road transport of more than 56 tons. Also, a surcharge of US$ 140,000 will be charged according to Tanzania National Roads Agency (TANROADS). For weights over 100 tons, the application will be assessed individually. For other projects, a record of 120 tons of material transport has been confirmed.

Aside from weight, there are also constraints on the dimensions of vehicle as mentioned below:

Maximum Overall Length	:	Rigid Vehicle 12.5m, Articulated Vehicle 17m, Any Combination of Vehicles 22m
Maximum Overall Width	:	2.6m
Maximum Overall Height	:	4.6m

As shown in ***Figure 2-13*****Error! Reference source not found.** and ***Table 2-16*****Error! Reference source not found.**, it seems that none of the bridges requires special reinforcement, which significantly affects the constructionn costs. . In addition, marine transport is possible from the Mtwara port to the 400kV New Mtwara substation.

Figure 2-13 Transport Route

Source: JICA Study Team, 2018

Table 2-16 List of Bridges from the Mtwara Port Mtwara

Name	Classification	Length (m)	Width (m)	Name	Classification	Length (m)	Width (m)
01 Magomeni1	Box Culvert	4.9	12	02 Magomeni2	Box Culvert	4.85	12
03 Magomeni3	Box Culvert	4.85	12	04 Magomeni4	Box Culvert	8	12
05 Magomeni5	Box Culvert	4.85	12	06 Mitengo1	Concrete Pipe	4	12
07 Mikindani1	Concrete Slab	11.85	7.1	08 Mikindani2	Concrete Slab	12	7.1
09 Mikindani3	Concrete Beam	30	8.7	10 Mbuo1	Concrete Beam	30	8.7
11 Mbuo2	Concrete Pipe	2.4	12	12 Changrawe	Box Culvert	4.85	12
13 Mpapura	Concrete Beam	28.9	8.7				

Lindi

Name	Classification	Length (m)	Width (m)	Name	Classification	Length (m)	Width (m)
01 Mkwaya1	Pipe Culvert	14.2	-	02 Mkwaya2	Box Culvert	14.2	-
03 Mkwaya3	Box Culvert	8	-	04 Mkwaya4	Box Culvert	8	-
05 Mkwaya5	Box Culvert	120	-	06 Mloweka	Concrete Pipe	15.2	-

Source: JICA Study Team, 2018

The major equipment that will be used for construction are as follows and the details will be determined after the contractor is selected. These equipment will

be transported through the major road between Mtwara and Dar es Salaam.

- Trucks for unloading materials and equipment at each tower site;
- Personnel Carrier
- Mobile cranes
- Excavator
- Concrete mixers
- Line winders
- Cable reel carriers

Temporary Facilities

During construction, temporary construction camps and access roads can be constructed where required. The location and extent of these components are however not known at this stage of the project.

Manpower

During construction of the transmission line and substations, around 100,000 workers in cumulative total number are expected during the construction. During the peak period of construction, around 100 to 200 workers on daily basis would be required.

Construction Schedule

Approximately 22 months is adopted as the construction period of the 400kV Transmission Line from Mtwara to Somanga (around 270km) subject to 3 divisions of the transmission line. Based on the past actual experience of a similar project, 22 months are adopted as the construction period of the 400kV Substations.

Waste generation and its impact assessment are described in 6.4.6.

2.5.2 *Operation phase*

Manpower

During operation phase, approximately 12 fulltime workers will be needed for the transmission line. For the Mtwara substation, approximately 10 workers will be needed.

Emissions and Discharges

The transmission line will not generate wastewater under normal operation. However, sewage will be generated from the substations. Assuming there are 12 employees working at three shift, it is expected that there will be three employees working at the same time, excluding maintenance personnel who visit the site intermittently. Kitchens and toilets (septic tanks with 3,000 litres capacity) will be constructed in the new substations. Sewage will be collected regularly.

The transmission line will not generate wastes. Waste oil and equipment parts will not be generated from the substations, under normal operation. Domestic wastes will be generated by maintenance workers (including maintenance personnel).

2.5.3 Decommissioning phase

During the decommissioning phase the main issues will involve demolition of the facilities such as transmission towers, substations, and factories. Decommissioning of the transmission line, substations and associated facilities may be carried out in the Environmental and Social Management Plan to be made as a part of the Environmental Impact Assessment report.

Therefore, dismantling of the unusable equipment will be carried out ready for removal from site and any other buildings and structures which can be used by others for other activities such as offices will be left behind and handed over to new users during the final years of the project. The main issues of concern will be removal and handling of cleared materials (rubbles). Others issues include noise and dust level due to demolition of structures and restoration of the area.

2.6 PROJECT BOUNDARIES

Determining the boundaries within which the EIA will be undertaken is an important process in the EIA since this determine the extent in which the impacts will be experienced.Designation of boundaries focuses and bound the impacts to where they are likely to be felt on the biophysical environment, social, legal and the local economy. Three types of boundaries were considered i.e. institutional, temporal and spatial boundaries as elaborated in the following paragraphs.

2.6.1 Institutional boundaries

These refer to institutions and sectors in which the project lies or interacts. They were determined in terms of political, legal, regulatory and/or institutional mandates and administrative structures. The proposed project development is about thermal power generation at Kisiwa village utilizing natural gas from Mnazi bay, Mtwara district in Mtwara region. This development touches the interests of national institutions such as Tanzania Petroleum Development Corporation (TPDC), TANESCO, EWURA and TANROADS; administrative units (Mtwara Regional Secretariat, Mtwara District Council, Village Governments of Kisiwa Village, Namgogoli, Mgao, and Naumbu are likely to be of interest to this EIA.

Similarly sector ministries such as Ministry of Energy, Ministry Livestock and Fisheries, Ministry of Natural Resources and Tourism, Ministry of Water and Irrigation; Ministry of Labor, Employment and Youth Development and Ministry of Lands, Housing and Human Settlement Development. In addition to the sector ministries there international institution with interest to the proposed development. These institutions will be consulted to get their view on the proposed development.

2.6.2 Temporal boundaries

These refer to the lifespan of the project and reversibility of impacts associated with the proposed project development and operation. For example, the impacts may be either short-lived or long term, reversible or irreversible, with implications stretching far into the future. Consideration is also given to what happens when the project ends i.e. decommissioning and the cumulative effects associated with this and several other power projects within the locality and those activities that the power generation will feed into.

3 ADMINISTRATIVE FRAMEWORK: POLICY, LEGISLATION, INTERNATIONAL GUIDELINES

3.1 INTRODUCTION

The proposed transmission line and substations will have both positive and negative impacts on the ecological, economic and social environment. As a result, there is need to ensure that throughout the life of the project, there is compliance with relevant national polices, legislations, administrative frameworks and standards on the management of the environment. Tanzania has also ratified several international agreements and conventions on environmental management, which demand interventions in, project planning, construction and operation. Also, others policies such as from the International Finance Corporation (IFC) and World Bank Policies and JICA guiding energy projects, need to be taken into account. Below is a review of the policies and laws that are relevant to the proposed development.

3.2 POLICIES RELATED TO THE PROJECT

The proposed Transmission Line development in Mtwara and Lindi Regions will have implications to several policies. Below is a brief description of some of the relevant policies that the project will touch upon and which have to be adhered to for guidance.

National Energy Policy, 2015

The main objective of the National Energy Policy of 2015 is to provide directives for sustainable development and utilization of energy resources to ensure optimal benefits to Tanzanians and to contribute towards the transformation of the national economy. Tanzania is intending to become an industrial – middle income country by 2025 and therefore, provision of affordable, sustainable and reliable energy is key prerequisite to the success of the planned development goal of becoming industrialized.

The main scope for the Energy Policy of 2015 includes the following:

- To promote petroleum and gas upstream, midstream and downstream activities
- To promote renewable energy and energy conservation (non -hydro renewables include solar, wind, biomass and geothermal)
- To address cross cutting issues such as matters of subsidies, institutional, legal, regulatory as well as monitoring and evaluation.

Matters related to the environment are discussed under the cross cutting theme of the policy, which focuses on (a) Transparency and accountability (b) Regional and International Cooperation (c) Safety, Occupational Health and Environment, and (d) Gender issues and HIV/AIDS in the Energy. In this context, the Policy is advocating the application of tools such as Environmental

Impact Assessment (EIA) for energy projects. Also, the Policy is promoting establishment of disaster prevention and response plans and the use of practices such as Polluter- Pays- Principle. Therefore, in order to meet the Policy objectives, the Government shall undertake the following measure:

- Enforce environmental, health and safety standards and laws governing the Energy Sector.
- Ensure that contractors in the energy sector establish a decommissioning fund for environmental restoration where appropriate.
- Strengthen institutional capacity in monitoring and enforcement of laws and regulations on safety, occupational health and environmental management.

The proposed transmission line system must take into account the provisions of this Policy in ensuring that the final project promotes the supply of energy in the most environmentally and socially acceptable way.

The National Natural Gas Policy, 2013

Tanzania has been exploring for oil and gas for the past 65 years since 1952. The first natural gas discovery was made in 1974 at the Mnazi Bay, Mtwara Region in 1982. The Songo Songo natural gas followed and its commercialization achieved in 2004 while that of Mnazi Bay was commercialized in 2006. This development triggered further explorations on land and off shore.

Since 2005, deep sea exploration started and has resulted to significant discoveries. Currently, Tanzania has more than 50 Trillion Cubic Feet (TCF) of gas reserves. Gas is playing an important rolein fueling the economy of Tanzania by supplying over 50 % of the required source of energy, only to be followed by hydro power generation and diesel powered engines.

Although exploration of gas and its generation started long ago,it was only in 2013 that the Government passed the National Natural Gas Policy. The Policy providesa comprehensive framework for addressing challenges that this sector faces. The Policy seeks to ensure optimal benefits to Tanzanians and the national economy. Maximization of the benefits will be attained through the optimization of the value chain which includes mid and downstream activities.

Thus specifically, the National Natural Gas Policy has several objectives but the following are relevant to this project:

- To ensure the reliability of natural gas supply;
- To promote linkages between the natural gas industry with other strategic sectors of the economy;
- To substantially improve Corporate Social Responsibility in communities neighboring natural gas facilities and operations;
- To promote rational use of natural gas in all sectors of the economy;
- To ensure compliance with Health, Safety and Environment standards in the natural gas value chain;
- To ensure that development of natural gas industry regionally and internationally benefits Tanzania;

- To support activities in the natural gas industry based on gender issues and addressing HIV/AIDS and other infectious diseases;
- To ensure maximization of benefits from the natural gas industry through PPP projects.

The proposed development will take into account some of the objectives of this policy.

Sustainable Industrial Development Policy – SIDP, 1996

Sustainable Industrial Development Policy-SIDP (1996- 2020) (URT, 1996) is a framework for Tanzania's industrialization process within the short, medium and long terms perspectives. The main objectives of the SIDP include human development and creation of employment opportunities; economic transformation for achieving sustainable economic growth; external balance of payments; environmental sustainability ad equitable development (URT, 1996).

The Policy outlines several strategies for achieving the mission and objectives of industrialization and a range of activities that are to be implemented within short, medium and long-term priority activities. Within the short-term period (1996-2000), the Policy will promote rehabilitation and consolidation of existing industrial capacities through a series of restructuring. The focus is privatization of the public industries. During the medium term period (2000-2010), the Policy promotes creation of new "capacities in areas with potential for gaining competitive advantage including preparation for exploitation of the country's iron ore deposits taking into account merging technological innovations" (URT, 1996). The long-term phase (2010-2022) will focus on basic goods industries. The 5th Phase Government is promoting industrialization drive and attainment of middle income level by 2025.The proposed transmission line system will support the objectives of this policy, which also recognizes the need for EIA prior to implementation of the projects. (*ibid*: 39).

Small and Medium Enterprises Development Policy, 2003

The Small and Medium Enterprises Development Policy (SMEDP) (URT, 2003) harmonizes the role of informal sector that constitute the bulk of the SMEs in Tanzania. The main objective of the SMEDP is to foster job creation and income generation through promoting the creation of new SMEs and improving the performance and competitiveness of existing ones to increase their participation and contribution to the Tanzania economy" (URT, 2003: 16). The Policy defines SME as entities mainly based on non-farm economic activities in manufacturing, mining, commerce and services, employing between 5 - 99 people with capital investment of Tshs. 5 million to 800 million (*ibid*: 4).

The proposed transmission line system is likely to stimulate growth and spread of SMEs, that may be engaged in a variety of activities, including service provision. This Policy therefore is relevant since certain businesses that will need power are likely to emerge or be intensified as result of the proposed development.

Community Development Policy, 1996

The Community Development Policy (URT, 1996) underscores the problems that communities in Tanzania are facing, including underdevelopment and notes that people must be enabled to develop their capacity to identify problems and develop ways of tackling them. The proposed development will have major implications on community development in terms of providing power that can stimulating growth in various sectors of the economy and improve human welfare and livelihoods.

National Land Policy, 1995

The overall aim of the National Land Policy (URT, 1995) is to address the various and ever-changing land use needs and "to promote and ensure a secure land tenure system, to encourage the optimal use of land resources and to facilitate broad-based social and economic development without endangering the ecological balance of the environment (ibid: 5). Several specific objectives are outlined in the Policy; however, the following are directly related to the proposed power generation project in Kilwa District:

- Ensure that existing rights in land especially customary rights of small holders (i.e. peasants and herdsmen who are the majority of the land users in the area are recognized, clarified, and secured in law;
- Ensure that land is put to its most productive use to promote rapid social and economic development of the country;
- Protect land resources from degradation for sustainable development.

The transmission line system will require land, and therefore this policy will be relevant to this proposed development.

National Environmental Policy, 1997

The National Environmental Policy of 1997 outlines six major environmental problems that include loss of wildlife habitats and biodiversity, environmental pollution, land degradation and deforestation (URT, 1997). The Policy stipulates that an EIA shall be mandatory for all major projects to ensure that environmental concerns receive due and balanced consideration in reconciling urgent development needs with long-term environmental sustainability goals. The proposed transmission line system will have to be developed taking into account the requirements of this policy, particularly issues related to air pollution.

Water Policy, 2002

The main objective of the National Water Policy of 2002 is to develop a comprehensive framework for sustainable development and management of the Nation's water resources and putting in place an effective legal and institutional framework for its implementation (URT, 2002).

The Policy recognizes the fundamental but intricate linkages between water and socio-economic development, including environmental services. The proposed transmission line system will put additional demand on water in an

area where already particularly during construction. Water is a very scarce resource. This EIA will examine water demand and supply issues for the proposed development in relation to available resources, other users and address the implications of water demand arising from the construction of the transmission line system.

The Wildlife Policy of Tanzania, 2007

The Wildlife Policy of Tanzania promotes the sustainable conservation of wildlife and wetland resources (URT, 2007). The overall objectives of the Policy are (a) Protection and conservation of wildlife and wetlands (b) Sustainable utilization of wildlife and wetlands (c) Management and development of wildlife and wetland resources (d) Strengthen resource monitoring and research (e) Enhance communication, education and public awareness (f) Coordinate implementation of the policy and, (g) Foster regional and international cooperation (URT, 2007: 19 - 41). The policy recognizes the importance of EIA as a tool that can support wise use of the resource. The proposed transmission line system may impact wildlife, therefore, the requirements of this policy will be taken into account.

The National Forestry Policy, 1998

The main objectives of the Policy includes sustainable supply of forest products and services by maintaining sufficient forest area under effective management; increased employment and foreign exchange earnings, ecosystem sustainability through forest conservation, enhanced national capacity to manage forest sector (URT, 1998:14).

The Forest Policy recognizes that investment projects in forest areas may cause adverse environmental impacts. EIA must be conducted in order to ensure damage to the environment is avoided and possible mitigation measures are provided. Although there are no forest with the conservation status in the proposed site, remnants of trees and shrubs are likely to be affected by this development and some of them may be of valuable nature and these will have to be taken into account. However in view of the nature if the plant and its potential to generate air pollution, any forest in the vicinity of the plant is to be considered to serve as carbon sink.

The National Strategy for Growth and Reduction of Poverty (NSGRP II), 2010

Tanzania adopted the first National Strategy for Growth and Reduction of Poverty (NSGRP), in early February 2005. In 2010 it was reviewed and the current second version, was to be implemented from 2010/11 and 2014/15. The NSGRP II makes linkages with Vision 2025 and is committed to Sustainable Development Goals (SDGs) as internationally agreed targets for reducing poverty. The NSGRP II aims to reduce poverty through three broad outcomes: growth and reduction of income poverty; improved quality of life and social well being; and good governance and accountability.

The proposed development is responding to the NSGRP II by investing in an energy supply, which will contribute to fuelling the economy. Issues such as

availability of reliable and affordable power not just for the industrial areas but also to local people as well as other sectors will be fulfilled through this project and the contribution of this project to economic and social development will be explored in this EIA.

The National Employment Policy, 1997

The National Employment Policy (1997) aims to identify potential areas for employment and to lay down strategies of how to utilize such opportunities in promoting employment in the country. The proposed Project provides avenues for employment opportunity and thus supports the national employment policy. Employment opportunities arising from this Project should be extended to all people in terms of skills, numbers and groups (youths, women and others as per the Policy).

Other Relevant Policies

Other relevant policies include the following:

- Gender Policy, 2000;
- HIV and AIDS Policy, 2001;
- National Health Policy, 2001;
- Construction Policy, 2003; and
- Investment Policy, 1996.

By implementing the EMP based on the result of this EIA, the proposed project will be in line with the objectives of the above-mentioned policies.

3.3 LAWS AND REGULATIONSRELATED TO THE PROJECT

3.3.1 Environmental Laws

The Environmental Management Act, 2004

The Environmental Management Act No 20.of 2004 (Cap 191) (URT, 2004) provide comprehensive environmental framework that is intended to streamline management of the environment in Tanzania. Part VI of this Act and in particular Section 81- 103 provides the requirements for EIA and critical aspects that have to be adhered to when undertaking EIAs in Tanzania. The Act makes EIAs mandatory prior to the development of any project. The Act is directly relevant to the proposed development as it calls for full and detailed environmental assessments for such projects.

The Water Resources Management Act, 2009

The Water Resources Management Act, 2009 (URT, 2009) provides a framework for the management and utilization of water, taking into account domestic, social, industrial and environmental needs. The Act provides principles and objectives of Water Resources Management, which includes among others (a) meeting the basic human needs of present and future generation (b) promoting equitable access to water (c) promoting the efficient, sustainable and beneficial use of water in the public interest (e) protecting biodiversity, especially the

aquatic ecosystem (f) providing a system for the management of the resources and implementation of international obligations.

The Act directs the need to apply and pay all required fees for water utilization permits. It also directs the adoption of integrated water resource management approaches and the application of principles such as (a) precautionary principle (b) polluter pays principle (c) the principle of ecosystem integrity, to mention some.

The proposed development will be located in areas that might result to polluting water bodies (underground or surface run off) and it will also require water for its operations and therefore, the provisions of this Act will be taken into account in order to safeguard this scarce resource.

The Forest Act, 2002

The Forest Act, (No.14), (URT, 2002) provides for the management of forests in order to enhance the contribution of the forest sector to the development of Tanzania and the conservation and management of natural resources. Also, the legislation fosters ecosystem stability through conservation of the forest biodiversity, water catchments and soil fertility. The site for the proposed development does not have a forest as such but, that development may trigger pressure on nearby forest areas leading to clearing of trees.

The provision of this Act in terms of forest conservation will be addressed in this EIA. Although the transmission line traverse in area with several forest reserves none of them is crossed by the transmission line. However, since these forest reserves habour significant biodiversity importance especially birds and other avian fauna appropriate mitigation measures are developed against avifauna. By conducting EIA and providing appropriate mitigation measures of the predicted impact the provision of this Act in terms of forest conservation has been addressed in this EIA.

The Wildlife Conservation Act, 2009

The Wildlife Conservation Act (URT, 2009) provides for the management and utilization of wildlife resources in Tanzania. Part 11, Section 5 (1) (a-m) of the WCA specifies the objectives of the Act, which include among others (a) To protect and conserve and administer areas with great biodiversity, including wetlands. (b) Protect and conserve wildlife resources and its habitats in game reserves, wetland reserves, game controlled areas, Wildlife Management Areas, dispersal areas, migratory routes corridors, buffer zones and all animals found in areas adjacent to these areas.

The Act stipulates various provisions including making it illegal for any off take of wildlife resources that is not regulated or authorized. It calls for the adoption of management tools such as management plans; environmental impact assessment, wildlife impact assessment and environmental auditing and monitoring in case development is taking place in wildlife resource areas. Wildlife in this Act includes large and small mammals, reptiles and the habitat

in which these are found. The provisions of this Act will be addressed in this EIA.

3.3.2 *Land-related Laws*

The Land Act and Village Land Act, 1999

The Land Act 1999 (Act No 4 of 1999) and the Village Land Act 1999 (Act No 5 of 1999) (URT, 1999) provides the legal framework for the implementation of the Land Policy. The two Acts addresses various issues including defining the legal framework for land tenure system, and how land could be used for social and economic development. The Acts also defines issues of land acquisition and compensation to affected people. The Village Land Act addresses land tenure issues with specific reference to land within the village jurisdictions, defining tenure, access and use of such land as well as responsibility for management of the land. The proposed development will require land and therefore the provisions of this Act will be taken into account.

The Land Regulations, 2001

Five regulations are relevant to this project as follows:

- The Land (Compensation Claims) Regulations, 2001;
- The Land (Assessment of Value of Land for Compensation) Regulations, 2001;
- The Land (Allocation Committees) Regulations, 2001;
- The Land (Conditions of Right of Occupancy) Regulations, 2001; and
- The Land (Disposition of Right of Occupancy) Regulations, 2001.

The Project proponent will have to comply with these regulations during the assessment of any land value, relocation, resettlement and compensation processes.

The Land Acquisition Act, 1967

The Land Acquisition Act, (Act No. 47 of 1967) provide for compulsory acquisition of land for public interest and in connection with development aspects. Part II (b) of the Act refers to issues related to compensation and procedures that have to be followed when land is acquired. These procedures are also outlined in the Regulation for the Land Act and include issues of fair and prompt compensation to affected persons. The proposed development will need land for its development therefore; the provision of this Act will have to be taken into account in this EIA.

The National Land Use Planning Commission Act, 1984

The National Land Use Planning Commission Act, (No.3), 1984, established the National Land Use Planning Commission (NLUPC), as the principal advisory organ of the Government on all matters related to land use. The NLUPC is responsible for ensuring that land resources are used in sustainable manner taking into account the need for land use plans.

The proposed development might trigger land use conflicts resulting from increased pressure on land as a result of acquiring the land that is set aside for transmission line which is currently being used by farmers and livestock keepers. Theses current and users will have to be reallocated to other lands and in the absence of a land use plan; conflicts might emerge and cause social and economic issues. The need for undertaking land use planning prior to acquiring the said land will be stressed in this EIA.

Town and Country Planning Ordinance (Cap 378 if 1958)

This ordinance establishes systems and procedures to control of development through planning areas and schemes. It stipulates requirements for land acquisition and compensation (including valuation of land and lodging of claims). The Project needs to acquire the area of the project site. It will abide by the provisions of this Ordinance.

3.3.3 Health and Safety Laws

The Occupation Health and Safety Act (OSHA Act)

The Occupation Health and Safety Act, (No. 5) (2003), deals with issues related to health and safety of workers in industrial areas. Under the Act, the Minister responsible for Labour shall appoint the Chief Inspector (CI) to perform the functions stipulated in the Act. Specific provisions of the OSHA Act – namely Section 21, 60, 61, 73-75 and 96 must be fully addressed in order to comply with this legal requirement.

The Act addresses issues of safe equipment, provision of personal protective equipment and a clean and safe work environment (e.g. provision of regular medical examination, air, drinking water, sanitary convenience, washing facilities, accommodation for clothing, first aid facilities: including safety training etc.).

The proposed development should operate within the requirements of this Act in additional to those of the Electricity Act and others as outlined in this section.

The HIV and AIDS (Prevention and Control) Act, 2008

This Act provides for: prevention, treatment, care, and control of HIV and AIDS; promotion of public health in relation to HIV and AIDS; appropriate treatment, care and support using available resources to those people living with or at the risk of HIV and AIDS; and related matters.

The Act also provides for the requirement of public education and programmes on HIV and AIDS. Section 8(1) of the Act states that the Ministry of Health and Social Welfare, health practitioners, workers in the public and private sectors and NGOs are required, for the purpose of providing HIV and AIDS education to the public, to disseminate information regarding HIV and AIDS to the public. Furthermore, Section 9 states that every employer, in consultation with the Ministry of Health and Social Welfare, shall establish and coordinate a workplace programme on HIV and AIDS for employees under his control and

that such programmes shall include provision of gender-responsive HIV and AIDS education.

The provision of this Act should be followed during the various stages of the project development in view of its potential to create conditions where such HIV/AIDS transmissions are likely to occur

The Employment and Labour Relations Act, 2004

This Act makes provision for: core labour rights to establish basic employment standards; a framework for collective bargaining: and the prevention and settlement of disputes and related matters. The Project proponent shall ensure that the employment standards as provided for by the Act are adhered to.

The Workers Compensation Act, 2008

This Act provides for compensation to workers for injuries suffered in the course of their employment, which result in disablement or death. This Act needs to be complied with as Project workers will be exposed to various dangerous and hazardous environments during project implementation.

The Public Health Act 2009

This Act is the overarching law that promotes the preservation and maintenance of public health. It stipulates requirements for waste management (solid, liquid, gas) including human wastes, hazardous wastes, sewerage and drainage in order to ensure the health and safety of workers and communities. It also covers the welfare and health of workers and stipulates monitoring and maintenance of workplaces and routine medical examinations.

This Act applies to the Project since project activities will generate impacts that may impact and pose risks to the health and safety of workers and neighboring communities. The Project proponent shall ensure that provision in this Act are adhered to.

The Water Supply and Sanitation Act 2009

The Water Supply and Sanitation Act No.12 of 2009 is an Act which provides for sustainable management and adequate operation and transparent regulation of water supply and sanitation services with a view to give effect to the National Water Policy, 2002. In addition the Act provides for the establishment of water supply and sanitation authorities as well as community owned water supply organizations; and for appointment of service providers,

The main objectives of this Act as provided in Part II section 4(1) is to promote and ensure the right of every person in Tanzania to have access to efficient, effective and sustainable water supply and sanitation services for all purposes.

The Act gives power to EWURA to exercise licensing and regulatory functions in respect of water supply and sanitation services as provided in section 28

subsections 1(a) therefore TANESCO shall need to abide to this Act in the course of water abstraction and provision of sanitation services.

In order to protect water and guide water supply and sanitation Part XIV section 47 subsections (1) and (2) of the Act provides for Offences and penalties; that "Any person who willfully or negligently damages the waterworks, any sewer, sewerage treatment plant, or other asset owned or vested in a water authority or community organization, or unlawfully draws off, diverts or takes water from the waterworks commits an offence and therefore shall be liable to a fine or to imprisonment for a term not less than one month and not more than five years or to both. TANESCO should observe the provision of this Act

3.3.4 Other Related Laws

Other regulatory frameworks that are relevant to the proposed development include; the Town and Country Planning Ordinance (Cap 378 of 1958) and Amendment of 1961, for planning purposes. Others are the Grave Removal Act, 1969; the Antiquities Act 1974 and the Local Government Act. No.9 of 1982. These Acts will be examined in relation to the proposed development.

The Electricity Act, 2008

The Electricity Act (URT, 2008) provides for the facilitation and regulation of generation, transmission, transformation, distribution, supply and use of electric energy and to support to broader trade in electricity and the planning and regulation of rural electrification and related matters (URT, 2008).

The Act provides requirements for obtaining licenses for (a) generation (b) transmission (c) distribution (d) supply, (e) physical and financial trade in electricity and electrical installation (URT, 2008). Any person intending to conduct any of the activities stipulated in Subsection 1 of Section 8 of this Act must apply for a license to the Energy and Water Utilization Regulatory Authority (EWURA).

The Energy and Water Utilities Regulatory Authority Act, 2003

The Energy and Water Utilities Regulatory Authority (EWURA) (Act # 11 of 2001 and # 8 of 2003 (URT, 2006) establishes a Regulatory Authority in relation to energy and water utilities and outlines its *modus –operandi*. The Authority is responsible for regulating energy development and water utilities in Tanzania and requires relevant developers to obtain permits and authorization from EWURA for any proposed development. The proposed development includes power generation, which requires permits. TANESCO as the main beneficiary has or is already allowed to establish and run such facilities in Tanzania and prior approval may not be necessary. In case, approval for this Project is not available, due processes to obtain it must be started to ensure compliance with the requirements of this Act.

The Industrial and Consumers Chemicals (Management and Control) Act, 2003

The Industrial and Consumers Chemicals (Management and Control) Act No 3 of 2003 (URT, 2003) provides a legal framework for the management and control of industrial and consumer chemicals throughout their life cycle.

The law requires that all those persons who intends to produce, import, export, sale, deal in industrial and consumer chemicals must register with the Registrar of Industrial and Consumer Chemicals so that their capacities to manage chemicals can be assessed. The law also requires that facilities used in the production, storage disposal of chemicals and waste must be registered for the same reasons of ensuring that they are of sound designs and that are operated properly.

The proposed development will possibly be dealing with various chemicals that fall under this Act and the developer will thus be required to register with the Registrar of Industrial Chemicals and have the facilities inspected and regularly monitored as provided for under Part III and IV of the Act. The carrying out of this EIA in part meets the requirement of the Act.

The Antiquities Act 1974

This Act is aimed at preserving and protecting paleontological, archaeological, historical and naturally important sites and articles. It describes procedures and restrictions related to the discovery and protection of monuments, relics and protected objects. The Project may discover important relics or artifacts during the construction phase. In that case, the Project will follow procedures stipulated in this Act.

The Local Governments (District Authorities) Act, 1982

The Act requires the Registrar of Villages to register an area as a village and issue a Certificate of Incorporation to the village, which enables the Village Council to become a corporate body with a perpetual succession and official seal. In its corporate name, a village is capable of suing and being sued and is capable of holding, purchasing or acquiring in any other way any movable or immovable property.

The District Council,s of Lind and Mtwara which will be affected by this Project, have the mandate to intervene on any local issues that may be related to the project. These are issues such as access to water bodies for local use, settlement etc.

Public Health Act (2009)

The Public Health Act No.1 of 2009 provides for the promotion, preservation and maintenance of public health with a view to ensuring the provisions of comprehensive, functional and sustainable public health services to the general public and to provide for other related matters. The Act through Part II section 4 (1) gives powers to the minister to promote, preserve and maintain a comprehensive, functional and sustainable public health system in Mainland Tanzania for the purpose of securing improvement in the health habits and lifestyles of people living in Tanzania.

Section 5 of the Act gives power to relevant authorities to:

(a) Take lawful, necessary and reasonable measures to prevent the occurrence of or deal with any out-break or prevalence of any infectious or communicable and non-communicable disease;
(b) Make sure an appropriate Environmental Health Impact Assessment Study to be conducted for all activities as may be provided for under the Environmental Management Act;
(c) Safeguard and promote the public health standards;
(d) Issue notices for rectification of any breach of public health standards;
(e) Implement and enforce public health standards through bylaws;
(f) Promote public health standards in its area through creation of awareness and educational campaigns;
(g) Carry out inspections; and
(h) Exercise the powers or perform duties in respect of the public health in accordance with this Act or any other written law.

With regards to water generation and management the law requires proper collection and dumping to the designated dumping sites using covered equipment or tools.

The Public Health Act stipulates clearly that the developer should ensure welfare and health of workers is maintained at all times and make sure that routine medical examination for workers is conducted. The proposed power transmission project shall observe the provision of this Act.

3.4 APPLICABLE REGULATIONS TO THE PROJECT

3.4.1 The Environmental (Registration of Environmental Experts) Regulations, 2005

Section 83 of the EMA (2004) stipulates that EIA shall be conducted by experts or firms of experts whose names and qualifications are registered as such by NEMC. NEMC maintain a registry of EIA experts. These Regulations also set code of practice of the experts for which the EIA experts for this Project to subscribe. This is relevant to the present study as the firm undertaking this EIA study been registered with NEMC as EIA experts.

The Environmental Management (Fee and Charges) (Amendment) Regulation, 2018

The Environmental Management (Fee and Charges) (Amendment) Regulations, 2018, which is read as one with the Environmental Management (Fee and Charges) Regulations, 2008, hereinafter referred to as the "principal Regulations" amended regulation 4 of the principal regulations specifically paragraph a, b, c and d. In addition the regulation stipulated plainly annual charges experts and developers need to abide. Thus this regulation is relevant to the project as both EIA experts and project developer need to abide. TANESCO shall need to abide among other things on Environmental Compliance Monitoring and Audit stipulated on regulation 3 which call for the project proponent to make sure pays Annual Charges for Environmental Monitoring and Audit. Furthermore the regulation particularly the annual

charges for Energy Project as provided in item 7 of the Environmental Management (Fee and Charges) (Amendment) Regulation

The Environmental Impact Assessment and Audit "Principal" Regulations, 2005

These Regulations were made in terms of Section 82 and 230 of the EMA (2004). The Regulations set procedures for carrying out EIAs and Environmental Audits (EAs). The Regulations are applicable to all projects contained in Third Schedule of the EMA (2004) and First Schedule of the Regulations. The Schedules list types of projects requiring EIA as well as those requiring project brief, project screening criteria, and steps for conducting EIA. *The steps enhanced further in the Environmental Management (Environmental Impact Assessment and Audit) (Amendment) Regulation, 2018 – GN 474.* The Regulations set out in detail the process to be followed in conducting an EIA, the form and content of EIAs, the review process, decision-making processes and appeals and also prescribes the stages and/or the EIA process, which are in principal managed by NEMC. The proposed power transmission project falls under the projects requiring EIA i.e. as stated in paragraph 7 (a) and (b) paragraph of the Environmental Management (Environmental Impact Assessment and Audit) (Amendment) Regulation, *2018*. It is thus a legally binding requirement to undertake the EIA of this Project.

The Environmental Management (Control of Ozone Depleting Substances) Regulations, 2007

The Environmental Management (Control of Ozone Depleting Substances) Regulations, 2007 is applicable to

a) all persons dealing or otherwise handling or using controlled substances or products that contain, is made with or is dependent on, or designed to contain chemical substances that have the potential to destroy ozone molecules in the stratosphere and includes the products listed in the First Schedule to these Regulations;
b) every importer and distributor of ozone depleting substances
c) every importer of technology which uses ozone depleting substances
d) every company and individual who services refrigerators, air conditioners including mobile and other ozone depleting substances technologies
e) every company or an individual using or servicing fire extinguishers.

Part II of the regulation consider about prohibition and disposal of controlled substances or products. Specifically Regulation 5 require any person who manufactures, or imports or exports, sells, offers for sale or installs a controlled substance or product listed in the First and Second Schedules to these Regulations to have a license issued by the Director of Environment commits an offence. TANESCO should observe these regulations during importation of any ozone depleting substance or products.
According to regulation 34(1) it is an offence to imports or exports any controlled substance or product without a valid license issued under these Regulations. The Regulations is relevant to the proposed power transmission line and therefore TANESCO would need to abide to it.

The Environmental Management (Quality Standards for Control of Noise and Vibration Pollution) Regulations, 2011

The Environmental Management (Quality Standards for Control of Noise and Vibration Pollution) Regulations, 2011 is among of the Legal Provisions on Pollution. The legal provisions for these standards is provided in Part X of the Environmental Management Act No. 20 Cap 191, which provides directives on environmental standards and compels the National Environmental Standards Committee of the Tanzania Bureau of Standards to develop, review and submit to the Minister (responsible for Environment) for approval standards and criteria covering:

- Water quality and discharge of effluent into water,
- Air quality and control of noxious smells,
- ***Control of noise and vibration pollution,***
- Soil quality,
- Light pollution, electromagnetic waves and microwaves, and
- Any other environmental quality standards.

The ***Control of noise and vibration pollution*** is made under Section 147 of the Environmental Management Act Cap.191 to provide for control of noise and vibration pollution. During the construction of the proposed Power Transmission projectfromKisiwa in Mtwara district to Somanga in Kilwa district the contractor and the developer in particular must adhere to emission standards. During mobilization and construction the contractor will incorporate measures stipulated in these regulations in order to control noise and vibration pollution emanating from construction site, vehicles, workshop, and quarries that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and of the environment.The proposed development can cause pollution in various aspects and this EIA recommends measures that will be taken to minimize pollution.

3.4.2 The EIA Process in Tanzania

According to the First Schedule of the Environmental Impact Assessment and Audit Regulations of 2005, the following projects require EIA for the energy sector:

- Production and distribution of electricity, gas, steam, and geothermal energy
- Storage of natural gas
- Thermal power development
- Hydroelectric power
- Development of other large scale renewable and non-renewable sources of energy

An activity listed in the First Schedule of the EIA and Audit Regulations cannot proceed without obtaining the necessary license from the relevant licensing authority (line ministry). The licensing authority, however, will not issue a license without having first received an EIA Certificate from the NEMC. The Developer must commence with his/her authorized development within three years.

The EMA 2004 makes a provision of the EIA to be conducted at the national, sectoral or local government levels. Currently, all EIA projects are still being administrated at the national level. **Error! Reference source not found.**shows an overview of the EIA process.

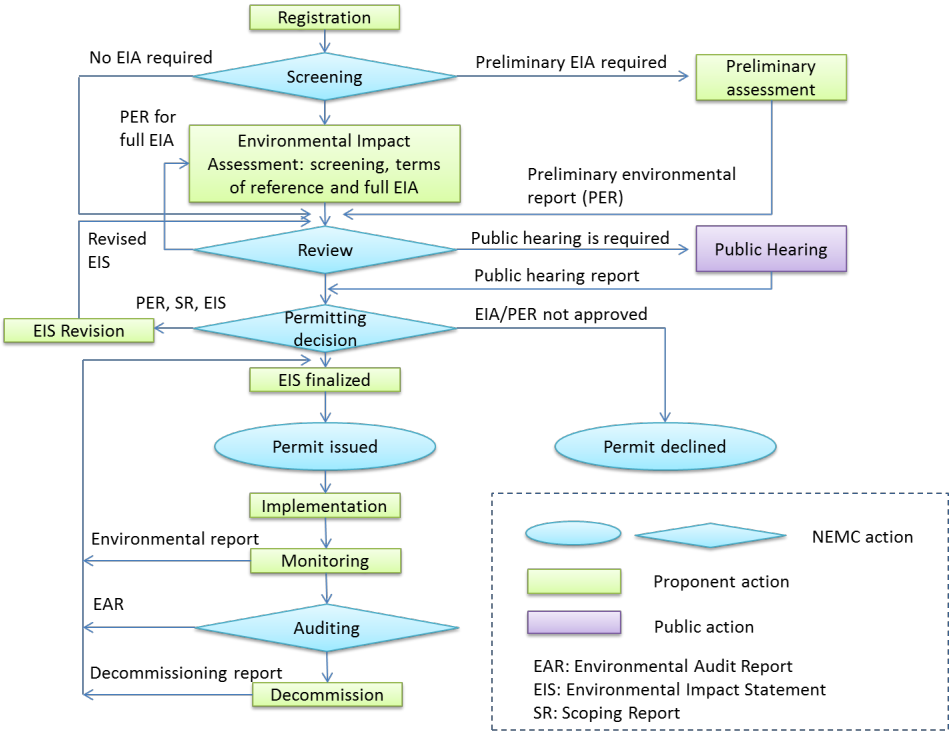


Figure 3-1 EIA Process Flow Diagram

Source: Energy Sector EIA guideline, MEM, 2012

Screening Phase

The proposed project must be registered with the National Environment Management Council (NEMC) to initiate the screening process. Registration is done by preparing and submitting to NEMC a project brief, that describes in brief the project, its scope and potential impacts and mitigation options, and filling in a project registration form. Screening is stage where NEMC determines the level of environmental assessment based on the screening criteria provided under Regulation 6 (1) of the EIA and Audit Regulations and its details provided under First Schedule of these Regulations. Level of environmental assessment is to determine if EIA is required for the project, or EIA is not required, or a preliminary environmental assessment is required.

Scoping Phase

This stage of the EIA process is intended to determine the scope of the study b defining the boundaries and the issues involved. The main objectives of this stage are:

- Development of appropriate study methods;
- Determination of spatial, temporal and institutional boundaries of the EIA study;
- Identification of relevant stakeholders;
- Identification and discussion of project alternatives and designs;

- Identification of the likely positive and negative impacts of the project;
- Identification of data requirements; and
- Development of Terms of References for undertaking a full EIA.

Detailed Impact Assessment

This stage will follow after NEMC has approved the Terms of Reference for this work that are submitted together with this scoping report. The Terms of reference provide details of the activities that have to be undertaken during detailed EIA.

Disclosure of the EIA Report

Disclosure of the project information helps affected people and other stakeholders understand the risks, impacts and opportunities associated with the project and is undertaken as part of the on-going stakeholder engagement. Thus, disclosure of the information will happen at different stages of the EIA process. For example, during the initial site visit, the scoping and detail EIA, access to relevant information will be provided to affected persons. More disclosure will happen when the draft EIA report will be submitted to NEMC and copies sent to various stakeholders for comments. This will provide opportunity to stakeholders to comment on the report and ensure their views are taken on board. The next disclosure will happen when the report is finalized and sent to Vice President's Office (VPO) for approval. At this stage the final report will be sent to various stakeholders including (in principle) the District Council that will have the information and understanding of the various issues addressed in the report. The copies will also have executive summaries in Kiswahili and English that will help stakeholders understand the issues contained in the report and mitigation measures.

NEMC or VPO does not as yet have a system of uploading EIA reports into their web sites, instead and according to the Environmental Management (Fee and Charges) (Amendment) Regulations, 2016, Government Notice #191 of 3rd June 2016, any person that want to access the EIA report for inspection and viewing will have to pay Tshs 15,000 and if they want to read they will pay Tshs 30,000.

3.4.3 National Environmental Standards Compendium (NESC), 2009

The National Environmental Standards Compendium (NESC) (URT, 2009) is a collection of various standards prepared at different times. The NESC consist of three parts. Part One comprises of standards that require compulsory compliance, which includes standards for industries with peculiar effect to the environment. Part Two consist of standards that may be implemented on voluntary basis. These include guidelines, codes of practice that can be enforced voluntarily by way of self – regulation. Part Three has the requisite test methods that should be followed when testing for compliance.

Although these are national standards, the NESC states that the standards "are to be reviewed independently to reflect sector specific needs as regulated by the National Environment Management Council". Most of the compulsory standards in the NESC are relevant to the proposed transmission line

development project during construction and operation. These include standards such as:

(a) TZS 860 – 2005. Municipal and Industrial Wastewater – General Tolerance Limits for Municipal and Industrial Wastewater
(b) TZS 845 – 2005. Air Quality Specification
(c) EMDC 2 (1778). Air Quality – Vehicular Exhaust Emissions Limits
(d) EMDC (1777). Protection against ionizing radiation –Limits for Occupational Exposure
(e) EMDC 6 (1733) P2. Acoustics- General Tolerance Limits for Environmental Noise
(f) EMDC 5 (3453) - For hand arm and whole body vibration
(g) EMDC 5 (3454) – For vibration at sensitive site including residential areas (subsonic/air over) vibration.

This project will have to comply with those standards to safeguard the environment and the people.

3.4.4 Applicable Environmental Standards

Environmental Management Act (2004)-Related Regulations

The Project will be required to adhere to various provisions and standards stipulated in the regulations below in order to comply with Section 141 and Part IX of EMA (2004).

- Environmental Management (Air Quality Standards) Regulations, 2007;
- Environmental Management (Soil Quality Standards) Regulations, 2007;
- Environmental Management (Water Quality Standards) Regulations, 2007;
- Environmental Management (Solid Waste Management) Regulations, 2009; and
- Environmental Management (Hazardous Waste Control and Management) Regulations, 2009.

The Project will be required to adhere to various provisions and standards stipulated in the above-listed regulations in order to comply with Section 141 and Part IX of EMA (2004).

Air Quality Standards

Table 3-1 shows comparison of emission standards for thermal power stations and ***Table 3-2*** shows the comparison of ambient air quality standards between national and international ones. These will be applied to the Project

Table 3-1 Comparison of emission standards for thermal power stations (mg/Nm3:O2 6% converted)

	Tanzanian regulation	IFC EHS GUIDELINES Natural Gas (all turbine types of Unit > 50MWth)
NOx	300 mg/Nm^3	51 mg/Nm^3 (25 ppm)

Source: Environmental Management (Air Quality Standards) Regulations, 2007, Tanzania, IFC, Environmental, Health, and Safety Guidelines (Thermal Power Plants) (December 2008)

Table 3-2 Comparison of ambient air quality standards

	Tanzanian regulation	IFC EHS GUIDELINES
NO_2	-	1-year: 40 (ug/m3) 1-hour:200(ug/m3)
NOx	24-hour: 150 (ug/Nm^3) 8-hour:120 (ug/Nm^3)	-

Source: Environmental Management (Air Quality Standards) Regulations, 2007, Tanzania, IFC, General Environmental, Health, and Safety Guidelines (2007)

Noise Standards

Table 3-3 shows the comparison of noise standards of Tanzanian regulation and IFC EHS guidelines. These will be applied to the Project

Table 3-3 Comparison of noise standards

	Tanzanian regulation (dB)		IFC EHS Guidelines (general) (dB)[1]	
	Industrial area	Residential building	Industrial area	Residential, institutional, educational
Daytime	70	50	70	55
Nighttime	60	35	70	45

Source: Environmental Management (Standards for the Control of Noise and Vibration Pollution) Regulations, 2015IFC, Environmental, Health and Safety Guidelines (Thermal Power Plants) (December 2008)

Wastewater standards

Table 3-4 shows comparison of the wastewater quality standards of Tanzanian regulation and IFC EHS guidelines. These will be applied to the Project

Table 3-4 Comparison of wastewater quality standards

	Tanzanian regulation PERMISSIBLE LIMITS FOR MUNICIPAL AND INDUSTRIAL EFFLUENTS	IFC EHS GUIDELINES
pH	6.5-8.5	6–9
Total suspended substances (SS)	100 mg/l	50
Oils	10	10
Total residual chlorine	-	0.2
Chrome (Cr)	1.0	0.5
Copper (Cu)	2.0	0.5
Iron (Fe)	5.0	1.0
Zinc (Zn)	5.0	1.0
Lead (Pb)	0.1	0.5
Cadmium (Cd)	0.1	0.1

[1] Daytime (7:00–22:00), Nighttime (22:00–7:00)

	Tanzanian regulation PERMISSIBLE LIMITS FOR MUNICIPAL AND INDUSTRIAL EFFLUENTS	IFC EHS GUIDELINES
Mercury (Hg)	0.005	0.005
Arsenic (As)	0.2	0.5
Temperature range	20 to 35	Temperature increase by thermal discharge from cooling system is to be Assessed in EIA

Source: Environmental Management (Water Quality Standards) Regulations, 2007, Tanzania, IFC, Environmental, Health, and Safety Guidelines (Thermal Power Plants) (December 2008)

Solid Waste Management

The Project will abide by the requirements of these Regulations, particularly

- Permit to transport solid waste
- Permit to dispose solid waste
- Duty to segregate waste at source
- Segregation and sorting of plastic wastes
- Storage of plastic waste safely before recycling or disposal
- Prohibition of litter

Hazardous Waste Control and Management Regulations 2008

The Project will abide by the requirements of these Regulations, particularly

- Labelling of wastes
- Handling and storing of hazardous wastes
- Transporting of hazardous wastes
- Reporting procedures

3.5 *REQUIRED PERMITS AND APPROVALS*

The following list presents indicative permits and approvals related to environmental and social considerations that will be required for the Project.

Table 3-5 List of required approvals and permits

Required Permit/Approval	Issuing Agency	Objective	Timing
Environmental Impact Assessment Certificate	National Environmental Management Council	To comply with the Environmental Management Act of Tanzania 2004	During project preparation (prior to construction)
Electricity License	Energy and Water Utilities Regulatory Authority	To comply with the Electricity Ordinance 1957	During project preparation (prior to construction)
Building permits	City council	To comply with the City Council law	During project preparation (prior to construction)
Permit for felling trees (mangroves)	Ministry for Natural Resources and Tourism	To comply with the Forest Act 2002	During project preparation (prior to site preparation)

Required Permit/Approval	Issuing Agency	Objective	Timing
Permission from the Ministry of Infrastructure to transport heavy loads from the port of entry to the site.	Tanzania National Roads Agency	To comply with the Road Traffic Act (Maximum Weight of Vehicles Regulations 2001)	During project preparation (prior to construction)
Plan Safety Inspection Permit	Ministry of Labour, Youth Development and Sports	To comply with the Occupational Health and Safety Act No. 5 of 2003	During project preparation (prior to construction)
Working Permit(s) for employees of the suppliers and its permitted sub-contractors	Ministry of Labour Youth Development and Sports	To comply with the Tanzania Immigration Act 1995	During project preparation (prior to construction)

Source: JICA Study Team, 2018

3.6 INTERNATIONAL TREATIES AND CONVENTIONS

Tanzania is signatory to several international conventions, indicating the country's commitment in implementing stipulations in those treaties and conventions. This project will have to adhere to these commitments. Some of the conventions that may be applicable to the project, include the following:

International Convention on Biological Diversity

Tanzania is signatory to the Convention on Biological Diversity (CBD) since June 1992 and has taken steps to ensure conservation and use of these resources in judicious ways. Biological resources in Tanzania are facing a significant threat from unsustainable utilization, including increased poaching of wildlife.

The proposed area where the transmission line traverses is rich in terms of forest reserves that represent a continuation of Zanzibar-Inhambane coastal mosaic. This region is rich in terms of biodiversity and endemism, this high he biodiversity and endemic importance if the region is still maintained in series of coastal forests present in Mtwara and Lindi regions. However the transmission line route is designed not to cross any of the available forest reserves in the area. Nonetheless appropriate mitigation measures have been developed to mitigate against avifauna flying from the coastal forests and the mangrove forest along the coast. Therefore by provision of this Convention are adhered to in all stages of the project development

UNESCO Convention for the Protection of the World Cultural and Natural Heritage (World Heritage Convention) 1972

This convention aims at encouraging the identification, protection, and preservation of earth's cultural and natural heritage. It recognizes that the nature and culture are complementary and that cultural identity is strongly related to the natural environment in which it develops.

The Convention provides for the protection of those cultural and natural 'properties' deemed to be of the greatest value to humanity. In the course of

implementing this Project, cultural and heritage objects may be discovered. Recommendations will be made according to the Tanzanian legislation and policies and international best practices on how to handle these objects.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1979

This Conventionseeks to control the trade in species of wild animals and plants that are, or may be, threatened with extinction as a result of international trade. Project sponsors must ensure that such trade is not happening in the project site during the construction of the project. During operation, such issues are under the jurisdiction of the Customs Department of the TRA and the Ministry of Natural Resources and Tourism (MNRT).

The African Convention on the Conservation of Nature and Natural Resources, 1968

This Convention requires contracting states to adopt measures necessary to ensure conservation, utilization and development of soil, water, flora and fauna resources in accordance with scientific principles and with due regard to the best interests of the people. Protected species should be accorded special protection, including the maintenance of habitats necessary for their survival. Although initially, the project site has been noted not to contain any significant number of biodiversity, detailed assessment of the status and characteristics of flora and fauna in the project site should be undertaken to ascertain the level of the threats the project may cause during the full EIA.

The Paris Agreement

This Agreement brings together nations across the globe to commit themselves in addressing climate change through intended nationally determined contributions (INDCs). The Agreement presents several frameworks (e.g. financial, technology, capacity building, monitoring and evaluation) that would enable countries to achieve their ambitious targets in terms of emission reductions and enhance support to developing countries, particularly those vulnerable to the impacts of climate change. The Project is aligned with Tanzania's INDCs, which stipulated an emission reduction target between 10-20% by 2030. It will expand the use of natural gas as an alternative source of energy, which is one of the intended action in the INDC's energy sector.

Ramsar Convention

The Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat is an international treaty aiming for the conservation, restoration and wise use of all wetlands through local and national actions and international cooperation. Signatory countries commit to: "work towards the wise use of all their wetlands; designate suitable wetlands for the Ramsar List and ensure their effective management; and cooperate internationally on transboudary wetlands, shared wetland systems and shared species". There is a Ramsar Site located close to the proposed Project.

3.7 *WORLD BANK SAFEGUARD POLICIES*

This EIA has also been prepared to fully comply with the World Bank Safeguard Policies and procedures, which have to be taken into account along with the Tanzanian legislations and policies during the implementation of the proposed Project. The World Bank Safeguard Policies include the Environmental Assessment: OP/BP 4.01, the Natural Habitats: OP/BP 4.04, the Forests: OP/BP 4.36, the Physical Cultural Resources: OP/BP 4.11, the Involuntary Resettlement: OP/BP 4.12, the Projects in International Waters: OP 7.50 and the Projects in Disputed Areas: OP 7.60.

Environmental Assessment: OP/BP 4.01

The objective of this Operational Policy (OP) is to ensure that environmental assessments is undertaken in those categories of projects that have or are likely to have potentially significant impacts on the environment.

Under this OP, projects are categorized as A, B, C and D according to their type, scale, location and anticipated significance of potential environmental impacts. The category indicates the scope and detail required for EIA. According to this OP, the proposed project falls under Category A as this may have significant adverse environmental and social impacts that may be irreversible and diverse, therefore requiring full and comprehensive EIA.

Natural Habitats: OP/BP 4.04

This Operational Policy recognizes that conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development. During project financing, the World Bank considers if that project supports the protection, management and restoration of natural habitats, as well as policy dialogue and economic and sector work. The World Bank supports and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. Natural habitats are land and water areas where most of the original native plant and animal species are still present. Natural habitats comprise many types of terrestrial, freshwater, coastal and marine ecosystems. They include areas lightly modified by human activities, but retaining their ecological functions and most native species.

In complying with this requirement, the EIA study has been done under the proposed project, as it has potential to cause significant conversion (loss) or degradation of natural habitats, directly (through construction) as well as indirectly (through human activities induced by the project).

Forests: OP/BP 4.36

The objective of this OP is to ensure forest resources are taken into account in any project design and implementation so as to ensure they are not affected.

This OP is relevant whenever any World Bank financed investment project has potential to cause impacts on the health and quality of forests or the rights and welfare of people and their level of dependence upon or interaction with forests or aims to bring about changes in the management, protection or utilization of natural forests or plantations.

The proposed project will have impacts on the health and the quality of natural trees and mangrove, e.g. where waste water would be disposed is directly linked with mangrove Therefore, the proposed Project will have to abide by the provisions of this OP in order to safeguard forest resources.

Physical Cultural Resources: OP/BP 4.11

OP 4.11 aims to assist countries to avoid or mitigate adverse impacts of development projects on physical cultural resources. For the purposes of this OP, 'physical cultural resources' are defined as movable or immovable objects, sites, structures, groups of structures, 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 ground, underground, or underwater. The cultural interest may be at the local, provincial or national level, or within the international community.

This OP is relevant to the project and therefore need to be abided.

Involuntary Resettlement: OP. 4.12

This OP acknowledges that development projects that displace people generally give rise to economic, social and environmental problems. Thus, the World Bank guidelines prescribe measures to minimize the negative impacts and ensure that the displaced community benefits from the project.

The objective of this OP is to:-

(a) Avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs;
(b) Assist displaced persons in improving their former living standards, income earning capacity, and production levels, or at least in restoring them;
(c) Encourage community participation in planning and implementing resettlement; and
(d) Provide assistance to affected people regardless of the legality of land tenure.

This OP does not only cover physical relocation, but any loss of land or other assets resulting in:-

(a) Relocation or loss of shelter;
(b) Loss of assets or access to assets; and
(c) Loss of income sources or means of livelihood, whether or not the affected people must move to another location.

The proposed project is going to displace people; some displaced persons will lose their property and the work will involve acquisition of the land and compensation costs issues. Thus the provisions of this OP must be followed when dealing with affected persons.

3.8 JICA'S GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

The objectives of the guidelines are to encourage Project proponents to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. The guidelines outline JICA's responsibilities and procedures, along with its requirements for project proponents in order to facilitate the achievement of these objectives.

While project proponents bear the ultimate responsibility for the environmental and social considerations of projects, JICA supports and examines appropriate environmental and social considerations undertaken by project proponents etc. to avoid or minimize development projects' impacts on the environment and local communities, and to prevent the occurrence of unacceptable adverse impacts.

JICA establishes "the Advisory Committee for Environmental and Social Considerations" as an independent council composed of external experts with the knowledge necessary to provide advice regarding support for and examinations of the environmental and social considerations of cooperation projects.

JICA confirms that projects comply with the laws or standards related to the environment and local communities in the central and local governments of host countries. JICA also confirms that projects do not deviate significantly from the World Bank's Safeguard Policies, and refers as a benchmark to the standards of international financial organizations; to internationally recognized standards, or international standards, treaties, and declarations.

There are some gaps between JICA guideline, World Bank Safeguard Policy and Tanzanian legislation on environmental and social consideration as below. Measures bridging the gaps are to be discussed with TANESCO.

Table 3-6 Gap Analysis between JICA Guidelines and National Laws

Response policy including JICA's guideline and the World Bank's Safeguard Policy	Relevant laws in Tanzania	Main gaps	Potential measures bridging the gap
・ Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests. ・ Whenever feasible, projects are sited on lands already converted (excluding any lands considered to have been converted in anticipation of the project). JICA does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs. If the environmental assessment indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measures acceptable to JICA. Such mitigation measures include, as appropriate, minimizing habitat loss (e.g., strategic habitat retention and post-development restoration) and establishing and maintaining an ecologically similar protected area. JICA accepts other forms of mitigation measures only when they are technically justified.	・ The Environmental Management Act 2004 stipulates that the Minister responsible for Environmental Protected Areas by considering flora and fauna, special feature, the interests of the local communities and accordance with international society. (Article 47) ・ Under the National Policies for National Parks in Tanzania, 1994, although, the primary objectives are the protection and inheritance of natural resources (Article3.1), permission of all projects in National Parks is granted based on Environmental Impact Assessment, which clarify positive and negative impacts.	Under the domestic law in Tanzania, even within National Parks, project permission can be granted depending on the EIA result. It is not prescribed as for the necessity of analyzing if the economic benefits outweigh environmental costs.	・Avoid protected areas. ・Wherever feasible, project location is sited on lands already converted.

Response policy including JICA's guideline and the World Bank's Safeguard Policy	Relevant laws in Tanzania	Main gaps	Potential measures bridging the gap
・ Confirm that projects comply with the laws or standards related to the environment and local communities in the central and local governments of host countries; it also confirms that projects conform to those governments' policies and plans on the environment and local communities.	There is Environmental Impact Assessment System provided by EMA. Regulation on air quality, water, soil, waste management are established by the following regulation under the EMA. Environmental Management (Air Quality Standards) Regulations, 2007; Environmental Management (Soil Quality Standards) Regulations, 2007; Environmental Management (Water Quality Standards) Regulations, 2007; Environmental Management (Solid Waste Management) Regulations, 2009; and Environmental Management (Hazardous Waste Control and Management) Regulations, 2009.	In terms of the legal framework on environmental management, there is not a difference in particular. However, there is some gasp in the environmental standards between Tanzania and IFC EHS guidelines.	The project will comply with both Tanzanian environmental standards and IFC EHS guidelines.
・ EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. For explanations, documents must be formulated in a language and manner, and that are understandable to the affected local people.	EISs (EIA reports) etc. should be formulated in languages understandable to stakeholders.	There is not a difference in particular.	-

Response policy including JICA's guideline and the World Bank's Safeguard Policy	Relevant laws in Tanzania	Main gaps	Potential measures bridging the gap
· In principle, host countries etc. disclose information about the environmental and social considerations of their projects. Assist project proponents etc.as needed. · Encourage host countries etc. to disclose and present information about environmental and social considerations to local stakeholders. · EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EISs are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted. · In principle, host countries etc. consult with local stakeholders to a reasonable extent. Assist host countries as needed.	· From screening step of project, participation opportunities are provided. During EIS review period, public consultation is held and EIS is made public and comments are received verbally and in writing. · Contents to be covered in EIA in Tanzania is stipulated in EIA and Audit Regulation, 2005. · Also, EIS is stored as official document by NEMC and available for perusal when needed.	There is not a difference in particular. Items to be covered in EIA is generally same.	-
· Confirm monitoring results through host countries etc. to verify environmental and social considerations are implemented surely. The information necessary for monitoring confirmation must be supplied by host countries etc. by appropriate means, including in writing. · Also, disclose the results of monitoring conducted by host countries etc. on its website to the extent that they are made public in host countries etc.	NEMC shall conduct environmental assessment. Project proponents should store monitoring data and formulate annual report and report actual result compared with original plan to NEMC. When negative impacts were occurred, appropriate mitigation measures shall be planned and implemented.	The gap is identified on monitoring. There is no regulation regarding monitoring result in Tanzanian regulation.	Monitoring information will be provided and the results will be disclosed.

Source: JICA Study Team, 2018

3.9 TANESCO'S HEALTH, SAFETY AND ENVIRONMENTAL (HSE) GUIDELINES

TANESCO has already prepared and approve the Health, Safety and Environmental (HSE) guidelines that every undertaking covering consultants, contractors and sub-contractor has to adhere to approved HSE guidelines to safe guard environment, community and for safety of worker and the environment.

The proposed construction of the transmission line system will be guided by similar operation principles where environmental and social issues will have to be guided by the guidelines. In addition to having its own guidelines TANESCO are obliged to comply to other safe guard principles and guidelines issued by financier of a particular project. In this case safe guard principles and guidelines will be mandatory.

3.10 INSTITUTIONAL AND ADMINISTRATIVE FRAMEWORK

Government Agencies Responsible for Environmental Issues

Sections 30 to 40 of the Environmental Management Act, 2004 provides for institutional arrangement covering Sector Ministries, Regional Secretariat, Township, Ward, Village, Mtaa and Kitongoji Environmental Management Officers. Thus the District environmental team, ward and village will have to be involved and if these are not in place as required by the law, efforts must be made to ensure they are installed and capacity is provided to them to effectively perform their duties.

In addition, beside the local institutional/administrative framework, the proposed project also falls under the Ministry of Energy, Ministry of Lands, Housing, Human Settlement Development and Ministry of Natural Resources and Tourism. These ministries, through their different units will have to be involved at various stages of the project development.

Other institutions whose administrative decisions will be relevant to the proposed development include the Ministry of Health, specifically OSHA that will be responsible for ensuring compliance to occupational health and safety standards as provided under OSHA. Details of how the various institutions should be involved and where necessary capacity development is provided will be addressed in the full EIA.

Regional and District Administrative Structures

The proposed Mtwara – Somanga 400 kV transmission line is a linear project touching Mtwara and Lindi Regions. Therefore, it falls under the jurisdictions of four district councils which are Mtwara District Council, Lindi Urban District Council, Lindi District Council and Kilwa District Council as well as the District Commissioners and Regional Administration/Secretariat for administrative and implementation purposes. Thus, these Regional Secretariat and District Councils in particular will support the implementation of this project. Critical areas such as implementation and enforcement of the mitigation measures including matters related to resettlement, provision of

alternative land for affected persons and alternative social services such as water will be handled by the district authorities in collaboration with the developer, TANESCO.

Institutional arrangement of TANESCO

TANESCO has been vested with the overall responsibility for the coordination, planning and implementation of the project. TANESCO will form a Project Implementation Unit (PIU) to implement the project and ensure compensation to the affected people and implementation of the Environmental and Social Management Plan (ESMP). It shall:

- Provide information on the project with respect to design, environment and resettlement action plans.
- Be the focal points for implementation of the project.
- Liaise with the district administrations and village communities for preparation of valuation document.
- Provide trainings
- Disseminate information relating to accidents and safety/prevention measures and also material relating to HIV/AIDS
- Prepare internal monitoring reports for TANESCO management

The PIU shall be supported by other agencies such as District Administrations, Communication Department of TANESCO, Agency for spreading awareness on HIV/AIDS and also for income restoration assistance to PAP.

4.1 BIOPHYSICAL ENVIRONMENT

This chapter provides an overview of the environment-biophysical baseline conditions within the Project Study Area based on secondary data from published sources as well as primary data collected. This section of the EIA report is organized by different biophysical parameters and also includes a discussion of the baseline conditions. The Project Study Area refers to the area that needs to be studied in order to adequately understand and describe the baseline conditions likely to be affected by the Project.

4.1.1 Climate and Meteorology

Mtwara Region is characterized by two main seasons: the hot and humid rainy season running from November/December to April/May, and relatively cooler and drier season from June to October. The mean annual rainfall ranges from 800-900 mm. The highest monthly mean air temperature at the regional capital of Mtwara is 270C around mid-March and the lowest is 23.80 C in July.

Temperature

The highest and lowest monthly mean temperatures in Mtwara are 27°C and 23.8°C in December and July respectively. The highest maximum temperatures are experienced in November and December and the lowest between June and September (***Figure 4-1***).

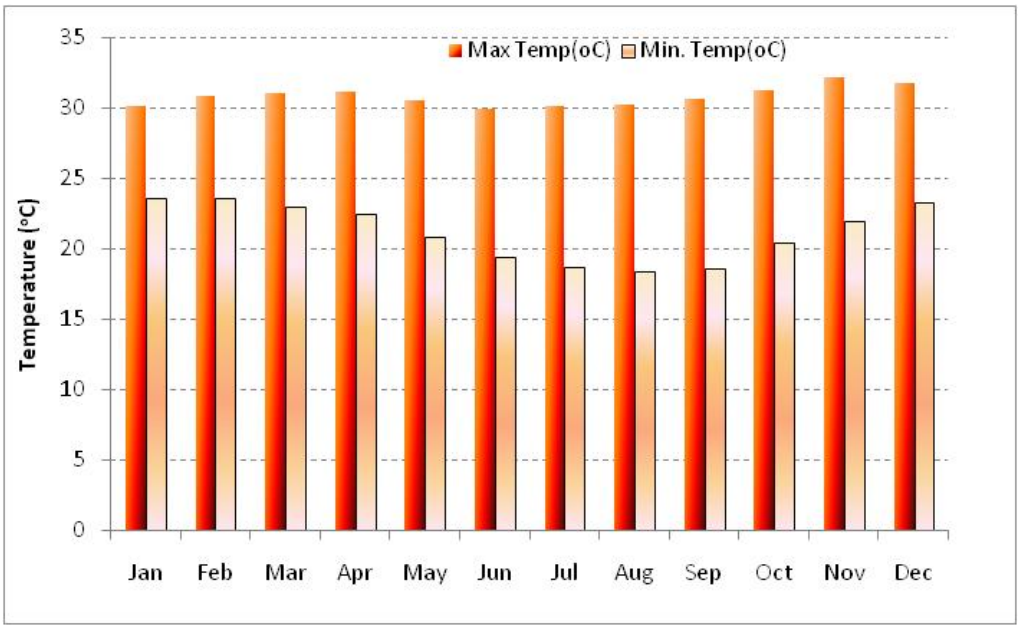


Figure 4-1 Maximum and Minimum Mean Temp at Mtwara Stn (2012-2016)

Source: Ruvuma and Southern Coast Basin Water Board, 2016

Rainfall

Rainfall distribution in the area is of unimodal pattern, commencing in November/ December and continues until April/May (***Figure 4-2***). The average annual rainfall is about 1000 mm.

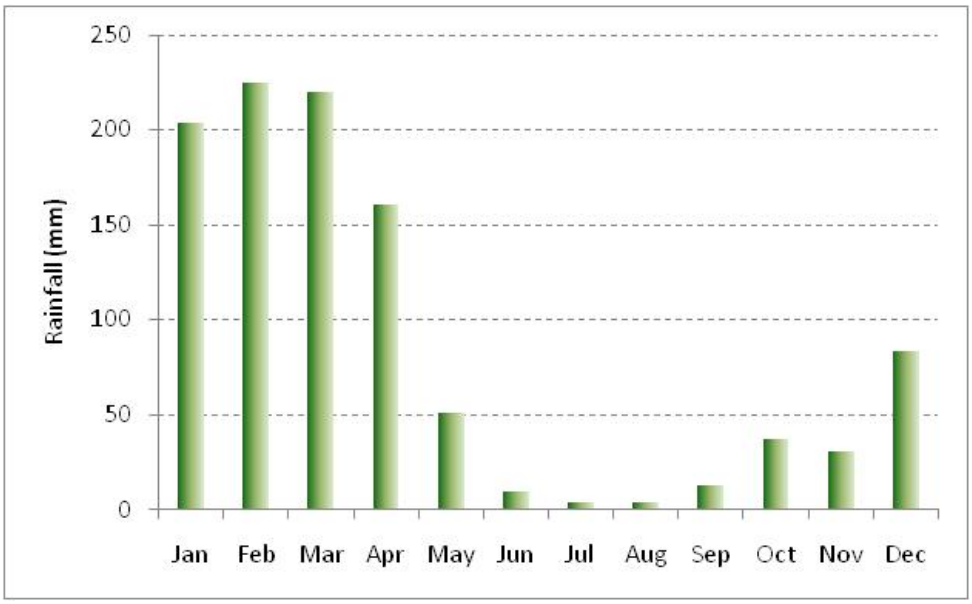


Figure 4-2 Mean monthly rainfall at Mtwara Stn (2007-2016)

Source: Ruvuma and Southern Coast Basin Water Board, 2016

Wind

Survey Method

The measurements were conducted using a Thermal Anemometer Testo 425 (***Figure 4-3***). The unit is a compact instrument for measuring flow velocities and temperature of flow by means of a permanently connected flow/temperature probe.

The wind speed and wind direction were measured at two locations (**L1 and L2**) defined by GPS coordinates **L1** (0528360, 9067767) at Somanga in Lindi region and **L2** (06082802, 8874335) at Kisiwa village in Mtwara region. Data were collected at an interval of one hour starting from 07:00 to 18:00 for the period of seven days. For each measurement, a multi-point and timed mean calculation of wind speed was used. The wind speed value recorded is the average of speed readings collected in a duration of one minute. Approximately 20 wind speed readings were captured and the average was automatically determined and recorded.

Figure 4-3 Thermal Anemometer Testo 425

Source: IRA 2018

Analysis

The wind speed and wind direction data were analyzed using WRPlot view software. ***Figure 4-4*** presents the average wind speed in different wind class intervals and directions measured at Somanga (**L1**) and Kisiwa (**L2**) village along the power transmission line. The wind direction indicates the direction the wind is coming from. The wind direction is distributed in 16 wind directions and 5 wind speed classes, including the calms (0 - 0.3 m/s). Rings for 5.2, 10.4, 15.6, 20.8, and 26% of the time are also indicated.

For location L1, the average wind speed is 1.78 m/s, whereas the calm winds frequency is 3.30%, respectively. The predominant average hourly wind direction varied throughout the period of measurement. For this location the most common wind at location L1 is Northwest as shown in **Error! Reference source not found.**(a). From this direction, the wind comes approximately 26% of the time with the maximum wind speed in the class interval 2.6 – 3.6 m/s. The wind blowing from this direction was recorded between 13:00 and 15:00 Tanzania local time. It can be seen that at this location the wind speeds between 0.3 and 1.60 m/s are quite common.

For location L2, the average wind speed is 2.55 m/s with calm wind frequency of 0.00%. At this location the common wind is Northeast (**Error! Reference source not found.**)b and the wind comes from this direction at approximately 22% of the time with the maximum wind speed in the class interval 2.6 - 3.6 m/s. The wind blowing from this direction was recorded between 11:00 and 17:00 Tanzania local time.

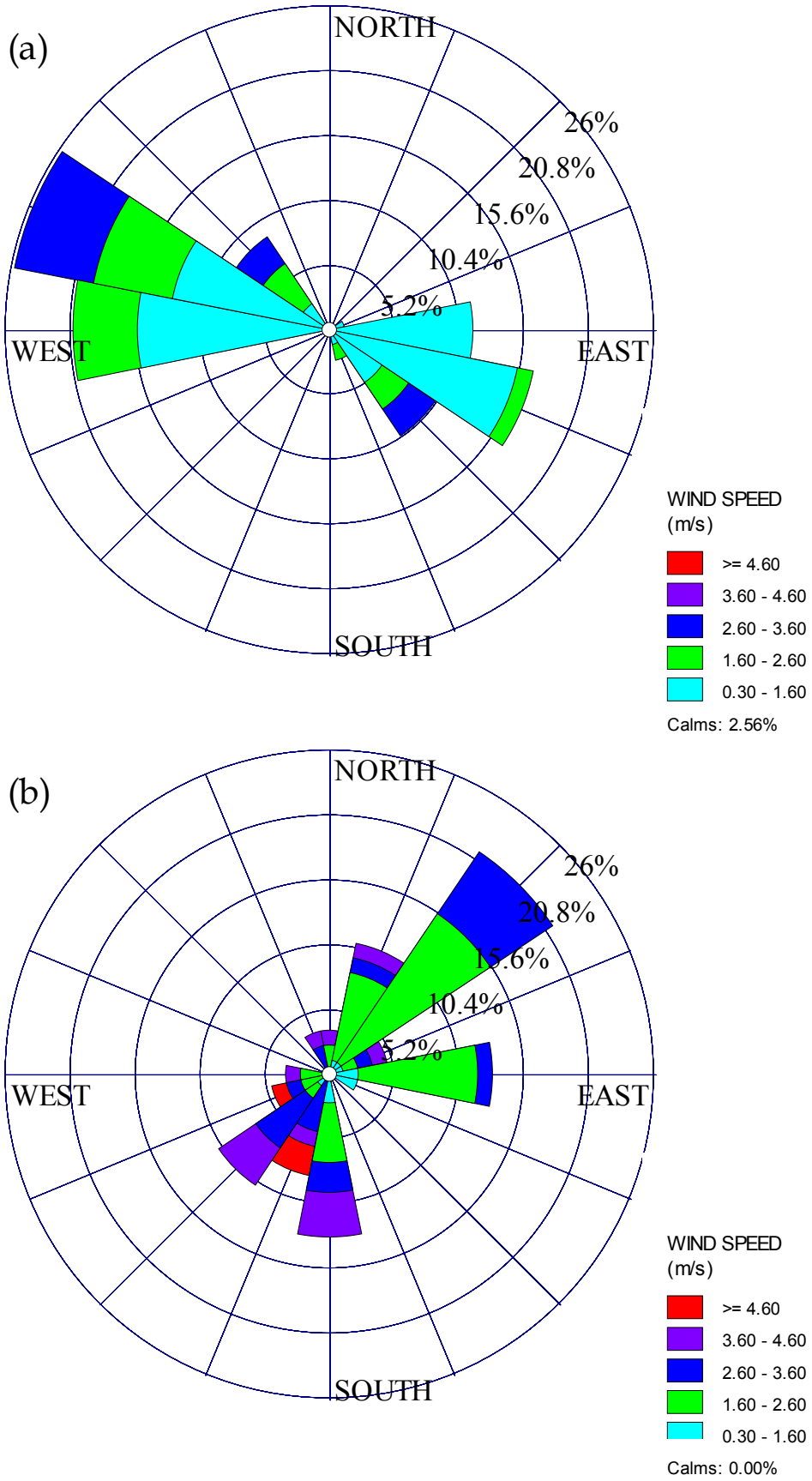
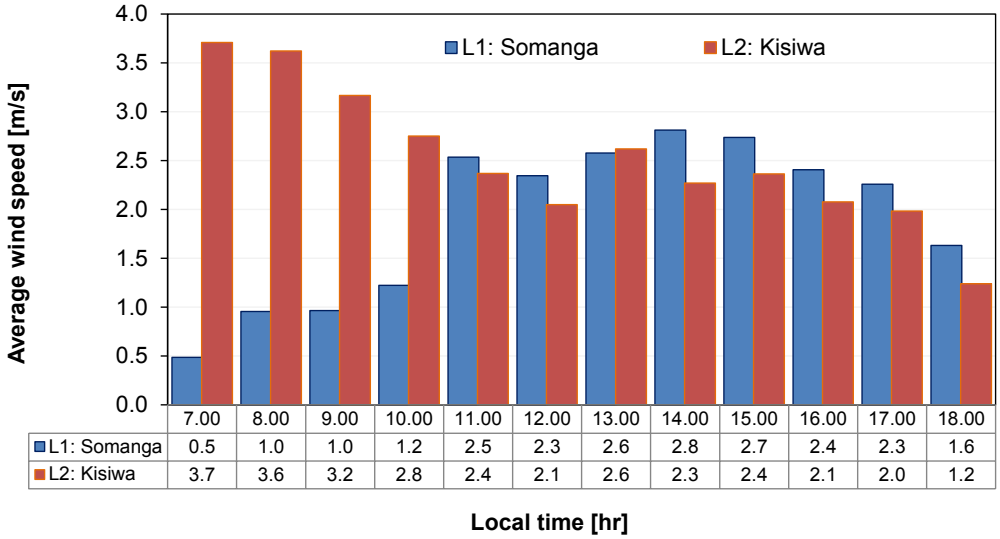


Figure 4-4 Wind Speed Distribution and Direction: (a) L1(GPS: 0528360, 9067767), (b) L2(GPS: 06082802, 8874335)

Source: IRA, 2018

Figure 4-5 gives the average of hourly wind speeds over the period of measurement as a function of time 07:00 to 18:00 Tanzania local time for location **L1** and **L2**. As observed from this figure the maximum average wind speed at **L2** is 3.7 m/s recorded at 07:00 hour of which the wind comes mostly from South-South-West and West-South-West directions. The minimum average wind speed is 1.4 m/s recorded at 18:00 hour with the wind mostly coming from between East and South directions. At location L1, the maximum average wind speed is 2.8 m/s recorded at 14:00 hour of which the wind comes mostly from the Northeast. The minimum average wind speed is 0.5 m/s recorded at 07:00 hour with the wind mostly coming from East and West directions.



	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
L1: Somanga	0.5	1.0	1.0	1.2	2.5	2.3	2.6	2.8	2.7	2.4	2.3	1.6
L2: Kisiwa	3.7	3.6	3.2	2.8	2.4	2.1	2.6	2.3	2.4	2.1	2.0	1.2

Figure 4-5 Hourly Average Wind Speed at L1 and L2

Source: IRA, 2018

Lightning

The Iso Keraunic Level (IKL) map for the 400kV New Mtwara Substation and Somanga Substation via the 400kV New Lindi Substation is shown in ***Figure 4-6***. The IKL in the area traversed by the transmission line route falls under the range of 22-36.

If IKL level is assumed as "100" in Africa, the probability of a lightning strike to actually reach the ground is estimated to be small, and the failure rate of the equipment without lightning protection is expected to be very low, therefore normal design for lightning protection will be sufficient for substations and transmission lines between Mtwara ~ Somanga.

Figure 4-6 IKL Map of Project Site Surroundings

Source: JICA Study Team, 2018

4.1.2 Land Use

The proposed 270km transmission line will run mostly beside existing roads. The proposed route has been determined by avoiding villages/settlements, ecologically sensitive areas, and minimizing land acquisition. The land use map of the Project Site and surrounding areas is presented in ***Figure 4-7***. The proposed route passes mostly on bushland, cultivated land, grassland, and woodland.

The majority of the land along the Mtwara-Somanga 400kV transmission line is arable and used for agriculture while the remaining constitute of forest/bush land and residential areas. The main food crops produced in the area are millet, rice, maize, sweet potatoes, legumes and cassava. Cash crops grown in the area include Cashew nuts, coconut, sesame, cassava, ground nuts, and pigeon peas. Many of the farms for cash crops especially cashew nuts are predominantly old

and abandoned, although, currently, the district governments are encouraging people within the districts and other investors from outside the districts to invest in cashew nuts plantation. For instance, the discussion with Kilwa, Lindi Rural and Lindi Municipal confirmed that they have allocated land and were encouraging people to engage in cashew nuts production.

Specifically the transmission line commences from agricultural land at (609313.0E, 8873911.55N) and traverse through farmland with mixed crops constituting permanent crops and seasonal crops to (610962.16E, 8866452.04)

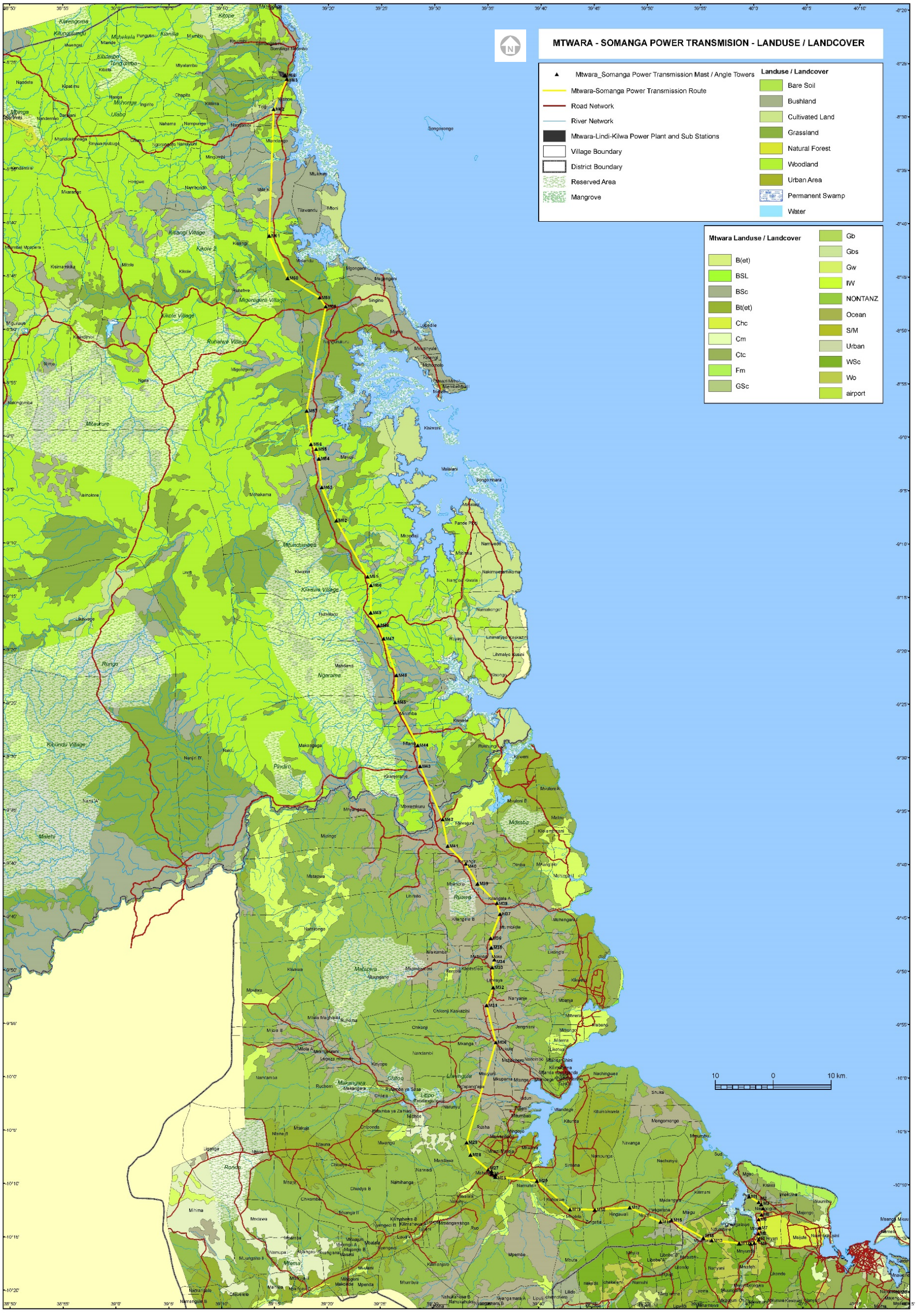


Figure 4-7 Land Uses of the Project Site Surroundings

Source: IRA, 2018

4.1.3 Topography

The project area of the proposed 400kV transmission line is located in the coastal areas of Mtwara region and Lindi region within the Ruvuma River and Southern Coast Basin (RSCB) as shown in ***Figure 4-8***. RSCB is underlain by deeply weathered sedimentary rocks and granites, and as a result is relatively flat. The main exception to this is the elevated sandstone plateau region, which stretches north-south through the eastern section of the Mtwara and Lindi regions, parallel to the Indian Ocean.

The northern part of the RSCB, within the Lindi region, is characterized by hilly, eroded terrain. Close to the coast, the elevation generally remains below 150 m. Several ocean gulfs extending inland also occur in the area.

The altitude of the Mtwara coastal area ranges between 1 and 200 m above sea level. The undulating topography is made up of a coastal sedimentary zone with a large presence of limestone with more sandy soils occurring along the coastline. The low-lying areas along the coast are especially vulnerable to flooding during the rainy season. Although the topography consists of predominantly rolling hills, there are a number of steep slopes which ranges between 11.31 and 18.43 degrees. These slopes will need to be taken into account when developmental areas and types are considered.

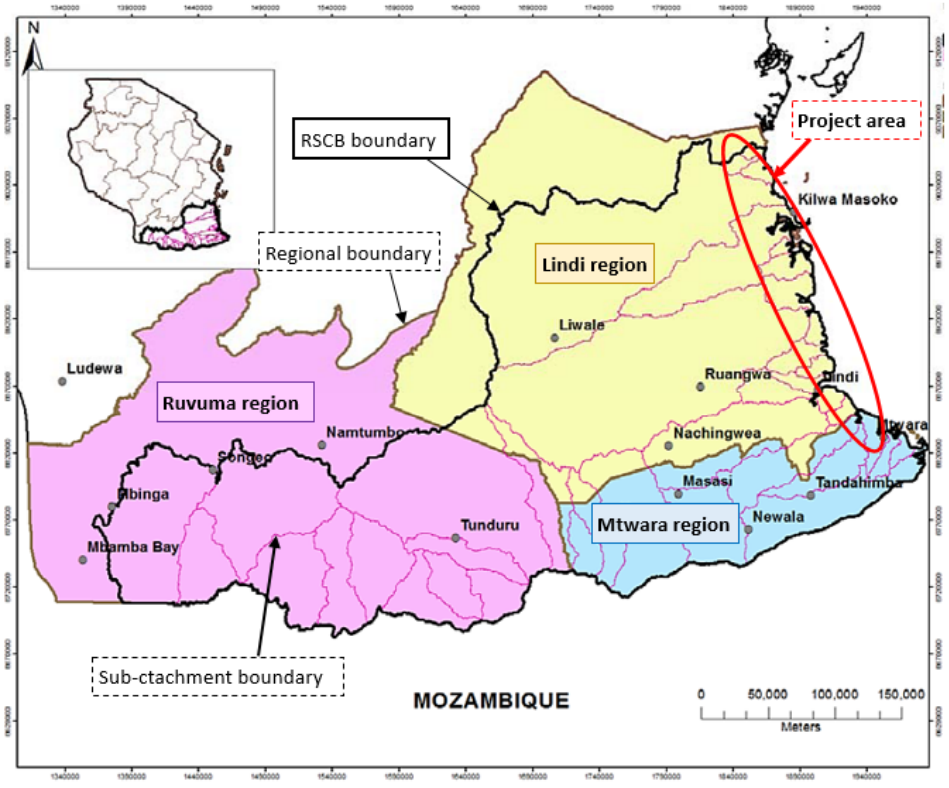


Figure 4-8 Ruvuma River and Southern Coast Basin (RSCB)

Source: Ruvuma and Southern Coast Basin Water Board, 2013

4.1.4 *Geology and Soil*

The land is mainly covered with deep sandy to heavy textured soils with moderate to high water content.

4.1.5 *Air Quality*

The air quality parameters (Particulate Matter and Nitrogen Oxides) along the project transmission line were measured at two locations (**L**) defined GPS coordinates and **L1**: **(0528360, 9067767)** at Somanga in Lindi region and **L2**: **(06082802, 8874335)** at Kisiwa village in Mtwara region.

Particulate Matter (PM10)

The TSI Dust Track model 8530 (***Figure 4-8***) was used in the measurement of dust using a 10 µm sieve size. The DustTrak is factory calibrated to the respirable fraction of standard ISO 12103-1, A1 dust. The equipment operates on the principle of scattered light. Air quality measurements were conducted between 07:00 and 18:00 for seven days. Each measurement lasted 30 minutes with a log interval of 1 minute and time constant of 1 second.

Figure 4-9 Dust Track II 8530 used for dust sampling

Source: IRA 2018

The time Weighted Average (TWA) baseline dust level collected for seven days compared with the limits set by the World Health Organization (WHO) and TBS Standards, are presented in ***Table 4-1*** and ***Table 4-2***. The maximum PM10 concentration recorded at **L1** in Lindi is 0.029 mg/m^3 whereas the minimum concentration is 0.010 mg/m^3. In Mtwara (**L2**) the maximum PM10 concentration recorded is 0.038 mg/m^3 whereas the minimum concentration is 0.010 mg/m^3. As

observed, nearly all values of suspended particulate (***PM10***) are significantly below the limits set by TBS and WHO standards. The slight difference in time weighted average (TWA) value between the two locations is attributed to the season during data collection. The PM10 measurements at location **L1** were taken during wet season whereas at **L2** were condcuted during dry season leading to slightly higher TWA.

It is worth noting that the concentration of particulate matter in the air is higher in the afternoon compared to the morning. PM10 concentration varies linearly with time (***Figure 4-10***) with minimum PM10 values recorded in the morning at 07:00pm and maximum values recorded in the afternoon at about 16:00pm. The increase of PM10 concentration with TZ local time can be linked to the increase of dust stirred up by wind.

Table 4-1 PM10 ambient air dust concentration at L1 (GPS: 0528360, 9067767)

Date	Time of measurement	Time Weighted Average (TWA) [mg/m^3]	TBS Standard [mg/m^3]	WHO Standard [mg/m^3]
18.02.2018	06:09	0.015	0.075	0.025
	12:00	0.017	0.075	0.025
	14:49	0.027	0.075	0.025
19/02/2018	06:13	0.012	0.075	0.025
	11:45	0.022	0.075	0.025
	16:08	0.030	0.075	0.025
20.02.2018	06:15	0.010	0.075	0.025
	11:55	0.022	0.075	0.025
	16:06	0.024	0.075	0.025
21/02/2018	06:58	0.012	0.075	0.025
	12:02	0.021	0.075	0.025
	15:00	0.028	0.075	0.025
22.02.2018	06:05	0.014	0.075	0.025
	12:56	0.017	0.075	0.025
	15:28	0.029	0.075	0.025
23.02.2018	06:07	0.015	0.075	0.025
	13:03	0.030	0.075	0.025
	15:55	0.029	0.075	0.025
24.02.2018	10:38	0.017	0.075	0.025
	17:15	0.027	0.075	0.025

Source: IRA 2018

Table 4-2 PM10 ambient air dust concentration at L2 (GPS: 06082802, 8874335)

Date	Time of measurement	Time Weighted Average (TWA) [mg/m³]	TBS Standard [mg/m³]	WHO Standard [mg/m³]
04.08.2018	07:00	0.016	0.075	0.025
	12:00	0.023	0.075	0.025
	16:00	0.027	0.075	0.025
05.08.2018	7:00	0.015	0.075	0.025
	12:00	0.026	0.075	0.025
	16:00	0.031	0.075	0.025
06.08.2018	07:00	0.014	0.075	0.025
	12:00	0.024	0.075	0.025
	16:00	0.032	0.075	0.025
07.08.2018	07:00	0.010	0.075	0.025
	12:00	0.034	0.075	0.025
	16:00	0.038	0.075	0.025
08.08.2018	07:00	0.018	0.075	0.025
	12:00	0.030	0.075	0.025
	16:00	0.032	0.075	0.025
09.08.2018	07:00	0.013	0.075	0.025
	11:00	0.028	0.075	0.025
	16:00	0.031	0.075	0.025
10.08.2018	07:30	0.016	0.075	0.025
	11:00	0.015	0.075	0.025

Source: IRA 2018

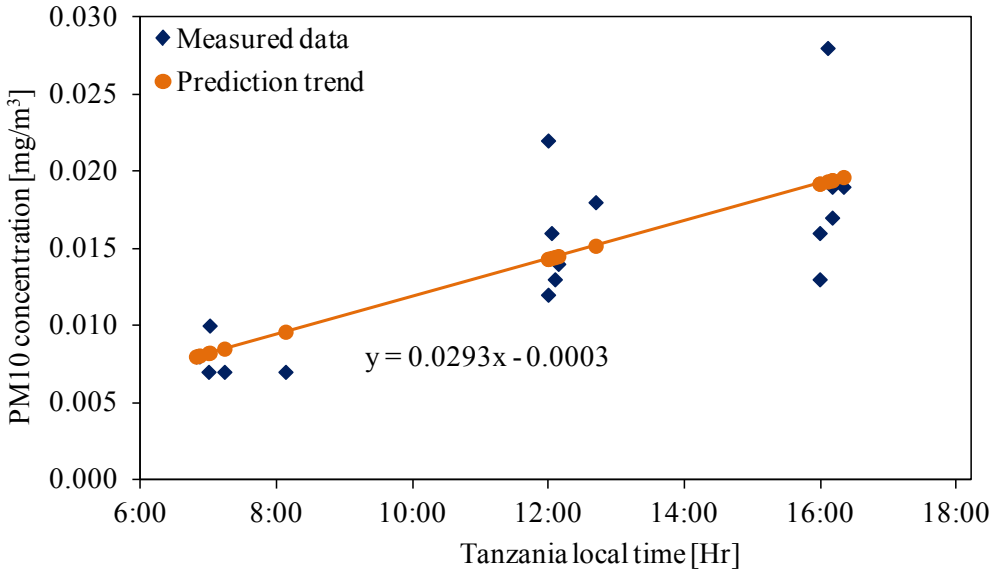


Figure 4-10 Linear Regression of PM10 Concentrations

Source: IRA 2018

Nitrogen Oxides (NOx)

The concentration of Nitrogen Oxides were measured using a Drägger Pump and Tubes. The Drägger Pump and Tubes (***Figure 4-11***) designated for different NOx, SOx, and COx compounds were used to characterize the ambient air quality.
The results obtained are summarized ***Table 4-3*** in and ***Table 4-4***. Measured concentrations of NOx gases at locations **L1** and **L2** were below the detection limit (BDL).

Figure 4-11 Drägger gas detection pump and Tubes

Source: IRA 2018

Table 4-3 NOx measurement in Lindi location L1(GPS: 0528360, 9067767)

Date	Testing time	# pressing, n	NOx gas tested	Value	Minimum detection level
18.02.2018	10:00	5	Nitr.-0.5	BDL	0.5 ppm
19.02.2018	12:00	5	NO_2 - 0.5	BDL	0.5 ppm
20.02.2018	12:00	10	NO + NO_2	BDL	2.0 ppm
21.02.2018	14:00	5	Nitr.-0.5	BDL	0.5 ppm
22.02.2018	14:00	10	NO + NO_2	BDL	2.0 ppm
23.02.2018	16:00	5	Nitr.-0.5	BDL	0.5 ppm
24.02.2018	16:00	5	NO_2 - 0.5	BDL	0.5 ppm

Source: IRA 2018

Table 4-4 NOx measurements in Mtwara location L2 (GPS: 06082802, 8874335)

Date	Testing time	# pressing, n	NOx gas tested	Value	Minimum detection level
4.8.2018	07:00	5	Nitr.-0.5	BDL	0.5 ppm

Date	Testing time	# pressing, n	NOx gas tested	Value	Minimum detection level
5.8.2018	12:00	10	$NO + NO_2$	BDL	2.0 ppm
6.8.2018	14:00	10	$NO + NO_2$	BDL	2.0 ppm
7.8.2018	10:00	5	Nitr.-0.5	BDL	0.5 ppm
8.8.2018	07:00	5	NO_2 - 0.5	BDL	0.5 ppm
9.8.2018	12:00	10	$NO + NO_2$	BDL	2.0 ppm
10.8.2018	15:00	5	Nitr.-0.5	BDL	0.5 ppm

Source: IRA 2018

4.1.6 Noise

Ambient noise levels along the project transmission line were measured at two locations (**L**) defined GPS coordinates and **L1**: (0528360, 9067767**)** in Lindi region and **L2**: (06082802, 8874335**)** in Mtwara region. Noise levels were measured using Peak Tech 8005 sound level meter ***(Figure 4-12***). The device was set in a slow response (1 unit per second), A-weighting with an automatic measuring range of 30 to 130 dB. The monitoring locations were isolated from human activities and the only source of noise was wind and leaves in motion. Typical illustration of on time continuous capturing of noise level at location L2 is presented in ***Figure 4-13***.

Figure 4-12 Peak Tech 8005 sound level meter

Source: IRA, 2018

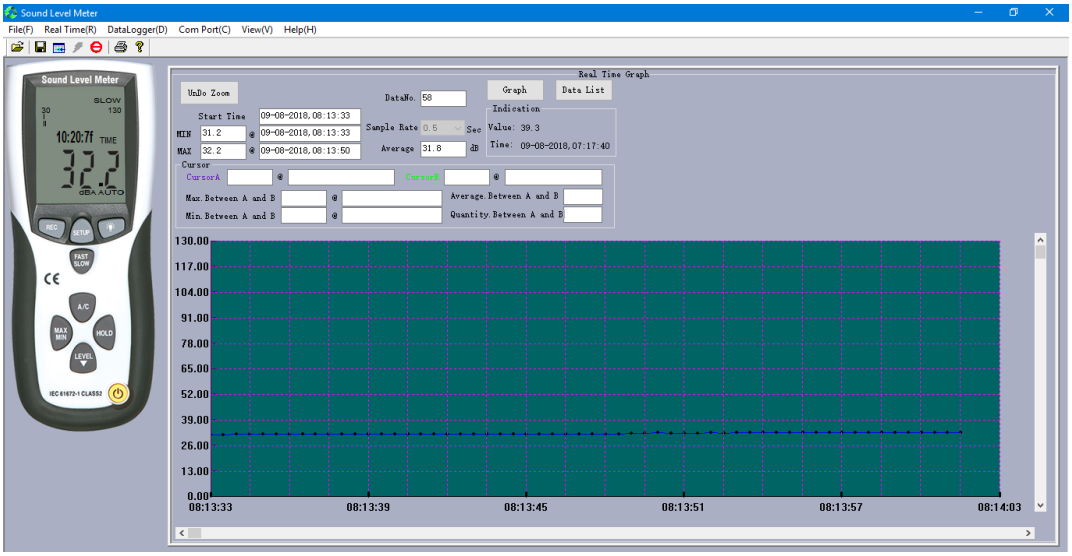


Figure 4-13 Continuous noise level recording on 09.08.2018, average noise level: 31.8 dBA

Source: IRA, 2018

Recorded noise levels, compared with TBS and WHO standard limits, are presented in ***Table 4-5***. It can be observed that recorded ambient noise levels at all monitoring stations were significantly lower than the limits set by the TBS and WHO standards.

Table 4-5 Noise level measurements (Average: dBA, Leq)

Local time	**22.02.2018** L1 (GPS: 0528360, 9067767)		**09.08.2018** L2(GPS: 06082802, 8874335)	TBS and WHO Standards
07:00	33.0		32.5	55
08:00	37.1		31.8	55
09:00	31.5		33.6	55
10:00	41.2		35.7	55
11:00	39.8		33.8	55
12:00	37.0		38.4	55
13:00	33.5		39.3	55
14:00	42.8		35.2	55
15:00	35.4		34.5	55
16:00	39.9		33.1	55
17:00	34.5		34.1	55
18:00	35.0		31.8	55

Source: IRA 2018

4.1.7 *Hydrology*

The proposed transmission line falls within the Ruvuma River and Southern Coast Basins (refer to ***Figure 4-8***). The Mambi sub-basin is divided into six sub-catchments (Mnazi, Nachenjere, Mikindani, Mbuo, Mambi, Madangwa). The annual total flow in Mambi sub-basin is estimated at 401 Mm3/year. Among these, Mbuo and Mambi sub-catchments are the ones close to the Project Site. The closest perennial river is the Ruvuma River, which is located approximately 40 kilometres to the south along the border of Tanzania and Mozambique. The remainder of rivers in the coastal Mtwara area and tributaries are non-perennial.

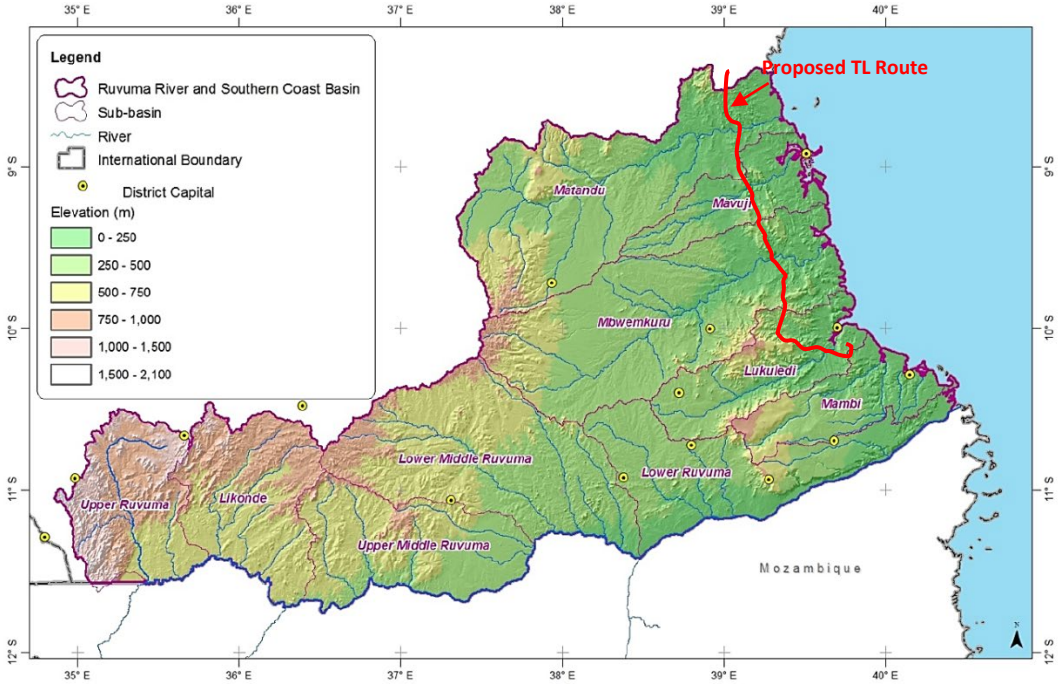


Figure 4-14 Ruvuma River and Southern Coast Basin (RSCB)

Source: Integrated Water Resources Management and Development Plan for the Ruvuma River and Southern Coast Basin, Ministry of Water, 2013

Surface water

There are number of rivers crossed by the transmission line in the Ruvuma and Coast River Basin (RSCB) for the Lindi and Ruvuma regions. During the field survey conducted in August 2018, five locations were selected for surface water quality analysis as shown in ***Table 4-6***.

Table 4-6 Surface Water Sampling Locations

S/N	Name of the river	Location		Remarks
		Easting	Northing	
1	Lukuledi	0571778	8879538	Located at Namunda village and Used for domestic purposes and irrigation
2	Mloeka	0567482	8881529	Located at Mnazi moja village. Used for irrigation, car washing and other non-drinking and cooking purposes

S/N	Name of the river	Location		Remarks
		Easting	Northing	
3	Ruaha	0561517	8882780	Located in Ruaha village. Used for domestic purposes
4	Mbwemkuru	0555515	8941258	Located in Mbwemkuru village. Used for irrigation and domestic purposes
5	Mavuji	0535122	8998827	Located in Mavuji village. Used for irrigation and domestic purposes

Source: IRA 2018

Physical, biological and chemical parameters were analyzed to establish the baseline data for the water quality parameters. Ideally, drinking-water should not contain any microorganisms known to be pathogenic capable of causing disease or any bacteria indicative of faecal pollution. The chemical and physical quality of water may affect its acceptability to consumers and may cause health risks. shows the water quality parameters for the sampled locations. It can be noted that the all parameters are within the acceptable range according to Tanzania drinking water and WHO standards.

Table 4-7 Surface Water Quality Analysis Results

S/N	Parameters	Lukuledi **Sampling date:** 13/8/2018 **Sampling Time:** 07:08	Mloeka **Sampling date:** 13/8/2018 **Sampling Time:** 07:21	Ruaha **Sampling date:** 13/8/2018 **Sampling Time:** 08:06	Mbwemkuru **Sampling date:** 12/8/2018 **Sampling Time:** 11:45	Mavuji **Sampling date:** 13/8/2018 **Sampling Time:** 12:00	TZS drinking water standards	WHO guidelines	Remarks
	pH	7.90	7.85	7.85	7.89	7.37	6.5-9.2	6.5-8.5	Acceptable
	Temperature (°C)	25	26.5	20.6	26.6	25	-	-	
1	EC (µS/cm)	690	642	382	1074	290	<2000		Acceptable
2	Total dissolved solids (mg/l)	360	320	190	550	150	1000 - 1500	500	Acceptable
3	Total hardness (mg/l $CaCO_3$)	145	130	80	250	62	500 -600	500	Acceptable
4	Calcium hardness (mg/l $CaCO_3$)	110	110	67	210	35	-	-	
5	Magnesium (mg/l)	25	18.4	5.3	50	7.8	50-100	150	Acceptable
6	Calcium (mg/l)	32	28	14	81.4	11	75-300	200	Acceptable
7	Chloride (mg/l)	70	64.5	40	126	31.5	200-800	250	Acceptable
8	Sulphate (mg/l)	46	39.6	21	90	25	200 - 600	400	Acceptable
9	Nitrate (mg/l)	5.5	12	5.8	10	3.2	10 - 75	0-30	Acceptable
10	Total Coliform (No./100ml)	0	0	0	0	0	0	0	Acceptable
11	BOD_5 (mg/l)	0	0	0	0	0	< 6	0	Acceptable
12	COD (mg/l)	0	0	0	0	0	< 10	0	Acceptable

Source: IRA 2018

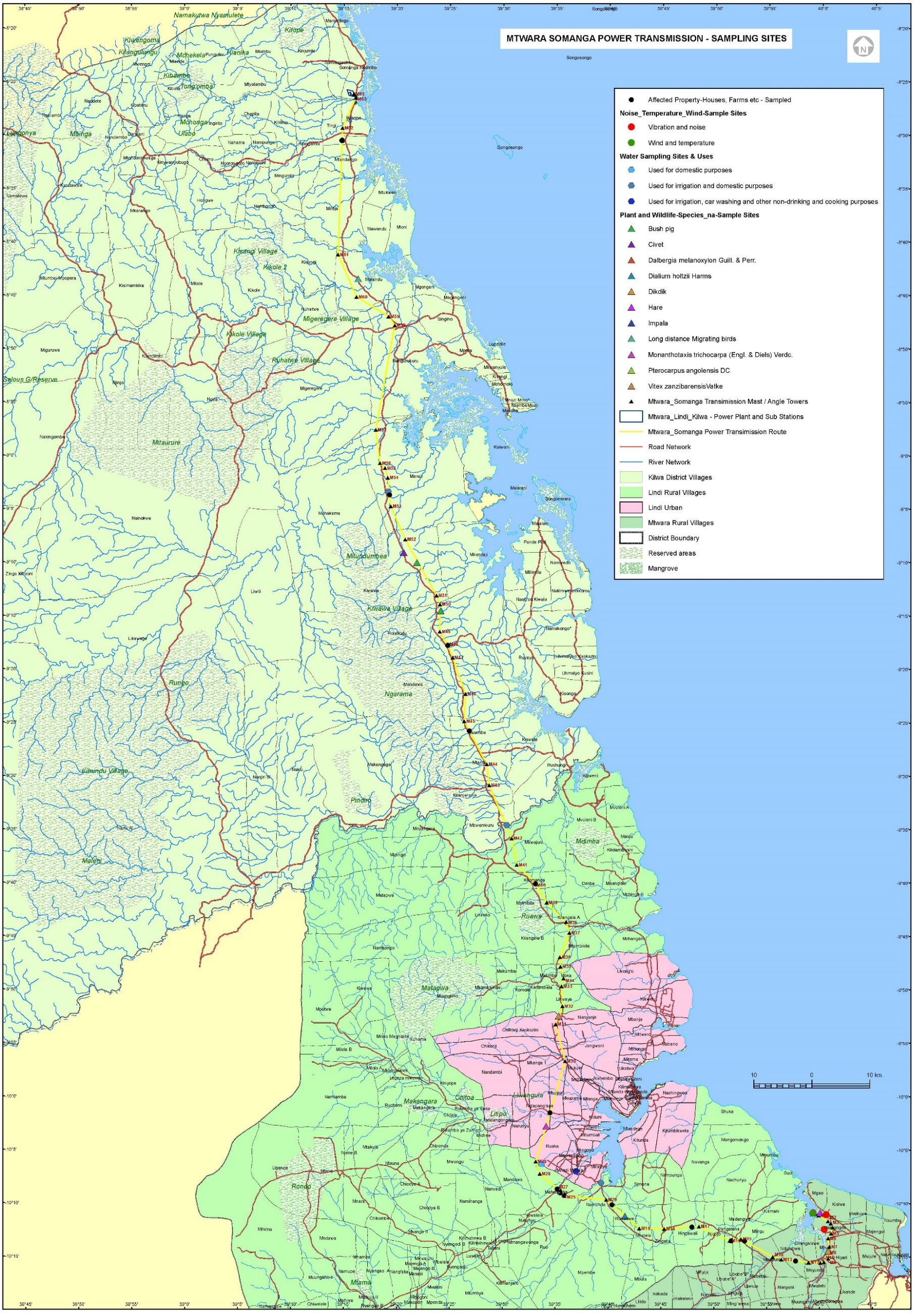


Figure 4-15 Transmission Line Route and Sampling Sites

Source: IRA 2018

Groundwater

Both shallow and deep groundwater is found in the coastal zone and river sediments in Lindi region and Mtwara region (***Figure 4-16***). It appears subject to large fluctuations in the water table and contributes to the relatively large number of seasonally insufficient or dry wells.

Groundwater in this sedimentary zone generally lies so deep that the use of boreholes is not viable, aside from along the narrow coastal zone, alluvial deposits and in the river valleys. Alluvial sediments exist in pockets in the coastal zones, predominantly in river valleys leading to the ocean. Significant quantities of groundwater exist in these sedimentary deposits and they may be accessible for rural water supply via hand dug wells. Examples are the Mtawanya aquifer near Mtwara, Mikindani, the sedimentary deposits inland from Lindi, and deposits near Kilwa.

Groundwater responses to rainfall in these sediments are generally rapid in the shallow groundwater. Fluctuations of the groundwater level at deep groundwater observation sites are small and slow e.g. at Mikindani, the rise of the groundwater level starts only at the end of the rainy season. This is likely to correlate with recharge moving down from the plateau areas into the river valleys.

The groundwater quality in this coastal zone will not be as good as the inland aquifers as the primary aquifers are at the lower end of the catchment and with increasing proximity to the coast, so the groundwater quality is likely to become more saline, especially for deep groundwater.

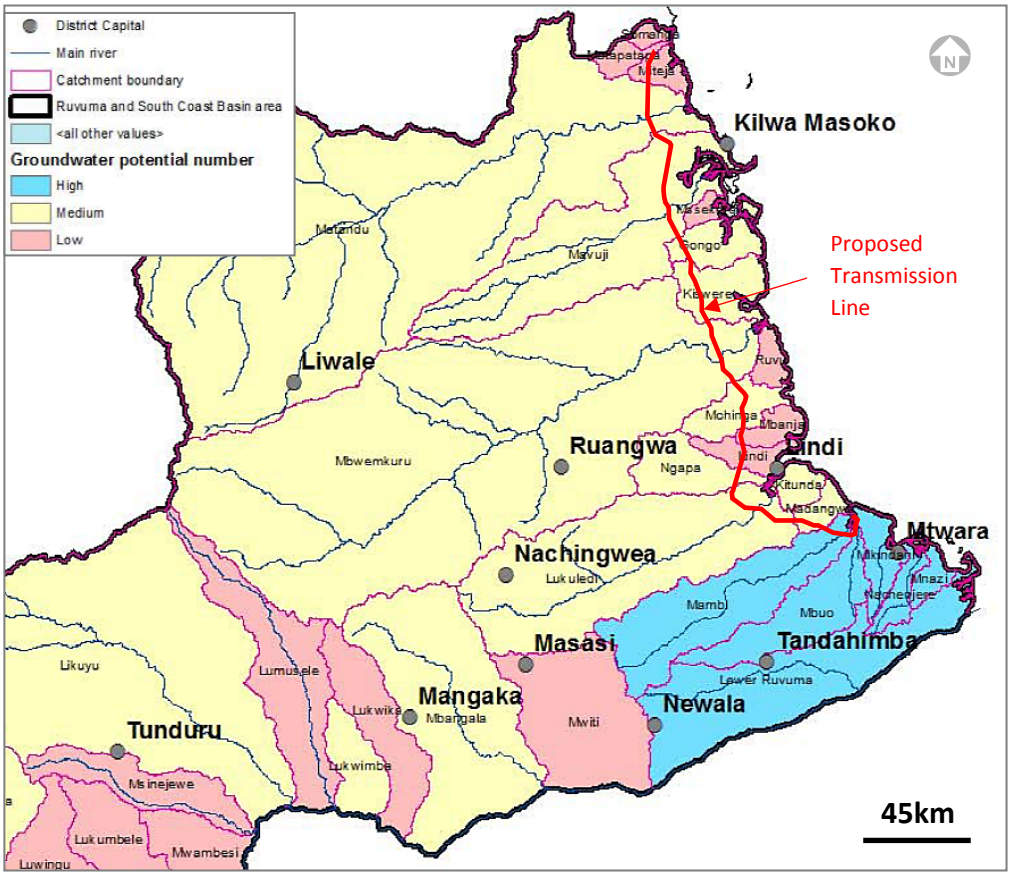


Figure 4-16 Groundwater Potential in Lindi and Mtwara Regions

Source: Integrated Water Resources Management and Development Plan for the Ruvuma River and Southern Coast Basin, Ministry of Water, 2013

4.1.8 Ecology

Protected areas

Lindi and Mtwara Regions, where the Project Site is located, has forest reserves, a marine park, and a Ramsar site. These protected areas are mapped out in ***Figure 4-17***. The Project Site neither inside nor passes through any of these protected areas.

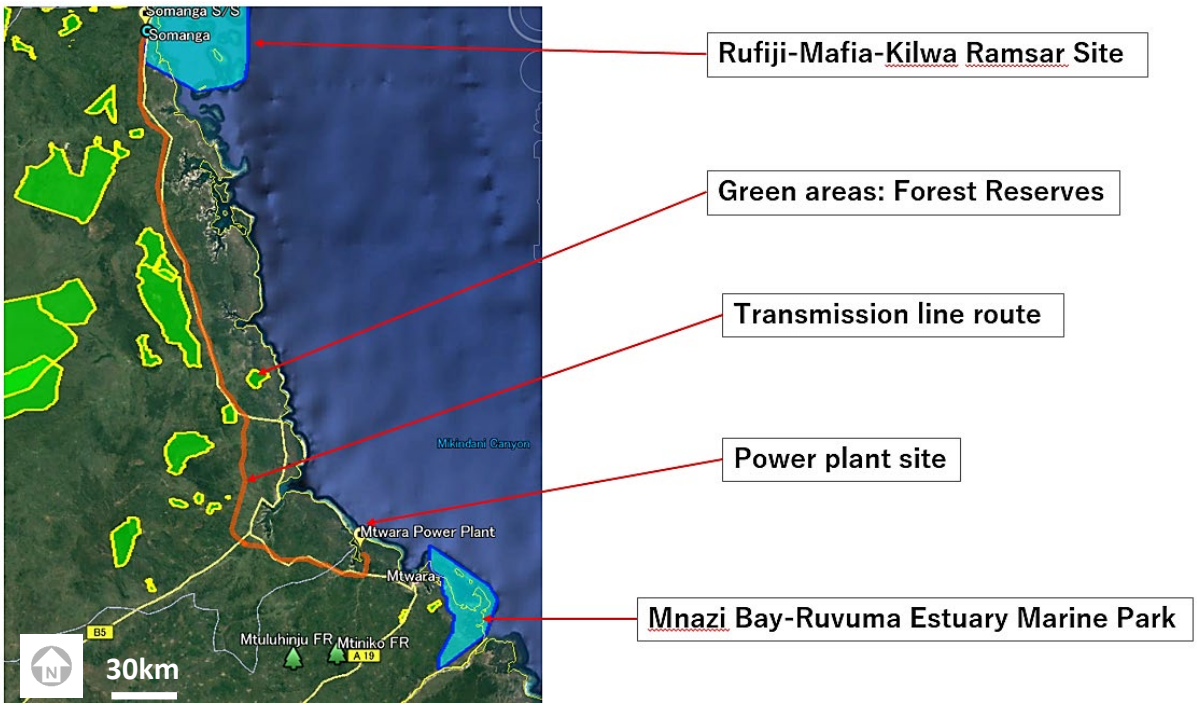


Figure 4-17 Protected Areas nearby the Project Area

Source: JICA Study Team using background map of Google Earth, 2018

Forest Reserves

There are five forest reserves in Mtwara District, these are Ziwani, Naliendele, mangrove forest, Mtiniko, Mtuluhinju. Three of them are under the management of Central Government. The other two are under management of the district council; Forest reserves under the management of Mtwara District Council include Mtiniko/Mnivata (1,736ha) and Mtuluhinju (296ha).

In Lindi region particularly Lindi and Kilwa districts are famous in terms of coastal forests, the region represent one of the remaining rich districts where intact coastal forest still exist. Most of these coastal forests are located on hills that form a discontinuous chain in SE Tanzania (Clarke 2001). Of the prominent discontinues series of blocks is the Matumbi and Mbarawala plateaus running parallel to the coastal about 30-40 km inland (TFCG, 2008). These coastal forests are part of the northern zambezian inhambane system which habour high level of endemic species ranging from plants species, amphibian and birds. Some forest reserves are located at close proximity with the proposed transmission line route. The closest forest reserve is Ruawa forest reserve at Kilangala B and Ngarama North and Ngarama south forest reserves at Mbwemkuru village located approximately 3 to 1.5 km respectively away from the transmission line.

Marine Park

There is one national marine park in Mtwara District; Mnazi Bay Ruvuma Estuary Marine Park (MBREMP). In 2000, MBREMP was gazetted as a Marine Park (Government Notice No. 285), published on 4/8/2000) made under Section 9 of the Marine Parks and Reserves Act, No. 29 of 1994 after being identified as an area of high biodiversity value at both the national and

international levels. IUCN Management Category for this marine park is VI (protected area with sustainable use of resources).

The park, which includes the last 45 km of coastline, to the Ruvuma River, has 11 villages within its boundaries that border the Republic of Mozambique with a total area of 650 square kilometers. The transmission line is 25km away from the MBREMP.

Ramsar Site (Rufiji-Mafia-Kilwa)

The extensive mangrove forest that form a continuous block of mangroves extending from Rufiji delta to Kilwa exhibits high biodiversity. This area is a designated Ramsar site, Rufiji- Mafia - Kilwa Ramsar site. A large part of this area comprise of mangrove forests covering an estimated area of 550 km², as well as extensive intertidal flats and sandbars (refer to ***Figure 4-18***). The Rufiji drainage basin forms a delta and covers about 20% of mainland Tanzania,.

According to Information Sheet on Ramsar Wetlands (RIS) ,"The Ramsar Site comprises a variety of coastal and marine habitats made up of four significant features. The Rufiji Delta formed by the outflow of Rufiji River; the Mafia Island about 25 km of-shore and surrounding smaller islands, sandbars and coral reefs; the Songo-Songo Archipelago to the south; and the deeper waters in between i.e. the Mafia Channel and the water between Mafia and Songo-Songo Archipelago." Within the Ramsar Site, various economic activities are taking place including fishing and extraction of other coastal and mangrove resources. Also cultivation especially rice, seaweed farming and tourism are the major activities.

The proposed transmission line will not pass through the Rufiji- Mafia - Kilwa Ramsar site. The closest distance between the border of the Ramsar Site and the proposed transmission line is approximately 800m.

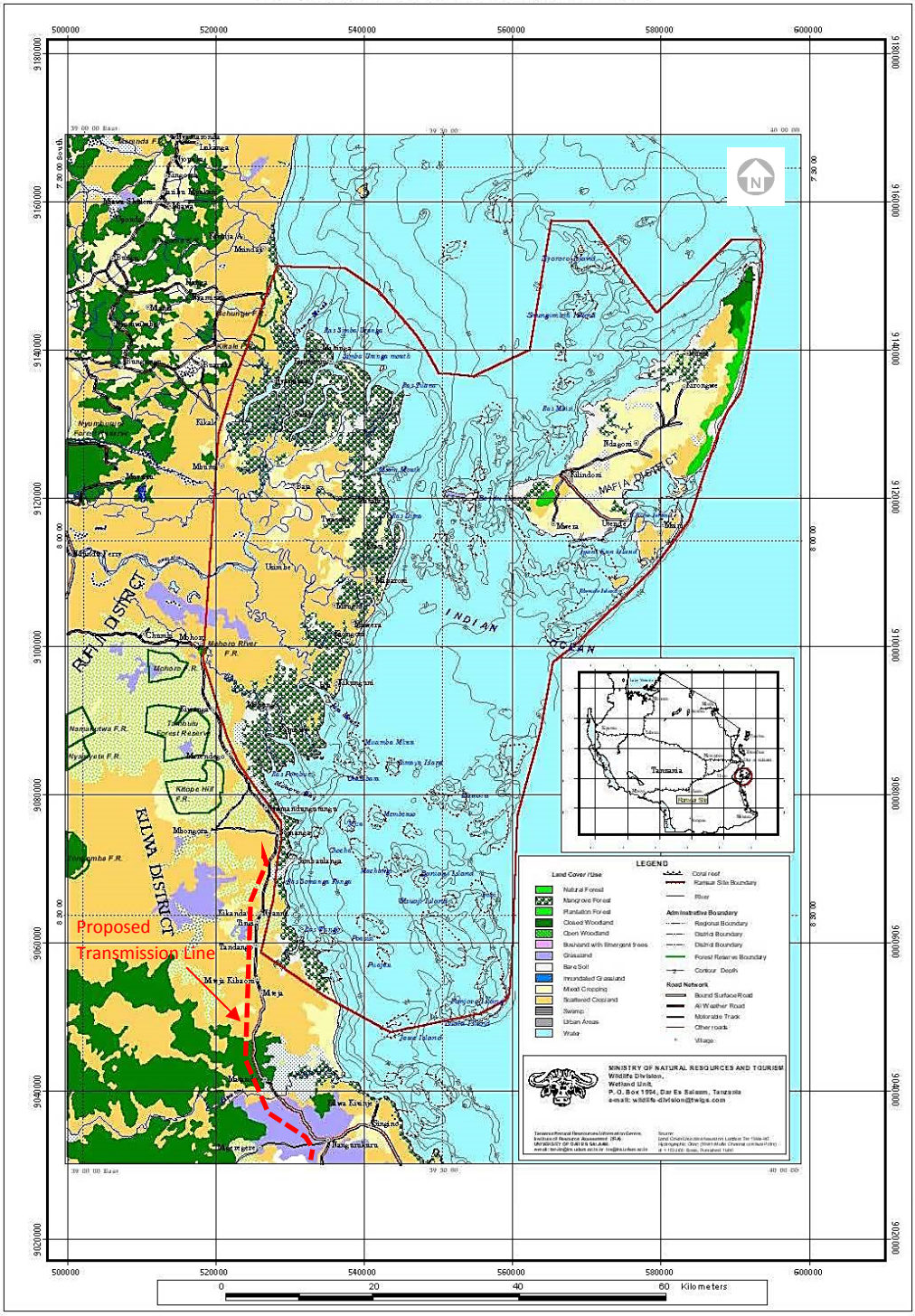


Figure 4-18 Rufiji-Mafia-Kilwa Ramsar Site

Ecologically Sensitive Areas

The proposed transmission line traverses coastal areas of Lindi and Mtwara Regions. Coastal areas provide habitat connection to the inland coastal forests for a number of birds including migrating species from Europe and Asia. Various species of birds found in nearby coastal forests migrate into the mangrove forest found onshore where they feed. Also the birds feeding in these areas utilize the intertidal zones rich in crustacean and crabs. Several forest reserves in this area are recognized both as Important Bird Areas (IBAs) and Key Biodiversity Areas (KBAs) by the Integrated Biodiversity Assessment Tool

(IBAT) Alliance, composed of BirdLife International, Conservation International, IUCN and UN Environment's World Conservation Monitoring Centre (UNEP-WCMC).

Important Bird Areas (IBAs)

The proposed transmission line route will not pass through any Important Bird Areas (IBA), recognized by the IBAT Alliance (***Figure 4-19***). However, it traverses areas closes to coastal forest reserves that are recognized IBAs. These IBAs are important due to presence of globally threatened species (with IUCN conservation status) and species endemic in the area.

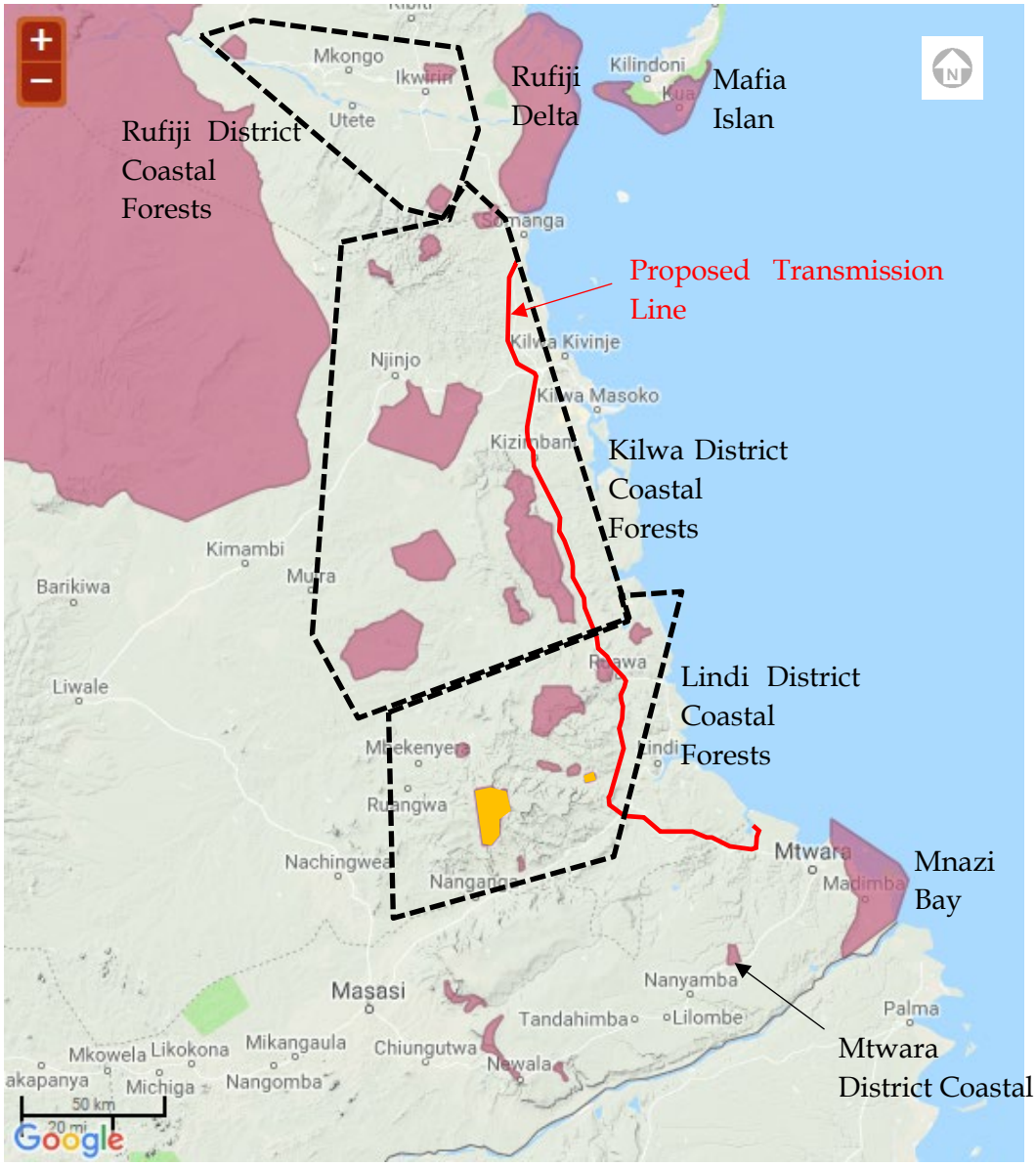


Figure 4-19 IBAs near the Proposed Transmission Line

Source: IBAT Alliance 2018
(https://www.ibat-alliance.org/ibat-conservation/mapviewerol213)

The Project may impact migratory birds that are present in the IBAs near the transmission line. Key species in these IBAs include one endangered species

(EN), three Near Threatened (NT) species, and sixteen species of Least Concern (LC) (refer to ***Table 4-8).*** The closest IBA to the proposed transmission line is "Ruawa Forest Reserve" which is one of six forest reserves designated as IBAs in Lindi District and 3km away from the proposed transmission line. According to "Important Bird Areas in Tanzania", Wildlife Conservation Society of Tanzania (WCST), 2002, Spotted Ground Thrush(EN) Breeds on the Rondo Plateau which extends behind Ruawa FR.

Table 4-8 Key Species in IBAs

IBA	Key Species	IUCN Red List Status
Kilwa District Coastal Forests	Plain-backed Sunbird (*Anthreptes reichenowi*); Southern Banded Snake-eagle (*Circaetus fasciolatus*)	NT
	Uluguru Violet-backed Sunbird (*Anthreptes neglectus*); East Coast Batis (*Batis soror*); Mouse-coloured Sunbird (*Cyanomitra verreauxii*); Zanzibar Red Bishop (*Euplectes nigroventris*); Kretschmer's Longbill (*Macrosphenus kretschmeri*); Black-bellied Starling (*Notopholia corusca*); Fischer's Greenbul (*Phyllastrephus fischeri*); Eastern Green Tinkerbird (*Pogoniulus simplex*); Brown-breasted Barbet (*Pogonornis melanopterus*); Brown-headed Parrot (*Poicephalus cryptoxanthus*); Chestnut-fronted Helmet-shrike (*Prionops scopifrons*)	LC
Lindi District Coastal Forests	Spotted Ground-thrush (*Geokichla guttata*);	EN
	Plain-backed Sunbird (*Anthreptes reichenowi*); Southern Banded Snake-eagle (*Circaetus fasciolatus*); East Coast Akalat (*Sheppardia gunningi*)	NT
	Uluguru Violet-backed Sunbird (*Anthreptes neglectus*); East Coast Batis (*Batis soror*); Mouse-coloured Sunbird (*Cyanomitra verreauxii*); Zanzibar Red Bishop (*Euplectes nigroventris*); Kretschmer's Longbill (*Macrosphenus kretschmeri*); Black-bellied Starling (*Notopholia corusca*); Green-headed Oriole (*Oriolus chlorocephalus*); Fischer's Greenbul (*Phyllastrephus fischeri*); Eastern Green Tinkerbird (*Pogoniulus simplex*); Brown-breasted Barbet (*Pogonornis melanopterus*); Brown-headed Parrot (*Poicephalus cryptoxanthus*); Chestnut-fronted Helmet-shrike (*Prionops scopifrons*); Lesser Seedcracker (*Pyrenestes minor*)	LC
Mnazi Bay	East Coast Batis (*Batis soror*); Greater Sandplover (*Charadrius leschenaultia*); Mouse-coloured Sunbird (*Cyanomitra verreauxii*); Crab-plover (*Dromas ardeola*); Zanzibar Red Bishop (*Euplectes nigroventris*); Mangrove Kingfisher (*Halcyon senegaloides*); Black-bellied Starling (*Notopholia corusca*); Brown-headed Parrot (*Poicephalus cryptoxanthus*)	LC

Source: IBAT Alliance 2018

Key Biodiversity Areas (KBAs)

KBAs are important and recognized due to presence of globally threatened species (with IUCN Conservation Status) and presence of species endemic in the area. The proposed transmission line route will not pass through any Key Biodiversity Area (KBA), recognized by the IBAT Alliance. However, it

traverses areas closes to coastal forest reserves, that are recognized KBA (refer to ***Figure 4-20***). The closest KBA to the proposed transmission line is "Ruawa Forest Reserve" which is also designated as IBA.

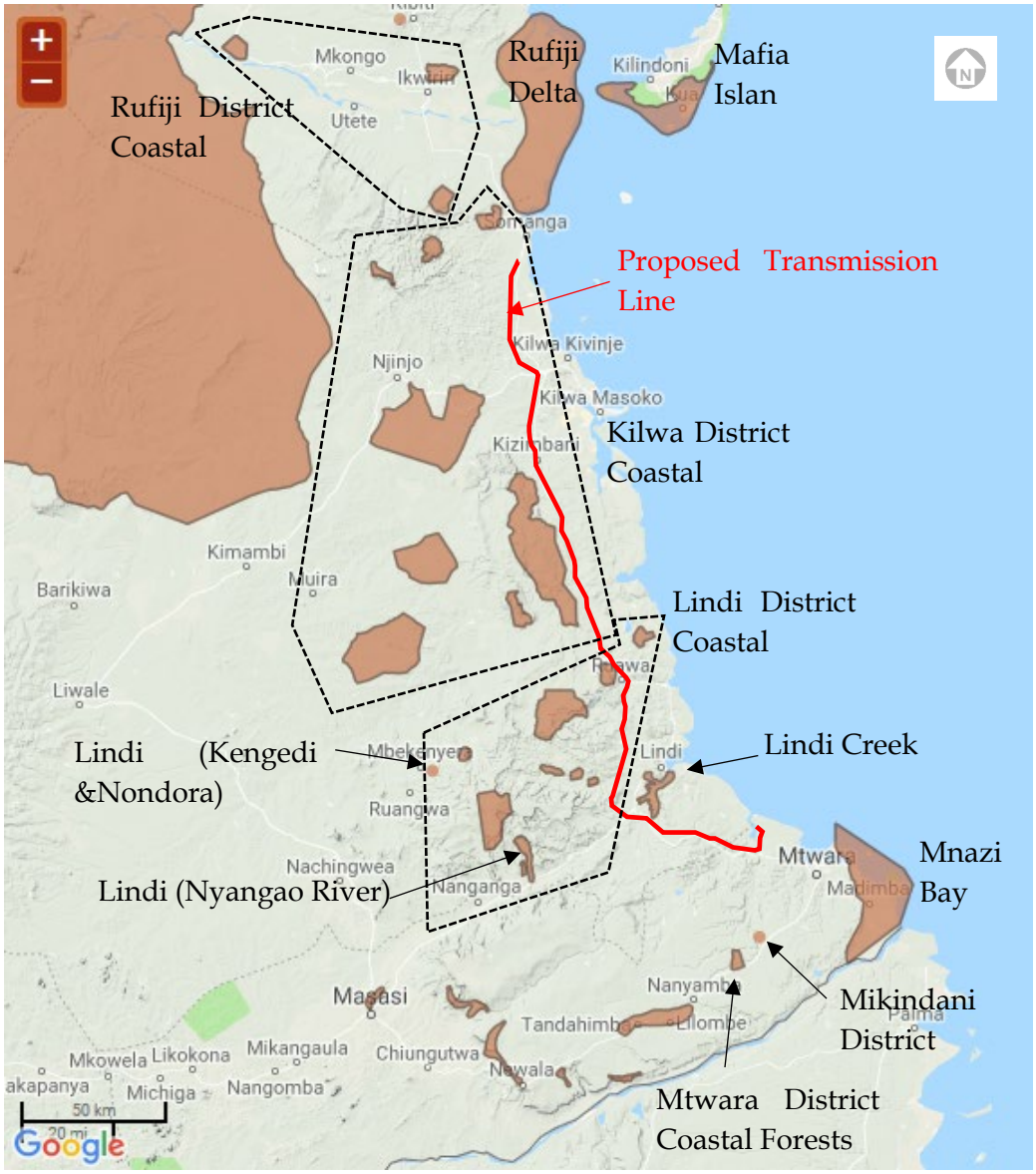


Figure 4-20 KBAs near the Proposed Transmission Line

Source: IBAT Alliance 2018 (https://www.ibat-alliance.org/ibat-conservation/mapviewerol213)

KBAs that are not part of coastal forests (IBAs), such as Mikindani District (Mtwara-Mikindani), Lindi Creek, Lindi (Nyangao River, and Mikindani have been recognized due to significant populations of globally threatened flora species (vulnerable, critical conservation status). The Project will not directly affect these KBAs.

The Project may impact fauna present in the KBAs near the transmission line. Key species in these KBAs include one Critically endangered (CR) species, three vulnerable (VU) species, and one species of least concern (LC) (refer to ***Table 4-9***). The Rondo Dwarf Galago(CR) is a species of primate, and inhabits in isolated forest patches on Rondo Plateau more than 10km away from the proposed transmission line.

Table 4-9 Key Species in KBAs

IBA	Key Species	IUCN Red List Status
Kilwa District Coastal Forests	African Elephant (*Loxodonta Africana*); East African Little Collared Fruit Bat (*Myonycteris relicta*); Black And Rufous Elephant Shrew (*Rhynchocyon petersi*)	VU
	Red Bush Squirrel (*Paraxerus palliates*)	LC
Lindi District Coastal Forests	Rondo Dwarf Galago (Galagoides rondoensis)	CR
	African Elephant (*Loxodonta Africana*); East African Little Collared Fruit Bat (*Myonycteris relicta*); Black And Rufous Elephant Shrew (*Rhynchocyon petersi*)	VU

Source: IBAT Alliance 2018

4.1.9 Wildlife Corridors

Migratory Birds

According to research, migratory birds use eight pathways to travel across continents. One of the pathways is the East Asia / East African Flyway. Migratory birds tend to travel South of Africa, going to West, East (including Madagascar), or further South (refer to ***Figure 4-21***). According to Birdlife International (2018), coastlines of Tanzania is mainly used during return migration (northward journey) through Eastern Africa.

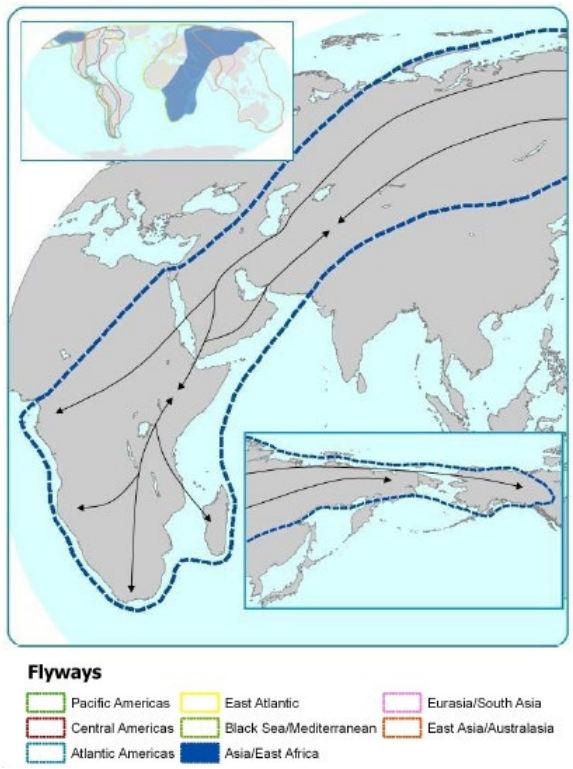


Figure 4-21 Flyway for the Project

Source: Birdlife International 2018
http://datazone.birdlife.org/userfiles/file/sowb/flyways/6_East_Asia_East_Africa_Factsheet.pdf

Among key bird species identified in the IBAs near the Project Site, only one species, the Spotted Ground-thrush (EN), is a full migratory bird (IUCN 2018). The Spotted Ground Thrush has breeding sites located in Litipo and Rondo Plateau Forest Reserves, which are both part of Lindi District Coastal Forests IBA (see orange shadings in ***Figure 4-22***). Litipo Forest Reserve is approximately

7km, while Rondo Forest Reserve is approximately 34km from the proposed transmission line route.

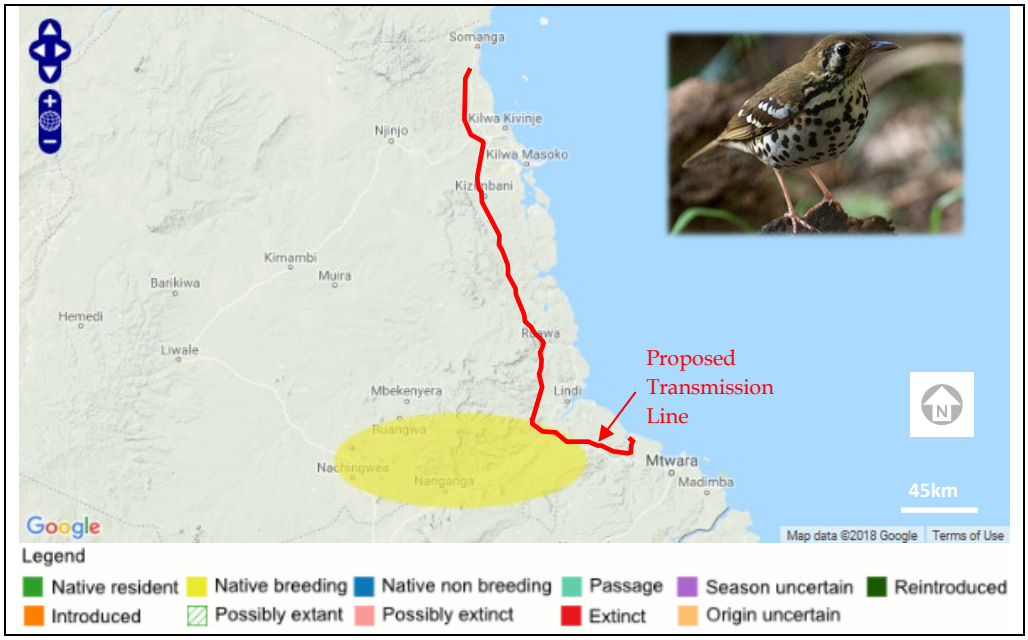


Figure 4-22 Distribution Map of the Spotted Ground Thrush

Source: Birdlife International 2018
http://datazone.birdlife.org/species/factsheet/spotted-ground-thrush-geokichla-guttata/distribution

According to the WCST, Spotted Ground Thrush has a wide but discontinuous distribution The breeding ground of this population occurs in some of the Tanzanian coastal forests and probably northern Mozambique. It is confined to the coastal forests. In Kenya it has been recorded north to Lamu, but with most records from the Gedi and Arabuko-Sokoke Forests. It is present at very low densities throughout the Arabuko-Sokoke Forest, but occurs at higher densities in the few tiny patches of thick coastal forest such as Diani, Jadini, Shimoni and Gede. In Tanzania, the Rondo Plateau and Litipo Forests reserves (among the coastal forests of Lindi District) are the breeding sites for the East African population of the species, and the bird is a regular passage migrant through the coastal forests of Pande and Dondwe (on the outskirts of Dar es Salaam), and those of Kisarawe District (Pugu hills, Kazimzumbwi and Ruvu Forest Reserves). Though not recorded, the species can be expected to occur on passage from Zaraninge forest in Bagamoyo District or other coastal forests in Rufiji, Handeni, Kilwa and Pangani Districts .

African Elephants

The African elephant (*Loxodonta Africana*) is regarded as an important animal in Tanzania. This species is considered Vulnerable based on the IUCN Red List of Threatened Species (2018). The Government of Tanzania, together with international organizations, is exerting efforts to protect these elephants from poachers. According to Worldwide Fund for Nature in Africa, "Tanzania has been extremely hard hit by the latest elephant poaching crisis that has hit the African continent for 10 years" (CNN, 2018).

Based on the database of IUCN Red List, the areas where African elephants are present in Lindi Region are shown in ***Figure 4-23.*** The orange area represents areas where elephants are present. The proposed transmission line will pass through an area in Kilwa District, where African elephants are possibly present ("possibly extant"). And this corridor is still active with the latest occurrence in 2018.

The Ngarama north and Ngarama south coastal forest near Mbwemkuru River are known to be corridors for elephants moving between forest reserves (west) and coastal mangrove forests (east). In particular, riverine forests (including of Mbemkuru River) provide serve as important wildlife refuge.

According to consultations with local people, the elephant corridor between Kilanjilanji village and Mtandi is the only known wildlife corridor in the Study Area. The other formerly know corridors have been largely blocked by agricultural settlements. During field survey, no signs of elephant movement was recorded. Increasing human population in the coastal villages is said to have contributed to this.

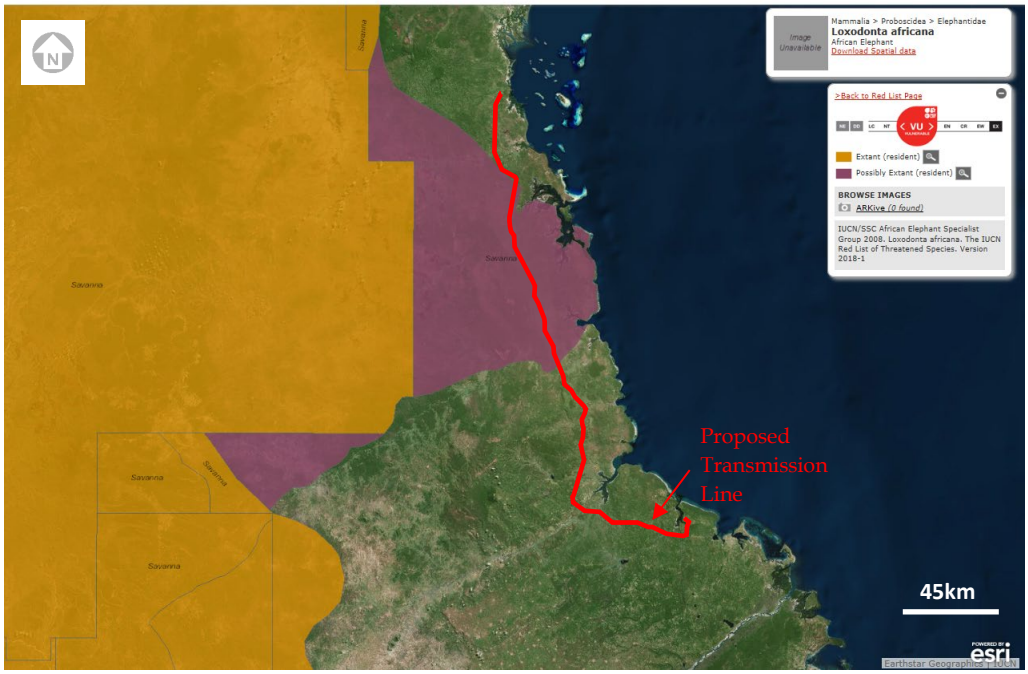


Figure 4-23 Extant Areas for African Elephants

Source: IUCN Red List 2018

4.1.10 Flora

The proposed transmission line route passes through different vegetation types from Mtwara to Lindi. Coastal thickets dominate the slopes and areas with clayey soils. Other vegetation types include miombo woodland with mosaics of cashew and coconut farms on ridges, and plateaus with well drained red soils.

Coastal Thicket/Bushland

This vegetation type is characterised by an assemblage of woody plants shrubs with scattered emergent trees and small patches of evergreen forest canopy of

height ranging between 5-8m. Common tree species includes; *Spyrostachys africana, Cleistanthus schlechteri, Dalbergia melanoxylon, Acacia, Acacia polyacantha, Lamprothamnus zanguebaricus, Afzelia quanzenzis* and *Lannea stuhlmanii*. In small patches of evergreen relic forests trees species of *Hymanaea verrucosa, Manilkara sulcata, Lecaniodiscus fraxinifolius, Pteleopsis myrtifolia, Berlinia orientalis, Manilkara zanzibarica, Markhamia obtusifolia*, *Dichrostachys cinerea*, *Diospyros zombensis, Haplocoelium inopleum* and *Maerua angolensis* becomes common. *Adansonia digitata* (Baobab), *Spyrostachys maproneufolia,Spyrostachys venenifera and Acacia polycantha* becomes more dominant especially on the low land areas, sometimes forming a pure stand of *Acacia polyacantha or Spyrostchys ssp*. This vegetation type covers large section where the transmission line will traverse in villages of Mpapura, Ruhokwe, Mnonela and Namunda of Mtwara and Lindi districts. Also this vegetation type is common from Mtange village, Mtumbikile, Moka, Mavuji and part of Nangurukuru and Matandu villages.

Figure 4-24 Typical Coastal Thickets with baobab on lowlands

Source: IRA, 2018

Lowland miombo Woodland

Lowland miombo woodland covers the raised ridges with well drained red soils. The vegetation is characterized by sparsely distributed wood trees with species like *Terminalia mollis, Jurbenadia globiflora, Milletia stuhlmanii, Milletia dula, Markhamia obtusifolia, Albizia petersiana, Pteleopsis myrtifolia, Combretum hereroense, Combretum apiculatam, Pterocarpus angolensis, Pterocarpus tinctorius, Afzelia quanzensis, Dialium holtzii* and other associated species. This vegetation type is dominated by high value timber species making them vulnerable to illegal harvesting for timber and charcoal. Valuable timber species recorded includes *Milletia dula, Milletia stuhlmanii, Afzelia quanzensis* and *Pterocarpus angolensis*. This vegetation type is common between Mnazi mmoja and Mbuyuni/Ng'apang'apa village in Lindi municipal council; between

Kitomanga village to Mkwajuni village (also in Lindi district) and between Hoteli tatu and Kiwawa and part of mavuji village.

Cashew nut - Coconut vegetation

This vegetation type is characterised by cleared natural vegetation and replaced with agricultural crops and settlements. The characteristic species include Cashew nut (*Anacardium occidentale*), Coconut trees (*Cocos nucifera*), cassava field (*Manihot esculenta*) and Mango (*Mangifera indica*). This vegetation type occurs near villages and settlement areas from Mtwara to Mbwemkuru River. After crossing Mbwemkuru River cashewnuts and coconut farms decreases sharply and are replaced by Simsim and millet farms. These simsim and millet farms extends all the way to Matandu River, after which cashew nut farms becomes more common up to Somanga.

Table 4-10 Plant species identified in the Project Area

	Species name	Author	Red list status	Red list criteria	Version	Year
1	*Milicia Excels*	(Welw.) C.C. Berg	LR/nt		2.3	1998
2	*Pterocarpus angolensis* GPS: 0575893S 8873819E	DC.	LC		3.1	2018
3	Dalbergia melanoxylon GPS: 0564518S 8908316E	Guill. & Perr.	LR/nt		2.3	2017
4	*Vitex zanzibarensis* GPS: 0564518 S 8908316 E	Vatke	VU	B1+2c	2.3	1998
5	*Monanthotaxis trichocarpa* GPS: 0562328 S 8889304 E	(Engl. & Diels) Verdc.	LC		3.1	2006
6	*Dialium holtzii* GPS: 0575893S 8873819E	Harms	VU	B1+2b	2.3	1998

Source: IRA, 2018

4.1.11 Fauna

In terms of fauna the vegetation types identified to characterize various sections of the project area largely creates habitat for small populations of mammals, reptiles, amphibians and birds, while mangrove vegetation tends to support marine organisms. The contribution of the coastal thicket habitat on fauna is important when treated relative to the size of remaining coastal thicket in southern Tanzania, and its impact to the fauna species is insignificant. Thus, consideration of individual taxa groups such as mammals, or amphibians, their populations in these habitats is relatively small.

Mammals

The assessment carried out at Kisiwa power plant sites did not register sightings of any single mammal species; nonetheless signs of mammals like bush pig, civet cat, hare, dikdik, and impala, in terms of droppings and tracks, were noted particularly. Also, large numbers of traps locally made by villagers targeting the mentioned species were observed. Based on observation and results of stakeholder consultations, hunting has significantly contributed to the dwindling population of these identified mammals

Birds and Reptiles

The project area indicates significant population of reptiles mostly on disturbed coastal thickets. The survey observed different types of reptiles including snakes and lizards. Snakes observed include black mamba, Egyptian cobra and sand snake.

In terms of birds, the presence of mangrove forest together with the intertidal zone of the sea shore creates suitable habitats for both resident and migrating birds. During the field survey the Yellow-billed Stork (*Mycteris ibis*) and the Wooly-necked Stork (*Ciconia episcopus*) have been observed. Both species are listed in the IUCN Red List. The Wooly-necked Stork is classified as Vulnerable while the Yellow-billed Stork is classified as Least Concern.

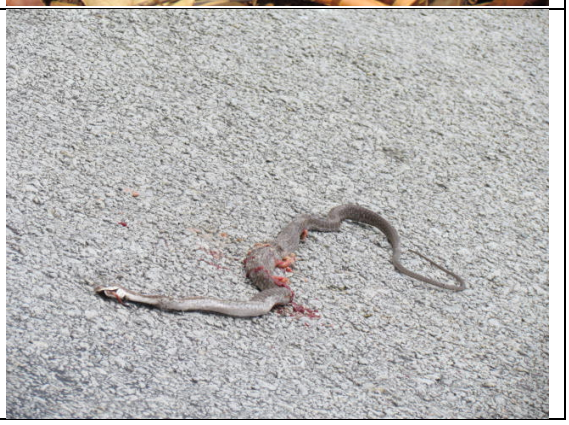
Observed Wildlife

Based on the field survey, wildlife species present along the proposed transmission line route include mammals and birds that are not considered threatened. Observed wildlife and their signs are listed in ***Table 4-11***. These species are not recognized as threatened and do not have conservation status.

Table 4-11 Recorded Wildlife and Signs

	Species name	Sign	Coordinates	Picture
1	*Civet*	Carcas of dead animal	0537792S: 8988276E	

	Species name	Sign	Coordinates	Picture
2	*Bush pig*	Feaces (droppings)	0540057S: 8986555E	
3	Left: Yellow-billed Stork (*Mycteris ibis*) left Right: Wooly-necked Stork (*Ciconia episcopus*)	Birds resting on swampy area at Matandu village	0529925S: 9035478E	
4	*Bush pig*	Wallowing sign	0544135S: 8978224E	
5	*Hare*	Feaces (droppings	0609553 S: 8874359 E	

	Species name	Sign	Coordinates	Picture
6	*Dikdik*	Feaces	0610990 S: 8867770 E	
7	*Impala*	Feaces	608442S: 8874329E	
8	*Black mamba*	Road kill	Mavuji village	

Source: IRA 2018

4.1.12 Sensitivity of the Project Site

In terms of the Project Site, bird corridors and important areas include the following:

- The area between power plant and Mbuo villages: – coastal thicket connected to mangrove forest at Kisiwa bay, other mangroves and tidal zones create important bird feeding ground and roosting site for migratory ones.
- **All major rivers with constant flow crossed by the transmission line**:- Rivers such as the Lukuledi, Mbwemkuru, Mavuji and Matandu create wetlands environments of various sizes and importance that are utilized by birds and other wildlife. The ecological characteristics of these areas constitute Riverine vegetation or habitats mostly with *Bridelia micrantha, Bridelia cathartica, Ficus ssp, Phragmites mauritianus,* sedges on uplands and strips of mangrove vegetation as they enter the Indian Ocean. Being habitast for both terrestrial and marine birds, such Rivers within the project area are considered to be sensitive.

- Coastal forests of Mtwara district, Lindi district and Kilwa district:- these are important bird areas according to IBA international (Baker and Baker, 2003)
- NB- Costal forests of Mtwara, Lindi and Kilwa districts are protected by the law and the map of the forest is attached. Similarly mangrove is protected by the law, Forest Act 2007.
- There is an active African Elephant Corridor which need to be taken into consideration in the design of the proposed transmission line.

With the above-mentioned information, the possibility of bird strikes/kill and elephant collision with the proposed transmission line, exists if precautions are not taken.

4.2 SOCIO-ECONOMIC ENVIRONMENT

This section reviews the project's socio-economic environment, the baseline of which is drawn up at national, regional and local levels. It presents the economic and social conditions in the baseline, using secondary data obtained from the various planning and analysis departments, as well as databases and documents obtained from all District Councils (Mtwara DC, Lindi Urban DC, Lindi DC, and Kilwa DC), which are actively involved in the preparation of the socio-economic profile of their districts. These sources are supplemented by information obtained from observations in the field and consultations with the various stakeholders at ministerial, regional and village levels. Within the context of the socioeconomic component of the EIA, two levels of influence have been considered with regard to the study area:

- The first level involves the project core impact area: This is the area where the actual transmission line and substations will be located and where the electricity will be generated and auxiliary infrastructure are actually located and, which would bear the most impacts than the rest.
- The second level involves the immediate impact area: This is the area that is outside the core area but plays an important role or bears relatively some of the impacts (positive or negative) felt in the core area. The immediate impact area in the case of the proposed transmission line project would generally include villages/settlements close to the transmission line route and substations.

4.2.1 Administrative boundaries and Administrative framework

The study area is administered by the Government of Tanzania under the Prime minister's office, local government and regional administration at the highest level: regions, districts, divisions, wards, villages/mtaa, and sub-villages at the lower level. While the project will be implemented by TANESCO.

Mtwara and Lindi regions where the project will be implemented are headed by a Regional Commissioners; the Mtwara Rural, Lindi Municipal, Lindi Rural and Kilwa districts are headed by the district commissioners. Under the districts, there are divisions headed by Divisional Officers; the division is followed by wards which are headed by ward executive officers, then villages

in rural areas and mtaa in urban setting which are headed by Village/Mtaa Executive Officers. There are also local authorities that generally deal with local service provision led by appointed director under the Local Government Regional administration. For example, all development issues at Mtwara Rural district, Lindi Municipal Council, Lindi Rural and Kilwa District Councils are managed by the Municipal/District Executive Directors.

Thus, the Municipal/District Councils, with its relevant officers, have the mandate to manage and supervise developmental activities under various sectors representing the sector ministries, for this project, the sectoral ministries are the Ministry of Energy through Tanzania Electric Supply Company Limited (TANESCO).

The proposed development of power transmission line from Mtwara rural at Kisiwa village to Kilwa district at Somanga Ndumbo village traverses two regions, four districts, 15 wards and 42 villages (refer to ***Figure 4-25***).

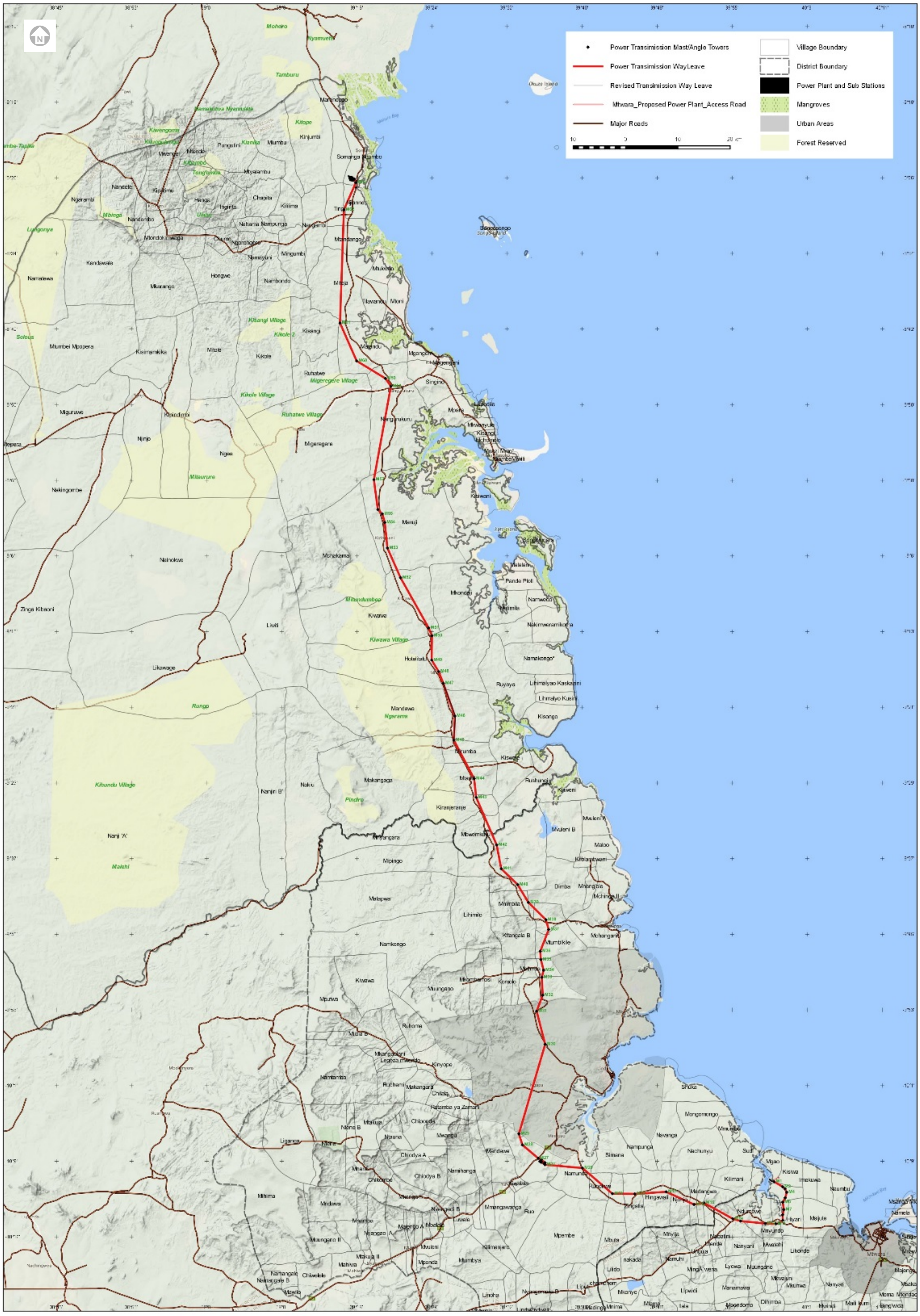


Figure 4-25 Project Affected Areas

Source: IRA, 2018

4.2.2 Demographic profile

Population and Demographic Patterns

According to the Population and Housing Census of 2012, Mtwara district has a population of 228,003. Among the population, 107,922are males and 120,081 are females. The Mtwara rural district population annual growth rate stood at 1.2 which is similar to the Mtwara regional annual population growth and lower than the national population annual growth rates which stood at 2.7. By area the sex –ratio of the population varies from one location to another, however, the general trend of sex ratio shows that the female population is slightly higher than the male population.The district had an average household size of 3.9 persons. The average household size was slightly higher than the regional and lower than the national average household size which stood at 3.7 and 4.8 respectively

Lindi municipality has a total population of 78,841 of whom, 37,525 are males and 41,316 were females. The Municipality has an average household of 3.5 and a sex ratio of 91 with an inter-censual growth rate of 0.9. The stated growth rate is lower than the National inter-censual population growth rate which was 2.9. The population at the current settlement and potential resettlement area are uneven with the female population being slightly higher than the male population, which is not uncommon in Coastal communities, where many males tend to migrate to urban areas looking for jobs. Lindi rural district has a total population of 194, 143 of whom, 91,647were males and 102,496 were females. The district has an average household of 3.7 and a sex ratio of 89 with an inter-censual growth rate of 0.9. The stated growth rate is lower than the National inter-censual population growth rate which was 2.9.

Kilwa District has a population of 190,744. Among the population, 91,661are males and are females. The Kilwa population annual growth rate stood at 0.9 which is similar to the Lindi regional annual population growth and lower than the national population annual growth rates which stood at 2.7. By area the sex –ratio of the population varies from one location to another, however, the general trend of sex ratio shows that the female population is slightly higher than the male population. The district had a total of 36,549 households, with an average size of 4.6 persons per household. The average household size was slightly higher than the regional and lower than the national average household size which stood at 3.8 and 4.8 respectively.

The population distribution along the project area is summarized in ***Table 4-12*** and ***Table 4-13.***

Table 4-12 Population distribution in Mtwara and Lindi region and the project area

Location	Population					Households	
	Male (people)	Female (people)	Total population (people)	Sex ratio (%)	Inter-censual growth rate (%)	Number of Households (HHs)	Average household size (persons)
Tanzania	**21,869,990**	**23,058,933**	**44,928,923**	**95**	**2.7**	**9,276,997**	**4.8**
Mtwara Region	**599,648**	**671,206**	**1,270,854**	**89**	**1.2**	**344,834**	**3.7**
Mtwara District	107,922	120,081	228,003	90	-	-	3.9
Lindi Region	**414,507**	**450,145**	**864,652**	**92**	**0.9**	**225,972**	**3.8**
Lindi Municipal	37,525	41,316	78,841	91	-	-	3.5
Lindi District	91,647	102,496	194,143	89	-	-	3.7
Kilwa District	91,661	99,083	190,744	93	-	-	4.4

Source: 2012 Tanzania Population and Housing Census

Table 4-13 Population Distribution in Project Affected Areas

No.	District Name	Ward Name	Village Name	Male	Female	Total
1	Mtwara	Naumbu	Namgogoli	1017	1026	2043
2	Mtwara	Ndumbwe	Mbuo	1538	1825	3363
3	Mtwara	Ndumbwe	Changarawe	306	430	736
4	Mtwara	Ndumbwe	Ndumbwe	1405	2285	3690
5	Mtwara	Mpapura	Mpapura	952	1573	2525
6	Lindi Rural	Sudi	Mtegu	595	668	1263
7	Lindi Rural	Sudi	Madangwa	985	1200	2185
8	Lindi rural	Sudi	Pangatena	514	711	1225
9	Lindi Rural	Sudi	Njonjo	443	564	1007
10	Lindi Rural	Sudi	Hingawili	1408	1442	2850
11	Lindi Rural	Mnolela	Zingatia	1400	1800	3200
12	Lindi Rural	Mnolela	Mnolela	1681	1185	2866
13	Lindi Rural	Mnolela	Ruhokwe	1343	1562	2905
14	Lindi Rural	Mnolela	Namunda	980	1068	2048
15	Lindi Rural	Kiwalala	Mahumbika	1129	2989	4118
16	Lindi Urban	Mingoyo	Ruaha	659	746	1405
17	Lindi Urban	Ngapa	Ng'apang'apa	299	320	619
18	Lindi Urban	Chikonji	Chikonji kaskazini	1829	1952	3781
19	Lindi Urban	Chikonji	Chikonji kusini			
20	Lindi Rural	Matimba	Likwaya	301	349	650
21	Lindi Rural	Matimba	Moka	540	727	1267
22	Lindi Rural	Kilangala	Mtumbikile	1233	908	2141
23	Lindi Rural	Kilangala	Kilangala A	1311	1321	2632
24	Lindi Rural	Kilangala	Kilangala B	1818	2254	4071
25	Lindi Rural	Kilanagala	Mnimbila	737	963	1700
26	Lindi Rural	Kitomanga	Kitomanga	1196	1223	2419
27	Lindi Rural	Kitomanga	Mkwajuni	1142	1158	2300
28	Kilwa	Mtandi	Mbwemkuru	850	1144	1994
29	Kilwa	Mtandi	Kiranjeranje	1587	1826	3413
30	Kilwa	Mtandi	Mtandi	516	653	1169
31	Kilwa	Mtandi	Mirumba	682	821	1503

No.	District Name	Ward Name	Village Name	Male	Female	Total
32	Kilwa	Mandawa	Mandawa	3000	2600	5600
33	Kilwa	Mandawa	Hoteli Tatu	783	923	1706
34	Kilwa	Mandawa	Kiwawa	989	1040	2029
35	Kilwa	Mandawa	Mavuji	1200	2200	3400
36	Kilwa	Kivinje Singino	Nangurukuru	2211	2509	4720
37	Kilwa	Kivinje Singino	Matandu	3008	2549	5557
38	Kilwa	Miteja	Miteja	1323	1315	2638
39	Kilwa	Tingi	Mtandango	750	871	1621
40	Kilwa	Tingi	Tingi	2035	4048	6083
41	Kilwa	Tingi	Njianne	3170	3150	6320
42	Kilwa	Kinjumbi	Somanga Kusini	810	885	1,670
			Total	49,675	58,783	106,763

Source: NBS, 2012 and Village government offices, 2018

Population Density

The land size and average population densities of the project affected districts are shown in ***Table 4-14***. Mtwara District has the highest population density, while Kilwa has the least density, which may be attribute to its wide area coverage.

Table 4-14 District Level Population Density

S/n	District	Population	Land size in km²	Population density per km²
1	Mtwara Rural	229,056	3,579	64.0
2	Lindi Rural	194,188	5,975	32.5
3	Lindi Municipal	78,842	1,064	74.1
4	Kilwa	208,500	15,000	13.9

Source: NBS, 2012 and District socio-economic profiles, 2015

Based on ***Table 4-14***, Lindi municipal is the most densely populated district which is followed by Mtwara rural district. Kilwa district is sparsely populated than other district. The observed population density for Mtwara rural and Lindi municipal is higher than the national population density while the population for the Lindi rural and Kilwa district is lower than the national populion density which stood at 51.0 (NBS, 2012). The field assessment revealed that most of the people are concentrated along the Dar es Salaam – Mtwara highway while most the areas where the proposed power transmission line traverse has no settlements, except in few villages such as Mbuo and Mirumba villages in Mtwara and Kilwa districts respectively, where the selected power line is crossing some settlements. Most of the project area is characterized by forest, bushland and farms.

Ethnicity and Religion

The ethnic composition along the proposed power transmission line is dominated by the Makonde, Makua, Yaoand Mwela, According the discussion with the district and village leaders, there is a significant number of Makonde peoplein Mtwara rural district as compared to other districts. In terms of religion, it was observed that the majority of the population is made up of mainly Muslims, with a small proportion of the population still practicing traditional African religions.

Gender analysis in the project area

Gender differences are a significant attribute in agriculture, from access, control and ownership of land to marketing of raw and processed produce. In Tanzania, despite constitutional proclamations of gender equality and many laws that promote equal opportunities for both men and women, it remains the case that on both smallholder farms and large plantations, men and women carry out different types of work, have different levels of access to resources, and are unequally rewarded for their contributions to the agricultural system, with women typically having less access and lower incomes (Rubin, 2010)

During the focus group discussion (FGD), it was revealed that there is clear demarcation of activities between men and women in crop production that extends to cassava and sesame. Generally the division of labor tends to follow along the lines of gender relations emanating from traditional practices and religious norms. It was also noted that division of labor vary between activities related to food and cash crops; and marital status. From the FGDs, interview with local authorities it was revealed that in Female Headed Households (FHH) women perform male based activities in both cash and food crops.

There is uneven distribution of labor between men and women. Land preparation activities and marketing in cassava and sesame production are mainly undertaken by males. Females primarily carry out activities from planting/sowing to harvesting. However, in FGDs, it was revealed that both men and women were mainly involved at various stages in plowing to harvesting. Findings from the FGDs showed that at some point women do men's tasks and vice versa and this happens during peak times of cultivation, harvesting, change in marital status and overtime with change in priority of crops as food or cash crops. Despite sharing of roles, overall women are overburden by having more activities and working hours.

Generally, gender equality in the study area is a problem due to cultural practices, religious norms, lower levels of education, poverty, and limited participation in decision making at all levels. It was noted in the FGDs that women have internalized the patriarchal system by being submissive, by losing their bargaining power and by being totally powerless without rights, influence and resource less.

Some villages along the transmission corridor are surveyed. In all villages land is in owned by individuals, villages, or institutions like schools and churches. Land is mainly inherited through a customary land tenure system and is sometimes associated with a particular family (genealogy). It was reported that through allocation by village councils, it is possible to acquire rights on coconut trees on a plot of land owned by another person under customary tenure arrangements. In addition, it is possible to rent farms on the lowlands which are suitable for paddy and tomato cultivation as well as dry season maize production because of the possibility of irrigation. Land rent is either paid in crop harvests or in cash. In some cases land can be borrowed or given. There is no land scarcity in the area.

However, a number of statutes deal with land tenure in Tanzania. The Land Act classifies land into general land which is land governed by the Land Act, 1999; reserved lands, which are lands designated for various purposes and governed by different Acts; and village land governed mainly by the Village Land Act, 1999. Compensation for the compulsory acquisition of land is also provided for by the Land Acquisition Act, 1967.

4.2.3 Housing Condition

Housing conditions is an important indicator of the quality of life in a particular area. Most of the houses in the study area are moderate made up of both traditional and modern construction materials such as corrugated iron sheets for roofing, mud and also cement in some cases for floor and wall.

Figure 4-26 Types of houses along the project area

Source: Source: IRA 2018

4.2.4 *Economic Activities and Livelihoods*

Agriculture

The project area has a number of economic activities principally dealing in agriculture, fishing, petty trade which includes small shops and restaurants. Agriculture is the main and important means of livelihood in all villages along the proposed power transmission line. The major food crops produced in the area are crops are millet, rice, maize, sweet potatoes, legumes and cassava. Cash crops grown in the area include Cashew nuts, coconut, sesame, cassava, ground nuts, and pigeon peas. Many of the farms for cash crops especially cashew nuts are predominantly old and abandoned, although, currently, the district governments are encouraging people within the districts and other investors from outside the districts to invest in cashew nuts plantation. For instance, the discussion with Kilwa, Lindi rural and Lindi municipal confirmed that they have allocated land and were encouraging people to engage in cashew nuts production.

Figure 4-27 Some of the crops grown along the proposed transmission line

Source: Source: IRA 2018

The field observation also noted that there are a few numbers of individuals are involved in off-farm activities such as shops, kiosks and restaurants as a means of livelihood. These were observed in almost all village centres.

Fisheries

The Mtwara and Lindi regions are famous for fishing activities, especially for villages along the coast. Mtwara district and Kilwa districts in particular, are one of Tanzania's coastal regions with a long (ca.130 km) coastline with a number of fisheries opportunities including unexploited commercial deep sea fisheries of tuna, sword fish, sea trout, octopus, and squid. Along the proposed project area, fishing activity was more pronounced at Kisiwa, Namgogolo and Mgao villages in Mtwara district and Somanga Kusini, Miteja, Hotel Tatu and Nangurukuru villages in Kilwa district.

According to the Mtwara regional profile, 2015, the region has about 5,459 registered fishermen involved in artisanal fisheries using simple fishing gear and equipment, thus being able to reach not more than 2.0 km off shore. The marine fisheries contribute 97% of the revenue collected from the fishing sector, while fresh water contributes only 3%. The type of gear and equipment used in fishing in Mtwara Region is poor including dug-out canoes, dhows, motorized boats, fish nets and hooks. Apart from fishing in the Indian Ocean, fishing is also undertaken in rivers (Ruvuma and Lukuledi) and in ponds(in ChidyanaKitele). The region has a total of 46fish ponds in various districts. Also there is crab fattening, and seaweed farming (of Pearl oysters).

Table 4-15 Fisheries yield trends in Mtwara Region

Year	2009	2010	2011	2012	2013
Approximate Weight (tons)	60.45	64.3	64.6	58.0	48.5
Revenue (Tzs)	168,808,741	182,109,670	83,298,350	204,255,645	172,106,140

Source: Mtwara Regional Secretariat, 2015

For management purposes, there are a total of 34Beach Management Units (BMUs) in Mtwara Region, most of which are in Mtwara Mikindani. During the last five years fish production in the region has been declining from 60,474 tons in 2009 to 48,487 tons, valued at Tsh 172,106,140.00 in 2013,resulting in declining revenues (***Table 4-15***). The main challenges facing the fishing industry are associated with human population growth, increased dynamite fishing, overexploitation, and overuse of coastal and marine resources e.g. mangroves cutting, coral mining, dynamite fishing, and construction along the coast. Others include absence of fish storage facilities and processing industries, as well as lack of education on sustainable fishing, inadequate regional budget for this sector, and lack of alternative jobs in rural coastal areas. The proposed measures for future development of fishing industry in the region include:

i. Protection of fish breeding grounds.
ii. Establishment of sea fish farming.
iii. Provision of morden fishing gears and equipment.
iv. Enforcement of national fisheries policy, rules and regulations.
v. Establishment of fish processing facilities in the region

Figure 4-28 Aquaculture and fishery at Kisiwa village in Mtwara district

Source: Source: IRA 2018

However, in Mtwara District council, fishing is done on a 125 km coastal strip and along the Ruvuma River using poor equipment and dynamite. The fishing industry in the district is faced with an acute shortage of modern fishing gear. Discussion with Mtwara District Fishery officer, acknowledged fish catch decrease due to environmental factors such as climate change and population increase which increases more fishers in the area, and illegal fishing gears.

Table 4-16 Fish production data in Mtwara district council

Fish catch (Kg)		Fish sold (Kg)		Amount earned(TSH)	
2014/15	2015/16	2014/15	2015/16	2014/15	2015/16
-	2,160	76,964.2	19,408.0	183,127,866.70	437,389,216.00

Source: Mtwara District Profile, 2015

Salt Production

Salt is also recovered from evaporation of seawater collected in salt pans located along the coast, adjacent to mangrove forests. Salt mining and illegal live coral mining has resulted into dramatic decrease in mangrove forests, destruction of coral reefs and marine environments in late 1990' there are a good number of saltpans in Mtwara some of which are abandoned of these, some are already doing milkfish farming, while the saltpans in Mtwara are sometimes owned by one person, the milkfish ponds in Mtwara and elsewhere are owned by groups of people.

Figure 4-29 Salt farms at Kisiwa village in Mtwara rural district

Source: Source: IRA 2018

Trading and services

Agricultural trade is one of the main trading activities in the area. It is conducted formally (companies with their own transportation coming to purchase commodities in villages) or informally. Petty trade is common, even in small villages. Normal items being sold via petty trade are: agricultural products (often those not produced in the area), charcoal (see ***Figure 4-30***), processed food products (tea, sugar, etc.), household items, kangas, and mobile credit. Petty trade is subject to district registration but it is common for only a small percentage of shops or stalls to be registered. Checks are not frequent and therefore enforcement is limited. Common infrastructure services are related to transportation (buses, motorcycles, boats), communication and leisure (recharge of mobile phones batteries, video-showing, small cinemas, bars, eateries).

Figure 4-30 Charcoal selling at Mkujuni village in Lindi rural district

Source: Source: IRA 2018

Access to Market

According to the study findings, it was reported that about 67.2% households had access to markets while 32.8% had no access to market. The status of the quality of markets was good and moderate by 50.8% and 42.9% respectively. Also, the study findings unveiled that most (42.3%) of the households or PAPs access market at a distance of 0km – 0.1km as shown in the Tables below

Table 4-17 Status of Markets

Status of markets	Number	Percent
Good	96	50.8
Moderate	81	42.9
Bad	12	6.3
Total	**189**	**100.0**

Source: IRA 2018

Table 4-18 Distance of Markets

Distance	Number	Percent
0-0.1km	80	42.3
0.1 - 0.5km	64	33.8
0.5-1.5km	28	14.8
1.5-3.0km	4	2.2
3.0-5.0km	7	3.7
Above 5.0km	6	3.2
Total	**189**	**100.0**

Source: IRA 2018

4.2.5 Health Facilities and Conditions

Health Facilities

Availability of health facilities and services is one of the indicators of quality of life. The districts have hospitals, health centres and dispensaries owned by the government and private institutions. The distribution of health facilities in the districts affected by the project is shown in ***Table 4-19***.

Table 4-19 Health facilities by operating agency

District	Facility Type	Government	Private	Total
Mtwara Rural	Hospital	-	-	-
	Health centers	3	1	4
	Dispensaries	41	-	41
Lindi Urban	Hospital	01	-	01
	Health centres			
	Dispensaries			
Lindi Rural	Hospital	0	01	01
	Health centres	04	02	06

District	Facility Type	Government	Private	Total
	Dispensaries	36	02	38
Kilwa	Hospital	01	01	02
	Health centres	04	-	04
	Dispensaries	37	02	39
Grand Total		**44**	**1**	**44**

Source: Mtwara, Lindi urban, Lindi rural and Kilwa socio-economic profiles, 2016

The health services being provided in the health facilities includes curative services, rehabilitation services, family planning services, child health services, hygiene and sanitation. However, the discussion with district officials with regard to health services revealed that the health performance is adversely affected by limited funds, shortage of essential drugs and staff. This has resulted into poor health service provision in the districts.

The most common diseases in all project affected districts are malaria, respiratory and gastro-intestinal infections. Malaria for three consecutive years has been the number one cause of illness. During the 2014/2015 fiscal year malaria alone accounted for 59% of all the cases that attended OPD and IPD. In addition TB, leprosy, AIDS, schistosomiasis and filariasis are endemic. Life expectancy at birth in Tanzania is 51 years and in MRD it is 46 years. Also in MRD, the infant mortality rate is 146 per 1,000 live births, the under 5 mortality rate is 167 per 1,000 live births and maternal mortality rate is 340 per 100,000 live births

Access to Health Services

According to the findings of socio-economic survey, it was reported that about 60.8% of respondent's households had access to health services while 39.2% had no access to health services. The status of the quality of health services was good by 37.6%. Also, the study findings unveiled that most (53.5%) of the households or PAPs access health services at a distance of 0.5km – 1.5km as shown in ***Table 4-20***.

Table 4-20 Access to dispensary

	Number	Percent
Yes	115	60.8
No	74	39.2
Total	189	100.0

Source: IRA, 2018

Table 4-21 Status of dispensary

Status	Number	Percent
Good	71	37.6
Moderate	109	57.8
Bad	9	4.6
Total	189	100

Source: IRA, 2018

Table 4-22 Distance to dispensary

Distance	Number	Percent
0-0.1km	6	3.2
0.5km	51	26.9
0.5-1.5km	101	53.5
1.5-3.0km	28	14.8
3.0-5.0km	1	0.5
Above 5.0km	2	1.1
Total	189	100.0

Source: IRA, 2018

4.2.6 *Social Infrastructure and Services*

The project areas have various social services such as schools, health facilities, water, transport and communication at different levels and quality. This section outlines different social services available in the project affected areas.

Education and Schools

Education in Mtwara Lindi Urban, Lindi Rural and Kilwa district

According to the Mtwara district profile, 2015, by 2014 the district had a total of 117 pre - primary schools. So that it is estimated more than 93% of eligible 5 to 6 years old attended pre-schools in 2014. The data show that the balance between sexes is almost 49:50. The average number of pupils per class is 49 to the district. On the other hand the average number of pupils per teacher varies a lot. The district average is 1:49. For the case of primary schools, the council has total of 127 primary schools with a total enrolment estimated at 46,519. Girls are 23,138 of the total enrolment, whereas boys are 23,381.

In Lindi urban and rural and Kilwa districts, every village along the proposed power transmission line has at least one primary school. The schools are suffering from insufficient number of classrooms, shortage of teachers in relation to the number of students and teaching materials.

Figure 4-31 Namgogoli primary school in Mtwara rural district

Source: IRA, 2018

Access to Primary School

According to the socio-economic survey within the project area, it was reported that about 94.2% households had access to primary schools while 5.8% had no access to primary schools as shown in ***Table 4-23***. Shortage of teachers and teaching materials were reported to be the major concerns of parents and teachers. Also, the study findings unveiled that most (41.8%) of the households or PAPs access primary schools at a distance of 0.1km – 0.5km as shown in ***Table 4-24***.

Table 4-23 Access to primary school

Access to primary school	Number	Percent
Yes	178	94.2
No	11	5.8
Total	**189**	**100.0**

Source: IRA, 2018

Table 4-24 Distance to primary school

Distance	Number	Percent
0-0.1km	51	26.9
0.1 - 0.5km	79	41.8
0.5-1.5km	40	21.2
1.5-3.0km	8	4.2
3.0-5.0km	7	3.7
Above 5.0km	4	2.0
Total	**189**	**100.0**

Source: IRA 2018

Access to Secondary School

According to the study findings, it was reported that about 45.5% households had access to secondary schools while 54.5% had no access to secondary

schools. The status of the quality of secondary schools was good by 25.4%. Also, the study findings unveiled that most (59.8%) of the households or PAPs access secondary schools at a distance of 1.5 km – 3.0 km. Long distance to secondary schools was reported as a major challenge to students and has resulted to truancy and school dropout.

Table 4-25 Access to secondary school O- level

	Number	Percent
Yes	86	45.5
No	103	54.5
Total	**189**	**100.0**

Source: IRA, 2018

Table 4-26 Status of Secondary School o-level

	Number	Percent
Good	48	25.4
Moderate quality	133	70.4
Poor quality	08	4.2
Total	**189**	**100.0**

Source: IRA, 2018

Table 4-27 Distance to Secondary School O-level

Distance	Number	Percent
0-0.1km	10	5.3
0.5km	23	12.2
0.5-1.5km	26	13.8
1.5-3.0km	113	59.8
3.0-5.0km	12	6.3
Above 5.0km	5	2.6
Total	**189**	**100.0**

Source: IRA, 2018

Education Level of PAPs

According to the result of socio-economic survey of the PAPs in the project area, PAPs have formal education with 36.1% of PAPs having undertaken primary education, 3.1% secondary education and 0.4% having university education while 15.1% do not have any formal education. Other level of education for the entire population is shown in ***Table 4-28*** and ***Table 4-29***.

Table 4-28 Level of education for household members

Level of education	Number	Percent
No formal education	166	15.1
Not of school age	93	8.5
College undergraduate	4	.4
Vocational/technical graduate	4	.4
Pre - primary school	30	2.6
Primary school	396	36.1
Secondary school O-level	34	3.1
Secondary school A-level	4	.4
Primary drop out	56	5.1
Secondary school drop out	13	1.2
Attending primary school	230	20.9
Attending secondary school	68	6.2
Total	**1,098**	**100.0**

Source: IRA, 2018

Table 4-29 Education Attainment

Administrative Unit	Population (Unit: %)										
	Not of school age	No formal education	pre primary school	Primary school		Secondary school				Collage undergraduate	Vocational /Technical graduate
				Drop out	Graduated	Drop out	Attending	O-level	A-level		
Mtwara	11.2	9.7	3.5	2.3	42.5	2.3	4.6	3.1	0.0	0.8	0.0
Lindi Rural	6.0	14.0	2.5	7.7	36.7	0.5	7.9	3.6	0.5	0.3	0.3
Lindi urban	0.0	15.2	6.1	3.0	30.3	0.0	18.2	3.0	0.0	0.0	3.0
Kilwa	8.9	21.5	2.8	4.5	32.0	0.6	3.9	3.3	0.0	0.3	0.6
Total	**8.1**	**15.5**	**2.9**	**5.0**	**36.4**	**1.0**	**6.0**	**3.3**	**0.2**	**0.4**	**0.4**

Source: IRA, 2018

Transportation

Road Transport

Mtwara District has a total of 951 km of roads, of which 25 km are made of gravel, 561 km are earth roads. The Mtwara - Masasi road is the only tarmac road which runs across Mtawara District. Besides this, there 25 trunk roads, 286.8 regional roads, 544 district roads and 92.5 feeder roads. It is estimated that the proposed transmission line will cross around 15 major roads. Bicycles are the main transportation mode on land.

Villages in Kilwa, Lindi Urban and Lindi Rural Districts are accessible by a tarmac road from Dar es Salaam, which is approximately 320 km away. All feeder roads are seasonal, passable only by four wheel drive vehicle during the rainy season.

Maritime Transport

On the other hand, boats also facilitate easy access to Mtwara town by coastal people. There are few cases of local cargo ships/boats operating between Mtwara, Kilwa, Lindi, Dar es Saalam, Zanzibar while other cargo and fishing boats operates between Mtwara and neighbouring Mozambique country.

Transport by sea comprise of boats from Dar es Salaam via Lindi to Mtwara, there also small boats, dhows and all sorts of sea transport equipment sailing from various townships such as Mafia and Zanzibar to Kilwa District.

Aviation

Kilwa is also accessible by air through chartered Cessna flights. The airstrip is small and has an earth surface runway; as such it cannot accommodate private airline companies such as Coastal Air and Tropical Air. On the other hand, Mtwara District has no airport.

Water and Sanitation

Water

According to the districts socio-economic profiles, it was evident that a significant number of people in Mtwara rural, Lindi urban, Lindi rural and Kilwa have limited access to safe and clean water. Based on the socio-economic profiles, in Mtwara district there is about 62.2% of rural population with access adequate clean and safe water through piped water supply schemes, deep and shallow wells fitted with hand pumps, charcoal dams and rain water harvesting tanks. The coverage of water supply falls below the national water supply coverage (65% in rural coverage by June, 2015). The situation of safe and clean water is worse in other districts where the majority of the people depends on rivers and shallow wells which become dry during the dry season.

Table 4-30 Water Supply Sources in Mtwara

Type water supply of Facility	Total	Functional	Non-Functional	Average Population Served	% served
Shallow wells fitted with hand pump	368	246	122	45,601	20
Deep wells fitted with hand pump	368	69	2	18,240	8
Piped Water Supply Schemes	25	19	6	69,997	30.7
Charco dams	10	8	2	7,296	3.2
Rain Water Harvesting Tanks	98	98	0	684	0.3
Total				**141,818**	**62.2**

Source: Brief report of district development status 2015

According to the socio-economic survey within the project area, it was reported that all households had different type of access to water services. A significant percent (44.4%) reported to access water from communal stand pipe, followed by 18.5% who accessed water from boreholes, river (11.1%) as shown in **Error! Reference source not found.**. Water from pipes within the house were accessed by very few households (7.9%). The status of the water quality in their villages was good by 52.4%. Also, the study findings unveiled that most (74.5%) households or PAPs access water at a distance of 100m – 500m.

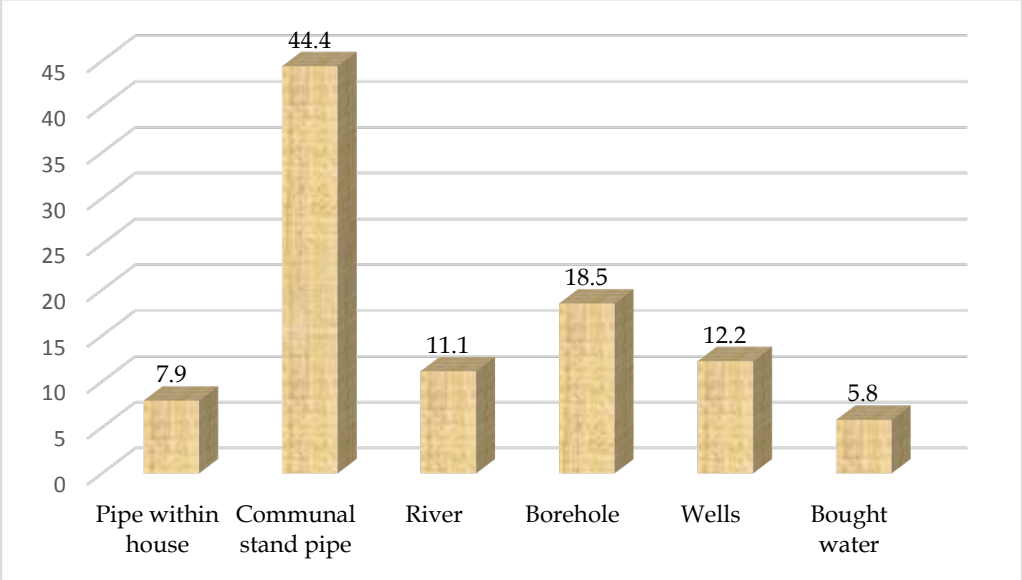


Figure 4-32 Source of drinking water supply

Source: IRA, 2018

The limited access to safe and clean water is attributed by several factors such as inadequate funds, malfunction of water facilities, dilapidated water facilities and lack of reliable water sources.

Sanitation

The socio-economic survey examined availability and status of sanitation facility such as toilets along the villages traversed by the proposed transmission line. In view of the findings of the study, it was reported that about 6.4% of the respondents had flush toilet, 32.8% of respondents are using pit latrine (VIP), 60.8% of respondents are using pit latrine. Refer to ***Table 4-31***.

Table 4-31 Status of sanitation facilities

Type of toilet facilities	Number	Percent
Flush toilet	12	6.4
Pit Latrine (VIP)	62	32.8
Pit Latrine	115	60.8
Total	**189**	**100.0**

Source: IRA, 2018

Energy

Source of lighting energy

The socio-economic survey found that about 35.9% of PAPs were using kerosene for lighting, 31.3% responded to use electricity while 32.8 of the respondents were using solar energy for lighting as shown in ***Table 4-32***.

Table 4-32 Source of lighting energy

Type of lighting energy	Number	Percent
Kerosene	68	35.9
Electricity	59	31.3
Solar Energy	62	32.8
Total	**189**	**100.0**

Source: IRA, 2018

Source of cooking energy

The socio-economic survey found that about 69.3% of PAPs were using fuelwood for cooking, 25.9% responded to use charcoal while 4.8% of the respondents were using kerosene for cooking as shown in ***Table 4-33***.

Table 4-33 Main Source of cooking fuel

Type of cooking energy	Number	Percent
Fuel wood	131	69.3
Charcoal	49	25.9
Kerosene	09	4.8
Total	**189**	**100.0**

Source: IRA, 2018

Solid waste management

Solid waste generation and management is a major problem in Tanzanian cities and town. For years the country has experienced increased waste generation while the capacity to manage the amount generated remains to be a big challenge. Solid waste management in Lindi and Mtwara-Mikindani municipalities is directly related to the growth of economic activities and population growth together with changes in economic status of the households.

The average solid waste generation per day in Lindi Municipality is 55.66 tons, while that in Mtwara-Mikindani Municipality is about 97.5 tons/day, with an average generation rate of 0.9kg per day per person. A large percent of this waste is domestic waste, which accounts for 73%. The collection capacity of Lindi Municipality is only 21 tons/day, which equals 37.73%, while that in Mtwara Mikindani is about 59 tons/day (60.51%). The nature of the waste generated is largely domestic due to the dominant economic activities characterized by none industrial waste. However Mtwara has experienced significant shift of economic activities with the discovery of natural gas where activities related to exploration of gas, growth of cement industries and related industries has increased generation of different types and nature of waste to deal with. (Mtwara LGAs 2015)

Solid waste management in Mtwara

The collection system is based on community collection points at which all nearby residents dump their waste. People bring waste to the collection points either manually, with push carts, or with private vehicles. There are 25 collection points, most of which are sand-block structures covered with corrugated iron sheets. They were designed to collect wastes brought by

community based organizations (CBOs) assigned to collect wastes from individual households and markets. Currently the collection points are served with skip containers in which individuals throw their waste, Transportation of the waste is conducted by municipal vehicles. The municipality has two skip masters and four tipper trucks for the transportation of waste to the dumpsite located at Mangamba about 10 km from the town centre.

The solid waste system described provide services to the municipal areas whereas the rural areas like Kisiwa and Namgogori villages such elaborate system of waste collection is lucking. Most of the rural setting practice burning or buried in individual household pits where different types of waste are dumped without sorting.

The increase in industries related to cement and natural gas will pose a challenge in dealing with the waste generated. The sanitary landfill developed at Mgamba site is designed to handle domestic to light industry waste. There will be a need to find a proper way of handling waste generated from the proposed power plant.

Currently, Mtwara-Mikindani municipality is implementing a decentralized system of solid waste management in which all collection of waste and refuse fees will be conducted at ward level. A number of CBOs have been organized and trained on how to collect waste from individual household and transport it to the nearby collection points. Each group will be assigned to a specific street/streets to collect waste and refuse fees in order to ensure continuity of service. The municipal vehicles will be available for transportation of the waste, while fuel and casual labor will be provided/ paid for by the specific ward in which the truck works on that specific date.

The low capacity for collection in these municipalities is attributed to the lack of equipment for solid waste collection and transportation, lack of staff in the cleansing and environment departments within the municipal councils, lack of proper organization and coordination of the solid waste management system by the municipal staff, the absence or weak involvement of community based organizations to deal with the waste at household levels, and failure of the municipalities to collect service charges and to enforce the solid waste management regulations.

Solid waste management in Lindi region

The collection system in Lindi is door to door, whereby a collection tractor and trailer pass along the roads and collect all wastes stored in plastic sacks and waste bins, especially in the CBD wards. Residents store the wastes they generate in their premises until the collection day when a few community groups collect and transfer the waste from the households to the roadsides. There, the waste is picked up by the municipal vehicle and taken to Machole dumpsite about six kilometers from the town centre. The municipalities low capacity to collect waste daily, result in the accumulation of heaps of waste, causing a nuisance to nearby communities. Communal collection points are only in the markets. Currently the municipality has hired two tractors and two

trailers for collection and transportation. Some individuals, especially those working in seed peeling and timber usually prefer to transfer their waste directly to the dumpsite to avoid accumulation of dust/residuals.

Currently, there is no formal material recovery process in place in the waste management system of Lindi municipality. However, there are various informal activities involved in recovering material from the waste stream. There are two groups involved in buying the plastic and metallic materials recovered from waste streams by individual scavengers. However the firms have no proper record of the waste received, making it difficult to estimate the amount of the waste being recycled.

Similarly for Lindi the solid waste system described provide services to the municipal areas whereas the rural areas likely to be crossed by transmission line luck such elaborate system of waste collection. Most of the rural setting practice burning or buried in individual household pits where different types of waste are dumped without sorting.

4.2.7 Socio-economic characteristics of Project Affected People

This section describes socio-economic status of the households that are to be affected by the proposed Project. The Socio-Economic Survey was conducted from 05th to 17th, August, 2018 using an open ended and closed ended questionnaires which were administered to the households that were found within the 52m wayleave of the transmission line.

Given the large area that will be covered by the Project, there will be a number of people that will be affected including the vulnerable and marginalized groups from different social and ethnic background. As a result, when preparing the RPF for this Project, it is important to consider these diversities and ensure that all affected people are included in the consultation and appropriate mitigation measures are devised to make sure no one will be worse off as a result of the project. Moreover, the social and cultural lives of the affected people are not disturbed and if it is necessary they have to be restored in socially appropriate manner. Based on the field observation, the number of Project Affected People for the entire transmission line were estimated to be 1,025. The analysis of each parameter of socio-economic characteristics of the households is provided in the following sub-headings;

Characteristics of Household Heads

The largest percentage of respondents falls within the age bracket of 41–60 (48.8%), followed by 20-40 (27.5%). Those who are in the age group of above 60 years of age accounts for 23.7% of the respondents as shown in ***Table 4-34***.

Table 4-34 Age group of Household Heads

Age group	Number	Percent
20 – 40	52	27.5
41 – 60	92	48.8
Above 60	45	23.7
Total	**189**	**100.0**

Source: IRA, 2018

The assessment of gender shows that out of the total head of households 87.3%, are males and the remaining 12.7% are females as shown in ***Table 4-35***. Based on local traditions in various parts of the country, men are considered to be the heads of households.

Table 4-35 Gender of Household Heads

	Number	Percent
Male	165	87.3
Female	24	12.7
Total	**189**	**100.0**

Source: IRA, 2018

Economic Activities of the interviewed PAPs

Data of socio-economic survey among adult population over working age shows that farming is the primary economic activity undertaken by a significant number of the heads of households 164 (86.8%). Other head of households were involved in petty trade (3.7%), fishing (3.2%), livestock keeping (1.5%) and casual labourer (4.8%) as shown in ***Table 4-36***. The major food crops grown in the village are maize, paddy, sorghum, cassava, sweet potatoes and millets. Maize and paddy are the major staple food crops. Other food crops in the area include groundnuts, tomatoes, fruits and vegetables.

Table 4-36 Population Distribution of head of households by Primary Occupation

Primary occupation	Number	Percent
Farmer	164	86.8
Livestock keeper	03	1.5
Petty trader	07	3.7
Casual labourer	09	4.8
Fisherman	06	3.2
TOTAL	**189**	**100.0**

Source: IRA, 2018

The assessment of primary occupation to all household's members is shown in ***Table 4-37***.

Table 4-37 Population Distribution of head of households by Primary Occupation

District	Farmer	livestock keeper	Petty trader	Students	Casual labour	fisherman	Total
Mtwara Rural	63.6	0.4	4.2	27.6	3.3	1.1	100.0
Lindi Rural	60.6	0.0	4.0	33.2	1.8	0.0	100.0
Lindi urban	67.4	0.0	0	30.2	2.3	0.0	100.0
Kilwa	72.6	0.5	2.3	23.4	1.0	0.0	100.0
Total	**68.5**	**0.3**	**3.5**	**25.4**	**2.1**	**0.3**	**100.0**

Source: IRA, 2018

Source and Average monthly income of the interviewed PAPs

During the household survey, the respondents were interviewed on the sources of their income in the past year and how such sources of income were important to their livelihoods. The study findings reveal that most (89.8%) of the households had sources of income while least (10.2%) had no source of income in the past year. For those who had sources of income, most of the respondents reported that their major (76.3%) source of income in the past year was agriculture. The average monthly income for the head of households is shown in ***Table 4-38***.

Table 4-38 Head of households' average monthly income

Average monthly income	Number	Percent
Less than 100,000	61	40.5
101,000 - 200,000	39	25.8
201,000 - 300,000	28	18.6
301,000 - 400,000	12	7.9
401,000 - 500,000	7	4.6
Above 500,000	4	2.6
Total	**151**	**100.0**

Source: IRA, 2018

Ownership of Durable Goods and Other Assets (Livestock)

The household survey indicated that majority of households had reported to have durable assets, although the level of ownership of durable assets differs from household to another depending on their socio-economic status. The percentage distribution of household's ownership of durable assets is shown in ***Figure 4-33***.

Overall, 95 percent of the district's households own their dwellings while 94 percent owns some land. 41 percent of all households own both small and large livestock while only 13 percent of all households own large livestock. While 74.7 percent of all interviewed households own a radio, 56.6 percent own bicycle, 20.6, 15.9, 8.5 and 5.3 percent own motorbike, television, electric fan, refrigerator respectively.

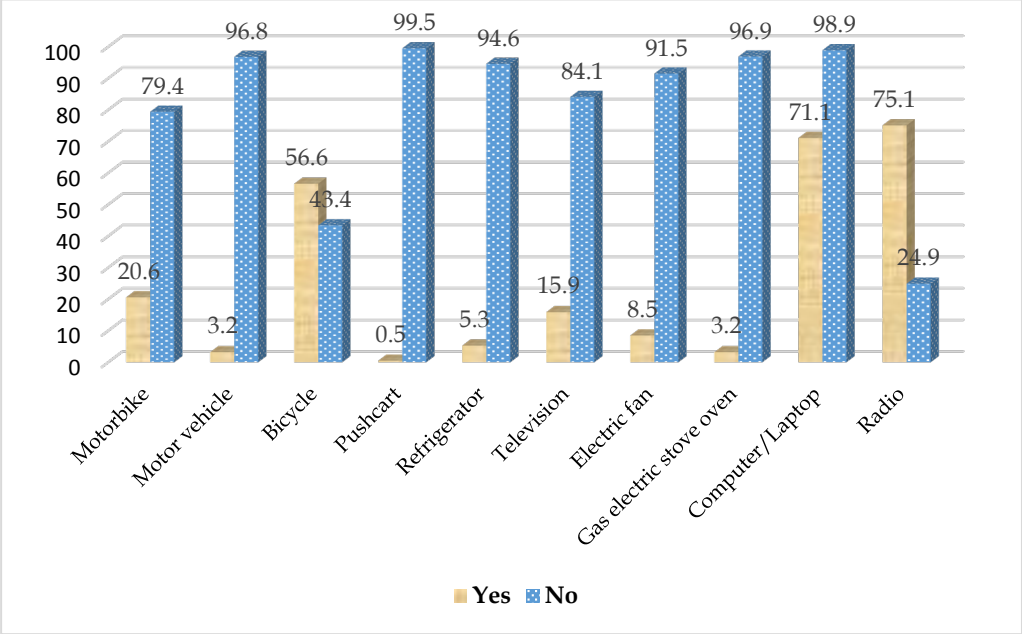


Figure 4-33 Ownership of Durable Goods

Source: IRA, 2018

Table 4-39 Ownership of Other Assets (Livestock)

Cow	Goats	Sheep	Chicken	Pig	Dog	Cats
12	167	09	746	01	05	01

Source: IRA, 2018

4.2.8 *Archaeological and Cultural sites/resources*

Given the ethno-historical surveys and random surface walkover archaeological surveys conducted during the scoping stage and based on sub-survey in particular through Shovel test pits conducted in one village in each of the project wards, it has been possible to identify the following archaeological sites and non-archaeological cultural heritage sites along the transmission line:

Graveyards and/ or ritualistic sites in Mandawa and Mandangwa villages along the transmission line.

Some are isolated graves while others are concentrated graveyards for the community. Some are abandoned and others are in use. As elsewhere, the graveyards are used for ritualistic activities. Given sensitivity of graveyards to the villagers, these non-archaeological sites have very high importance.

Archaeological sites in Mahumbika and Kitomanga villages.

The archaeological sites are mostly composed of potsherds. Based on the concentration of the materials, chronology and sensitivity of the people, it is suggested that these have low to high importance.

Table 4-40 Identified Archeaological Sites

Village name	Site name	Significance	Importance	Easting	northing
Mahumbika	Mahumbika archaeological site	Archaeological	Medium	564239	8878521
Kitomanga	Kitomanga archaeological site	Archaeological	Low	560759	8930698
Mandangwa	Mandangwa graveyard site	Religious	Very High	594179	8869572

Source: IRA, 2018

Archaeological site test pits (STPs).

There are 13 STPs found along the proposed transmission line route. Although these sites are not protected by law, these sites have the potential to contain archaeologically, historically and/or culturally important items. These sites will have to be considered when something has been discovered during construction stage.

Table 4-41 STP excavated along the TL

Village Name	Location	STP	Easting	Northing
Mpapura	Mtwara – Somanga Transmission Line	STP1	600741	8867135
Mtegu	Mtwara – Somanga Transmission Line	STP2	596815	8869335
Zingatia	Mtwara – Somanga Transmission Line	STP3	582652	8871617
Mahumbika	Mtwara – Somanga Transmission Line	STP4	564239	8878521
Ng'apa	Mtwara – Somanga Transmission Line	STP5	563080	8891875
Changalawe	Mtwara – Somanga Transmission Line	STP6	606826	8865918
Chikonji	Mtwara – Somanga Transmission Line	STP7	564868	8903408
Moka	Mtwara – Somanga Transmission Line	STP8	565294	8914655
Kitomanga	Mtwara – Somanga Transmission Line	STP9	560759	8930691
Kiranjeranje	Mtwara – Somanga Transmission Line	STP10	552571	8947959
HoteliTatu	Mtwara – Somanga Transmission Line	STP11	545346	8972352
Matandu	Mtwara – Somanga Transmission Line	STP12	527975	9036200
Tingi	Mtwara – Somanga Transmission Line	STP13	527153	9059683

Source: IRA, 2018

5 STAKEHOLDER CONSULTATION AND PUBLIC PARTICIPATION

5.1 INTRODUCTION

Section 89 of the Environmental Management Act (EMA, 2004) and EIA Regulation17 (URT, 2005) provide details and procedures for public participation in the EIA process. The term "stakeholders" has become common in the EIA process and stakeholders' participation is important component of the EIA process. It is one of the key factors that enhance environmental governance. Stakeholders are individuals, groups of individuals or institutions that have interest in the proposed project. This includes those positively and negatively affected by the project. Stakeholder participation involves processes whereby all those with an interest in the outcome ofa project actively participate in decisions on planning and management of the proposed development.

In EIA process stakeholder is given a very broad definition to encompass all different individuals, groups of individuals, government agencies, and beneficiaries, cooperate bodies and all other formal or informal groups associated with a project. The range of potential stakeholders to EIA was greatly a factor of the definition of the project boundaries but it is important to be 'inclusive' rather than 'exclusive' and ensure that all those who might be affected or affect the project are fully engaged in the EIA process. Simple methods such as networks diagrams, literature review and interviews were used to identify the range of stakeholders for the proposed development. The list of stakeholders is provided in **Section 5.3** of this report.

5.2 AIMS AND OBJECTIVES OF THE PUBLIC CONSULTATION

The purpose of public consultation, during the scoping and full EIA, was to ensure that the views, interests, and concerns of project stakeholders are taken into account in the assessment of the potential impacts of the project as well as in project decisions, particularly in the design of mitigation measures. In addition, the public consultation aims to improve communication between the project and impacted or interested groups. In the course of preparing for stakeholders consultation, the following activities were undertaken:

- Stakeholder identification and analysis;
- Determine the type of consultation activities to be undertaken with each category of stakeholders;
- Information disclosure, specifically the provision of timely and meaningful information that is accessible to all stakeholders;
- Prepare the approach to and mechanisms for obtaining stakeholder feedback on the information disclosed;
- Prepare principles and ground rules guiding consultation with local communities; and the program for consultation to ensure timely notification of consultation activities and to tie in with key stages in the EIA process.

5.3 STAKEHOLDER IDENTIFICATION AND ANALYSIS

Identification of stakeholders is a first and essential step in effective engagement. It is necessary to determine exactly who the stakeholders are and understand their priorities and objectives in relation to the proposed project. By classifying and analyzing the stance, influence, capacity and interests of stakeholders it was possible to develop a plan that was tailored to the needs of different stakeholder groups. This information was then used to tailor engagement to each type of stakeholder. As part of this, it was important to identify individuals and groups who may find it more difficult to participate and those who may be differentially or disproportionately affected by the project because of their marginalized or vulnerable status. It was also important to understand how each stakeholder may be affected - or perceives they may be affected – so that engagement can be tailored to inform them and understand their views and concerns in an appropriate manner.

For the Mtwara-Somanga Transmission Line Project stakeholders were identified on an ongoing basis by:

- Identifying the different categories of parties who may be affected by or interested in the project; these groups are presented in Table 5-1 and
- Identifying specific individuals or organizations within each of these categories taking into account:
    - the expected area of influence of the project, that is the geographical area over which it may cause impacts (both positive and negative) over its lifetime, and therefore the localities within which people and businesses could be affected; and
    - the nature of the impacts that could arise and therefore the types of government bodies, nongovernmental organizations, academic and research institutions and other bodies who may have an interest in these issues.

Stakeholder identification was a particular priority at the beginning of the EIA process; however additional stakeholders were identified during the full EIA study. The process of identifying the individuals and organizations within each group is a continuing one. A large number of potentially affected and interested parties were identified from:

- contacts that the project has already made with communities, government departments and other organizations as part of its public consultation and government relations activities to date; consideration of the area of influence of the project as it has currently been defined during the initial stages of the EIA;
- contacts made through a EIA done for the other related thermal plant located within the project area and

Details of individual stakeholders are shown in ***Table 5-1*** ; however, the list will be periodically updated throughout the engagement process.Stakeholders were pre-determined based on the nature of the project as follows:-

Table 5-1 List of stakeholders

Stakeholder Groups	Stakeholder	Relevance to project
Central Government	Ministry of Energy	Client and beneficiary
	Ministry of Land, Housing and Human Settlement Development	Land acquisition and land rights (titles); Resettlement issues
	Ministry of Natural Resources and Tourism	Natural resource base (water, land, wildlife, forest) their use, management and issues
	Ministry of Energy	To set and monitor implementation of policies, strategies and laws for sustainability of energy to enhance growth and development of the economy
Regional and local government: administrative and technical	i. Mtwara Regional Secretariat ii. Lindi Regional Secretariat iii. Mtwara District Council iv. Lindi Municipal Council v. Lindi District Council vi. Kilwa District Council	Beneficiaries from employment and Direct and indirect economic opportunities.
Government agencies	i. Tanzania Electric Supply Company –Mtwara - Zone and Regional office. ii. Tanzania Electric Supply Company – Lindi Regional office iii. Tanzania Forest Service iv. Marine Park – Mtwara office	Electricity generation, electricity transmission, electricity distribution and sale of electricity. Natural resource base (water, land, wildlife, forest) their use, management and issues
	TARURA – Mtwara Regional office	Responsible for infrastructure Development – Access road to Kisiwa village
International and Regional Governmental Bodies / Financial Institutions	International Finance Corporation – Japan International Cooperation Agency (JICA)	Financiers and regulators.(International standards)
Ward, Villages and Mtaa	Ward, Village and Mtaa Executive Officers	PAPs representatives
	Physically and economically displaced Project Affected People (PAPs)	Land and properties owners, Entitles to compensation for land acquired in accordance with the Land Acquisition Act and Livelihood Restoration Plans
Civil Society	National and regional NGO's	Protection of rights of residents of the local communities and the Environment during the project implementation Education and raising awareness

N.B: Stakeholders listed in the table above may change and are only an indication of potential stakeholders to be engaged

Source: IRA, 2018

5.4 LIST OF STAKEHOLDERS CONSULTED

Simple methods such as networks, literature review, focused group discussion and interviews were used in the process of stakeholder identification. From one stakeholder, the team was connected to another stakeholder, in a chain like or network process. The range of potential stakeholders to an EIA was guided by the definition of boundaries for the EIA. In this EIA the following stakeholders were identified and consulted.

Table 5-2 Total number of participants

Main Topic/Meeting Name	Male	Female	Total
Sensitization and awareness meeting with Regional and District Officials	66	11	77
Meeting and consultation with village leaders	68	11	79
Public meeting and awareness with normal villagers	2,367	749	3,216
Focus Group Discussion	00	197	197
Consultation with other Stakeholders	04	01	05
Consultation with Sectoral Ministries	05	01	06
Total	**2,510**	**970**	**3,580**

Source: IRA, 2018

Regarding the institutional stakeholders, following stakeholders were identified and consulted.

i. Mtwara Regional Secretariat
ii. Lindi Regional Secretariat
iii. Mtwara District Council
iv. Lindi Municipal Council
v. Lindi District Council
vi. Kilwa District Council
vii. Tanzania Electric Supply Company –Mtwara - Zone and Regional office
viii. Tanzania Electric Supply Company – Lindi Regional office
ix. Tanzania Forest Service
x. Marine Park – Mtwara office
xi. 15 wards and 42 villages along the proposed power transmission

Other stakeholders at ministerial level are:-

i. Ministry of Energy
ii. Ministry of Natural Resources and Tourism
iii. Ministry of Water and Irrigation
iv. Ministry of Lands, Housing and Human Settlements Development
v. Ministry of Agriculture, Food Security and Cooperatives

5.5 METHODS OF STAKEHOLDER'S PARTICIPATION

The public participation process for the proposed development has been designed to satisfy the requirements laid down in the Environmental Management Act (EMA, 2004) and EIA Regulation 17 (URT, 2005) and is also compliant for the other relevant Acts. The process ensures that all stakeholders have an opportunity to raise their concerns and views as part of an open and transparent process, which in turn ensures a comprehensive environmental study. The purpose of stakeholders participation and the engagement process was to: (i) inform a broad range of stakeholders about the project and the environmental process to be followed; (ii) establish lines of communication between stakeholders and the project team; (iii) identify all the significant issues in the project and; (iv) identify possible mitigation measures via environmental management plans to minimize and/or prevent environmental impacts, associated with the project.

Various methods were used in ensuring that all relevant stakeholders are consulted and their views incorporated in this EIA report. Participatory methods such as focus group discussion, household questionnaires and public meetings were used. The team also visited all critical sites in the proposed project area and conducted discussions with stakeholders on site to identify their views and concerns. Specifically the following methodologies were used in undertaking this exercise include the following:

5.5.1 *Notification to stakeholders*

It is important to ensure that stakeholders are well informed prior to undertaking and consultation. Introduction letter was written by TANESCO to the Mtwara and Lindi Regional Administrative Secretaries (RAS) to inform about the project as well as secure permission to work in the respective districts. These letters were then channelledto District Administrative Secretaries (DAS) and District and Municipal Executive Directors for the same purpose and to seek appointments to consult the district officials and to undertake the EIA study at scoping level in the respective villages. Letters from the DED offices were then distributed to all relevant villages to secure appointments with village government officials as well as the local communities.

5.5.2 *Village public meetings*

In order to ensure that the villagers are informed of the project, the team conducted public meetings in two phases. The phase of public meeting was done during scoping from 22nd March, 2018 to 07th April, 2018 where a sample of 14 selected affected villages were involved. The second phase of village meetings was conducted during the full EIA study from 8th – 17th August, 2018. In this phase, the public meetings was conducted to all 43 villages where the proposed transmission line traverse. The team ensured that women attended and participated in the meetings.

Also the number of women who attended the meetings were very low compared to men due to cultural and religious believes which does not allow

direct involvement and interaction of women with men in meetings. The meeting aimed at informing the villagers regarding the project and the activities that are associated with the project as well as project equipment and materials. Villagers were sensitized on their right to be compensated and what is to be compensated if they will either loose land, crops and houses. Villagers were also given an opportunity to ask questions, raise their concerns and provide information to the team on issues such as availability of land in the village for resettlement purposes.

The minutes for village meeting conducted in August 2018 was prepared as Appendix 4.

5.5.3 Focus Group Discussion

A Focus Group Discussions and interviews were done for women in 6 villages and resulted in 196 attendances of women in total. The minutes for focus group discussion conducted in August 2018 was prepared as Appendix 5.

5.5.4 Official Meetings with village leaders

Village meetings were conducted in all affected villages. These meetings aimed orienting the village leaders about the potential location of the transmission line (both the selected and the proposed alternatives) within the villages and seek their opinion on which route is more preferable. Also the meetings intends to collect specific data at the village level, discussing about availability of land for relocation and their preferences of where to be relocated in case their structures will be affected.

Figure 5-1 Meeting with village leaders at Kisiwa village in Mtwara district (Mar 22, 2018)

Source: IRA, 2018

The discussion also focused on identification of sensitive sites/areas such as cultural sites that are within the village or its neighbourhood. A checklist of village social services, economic activities and other infrastructure was also obtained during these meetings. The meetings also aimed at sensitizing the village leaders regarding how they can handle compensation matters and also to ensure that they will continue to sensitize and inform other villagers who were unable to attend the village public meetings.

The village meetings were attended by males and females, as shown in Table 6.3.

5.5.5 Meetings with regional and districts officials

Meetings were held with regional and district officials. The aim was to introduce and discuss about the project and to obtain relevant data and information from the respective authorities. Issues about how the region and the district administration are prepared to benefit from the proposed project, resettlement and compensation were also discussed.

5.5.6 Consultations with relevant Government Ministries

In Dodoma, consultation was conducted from 27th – 29th August, 2018 by visiting and discussing with key stakeholders such as Ministry of Energy, Ministry of Lands and Human Settlement on issues related to land acquisition procedures for linear projects, Ministry of Natural Resources and Tourism on issues related to forests, wildlife corridors and potential archaeological sites.

5.5.7 Consultations with other relevant stakeholders

In all respective regions and districts consultation was conducted by visiting and discussing with key stakeholders such as TANESCO – regional office (project proponent to share issues raised by stakeholders mainly associated with compensation issues). Consultations were also undertaken with Tanzania Forest Service, Marine Parks – Mtwara office, existing power plant in Mtwara and two NGO's namely Volunteer for Youth in Health and Development and Mtwara Society Against Poverty (MSOAP).

5.6 SUMMARY OF STAKEHOLDER ENGAGEMENT ACTIVITIES

The number of participants,main comments and responses during the stakeholder engagement meetingsdescribed in earlier sections are presented in ***Table 5-3*** .

Table 5-3 Number of people participated in the meetings and Comments and Responses during the meetings

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
Sensitization and awareness meeting with Regional and District Officials	Mtwara Rural	First phase 21st23rd.03.2018 and Second phase 07th.08.2018	25	03	The project will be beneficial to the community as it will help solve electricity problem in Mtwara region as well as increase the level of electricity generation capacity to the National Grid.	Noted
					The development of the project will be a winning point for the political leaders because it will help solve electricity problem in the community.	Noted
					The construction of the power plant will result to water pollution and impact on aquatic resources and marine biodiversity including the mangroves, there is a need to take this into consideration especially during the construction and operation of the project.	Waste water treatment plant and all discharge will meet IFC and Tanzania standards. There will monitoring plots in Mangrove to monitor changes of species composition of marine organism
					The Project Affected Persons (PAPs) should be compensated and given relative amounts that will help them restore their livelihoods and if possible, provide alternative areas for the relocation of the PAPs.	The compensation will be determined based on Tanzanian laws and JICA Guideline to ensure that the PAPs are not adversely affected. Most of PAPs opted for cash compensation, therefore, they will be required to find their own place for relocation. In kind compensation will be done for public infrastructures (if any)
					The road from Mikindani to Kisiwa village is challenging as it has corners around, and the best way to transport the other heavy electrical equipment which will be having above 50 tones and can't dismantled is through water ways.	For smooth transportation of materials an assessment of the road will be undertaken to ensure that unnecessary corners are removed during construction

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
	Lindi Rural	26th – 27th.03.2018	15	03	In most caseslocal communities are not well informed of their rights as well as the whole procedure for valuation.	Awareness program will be prepared and undertaken before and valuation of properties. However, the EIA exercise is also a platform for public awareness
					Delayed compensation once properties including land and houses have been evaluated and acquired by a developer. "	In case of any delay in compensation, PAPs will be paid with interest depending on the number of days. The project is going to start before physical acquisition of land
	Lindi Urban	26th – 27th.03.2018	13	02	Value given to affected properties. It was noted that prices given to crops both seasonal and perennial was very low compared to the actual value of investment cost of a particular crop.	It is the responsibility of the Ministry of Agriculture to determine the value of crops. The price are normally reviewed after three years.
	Kilwa	04th – 05th.04.2018	13	03	Review of crop prices for compensation should be conducted every year and should involve relevant officials because investment costs of crops differ from one area to another due to variation in physical environment. Compensation of land value should include investment cost example preparation of rice/paddy farms one has to invest more compared to preparation of a maize farm. Compensation should also consider fertility of land and pay a much higher price to fertile land. For instance price of a land adjacent to a water source v/v a barren land.	The price of various crops is reviewed by the Ministry of Agriculture after every three years. Seasonal crops are not compensated. PAPs are given time to harvest their crops before the project begin. The value of land is determined by the market of a particular area. Therefore, if the land fertile, the market will reflect that situation
Meetings with Village leaders	Mtwara Rural	21st - 28th.03.2018	05	00	The project such as increase of employment opportunity especially for young people though they were concerned that employment may be given to outsiders whilst the local people are left with simple manual jobs; other benefits include	The contractor will ensure that all activities which does not need specialized skilled are undertaken by villagers, however, this will depend on the arrangement of the village government and accountability of those who will be recruited

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					emergence of auxiliary activities, increase supply of electricity. The developer should assist the local communities in other projects since they will not directly benefit from the project e.g. construction of classrooms for schools, assist students from the villages to attend secondary schools, drill borehole for villages, assist in control of HIV/AIDS, etc.	
	Lindi Rural	10th – 13th.08.2018	28	07	The project will improve businesses in the area and also create job opportunities to the local Youth during construction phase. The project will enhance Security due to lighting in the neighborhood at night. Attraction of innovation and invention leading to new investments due to adequate power access which will promote the local and national economy.	Noted
	Lindi Urban	11th – 12th.08.2018	09	04	The project is good for the development of the country since it will boost power supply and improve on industrial development, and should therefore be undertaken.	Noted
	Kilwa	First phase 04th–06th. 04. 2018 and Second phase 13th – 17th.08.2018	26	06	There would be possibility of insecurity in the areas due to the influx of other people during construction phase. There would be loss of land and property since residents may be required to relocate The proponent should consider employing casual workers from the local areas during construction phase of the project.	The contractor will ensure that all activities which does not need specialized skilled are undertaken by villagers, however, this will depend on the arrangement of the village government and accountability of those who will be recruited.
Public meetings with Normal villagers	**Mtwara Rural** Namgogoli Mbuo Changarawe	First phase 21st – 28th.03.2018	212	62	How much are we going to be compensated for the loss of crops, trees and land?	Recently, the amount to be paid to the PAPs has not been stipulated yet. The valuer will disclose the prices during valuation based on the consultation and survey in the village.

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
	Ndumbwe Mpapura	Second Phase 08th.08.2018			Will there be a difference in the value of crops and land during compensation depending on regions?	Yes, there will a variation in land and crop prices according to regions.
					How is the compensation on the loss of land? Will I be paid based on square meter or acre?	Land is compensated based on square meter or acre.
					There should be fair and prompt compensation after valuation process.	There will be a verification process before the PAPs are compensated. The PAP will be given a copy of the valuation form number one so as to have assurance and clear doubt during compensation.
					There has been a challenge during valuation where some members' properties who are not part of the community are valued in our village. For example, a person from Mbuo village, will stand on the farm at Mpapura claiming to be theirs.	In order to ensure justice and clear doubt on land ownership, during valuation there called witnesses including village chairperson and neighbors to verify on land ownership.
	Lindi Rural Mtegu Madangwa Pangatena Njonjo Hingawili Zingatia Mnolela Ruhokwe Namunda Mahumbika	Second Phase 10th – 13th.08.2018	617	172	The proposed project has been accepted by the community and they have understood what has been told on compensation issues.	Noted
					What is the benefit of the project to us as a community? We are requesting to be supplied with electricity at a reasonable price and the village gets a percentage from the project.	The project will be beneficial to the local communities and the nation at larger. There will be temporal employment such as clearing the project site and safe guarding the project area. The village council will receive a percentage for ensuring the safety of the project area and compensated for the village properties. In terms of nation wise, the project is expected to improve the power supply in south-eastern part of Tanzania and ensure availability of electricity.
					Who is supposed to establish the Grievance Redress Committee (GRC) and who will be the members that form the committee?	This is a requirement from the donors, a GRC needs to be established in order to address complaints that may arise in the process. The committee will be composed of people of

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
						different categories including elders and youth and will base on gender. Among the members who will be involved in the committee include; representative from the village council, few affected persons and some village members.
					There are burial sites for the village and most of the members of the community use the burial site, who is given the allowance for the graves?	There is no compensation for the graves but there is an allowance that will be given to the family members of the deceased for conducting different traditional and religious rights during the relocation of the graves.
					Most of the people in the village depend on cashew nuts crops as a source of livelihood. It is necessary that during compensation, the crops are valued depending on the price within a specific village and relates to the crops.	The complaints during the project implementation can be resolved through Grievance Redress Committee, it is necessary to establish a Grievance Redress Committee to provide a platform for PAPs to voice their concerns and opinions related to RAP implementation
					How should we solve the complaints during the project implementation especially if there are problems in the valuation process?	Those are among the challenges that may happen during the administrative procedures, we shall advice the responsible people to use a language that is understood by many so that most can understand and avoid conflicts.
					We are requesting that the documents that will be brought during valuation and compensation should be written in Swahili language, a language we are used to. This is because in previous projects, were brought documents written in English language and we were told to sign the documents. Compensation should be fair and prompt and transparent in order to ensure justice to the affected PAPs.	These are issues that may not be planned and may happen even before the PAPs has been compensated. If it happens, the wife or the close relative living with the deceased will be given the compensation after following the legal procedures of inheritance. The compensation will be determined based on Tanzanian laws and JICA Guideline to ensure that the PAPs are not adversely affected.

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					The contractor should establish an access road to the site so as to avoid damage to the crops during construction.	The land for access roads to the proposed transmission line will be acquired and compensated. Part of the land for access roads will be temporary acquired during construction, the roads will be closed after construction. Other roads will be maintained for in order to be used during maintenance.
					After the valuer has valued my properties and I die, who will be compensated?	Next to kin will be compensated. However, this will need confirmation of the deceased relatives.
	Lindi Urban Ruaha Ng'apang'apa Chikonjikaskazini Chikonji kusini	Second Phase 11th – 12th.08.2018	270	178	Will the transmission line be constructed in the same location with the gas pipeline?	No, technically it is advisable to leave some few meters between the gas pipelines and the transmission because it is hazardous to position them together at the same place.
					How long will it take for the project to start?	The project is expected to start in 2022.
					What are the benefits to the village as a result of the project?	The community will benefit from the project through various opportunities including; temporary employment such as clearing the area and security guards to the project area.
					We are requesting for electricity available as a result of the project because there is shortage of electricity in the region and especially in Ruaha village.	The project will enhance availability of electricity because it intends to improve the power line capabilities for smooth power transfer to the coastal regions and beyond.
					There could have been a chart that shows prices of crops, and even value of land per acre. The valuer should come along with it in order to know the exactly amount of our compensation on the very day of valuation.	The valuer will come with a chart of listed prices of crops and land during the valuation day.
					Who will be responsible to handle the cost associated with grievances redress mechanism issue?	There will be a fund set aside as part of the project cost to facilitate all maters associated, but in a controlled manner.
					The PAPs should be compensated without delay.	The law suggest that PAPs are compensated within six months after the valuation date. If there will be any delay, the PAPs will be compensated with an interest rate.

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					Can I be allowed to continue with farming after compensation?	No, you will not be allowed to continue farming or other related activities soon after compensation because the land does not belong to you anymore.
					Will the transmission line be constructed in the same location with the Gas pipeline?	Transmission line will not pass along the pipe line gas due to both are hazardous material. TANESCO transmission line has way leave of fifty two meter (52m) while pipe line gas has way live of sixty meter (60 meter) separate
					How will the village government/local government benefit from the project?	Village government will be provided with services from TANESCO for security and cleanness of the project site area.
					What about the traditional and ritual sites, if the transmission line will cross that area?	The sites will transferred according to the traditional process of specific area and the client (TANESCO) will take care of the costs for the relocation of the traditional and ritual sites.
					Will the house compensation have the same value with that of my house?	Yes, compensation will be paid according to replacement cost so as to enable the owner to build the same house
					Will there be any compensation to the affected persons before commencement of the project or compensation will be done after the project?	The affected persons will be compensated before commencement of the project soon after the valuation process. The law requires that the PAPs are paid within 6 months after the valuation date.
					What if the project cut across a farm, will that person be allowed to own the other two sides of the farm?	Yes, because you have been compensated only that part being affected by the project meaning that you still have rights over the other remaining piece of land.
					When the implementation of this project will start.	The project is expected to start in 2022.
					How are we going to benefit from the project?	The project will ensure availability of electricity to the nation and enhance employment opportunities to communities adjacent to the way leave.

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
						The village will benefit through availability of employment opportunities during construction such as casual labour, small business opportunities such as food vendors and soft drinks. Also, availability of electricity since the line will be connected to the national grid to enhance national development
	Kilwa Likwaya Moka Mtumbikile Kilangala A Kilangala B Mnimbila Kitomanga Mkwajuni Mbwemkuru Kiranjeranje Mtandi Mirumba Mandawa HoteliTatu Kiwawa Mavuji Nangurukuru Matandu Miteja Mtandango Tingi Njianne SomangaKusini	First phase 04 – 06. 04. 2018 and Second phase 13 – 17.08.2018	1,268	337	Will graves be relocated?	Yes, the graves on the project area will be relocated through the district health department.
					If farms and trees will be compensated, what about seasonal and permanent crops, will they be compensated?	Permanent crops will be compensated for while the seasonal crops will not, owners of the seasonal crops will be given time to harvest the seasonal crops including; maize, pigeon peas and cassava
					What is the distance from the project area to the main road?	It has been varying from one village to another in a sense that there are some villages which the transmission line passes too close to the center of the village/main road but other villages a bit far
					What evidence will be used for the proof that a certain piece of land belongs to the said person?	During valuation, the land owner will be around and witnesses including the village chairperson and neighbors to verify that the area belongs to the said person
					During the valuation process, is it possible to have a breakdown of the properties and the right amount that will be paid to the PAP?	The valuer will come with a valuation form number one and list the properties that will be affected by the project. The PAP is supposed to remain with a copy of the form to have evidence and proof during compensation. It is not possible for the valuer to have the right amount at the moment he comes to value the properties. This will be done later after identifying the PAPs and their properties.
					Will there be awareness creation on the impacts of the project to the community?	As an EIA team, we are playing this part now, we have to communicate to the

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
						community, inform them about the project and the impacts of the project. It is not safe to stay around the electrical wires in order to avoid accidents and risks that may occur due to the electrical wires.
					When will the project start, and get to know that my properties will be affected so that I can get the farms ready?	The project will undergo different stages till it is complete, before valuation, information will be sent to the community prior the valuation date. You will know if the properties have been affected during valuation and the project cannot start till the PAPs have been compensated.
					We suggest that, there could have been a chart that shows prices of crops, and even value of land per acre and the valuer should come along with it in order for us to know the exactly amount of our compensation on the very day of valuation	Villagers will be informed to change the ritual sites according to their tradition and to let the project to be constructed soon after the valuation process
					Basically our main trouble here is on compensation, but all and we are thankful for this education you have provided us with because we have never experience something like this before. Even the issue of grievance redressing mechanism is very new to use, we couldn't have known it if it wasn't for you	There will be a fund set aside as part of the project cost to facilitate all maters associated, but in a controlled manner.
					What if I have prepared all construction material at my site ready for house construction and now coming with this project, what should I do?	
					We don't want you to involve people from the District Council because they have never been fair for compensation; if it will be possible you just come with different valuers to do this work	It is the responsibility of district council valuer to undertake the valuation, what is important is for the valuer to follow the process of valuation. In case the district have no valuer, the valuer will be hired from nearby district/municipal

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					Are we going to be distributed with that electricity or it will just pass by our village?	No, because It is high voltage (400kv) and that's why is being transmitted to Somanga power station with aim of adding power to the National grid.
					What if the project cut across a farm, will that person be allowed to own the other two sides of the farm?	Yes, land outside the project boundary will belong the owner
					The sandwich situation on piece of land left between the gas pipeline and this new proposed transmission line even lower the value of that land. We request TANESCO to compensate the whole land from where the gas pipeline way live end to the whole section of the transmission line	Payment for land which is required by the project is possible because it will be difficult to account for during auditing and verification
					We are so thankful for the education you have provided us with, because during the gas pipeline project, compensation was not fair as it happened to an extent that other people were compensated twice while others didn't receive compensation at all.	Noted
					We also request you to tell the valuers to give us copy of the valuation form number one that has listed all our properties that are going to be compensated	This is a requirement of law, that the PAPs must be given the form for their record
Sensitization and awareness in Focus Group Discussion	**MNOLELA VILLAGE**	11.08.2018	00	34	The project is expected to be constructed in our village, how are we going to benefit from the project?	No activities will be allowed at the site once construction has started, this is for the sake of security purpose. They will be compensated once the land has been acquired.
					Who will benefit from the project the most? Is it men, women, the youth or elders?	All will benefit from the project depending on the opportunities that will be available. There is expected to be temporary employment and for the women that will be residing close to the project area, can get

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
						opportunity to cook food for the constructors.
					My farm of cashew nuts crops will be affected by the project, I am afraid that the cost may not be sufficient enough to replace the crops.	The crops will be compensated based on the percentage of the growth rate whether young or old. The crops will be compensated based on the current market price and will be sufficient to replace the cost used for cashew nuts.
					We are requesting for transparency during the valuation process and areas demarcated within the specified meters.	During the valuation process, the valuer will have the valuation form number one and will list the affected properties, then the owner of the property will remain with a copy of the form for assurance and clear doubt in case of any inconvenience.
	MAHUMBIKA VILLAGE	12.08.2018	00	24	Before construction of proposed project the surveyor should put permanent bicorn so as affected people should know the alignment. Accept the proposed project, there is an issue of employment to women especially during the construction period.	Final design of the project route will be done and the alignment will be clear Unskilled labors will be hired from the adjacent village however chances of women employment may be low negligible due to the nature of the infrastructure development.
					Land acquisition for the project will negatively affect women livelihood because most of women are engaged in cultivation and their livelihood depend on farming activities which enable them to get food and money for various uses. They requested TANESCO to pay compensation on time to enable them buy other land for cultivation. Resettlement Issue: Women in many occasions are denied land or property rights and hence will be deprived from receiving compensation because some of women are elderly and widow who makes them difficult to gets their right.	Livelihood restoration have been prepared to ensure that the livelihood of the affected vulnerable people is restored TANESCO and the contractor will prepare and undertake awareness programs in relation to HIV/AIDS and other STD's before and during project contraction.

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					During project implementation, there is a potential for spread of diseases such as HIV/AIDS and other STD's due to influx of people with different cultural background.	
	MKWAJUNI VILLAGE	14.08.2018	00	14	Accept the proposed project to undertake in the village. Women at Mkwajuni insist on fair and promptly compensation, so as widow and elderly's can able to find other area for cultivation During project implementation there is compensation and in most cases compensation is delaying which cause women to have difficult in to get settlement and area where they can cultivate. Spread of diseases such as HIV/AIDS, during project implementation there is influx population of people with different cultural which can cause spread of diseases such as HIV/AIDS and to ensure the minimize the impact the contractor should provision of proper sexually education to labor and surrounding community in order to reduce new transmission.	According to the law governed compensation , it say that after valuation the compensation should payed to affected people within six month, and when the compensation delay and exceed six month the responsible institution should pay compensation with interest rate. TANESCO and the contractor will prepare and undertake awareness programs in relation to HIV/AIDS and other STD's before and during project contraction.
	MTEGU VILLAGE	10.08.2018	00	34	Some of the women along the proposed power transmission line are engaged in food vendors activities. Therefore, they requested government to support them by providing soft loan to sustain their livelihood	Noted
					Land acquisition during project implementation may cause the women livelihood to change because most of women engage to cultivation so their livelihood depend on farm to cultivate different crops and selling so as to get money for their house consumption,	According to the law governed compensation , it say that after valuation the compensation should payed to affected people within six month, and when the compensation delay and exceed six month the responsible institution should pay compensation with interest rate.

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					because of that the women beg government through its instruction TANESCO do not delaying on the compensation so as they can able to buy other area for cultivation. Resettlement Issue: Women in many occasions are denied land or property rights and hence will be deprived from receiving compensation because some of women are elderly and widow who makes them difficult to gets their right.	
	MTANDI VILLAGE	14.08.2018	00	41	Spread of diseases such as HIV/AIDS, during project implementation there is influx population of people with different cultural which can cause spread of diseases such as HIV/AIDS and to ensure the minimize the impact the contractor should provision of proper sexually education to labor and surrounding community in order to reduce new transmission	TANESCO and the contractor will prepare and undertake awareness programs in relation to HIV/AIDS and other STD's before and during project contraction
					During project implementation there is compensation and in most cases compensation is delaying which cause women to have difficult in to get settlement and area where they can cultivate.	according to the law governed compensation , it say that after valuation the compensation should payed to affected people within six month, and when the compensation delay and exceed six month the responsible institution should pay compensation with interest rate
					During compensation phase the valuer do not put exactly amount of the affected people is supposed to have where the affected people can be go so as can get their right?	They is need of establishment of grievance committee so as solve the grievance , this committee it formed by member from local government, affected people and NGO's this will help to affected people to get their right.
					Security Concerns for Women: The proposed project can potentially increase the security risk for women specifically during the construction phase of the	The power transmission traverse in settlements and farmland and forest are close to settlements and the Dar es Salaam –

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					transmission line if it is near settlements, the workers blockage access road which make difficult of women to go fetch water and collect firewood.	Mtwara main Road. Therefore, there is no threat for security.
	CHIKONJI VILLAGE	12.08.2018	00	50	There are some people who have their properties around the project area, how will they benefit from the project?	Those who have their properties whether it is a crop, tree, residential land and structures will be compensated for the loss of properties.
					What happens to those who loose structures, who will get for them an alternative place to stay?	For the loss of structures, the owners will be given an allowance for an alternative accommodation of not less than 36 months. Compensation for luggage of not less than 12 tones and luggage allowance of not more than a distance of 20 km. They will also be entitled to transport and disturbance allowance. The owner of the choice will have to go and look for another place to stay after being given the allowance. The project will not start if people are not compensated.
					What about a community grave yard, who will be given the allowance?	The relatives of the deceased will be given an allowance to enable them perform traditional and religious rights.
					How long will the project take till it is complete?	The project is expected to undergo different procedures till it is complete, after the completion of the Environmental and Social Impact assessment, the valuer will come to value the properties and the surveyor demarcate the areas and the affected PAPs. Then the PAPs will have to be compensated and then the project will go through.
					How is the village expected to benefit from the project?	The community is expected to benefit from the project though employment opportunities such as clearing the site for the construction of the electrical pillars and safe guarding the project area.

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					We are requesting that the ones who will be affected by the project are compensated without delay.	The law suggests that the PAPs are compensated within six months from the valuation date and if they are not compensated within that period, they are supposed to be paid with interest rate.
					We are asking to be given priority in employment opportunities during the project construction.	This has been taken into account and will be addresses in the report for further actions.
					Who forms the Grievance Redress Committee?	The Grievance Redress Committee constitutes a representative from the village council, affected person and some representatives from the community.
Consultation with Sectoral Ministries	Ministry of Energy	28th.08.2018	01	00	The proposed project is one of the national priorities in power sector with the purpose of improving availability of power in the southern part of the country. And meet the government target to get 4,915 by 2020. The proposed project will enable utilization of resources, gas being the source of the proposed electricity. The project proposed project will ensure voltage stabilization in order to avoid voltage loss and reliability. The Ministry in collaboration with Ministry of Finance and Planning an TANESCO is responsible to make all Project Affected People are compensated before commencement of the project, however, timely availability of funds have remained a challenge to many power project in the country. In a situation where the compensation have delayed, the PAPs are paid with interest that	Noted

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					are determined by government valuers as required the law. In order to ensure timely compensation, there is a need to convince project funders to include compensation package as part of the loan. In order to reduce the cost of compensation, it is a high time to reduce the size of land to be acquired by taking land in areas where towers will be constructed, there is no need to acquired land which will be under transmission line. The system is also practiced in other countries like Zambia	
	Ministry of Natural Resource and Tourism. Wildlife Division and Forest and Beekeeping		03	01	Kilwa district is one of the wildlife dispersal area in the southern part of the country, however, the project impact on wildlife will be minimal. Movement of elephants have been reported in Lindi rural, notably in Miguruwe village. There is wildlife corridor at Mbwemkuru village, however, due to increased human activities such as agriculture, the corridor is not active. Due to possibility of having wildlife in the project area, the involvement of wildlife officers during project construction will be crucial, not only for the security of wildlife, but also to the workers themselves. There is a need to involve the Tanzania Forest Service in the process to determine the magnitude of forest destruction and	Noted

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					assessment of biomass, especially during project construction. Undertake inventory in order to understand the species that will be affected by the project. The Ministry will write a letter to TFS to emphasize the need for TFS involvement in in critical stages of project implementation such as mobilization and construction to ensure all issues related to forest management is stages ensure that the contractors and client respect	
	Ministry of Land and Human Settlement Development Policy and Planning Department				It is important to raise awareness to the people who will be affected by the project to ensure they well informed about the implication of the project and their rights, especially where there is a need for land acquisition. The issue of compensation is governed by Tanzanian laws. The land to be acquired for project implementation should be compensated. Chief Government Valuer is responsible for approval of all valuation reports in the country. In case of any delay in compensation, PAPs should be paid with interest as required by law	Noted
Consultation with Other Stakeholders	VOLUNTEER FOR YOUTH IN HEALTH AND DEVELOPMENT (VOYOHEDE) Non-Governmental	23.03.2018	01	0	The organization has been registered to work with the whole community within boundaries of Tanzania as a nation and deals with provision of advocacy and health advice to women but also advice youth to engage on development activities even if by volunteering as to keep them away from engaging on unethical influential groups.	

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
	Organization (NGO).				Currently, they are concerned with 50 social issues with HIV/AIDS being the main case. The organization has been working with Majengo and Vigaeni wards and is being supported by different donors to assist those families living in with poor health and unpleasant environment. 12 women dealing with tailoring have been provided with maternity health education and 56 people home basic care.	
	MTWARA SOCIETY AGAINST POVERTY (MSOAPO) - NGO	23.03.2018	03	01	The organization has 17 staffs, it deals with provision of assistance in different sectors including agriculture, health, good governance, pastoralism, environment and Natural resources. There is an ongoing project supported by World Wide Fund for nature (WWF) in Newala, the project is about better use of solar system, which include installation, maintenance and repair. The organization is also working with US Aid through deloitte Company on issues concerned with health especially HIV/AIDs, Nutrition, TB, Family planning (Reproduction) and Gender violence. The project area is also their area of consideration because they are working with Mtwara rural by dealing with HIV/AIDs victims through reminding them on proper use of their medications. There is another project in which the organization is working togetherwith Oxfam, and it is divided into 3 subdivisions. Oil and Gas (as to make the community understand opportunities together with direct and indirect benefits of Oil and Gas).	

Main Topic/Meeting Name	Place	Dates	Number of Participants		Main Comments from the Participants	Response of TANESCO to Comments
			MALE	FEMALE		
					Gender (establishment of groups of women engaging with farming and pastoralism as well as creation of better relationship with the surrounding community). Good governance and involvement. There is another project about supporting agriculture in which they are working with Swiss Aid and more than 500 people are being benefited from the project. Animation approach has been the best strategy though the use of famous people on villages to educate their fellow villagers on different development matters as been trained by the organization, this will be easy to educate the villagers.	
Total			**2,510**	**970**		

Source: IRA 2018

5.7 IDENTIFIED ISSUES AND CONCERNS DURING CONSULTATIONS

As a result of public engagement and consultation, a number of issues and concerns were identified and are addressed. In general, stakeholders have different opinions with regard to implementation of the proposed project that mainly focus on issues of compensation and environment as well as benefits of the project to the nation and local communities. Their view and concerns include the following: Identified issues and Concerns during Consultation Environmental concerns

Vegetation clearance and biodiversity change

The implementation of the proposed transmission line entail significant loss of plant biomass. Since the project will adapt a 300kV power line, a 50 meter wide way leave will be required. Accordingly, a corridor of 50m x 300km (approx. 150km^2) will have to be cleared of vegetation and kept to less than a meter high. Significant loss is anticipated due to the presence of dense miombo woodland along most of the proposed transmission route. The woodland characterizing the project site is rich in valuable timber species. Some of the species include *Albizia vescolor, Albizia gurmifera, Pterocarpus angolensis, Pericopsis angolensis, Pterocarpus sp, Baphia sp, Swartzia magadaschariensis and Podocarpus latilifolia.* There is a need to quantify the abundance and biomass of these species so that appropriate measure to harvest for commercial use or other valuable use can be decided. Removal of plant species along the way leave will lead to change in habitat and species diversity. In the process there could be complete loss of habitats and species of flora and fauna. The Tanzania Forest Service needs to be involved in the construction planning and final Environmental and social Management Plan so that these issues are properly addressed.

Soil and soil erosion

The lengths of the areas required for the power transmission line means that numerous points along the alignments will be disturbed and there will be localised disruption of the surface soils. This will happen as a result of constructing access roads and erection of the towers. The soils in some parts of the project area are known to be relatively unconsolidated and thus highly erodible, especially in steep areas with high rainfall. The construction period will be the most crucial and adequate mitigation measures will be required in order to reduce the potential erosion. These mitigation measures will be considered during the detailed EIA.

5.7.1 Socio-economic concerns

Loss of land, properties and compensation issues

The 300 kV transmission line will require a right of way (way- leave) of 50m (that is 25m from the centre conductor to either side of the line). The acquired land will be used for various project activities such as construction of substation at Kisiwa and Namgogoli villages, construction of towers, the way leave for the transmission line in all affected villages and access roads for transportation of materials. The proposed transmission traverses agricultural lands and settlements in some villages. Villagers were concerned about loss of land and

other properties such as houses and associated structures. Villagers were also concerned about compensation for their lands and structures for those who will be affected. Based on the experience from other development projects such as roads, the villagers expressed their concerns about delay in compensation and land lack of transparency during the valuation of properties and payment of delayed compensation

Cost to local communities

Cost to local communities would vary and be in different forms. This may include the cost of loss of land and properties. In the absence of land use plans land development will be haphazard and chaotic, thus also affect the quality of life and increase land use conflicts.
Several hundreds of people will be employed in this project. Such an influx of people will certainly put pressure on the already limited socio-economic services (health, education, water). Increasing demand on resources and services may lead to scarcity, which may push prices up and increase the cost of living.

Rural electrification

Although the Mtwara, Lindi both rural and urban as well as Kilwa districts have electricity from the National grid, still the electricity is not reliable and villagers have been experienced frequent power cuts. According to the villagers, due to frequent cutting they are compelled to find alternative source of power such as diseal generators and solar panel. The decision of finding alternative sources of power is adding cost of living while they have already incurred some electricticity connection costs. Frequent power cut have been a major cause of destruction of assets such as radio, televison and fridges.

Due to this power problem, the district authorities and other stakeholders have shown concern whether or not the local communities along the transmission power lines will benefit from the electricity line passing over their lands.If this is not done, it is likely to create resistance and negative attitude towards the project. The availability of electricity from gas will enable the local communities' access clean energy cheaply at least for lighting. Such a move not only will reduce the risks of respiratory diseases, but also too, could reduce the ongoing deforestation and environmental degradation in the district. This could also stimulate the establishment of small and medium scale industries in agro-processing, irrigation and carpentry works in the district thus, improve people's incomes and their economy as well as reduce rural povertyvillagers were concerned if the construction of transmission line will help to reduce or eliminate the problem power in the villages.

Risks and hazards

Factors which may lead to risk of fire or accidents need to be considered and programs to mitigate these factors instituted. Due to potential electrical fields and magnetic fields (hazards) caused by high voltages and high currents, it is important to ensure that substations are enclosed to avoid exposure of these hazards to unprotected personnel. Other factors could be associated with accidental fires due to possible transformer explosions; property damage due

to improper operations and potential for electrocution should children climb on pylons. These need attention and consideration during design, construction and operation.

There are additional fire hazards from transformers, which are insulated by oil, making them flammable. There are three different types of oil fires that can take place in or near the transformer: spray, pool, and three-dimensional. Spray fires happen when highly pressurized oil is released; 50% of the time, this fire happens because of malfunctioning bearings. If there is an unpressurized leak, plants could see a pool fire when the oil catches fire after it has accumulated on the floor or a three-dimensional fire if it catches fire while flowing downhill.

Also, a 'flashover' occurs when electricity, especially at higher voltages, jumps across an air gap to create a conductive path. A flashover may occur between wires or from wires to the ground – this may be seen as a flash or heard as an explosion or loud 'crack'. Flashovers are potentially life threatening to a person standing in the near vicinity of the flashover (much like when lightning strikes the ground near a person). Flashovers can also cause damage to nearby equipment and the transmission line

Another potential risk involves migratory birds that can hit the line and die, especially when on high speed. During detailed EIA, when consulting stakeholders, these issues will be assed and mitigation measures developed to ensure that the adverse impacts are minimized.

Opportunities for employment and other economic activities

Employment opportunities will be provided through this investment. Despite the opportunities for job employment, various stakeholders were concerned with lack of local skills especially on power transmission project and the skills that are needed, thus the majority of the people along the proposed trasnmission line may not benefit from this opportunity on a short term basis, unless efforst are made to build the skills for future egnagement.

The power transmission line project will also offer indirect employment opportunities to surrounding community and encourage the establishment of businesses related to project demands. These include local construction materials, agricultural products (food, cereals, fruits, vegetables; vegetable oil, i.e sunflower oil), livestock and fisheries products. In particular, the presence of people in villages along the transmission line will provide a potential economic opportunities that will change the socio-economic wellbeing of the communities.

This chapter describes the potential environmental and social impacts of the proposed transmission line system. It assesses how the project will interact with elements of the physical, ecological, social, cultural or human environment to produce impacts to resources/receptors, and the mitigation measures to the potential negative impacts. The potential environmental and social impacts due to the project activities are considered in the stages of the construction phase and the operation phase.

6.1 IMPACT ASSESSMENT METHODOLOGY

Impact identification and assessment starts with scoping and continues through the remainder of the EIA Process.

- **Impact Prediction:** to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities;

- **Impact Evaluation:** to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor

6.1.1 *Impact Prediction*

The terminology and designations used to describe impact characteristics are shown in ***Table 6-1*** below.

Table 6-1 Characteristic of Impacts

Characteris..	Definition	Designations
Type	A descriptor indicating the relationship of the potential impact to the Project (in terms of cause and effect).	Direct Indirect Induced
Extent	The "reach" of the potential impact (e.g.,confined to a small area around the Project Footprint, projected for several kilometres, etc.).	Local Regional International
Duration	The time period over which a resource /receptor is potentially affected.	Temporary Short-term Long-term
Scale	The size of the potential impact (e.g., the size of the area with the potential to be damaged or impacted, the fraction of a resource that could potentially be lost or affected, etc.).	[No fixed designations; intended to be a numerical value or a qualitative description of intensity]
Frequency	A measure of the constancy or periodicity of the potential impact.	[No fixed designations; intended to be a numerical value or a qualitative description]

Source: JICA Study Team, 2018

The definitions for the type designations are shown in ***Table 6-2*** below.

Table 6-2 Type of Impact

Type	Definition
Direct	Potential impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected).
Indirect	Potential impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).
Induced	Potential impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).

Source: JICA Study Team, 2018

Once impact characteristics are defined, the next step in the impact assessment phase is to assign each potential impact a "**magnitude**". Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent;
- Duration;
- Scale;
- Frequency; and
- Likelihood (for unplanned event).

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the potential impact. The universal magnitude designations are:

- Positive;
- Negligible;
- Small;
- Medium; and
- Large.

In addition to characterizing the magnitude of impact, the other principal impact evaluation step is definition of the "**sensitivity/vulnerability/importance"** of the impacted resource/receptor. As in the case of magnitude, the sensitivity/vulnerability/importance designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor basis.

- Low;
- Medium; and
- High.

6.1.2 Evaluation of Impact Significance

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact. Impact significance is designated using the matrix shown in ***Table 6-3***.

Table 6-3 Impact Significance

		Sensitivity/Vulnerability/ Important Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	High
	Large	Moderate	High	High

Source: JICA Study Team, 2018

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/ vulnerability/ importance designations that enter into the matrix.

6.1.3 Mitigation Hierarchy

- **Mitigation and Enhancement:** to identify appropriate and justified measures to mitigate potential negative impacts and enhance potential positive impacts. The following mitigation hierarchy is considered.

  - *Avoid at Source, Reduce at Source*: avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity);

  - *Abate on Site*: add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping);

  - *Abate at Receptor*: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site);

  - *Repair or Remedy*: some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures; and

  - *Compensate in Kind, Compensate Through Other Means*: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

- **Residual Impact Evaluation:** to evaluate the significance of potential impacts assuming effective implementation of mitigation and enhancement measures.

6.2 SCOPING OF POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

Scoping study was undertaken to delineate the potential Area of Influence for the Project, and to identify potential interactions between the Project and resources/receptors in the Area of Influence. The Scoping study was undertaken as a means to ensure that there is a focus on the issues that are important for Project planning, decision-making and stakeholder interests. During the scoping study, potential interactions between the Project, environmental and human resources/receptors were identified.

The environmental and social concerns related to the proposed 400kV transmission line have been identified based on the JICA environmental and social consideration guidelines (April 2010), relevant environmental legislation in Tanzania, and other applicable environmental and social conditions.
For each impact item, potential impacts in each stage of development (in planning and construction, and in the operation phase) are divided into negative impacts (−) and positive impacts (+), and the degree of impacts is classified as shown below. **Error! Reference source not found.** shows the scoping result.

A (+/ -): Major positive / negative impacts are Projected
B (+/ -): A certain degree of positive / negative impacts is Projected
C: Impacts are unclear (further investigation is needed. Impacts may become apparent as the survey progresses)
D: No impacts are Projected

Table 6-4 Scoping Results for the Mtwara-Somanga Transmission Line

Impact item		Assessment		Reason for the assessment and points of attention
		Planning construction	Operation phase	
Pollution control measures				
1	Air pollution	B-	D	**Construction phase:** Sand and fine particles may fly up when carrying in or out construction materials, preparing site land and so on. **Operation phase:** Air pollution will not be generated.
2	Water pollution	B-	D	**Construction phase:** There is a possibility that muddy water generated in line with banking and cutting works will impact surface water. **Operation phase:** It is not anticipated that significant water pollution will be generated.
3	Noise/ vibration	B-	D	**Construction phase:**Noise due to the operation of construction equipment, vehicles, etc., is anticipated. **Operation phase:** It is not anticipated that significant noise/ vibration will be generated.
4	Wastes	B-	D	**Construction phase:** It is anticipated that waste materials and soil will be generated by the construction activities. **Operation phase:** Wastes will not be generated.
Natural environment				
5	Nature reserve	B-	B-	The proposed transmission line route does not pass the nature reserves designated under Tanzanian law. However, there are some forest reserves and Important Bird Areas (IBAs) are located around the proposed route. Details will be studied.
6	Ecosystem	B-	B-	**Construction phase:** It is anticipated that the air pollution, water pollution, noise and vibration generated by the construction works will impart temporary impacts on land ecosystems. **Operation phase:** Bird strikes and collision with African elephant are anticipated.
7	Water environment	B-	B-	**Construction phase:** Considering the depth of foundation, it is not anticipated that the project will affect groundwater, but the construction may affect the surface water quality.
8	Topography and geology	D	D	**Construction and operation phase:** There is no large alternation of topography anticipated.
Social environment				
9	Involuntary resettlement	B-	D	**Before works:** The route will be selected with a view to averting or minimizing the involuntary resettlement, however, there is a possibility that the involuntary resettlement will arise. The degree of impacts is unclear at the present time and details will be studied in the EIA and RAP study. In order to establish the wayleave for the 400kV transmission line, the land acquisition of 1,350ha (50m width x 270km) are expected between Mtwara and Somanga. At the time of scoping, expected physical relocation is not more than 100 households.

Impact item		Assessment		Reason for the assessment and points of attention
		Planning construction	Operation phase	
10	Poor people	B-	C	**Construction / Operation phase:** There is a possibility that impacted residents including poor people may need to change their means of livelihood. However, the degree of impacts is unclear at the present time. Details will be studied in the EIA and RAP study.
11	Ethnic minorities and indigenous people	D	D	Influence on ethnic minorities and indigenous people is not expected. Tanzania has a multi-ethnic population with more than 125 different ethnic communities. Four of these, the Hadzabe, the Akie, the Maasai and the Barabaig, identify themselves as indigenous peoples. The majority of the indigenous peoples live in northern Tanzania, in the Arusha and Manyara regions.
12	Cultural assets	C	C	Since the route will be selected with a view to averting cultural assets and so on, no impacts are anticipated, however, this is unclear at the present time. Details will be studied in the EIA and RAP study.
13	Landscape	B-	B-	**Construction / Operation phase:** It is anticipated that construction of transmission line will adversely affect the landscape.
14	Local economy, such as employment and means of livelihood	B-/ B+	B-	**Construction phase:**There is a possibility that the construction works will temporarily render farmland useless and cause means of livelihood to be lost. Implementation of the project will create employment for local workers. **Operation phase:** Following construction, it will not be possible that land can still be used as farmland, and, the impact of loss of means of livelihood needs to be recovered.
15	Utilization of land and local resources	B-	D	**Construction phase:** The construction works will temporarily render farmland and roads useless. **Operation phase:** No significant impacts are anticipated.
16	Use of water	D	D	**Construction /Operation phase:** No significant impacts are anticipated on the use of water.
17	Existing social infrastructure and social services	B-	B+	**Construction phase:** There is a possibility that the land acquisition and construction works will exert an impact on existing social infrastructure. **Operation phase:** It is expected that the stable supply of electric power will contribute to local economic development and improvement of local social infrastructure and social services.
18	Society-related capital and social organizations	D	D	It is not anticipated that serious impacts will be caused on the decision makers and other functions of local communities.

Impact item		Assessment		Reason for the assessment and points of attention
		Planning construction	Operation phase	
19	Imbalance of harms and benefits	D	D	No particular impacts are anticipated in terms of imbalance of harms and benefits
20	Gender	B-	B+	**Before Construction:** The establishment of transmission line involves acquisition of land used by local people such as for farming. Relocations and livelihood restoration due to the land acquisition might have some influence on gender perspective. **Operation Phase:** With the stable supply of electricity, there may be opportunities to fill the gender gap to some extent.
21	Children's rights	B-	D	**Construction phase:** The establishment of transmission line involves acquisition of land used by local people such as for farming. Relocations and livelihood restoration due to the land acquisition might have some influence on children's rights perspective. **Operation phase:** The stable supply of electricity may contribute to the children's right to education.
22	HIV/ AIDS and other infections	B-	D	**Construction phase:** In view of the scale of the project construction and operations, there is a risk that HIV/ AIDS and other infections will arise due to the influx of labor from outside the area. **Operation phase:** No impacts are anticipated regarding HIV/ AIDS and other infections.
23	Working environment	B-	B-	**Construction phase:**It will be necessary to pay attention to the working environment for construction workers during the construction. **Operation phase:** There is a possibility that accidents will occur during maintenance work on the transmission line.
Others				
24	Accident preventive measures	B-	B-	**Construction / Operation phase:** There is a possibility that the transmission line system will be damaged by natural disasters such as flooding and strong winds.
25	Cross-border impacts and climate change	D	D	It is not anticipated that impacts related to climate change will be caused by the proposed transmission line.

Legend
A+/ -: Major positive / negative impacts are Projected
B+/ -: A certain degree of positive / negative impacts are Projected
C : Impacts are unclear - further investigation is needed
D : No impacts are Projected
Source: JICA Study Team, 2018

6.3 IMPACT MATRIX

The correlation matrix between project activities and impacts for construction and operation phases of the project is presented in ***Table 6-3***. In this table, using a set of developed criteria impacts were awarded a score ratings on particular impacts as follows:
+3 Very high positive impacts
+2 High positive impacts
+1 Minor positive impacts
0 No impacts
-1 Minor negative impacts
-2 High negative impacts
-3 Very high negative impacts

Mitigation and enhancement measures are developed for significant impacts that were rated +2, +3, -2, and -3. However some impacts that appears to have less significant values by scoring -1 or +1 on the rating matrix as they stand alone cumulatively they have significant impact to the environment, these were considered and were discussed under cumulative and residual impacts

A summary of the interaction between Project activities and its potential impacts is provided in the ***Table 6-5*****Error! Reference source not found.** below.

Table 6-5 Impact Correlation Matrix for 400kV Mtwara-Somanga Transmission Line

		Mobilisation phase				**Construction phase**				**Operation phase**			**Decommission phase**			
		Mobilization of equipment and materials	Recruitment of labour	Site clearance	Land acquisition	Construction of workers camp	Construction of transmission line	Construction of Substations	Construction of access/services roads	Transmission of electricity	Management and maintenance of power line	Management and maintenance of substations	Layoff of workers	Demolition of infrastructure	Site rehabilitation	Spoil management
	A: Impacts Related to the Physical Environment															
1	Acceleration of soil erosion	-1	0	-1	0	-1	-1	-1	-2	0	0	-1	0	-2	+1	-1
2	Reduced surface water infiltration	0	0	-1	0	-1	-1	-1	-1	0	0	0	0	-1	+1	-1
3	Impaired surface water quality	0	0	-1	0	-1	-1	-1	-1	0	0	-1	0	-1	+1	-1
4	Impaired ground water quality	0	0	-1	0	-1	-1	-1	-1	0	0	-1	0	-1	+1	-1
5	Generation of solid and liquid waste	-1	-1	-1	0	-2	-1	-2	-2	0	-1	-2	0	-2	+1	-2
6	Pressure on water resources	0	0	0	0	-1	-1	-1	-1	0	0	0	0	0	+1	0
7	Impaired landscape/aesthetics	0	0	-1	0	-1	-2	-2	-2	0	0	0	0	-1	+2	-2
	B: Impacts Related to the Ecological/Biological Environment															
8	Loss of vegetation	-1	0	-1	0	0	-1	-2	-2	0	0	0	0	-1	+1	0
9	Loss of wildlife	-1	0	-1	0	0	0	-1	-1	0	-1	-2	0	-1	+1	0
10	Loss of local terrestrial biodiversity	-1	0	-1	0	0		-1	-2	0	-1	0	0	-1	+1	-1
	Increased avian collision and Electrocution	0	0	0	0	0	-2	-1	0	-2	-1	0	0	+1	+1	0
11	Introduction of alien and invasive species	-1	0	-1	0	0	-1	-1	-1	0	-1	0	0	-1	+1	0
12	Loss of rare, endemic and endangered spp	0	0	0	0	0	0	-1	-1	0	0	-2	0	0	+1	-2
	C: Impacts Related to Socio-economic Environment															
13	Change in land use/tenure	0	0	0	-2	0	0	0	0	0	0	0	0	0	+1	-2
14	Increased employment opportunities	+1	+2	+1	0	+1	+2	+2	+2	+2	+1	0	-1	+1	+1	0
15	Enhancement of government revenues	+1	0	0	-1	0	0	0	0	+2	0	0	0	0	0	0
16	Increased power supply	0	0	0	0	0	0	0	0	+2	+1	+1	0	-2	0	0
17	Impaired local air quality	-2	0	-1	0	-1	-1	-1	-1	0	0	0	0	-1	0	--1
17	Increased noise disturbance	-2	0	-1	0	-1	-1	-1	-1	0	0	0	0	-1	0	-1
18	Deterioration in local food security	0	0	-1	-2	0	0	0	-1	0	0	0	0	0	0	0
19	Increased costs to local communities	-1	-1	0	-2	0	0	0	0	0	0	0	-1	-1	0	0

		Mobilisation phase				Construction phase				Operation phase			Decommission phase			
		Mobilization of equipment and materials	Recruitment of labour	Site clearance	Land acquisition	Construction of workers camp	Construction of transmission line	Construction of Substations	Construction of access/services roads	Transmission of electricity	Management and maintenance of power line	Management and maintenance of substations	Layoff of workers	Demolition of infrastructure	Site rehabilitation	Spoil management
20	Increased water use conflicts	0	0	0	0	0	0	0	-1	0	0	-1	0	0	0	0
21	Change in population characteristics	0	-1	-1	0	-1	-1	-1	-1	-1	0	0	0	0	0	0
22	Increased pressure on social services	-1	-1	-1	0	-1	-1	-1	-1	0	-1	-1	-1	-1	0	-1
23	Increased land use conflicts	0	0	0	-2	-2	-2	0	-2	0	0	0	-1	0	0	-2
24	Increase in risks and hazards	-2	0	-2	0	-1	-2	-2	-2	-2	-2	-2	0	-2	-1	-2
25	Loss of land and properties	0	0	0	-2	0	0	0	-2	0	0	0	0	0	0	0
26	Increased risk of HIV/AIDS and other STDS	-2	-2	-2	0	-2	-2	-2	-2	-2	-2	-2	0	-2	-2	-2
	E. Impacts Related to Archaeological and cultural heritage values															
27	Loss of Artefacts	0	0	-1	0	-1	-1	-1	-1	0	0	0	0	-1	0	0
28	Destruction of graves and graveyard	0	0	-1	0	-0	-0	-1	-2	0	0	0	0	-1	0	0
29	Change on cultural values and norms.	-1	-1	-1	0	-1		-2	-1	-1	0	0	0	-1	0	0

Source: IRA 2018

6.4 BIOPHYSICAL IMPACT ASSESSMENT

6.4.1 Terrestrial Ecology

Sensitivity of the Study Area

The proposed transmission line route mostly runs along existing roads thus the area has already been altered due to the presence of existing roads, and in some areas, villages. Also, the transmission line will not go through any protected areas and/or areas with ecological significance. However, some of these protected areas are adjacent to the transmission line route.

Construction Phase

The Project has the potential to impact the local ecological environment, especially during site preparation activities. Natural vegetation and crops will be cleared to give way to access roads, the transmission line's ROW, and areas for the new substations. Considering the length and the ROW of the transmission line, this may lead to habitat loss, habitat fragmentation, degradation, disturbance of native species and fauna mortality. There is a need to ensure that areas with ecological significance and protected areas will not be affected by the Project negatively.

Also, during construction, alien/invasive species could be introduced through imported vehicles, construction equipment and machines. Due to the fact that Kilwa district has now began to experience large heard of cattle from different area of the country particularly northern region is area will begin to experience new exotic species brought in by livestock.

Mitigation and Management Measures

- Vegetation clearance should be confined only to necessarily designated sites. The planned clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing.
- Implement landscaping and re-vegetation after completion of construction using native species where possible.
- Weed and pest management measures shall be implemented to avoid introduction of invasive weeds to natural and modified habitat areas.
- Oil, chemical and solid waste will be stored, and handled and disposed of by appropriately licenced waste management contractors.
- Construction materials and chemicals will be appropriately secured and locked down during flood season to avoid accidental release to the natural environment.
- Appropriate speed limits for construction vehicles will be enforced to limit noise and dust generation and to minimise potential for fauna strike.

Table 6-6 Impact Significance on terrestrial fauna due to construction

Impact	Impact on terrestrial flora and fauna due to pre-construction and construction activities				
Impact Nature	**Negative**	Positive	Neutral		
	The impact on the terrestrial ecological environment is negative.				
Impact Type	**Direct**	**Indirect**	Induced		
	Directterrestrialhabitatlossintheprojectfootprintinareastobedeveloped.Indirecteffectsonremnant/isolatedhabitats.				
Impact Duration	Temporary	Short-term	Long-term	**Permanent**	
	Although construction is temporary, the loss/conversion of habitats will be permanent.				
Impact Extent	**Local**	Regional	International		
	The impact is expected to be local for habitats.				
Impact Scale	It is anticipated that vegetation clearing will be limited within the acquired land				
Frequency	Construction occurs only once.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	Due to the total area which need to be cleared to give way to the transmission line and its ROW, the magnitude of impacts is **Medium**.				
Receptor Sensitivity	**Low**	Medium	High		
	Given the large proportion of the area affected is covered by habitats with low sensitivity, the overall sensitivity is considered **Low**.				
Impact Significance	Negligible	**Minor**	Moderate	Major	Critical
	The significance of this impact is **Minor**.				

Source: JICA Study Team, 2018

Operation Phase

During operation, human movement in the Project Site will be limited to maintenance and inspection activities. However the presence of the transmission towers and high voltage electric lines over a long stretch may pose risks to wildlife species, particularly birds, bats and elephants. This is of particular importance because within ecologically sensitive areas adjacent to the transmission line, there are fauna species with conservation status. Of particular concern is the Spotted Ground Thrush (classified as endangered by the IUCN Red List), which has breeding sites close to the proposed transmission line route. Also as mentioned in Chapter 5.9, the transmission line route intersect with an area where African elephants may be present and it also crosses with the direction of East Africa flyway which is followed by migratory birds.

Also, during maintenance of ROW vegetation will be cleared again to avoid contact with the transmission line. No vegetation will be allowed to grow 5m within the wayleave.

Mitigation and Management Measures

- Vegetation clearance should be confined only to necessarily designated sites.
- Weed and pest management measures shall be implemented to avoid introduction of invasive weeds to natural and modified habitat areas.
- Appropriate speed limits for construction vehicles will be enforced to limit noise and dust generation and to minimise potential for fauna strike
- Conduct bird survey and install marks/reflectors, as necessary, to reduce risk of wildlife collision with the transmission line and tower.

- Keep appropriate height of towers to allow elephants to pass safely; Install fence where necessary

Table 6-7 Impact Significance on terrestrial fauna due to operation

Impact	Impact on terrestrial ecology due to maintenance activities and presence of transmission line				
Impact Nature	**Negative**	Positive	Neutral		
	The Impact on the terrestrial ecological environment is negative				
Impact Type	**Direct**	Indirect	Induced		
	Direct terrestrial habitat loss in the project footprint in areas to be developed. Indirect effects on remnant/isolated habitats.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	The loss/conversion of habitats will be permanent.				
Impact Extent Impact Scale	**Local**	Regional	International		
	The impact is expected to be local for habitats. It is anticipated that the project will be located within the acquired land covering a land area of approximately 92 ha.				
Frequency	Operation is continuous. Transmission line towers will stay until end of the Project				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	Considering the magnitude of impacts to modified habitat discussed above, the overall magnitude of this impact is Negligible to Small.				
Receptor Sensitivity	Low	Medium	**High**		
	There are sensitive species with important conservation value (an endangered bird species and elephants) that may be affected by the presence of transmission towers and electricity lines. Therefore, receptor sensitivity is High.				
Impact Significance	Negligible	Minor	**Moderate**	Major	Critical
	The significance of this impact is **Moderate.**				

Source: JICA Study Team, 2018

6.4.2 Soil

Construction Phase

Top Soil Disturbance from Site Preparation Activities

Soil works, including vegetation clearance, potential grading and levelling, compaction, backfilling, and construction of various structures will be carried out at the power plant site and access roads. Changes to soil structure may be caused by mechanical disturbance to the soil from these activities. Exposure of soil to rain and wind may in turn cause erosion and loss of top soil.

If compaction and erosion are not managed, associated potential impacts could include sedimentation of local waterways, loss of topsoil and reduction in soil fertility. Soil erosion is a particular concern during periods of high rainfall.

Mitigation and/or Management Measures

- Delineation of clearance boundaries to limit the areas to be cleared.
- Scheduling clearance activities, if possible to avoid extreme weather events such as heavy rainfall, extreme dry and high winds.
- Revegetation areas with temporary land use, conducting progressive rehabilitation.

- Demarcate routes for movement of heavy vehicles to minimise disturbance of exposed soils and compaction of sub-surface layers.
- Reuse topsoil as much as possible within rehabilitation activities.
- Control erosion through diversion drains, sediment fences, and sediment retention basins.

Table 6-8 Assessment of Top Soil disturbance due to site preparation activities

Impact	Impact on top soil due to site preparation activities			
Nature	**Negative**	Positive	Neutral	
	Potential impacts to soil would be considered to be adverse(negative).			
Type	**Direct**	Indirect	Induced	Cumulative
	Impact on topsoil is direct			
Duration	Temporary	Short-term	**Long-term**	Permanent
	Impactsareconsideredlongtermasalossoftopsoilmayoccuroveraperiodlongerthantheconstructionphase			
Extent	**Local**	Regional	International	
	Impact is expected to be limited to the project footprint only, and therefore the extent is considered local.			
Scale	The scale of this impact is expected to be small given that it will occur over a relatively small area compared to the rest of the landscape.			
Frequency	This impact will occur throughout the construction phase, with the most intensive time being during the clearance TL ROW.			
Magnitude	Positive	Negligible	**Small**	Medium	Large
	Potential impacts associated with topsoil loss are anticipated to be small based upon the limited extent and scale.			
Receptor/ Resource Sensitivity	Low	**Medium**	High	
	The resource sensitivity (being the topsoil) is considered to be medium as it is a valuable asset which can be easily lost due to inappropriate management practices.			
Significance	Negligible	**Minor**	Moderate	Major
	The combination of a Medium Resource Sensitivity and Small Impact Magnitude will result in an overall Minor Impact.			

Source: JICA Study Team, 2018

Accidental leaks, spillage, and contamination

Soil contamination may occur on the project site and surrounding areas during the construction phase due to accidental leaks or spills of chemicals or hazardous materials such as oils, lubricants or fuel. Spills and leaks may occur during vehicle/equipment operation (e.g. fuelling, and maintenance) and from improper handling and storage of chemicals and fuel.

Mitigation and/or Management Measures

- Fuel tanks and chemical storage areas will be sited on sealed hardstand areas, provided.
- Secondary containment, with appropriate drainage connection and/or provision for removal of spilled liquids, will be provided around places of fuel and hazardous materials storage such as oil filled transformers, oil pumps and tanks, generators, chemical storage houses etc. to contain any hazardous spills and to exclude surface water run-off from entering the contained area.
- Provision of spill kits on site.

- A training program will be implemented to familiarise staff with measures to be taken to prevent spills and leaks, and for emergency procedures and practices related to contamination events.
- Unloading and loading protocols will be developed to ensure that staff are able to undertake these tasks in a manner that minimises the risks of spills occurring.
- Appropriate management, storage and disposal of all waste streams will be implemented.

Table 6-9 Impact Significance on Soil Quality due to accidental leaks/spills

Impact	Soil Contamination due to Potential Leaks, Spills during construction			
Nature	**Negative**	Positive	Neutral	
	Potential impacts to soil would be considered to be adverse (negative).			
Type	**Direct**	Indirect	Induced	Cumulative
	Impacts to soil would be direct impacts from Project activities.			
Duration	Temporary	Short-term	**Long-term**	Permanent
	The construction phase will last approximately 31-36 months. However, if a groundwater aquifer is impacted, it may take a long time for natural recovery, unless active measures are taken to remove the contaminants. The duration is therefore long-term.			
Extent	**Local**	Regional	International	
	Potential impacts would be limited to the aquifer in the Project area and neighboring area, and hence would be considered to be local.			
Scale	The scale of potential impacts due to release of hazardous materials is potentially large due to the quantities present during this stage, but accidental release is an unlikely, unplanned occurrence. The amounts of fuels, oil, chemicals or waste spills/leaks, if they occur are expected to be small and are already reduced with the existing controls.			
Frequency	Potential impacts would be expected to be infrequent, only taking place during rainfall, after loss of containment or accidental spills.			
Magnitude	Positive	Negligible	**Small**	Medium	Large
	Potential reduction of soil quality in Project area is expected to be of Small magnitude, given that any spills of fuels, oil, chemicals or wastes, if they occur are expected to be very localised and small.			
Receptor/ Resource Sensitivity	Low	**Medium**	High	
	The project site is located in a coastal area. Storm/rain water runoff will be flowing towards nearby estuary/sea. The marine ecology may be impacted. Thus, receptor sensitivity is Medium			
Significance	Negligible	**Minor**	Moderate	Major
	The combination of a Medium Resource Sensitivity and Small Impact Magnitude will result in an overall Minor Impact.			

Source: JICA Study Team, 2018

Operation Phase

Once built, the ROW of transmission lines are maintained, and in most cases cleared. This results in loss of production land due to increased risk to soil erosion. If not mitigated, eroded soil may cause siltation of surface water resources during rain or increase dust particle in air.

Mitigation and/or Management Measures

- Delineation of clearance boundaries to limit the areas to be cleared.
- Scheduling clearance activities, if possible to avoid extreme weather events such as heavy rainfall, extreme dry and high winds.

- Demarcate routes for movement of heavy vehicles to minimise disturbance of exposed soils and compaction of sub-surface layers.
- Reuse topsoil as much as possible within rehabilitation activities.
- Control erosion through diversion drains, sediment fences, and sediment retention basins.

Table 6-10 Assessment of Top Soil disturbance due to ROW maintenance

Impact	Impact on top soil due to ROW maintenance during operation			
Nature	**Negative**	Positive	Neutral	
	Potential impacts to soil would be considered to be adverse (negative).			
Type	**Direct**	Indirect	Induced	Cumulative
	Impact on top soil is direct			
Duration	Temporary	Short-term	**Long-term**	Permanent
	Impacts are considered long term as a loss of topsoil may occur over a period longer than the construction phase			
Extent	**Local**	Regional	International	
	Impact is expected to be limited to the project footprint only, and therefore the extent is considered local.			
Scale	The scale of this impact is expected to be small given that it will occur over a relatively small area compared to the rest of the landscape.			
Frequency	This impact will occur throughout the construction phase, with the most intensive time being during the clearance of the power plant site.			
Magnitude	Positive	Negligible	**Small**	Medium	Large
	Potential impacts associated with erosion are anticipated to be small based upon the limited extent and scale.			
Receptor/ Resource Sensitivity	Low	**Medium**	High	
	Silted storm and rainwater runoff will be directed to the sea. This may impact the marine ecosystem. Thus, receptor sensitivity is Medium.			
Significance	Negligible	**Minor**	Moderate	Major
	The combination of a Medium Resource Sensitivity and Small Impact Magnitude will result in an overall Minor Impact.			

Source: JICA Study Team, 2018

6.4.3 *Water Resources*

Sensitivity

There are at least three rivers that will be crossed by the proposed transmission line route. The numbers will increase if seasonal streams are included. Also the transmission line route is located in coastal areas with some areas which are part of estuaries. Impacts on rivers and streams may directly go to the sea.

Construction Phase

Wastewater and Stormwater Runoff

Workers will be accommodated in a worker camp adjacent to the substations, and sanitary wastewater streams from the workers could potentially impact surface water. Sanitary facilities, including toilets and septic tanks, will be provided for the use of the construction workforce both on-site and at the workers' accommodation. If not adequately designed and positioned, untreated sanitary wastewater due to leakages or overflows could have the potential to enter surface water and/or subsurface water.

Periods of high rainfall could lead to overflow, or rapid through-flow, of the effluent to surface water prior to its full digestion in the septic tanks. Raw sewage can impact surface water quality. Sanitary wastewater is generally characterized as having a high concentration of solids (suspended and dissolved), biochemical oxygen demand (BOD) and chemical oxygen demand (COD), nutrients (nitrogen, ammonia) and faecal coliform counts.

The approximate number of people onsite during the construction phase is expected to be 1,800 people per day during peak period. Conservatively assuming 100 L/person/day of water consumption, and considering sanitary wastewater production to be 80% of water consumption per person (for non-continuous use), this equates to the production of 180,000 liters of sanitary wastewater daily.

In addition, construction activities such as site clearance, earthworks, disposal of back fill materials, and installation of hard standing areas could cause runoff of unconsolidated sediments during rainfall. The generation of sediment laden run off could be transferred to the nearby freshwater bodies, which could increase total suspended solids and turbidity in receiving waters.

Wastewater may also be generated from washing of equipment and machinery on site, as well as from the concrete batching plant. This wastewater may contain suspended solids and traces of hydrocarbons. The discharge of wastewater produced during concreting can also lead to changes in the pH of the receiving water body, if not first treated.

Mitigation and Management Measures

- Adequate sanitary facilities will be provided for the construction workforce. Septic tanks will be provided to treat sanitary discharge.
- Contaminated storm/rainwater runoff from the substation will pass through oil separator prior to discharge
- Design drainage for the controlled release of storm flows.
- Regularly, and particularly following rainstorms, inspect and maintain drainage and erosion control and silt removal measures to ensure proper and efficient management at all times.
- Mulch to stabilise exposed areas, where practicable and appropriate. Re-vegetate areas promptly, where practicable and appropriate.
- Construct sediment basins.
- Wastewater collected from canteen kitchens, including that from basins, sinks and floor drains, should be discharged into sanitary sewers via grease traps.
- Oil-contaminated water will be collected and handled by local licensed wastewater sub-contractors.

Table 6-11 Impact Significance on Water Resources due to Wastewater and Stormwater Runoff

Impact	Potential for impacts to water resources due to wastewater discharges and stormwater runoff.			
Nature	**Negative**	Positive	Neutral	
	Potential impacts to water resources would be considered to be adverse			
Type	**Direct**	Indirect	Induced	Cumulative
	Impacts to water resources would be direct impacts from Project activities.			
Duration	Temporary	Short-term	**Long-term**	Permanent
	Theconstructionphasewilllastapproximately31-36 months. The duration of potential impacts is therefore long-term.			
Extent	**Local**	Regional	International	
	Potential impacts would be limited to the Project site footprint, as well as areas downstream of the Project site, and hence would be considered to be local.			
Scale	The total approximate quantities of wastewater that could be a potential source of impact during this stage (assuming maximum of 1,800 workers per day) include 180,000 L/day of sanitary wastewater.			
Frequency	Impacts to surface water from wastewater discharges could occur intermittently but repeatedly throughout the day for the duration of the construction phase.			
Magnitude	Positive	Negligible	Small	**Medium**	Large
	Potential impacts to surface water quality in the Project area from wastewater discharges and runoff are expected to be of Medium magnitude.			
Receptor/ Resource Sensitivity	Low	**Medium**	High	
	The Project is near some sensitive receptors with regards to surface water quality, such as river crossings. Also, groundwater is a valuable resource for the villages. Overall sensitivity is rated as Medium.			
Significance	Negligible	Minor	**Moderate**	Major
	ThecombinationofaMediumResourceSensitivityandMediumImpactMagnitudewillresult in an overall Moderate Impact.			

Source: JICA Study Team, 2018

Operation Phase

Stormwater Runoff and Accidental Spills and Leaks

During rain events, substations may generate oil contaminated rainwater. If released in surface water untreated, this discharge may have a direct impact on the water quality and ecological implications.

In order to minimize this risk, oil separators will be installed so as to capture oil in rainwater prior to discharge. For Mtwara substation, this discharge stream will be sent to an on-site wastewater treatment plant.

Mitigation and Management Measures

- The storage areas for batteries and waste in substations and other storage areas will be surrounded by containment/spill control measure to prevent spilled oil, fuel and chemicals from percolating into the ground or reaching the receiving waters.
- All drainage/tanks, etc. will be positioned on concrete hard standing to prevent any seepage into ground.
- Use of spill or drip trays to contain spills and leaks
- Guidelines and procedures should be established for immediate clean up actions following any spillages of oil, fuel or chemicals.

- Standard operation procedures (SOPs) will be prepared to manage any oil spills, leaks and/or seepages. SOPs will cover transport, handling, storage, use and disposal of oil/ oil wastes/ empty drums etc.
- Operating personnel will be trained on the SOPs.
- Regularly check and replace oil separators.

Table 6-12 Impact Significance on Water Resources due to potential leaks/spills and stormwater runoff

Impact	Impact on water resources due to accidental releases of hazardous substances and storm water runoff			
Nature	**Negative**	Positive	Neutral	
	Potential impacts to surface water would be considered to be adverse (negative).			
Type	**Direct**	Indirect	Induced	Cumulative
	Impacts to surface water would be direct impacts from project activities.			
Duration	Temporary	Short-term	**Long-term**	Permanent
	The operation phase will last for approximately 40years. The duration of potential impacts is therefore long-term.			
Extent	**Local**	Regional	International	
	Potential impacts would be limited to the project site footprint, and hence would be considered to be local.			
Scale	The scale of potential impacts due to release of hazardous materials is potentially large due to the quantities present during this stage, but accidental release is unlikely, unplanned occurrence.			
Frequency	Potential impacts would be expected to be infrequent, only taking place during rainfall, after loss of containment or accidental spills.			
Magnitude	Positive	Negligible	**Small**	Medium	Large
	Potential impacts to surface water quality in the project area due to accidental releases is expected to be of Negligible due to treatment (oil separator) prior to discharge.			
Receptor/ Resource Sensitivity	**Low**	Medium	High	
	Accidental releases of hazardous substances are likely to happen only in substations which are located at a distance to sensitive surface water sources. Therefore, sensitivity is rated as Low.			
Significance	**Negligible**	**Minor**	Moderate	Major
	The combination of a Low Resource Sensitivity and Small Impact Magnitude will result in an overall Negligible Impact.			

Source: JICA Study Team, 2018

6.4.4 Air Quality

Construction Phase

The key activities which may potentially cause air quality impacts are listed below:

- Site clearance, site formation and levelling involving excavation and backfilling;
- Construction of substations and transmission towers.

Potential air pollutants during construction include fugitive dust emissions from site preparation and construction activities, stock piles, handling and transport of materials; emissions from vehicles and other construction machineries.

Site formation and levelling works will be required within the Project site area where material handling from excavation, backfilling and stockpiling of materials will be carried out on site and there will be potential to cause fugitive dust impact. The excavated materials will be re-reused on site as far as practicable. The excavated materials suitable for backfilling will be temporarily stockpiled onsite.

In addition, trucks movements within the work sites and wind erosion of the open uncovered areas are also potential sources of fugitive dust emissions. Dust suppression measures and good site practices as mentioned below will be implemented to minimize the fugitive dust emission during the construction works.

Furthermore, construction equipment (electric and diesel-powered) will be operating in different areas within the Project site area and the associated emissions from their operation may also contribute to air quality impact during the construction phase.

With the implementation of the dust suppression measures and good site practices mentioned below, the fugitive dust impact arising from the potential dust generating activities and air quality impact from operation of construction equipment during the construction of the Project on the nearby air sensitive receptors (ASRs) is anticipated to be minor and transient.

Mitigation Measures

- Specifying transport networks and locating stockpiles as far away from the site boundary which is close to the air sensitive receptors, as practicable to minimize the impact of air pollutants and dust;
- Minimizing the size of exposed areas and material stockpiles and the periods of their existence;
- Temporary stockpiles of dusty materials will be either covered entirely by impervious sheets or sprayed with water to maintain the entire surface wet all the time;
- Covering the construction materials transported by trucks or vehicles entirely to prevent dust emissions;
- Cleaning wheels and the lower body parts of trucks at all exits of the construction site;
- Controlling the height of unloading the fill materials during filling as far as possible. Where possible, this should be well below the height of the hoardings along the Project site boundary;
- Prohibiting the burning of waste or vegetation on site;
- Compacting the reclaimed land immediately to avoid fugitive dust emissions;
- Maintaining and checking the construction equipment regularly;
- Switching off engines when idling

Table 6-13 Impact Significance on air quality due to construction

Impact	Impact on air quality due to construction activities.				
Impact Nature	**Negative**	Positive	Neutral		
	Impact on human health within the general population is negative.				
Impact Type	**Direct**	Indirect	Induced		
	Impact on human health within the general population is direct.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impacts are considered short-term				
Impact Extent	**Local**	Regional	International		
	Impacts on human health within the general population are expected to be local.				
Impact Scale	The fugitive dust impacts are expected to be limited, localized (within 100m from the worksite boundary) and short-term. The air quality impacts are expected to be small provided that all mitigation measures and good site practices are implemented.				
Frequency	Throughout the construction period.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	Impact magnitude is considered to be small as the fugitive dust impact will be reduced as much as possible after the proper implementation of all in-place dust suppression measures and good site practice.				
Receptor Sensitivity	Low	**Medium**	High		
	The transmission line towers will be located as far from local residents as possible. However, there are nearby villages located close to the transmission line route. Residents living along access roads may also be affected. Thus, the receptor sensitivity is considered Medium.				
Impact Significance	Negligible	**Minor**	Moderate	Major	
	Significance of impact is considered to be **Minor.**				

Source: JICA Study Team, 2018

Operation Phase

During operation, the transmission line will not generate air emissions. Thus, impact on air quality is not foreseen.

6.4.5 Noise& Vibration

Construction Phase

In some locations, work will be done in close proximity to residences or farms located along the ROW. Traffic, as well as the use of construction equipment and machinery, will result in temporary noise emissions. Other than in urbanized areas, there has been minimal noise stress in the project areas prior to the construction.

Noise resulting from the construction of access roads and transmission line may disturb neighbouring communities and local fauna. Since a detailed breakdown of activities and a construction plant inventory are both not available at this stage, assumptions are made based on experience with similar projects. Noise levels generated by general construction equipment are provided in ***Table 6-14*** .

Table 6-14 Assumed Construction Equipment Sound Pressure Level Inventory

Construction Equipment	SPL, dB(A)
Bulldozer	115
Backhoe	96
Impact pile driver	101
Loaders	108
Vibratory roller	102
Fuel truck	104
Welding machine	101
Cranes	106
Dump truck	105
Grader	114
Fork lifts	112
Compressors	104
Generators	93

Source: OSHA, 2003

Looking at the noise levels, it can be predicted that noise impacts will be more predominant within 500m of the construction site. This impact will only be of a temporary nature and can be minimised by adopting appropriate mitigation measures. Also, there are no residential area within the 500m diameter of the Mtwara and Lindi substations.

Where explosives will be used i.e. blasting during foundation excavation there could be significant noise and vibrations in areas adjacent to construction activities and sometimes causing cracks to building. This impact will be sporadic and short term.

Mitigation and management measures

- Maintaining equipment and vehicles to manufacturers' standards; and
- Limiting operating times to daylight hours;
- Information of blasting incidence, time should be available either written or disposed on local gathering areas.

Table 6-15 Impact Significance of noise impact during construction

Impact	Noise impact due to site preparation and construction activities			
Impact Nature	**Negative**	Positive	Neutral	
	Adverse potential noise impacts would not be anticipated.			
Impact Type	**Direct**	Indirect	Induced	
	Potential impacts would likely be direct impacts.			
Impact Duration	**Temporary**	Short-term	Long-term	Permanent
	The impact from construction activities is temporary for the duration of the proposed Project.			
Impact Extent	**Local**	Regional	International	
	Noise impact from construction equipment and activities will have localised impact.			
Impact Scale	NSRs near Project area may have significant impact due to construction activities.			
Frequency	Throughout construction period			
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	Noise levels generated by construction equipment and machineries are significant, particularly within a distance of 500m from the construction site. The impact magnitude is **Medium**.			
Receptor Sensitivity	**Low**	Medium	High	
	The transmission line towers will be located as far from local residents as possible. However, there are nearby villages located close to the transmission line route. Thus, the receptor sensitivity is considered Low.			
Impact Significance	Negligible	**Minor**	Moderate	Major
	The significance is likely to be **Minor**.			

Source: JICA Study Team, 2018

Operation Phase

Substations may generate noise coming from transformers, air compressors, fans, and generators. Typical noise levels generated by the proposed transformer that will be used for the project range from 82-84dB.Considering that the nearest resident to the new Lindi S/S is approximately 1km, the expected noise level from that receptor is calculated below.

Noise levels experienced at a receptor is given by the following equation.

$$L = Lw - 20\log(r) - 8dB(A)$$

Where,
L = Noise level at a distance of r (m) from the noise sources (dB (A))
Lw = Noise power level of noise source (dB (A))
8dB(A)= Noise level at l m from the noise source

In addition, the combined noise level generated from the operation of several construction machineries is given by the following equation;

$$L = 10\log(10^{\left(\frac{L1}{10}\right)} + 10^{\left(\frac{L1}{10}\right)} + \cdots + 10^{\left(\frac{Ln}{10}\right)})$$

Where,
L = Combined noise level (dB (A))
L1, L2,…, Ln=Noise level of each equipment (dB (A))

Using the above-mentioned formulas, the predicted noise level range at the nearest sensitive receptor is approximately 21.4-23.4db(A), which is lower than the noise standard for night time (35dB(A)).

On the other hand, noise from overhead line due to Corona effect is also expected from transmission line and sub stations. However, considering the voltage grade of the Project transmission line and that this noise will only reach maximum levels during rainy events, it is highly unlikely that the corona discharge noise will exceed the normal background noise levels in the area.

Mitigation Measures

- Well-maintained equipment to be operated on-site;
- Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components;
- Orientate equipment known to emit noise strongly in one direction so that the noise is directed away from receptors far as practicable; and
- Avoid transportation of materials on- and off-site through existing community areas.

Table 6-16 Impact Significance of noise impacts during operation

Impact	Noise impact due to operation of substations				
Impact Nature	Negative	Positive	**Neutral**		
	Adverse potential noise impacts would not be anticipated.				
Impact Type	**Direct**	Indirect	Induced		
	Potential impacts would likely be direct impacts.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impact from construction activities is temporary for the duration of the proposed Project.				
Impact Extent	**Local**	Regional	International		
	Noise impact from construction equipment and activities will have localised impact.				
Impact Scale	NSRs near the Project area may have significant impact due to operation of substations.				
Frequency	Throughout construction period				
Impact Magnitude	Positive	**Negligible**	Small	Medium	Large
	The predicted noise levels at all NSRs comply with the daytime and night time criteria. The magnitude of the noise impact is **Negligible**.				
Receptor Sensitivity	**Low**	Medium	High		
	The identified NSR are residential, but these houses are located at a minimum distance of 600m away from the substations. Thus, the sensitivity of the receptor is considered as Low.				
Impact Significance	**Negligible**	Minor	Moderate	Major	
	The significance is likely to be **Negligible**.				

Source: JICA Study Team, 2018

6.4.6 *Wastes*

Construction Phase

During the construction phase, waste materials, if not stored and disposed of appropriately, have the potential to cause soil and water contamination through direct release or from contaminated stormwater runoff.

The majority of the generated wastes from the project during the construction phase will be non-hazardous. General construction waste will comprise of surplus or off- specification materials such as concrete, steel cuttings/filings, wooden planks, packaging paper or plastic, wood, plastic pipes, metals, etc. Domestic wastes consisting of food waste, plastic, glass, aluminium cans and waste packages will also be generated by the construction workforce. A small proportion of the waste generated during construction will be hazardous, including used paint, engine oils, hydraulic fluids and waste fuel, spent solvents from equipment cleaning activities, and spent batteries or spent acid/alkali from the maintenance of machinery on site.

The total approximate quantities of non-hazardous and hazardous waste that could be a potential source of impact during this stage (assuming a maximum of 1,800 workers per day) include 550 kg/day of solid (non-hazardous) waste. Hazardous wastes will be contracted out to authorized industrial waste companies. All wastes will be handled, stored and disposed in accordance with applicable guidelines.

The significance of potential impacts to water resources due to contamination from inappropriate waste storage and disposal during the construction phase are assessed in the following Table, and mitigation measures are presented.

Potential impacts would be limited to the project area and its downstream, and hence would be considered to be local.

Mitigation and Management Measures
The following measures will be put in place for the project during construction phase:

- Pursue the policy of Four R's – Recover, Recycle, Reduce and Reuse – to manage its waste.
- Provide training to labourers for waste disposal in designated areas and use of sanitation facilities.
- Implement proper storage of the construction materials and wastes to minimise the potential damage or contamination of the materials.
- Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type.
- Store waste systematically to allow inspection between containers to monitor leaks or spills.
- Ensure that storage areas have impermeable floors and containment.
- Dispose of waste by licensed contractors.

Table 6-17 Impact significance of improper waste management during construction

Impact	Impact of improper waste management			
Nature	**Negative**	Positive	Neutral	
	Potential impacts to water resources would be considered to be adverse			
Type	**Direct**	Indirect	Induced	Cumulative
	Impacts to water resources would be direct impacts from project activities.			
Duration	Temporary	Short-term	**Long-term**	Permanent
	The construction phase will last approximately 31-36 months. The duration of impacts is therefore long-term.			
Extent	**Local**	Regional	International	
	Potential impacts would be limited to the project area and its downstream, and hence would be considered to be local.			
Scale	Construction activities will take place within the project area. The total approximate quantities of waste that could be a potential source of impact during this stage (assuming a maximum of 1,800 workers per day) include 550 kg/day of solid waste. The scale of potential impacts due to release of waste is potentially large due to the quantities present during this stage, but appropriate waste management practices will mitigate the impacts.			
Frequency	Impacts to soil and water resources due to inappropriate waste storage and disposal could occur intermittently but repeatedly throughout the day for the duration of the construction phase.			
Magnitude	Positive	Negligible	**Small**	Medium	Large
	Potential impacts to water quality in project area due to inappropriate waste disposal are expected to be of Small magnitude.			
Receptor/ Resource Sensitivity	Low	**Medium**	High	
	Surface water quality analysis from the baseline surveys indicated compliance with drinking water standards. The project is near sensitive resources with regards to water quality, such as agricultural lands and domestic use. Overall sensitivity is rated as Medium.			
Significance	Negligible	**Minor**	Moderate	Major
	The combination of a Medium Resource Sensitivity and Small Impact Magnitude will result in an overall Minor Impact.			

Source: JICA Study Team, 2018

Operation Phase

During operation, wastes will be limited to wastes generated from the substations, such as waste oil and general wastes. If not stored and disposed of appropriately, have the potential to cause soil and water contamination through direct release or from contaminated stormwater runoff.

General wastes will comprise of food waste, plastic, glass, aluminium cans and waste packages will also be generated by the employees in Mtwara S/S. A small proportion of the waste generated will be hazardous, including used paint, engine oils, hydraulic fluids, light bulbs, and waste fuel, spent solvents from equipment cleaning activities, and spent batteries or spent acid/alkali from the maintenance of machinery on site.

Since employees during operation will be limited, and oil waste will not be generated frequently, impact significance is negligible.

Mitigation and Management Measures

The following measures will be put in place for the project during construction phase:

- Education to workers on site shall be undertaken to avoid, reduce and reuse wastes generated.
- Waste storage facilities shall be sited and signposted in the project site. Solid waste generated by daily operations at the site should be collected using on-site bins before being disposed appropriately.
- All waste collected will be managed and disposed of in accordance with the required regulations.
- Dispose of waste by licensed contractors.

Table 6-18 Impact Significance of improper waste management during operation

Impact	Potential for contamination from inappropriate waste management.			
Nature	**Negative**	Positive	Neutral	
	Potential impacts to water resources would be considered to be adverse (negative).			
Type	**Direct**	Indirect	Induced	Cumulative
	Impacts to water resources would be direct impacts from project activities.			
Duration	Temporary	Short-term	**Long-term**	Permanent
	The duration of impacts is therefore long-term.			
Extent	**Local**	Regional	International	
	Potential impacts would be limited to the project area and its downstream, and hence would be considered to be local.			
Scale	Wastes will be limited to wastes generated from the substations, such as waste oil and general wastes Considering proper waste management practices will be implemented, the scale of potential impacts due to release of waste is considered small			
Frequency	Impacts to soil and water resources due to inappropriate waste storage and disposal may occur but the likelihood of this happening is low.			
Magnitude	Positive	**Negligible**	Small	Medium	Large
	Considering mitigation measures in place, potential impacts to soil and water quality in project area due to inappropriate waste disposal are expected to be of Negligible magnitude.			
Receptor/ Resource Sensitivity	Low	**Medium**	High	
	The project is near sensitive resources with regards to water quality, such as agricultural lands and domestic use. Overall sensitivity is rated as Medium.			
Significance	**Negligible**	Minor	Moderate	Major
	The combination of a Medium Resource Sensitivity and Small Impact Magnitude will result in an overall Negligible Impact.			

Source: JICA Study Team, 2018

6.5 SOCIAL IMPACT ASSESSMENT

This chapter describes the predicted socio-economic impacts associated with construction and operation of the project. It is based on the baseline data presented and the impact assessment methodology detailed in Chapter 4.

A project's area of influence generally includes the following:

- Direct footprint of the land that will be acquired and used. This is generally the land area that will be fenced and reserved for the project and where the public will not be allowed access.
- A physical distance around the direct footprint at a scale depending on the emissions related to a particular activity.
- A physical distance around the direct footprint at a scale depending on the indirect effects of a particular activity.

Impacts are described in the context of the effect that a project or a project's activities will have on a receptor. In this instance, the project receptors are the local people located within the area of influence and along ROW that may be impacted or influenced by the project (as a result of their proximity to the project site and/ or project associated infrastructure).

6.5.1 Employment and economy

The project will generate a range of employment opportunities. During construction, it is expected that around 100,000 workers in cumulative total number are expected during the construction. During the peak period of construction, around 100 to 200 workers on daily basis would be required. This includes skilled and unskilled workers.

The number of people employed by the project will decrease at the end of the construction phase. It is anticipated that approximately 50 employment opportunities will be created during the operation phase.

The resulting impacts (e.g. increase in employment opportunities, increase in income for local people employed by the project) were assessed as a positive.

On the other hand, livelihood of farmers whose land will be acquired will also be impacted. This impact will be evaluated under land acquisition.

Measures to maximize positive impacts

- Develop and implement a local recruitment and procurement management plan.
- Consult with relevant stakeholders, including government authorities and local villagers in developing the local recruitment plan.
- Review opportunities to establish a skills training program with an aim of training interested local villagers who can contribute to the project.
- Inform local villagers of job opportunities in a timely manner.
- Inform local businesses of contracting opportunities in a timely manner such as awareness on forthcoming investment and employment opportunities, including sensitization of farmers for production of required quality of foods such as vegetables.

Mitigation and Management Measures for loss of livelihood.

- Keep open communication with the affected people
- Study the alternative options for livelihood restoration
- Develop a livelihood restoration plan

6.5.2 Community health, safety and security

Construction Phase

Site preparation activities, transport of materials and civil works will cause disturbances to neighbouring villages due to dust, noise and vibration that will be generated by these activities. Particularly, villages located close to the transmission line route and along access roads will be affected.

Around 100,000 workers in cumulative total number are expected during the peak of construction. During the peak period of construction, around 100 to 200 workers on daily basis would be required. Since the transmission line construction will occur on a rolling section-by-section basis and construction site moves along the route as it proceeds, temporary demographic changes during construction are not likely to be significant.
There is potential for the influx of workforce to introduce and/ or increase the rate of spread of communicable diseases in the project area. This includes the introduction of a new disease and/ or a more virulent strain of an existing disease.

The influx of people to the village will influence the change of behaviour of some members in the community due to the interaction of people with different lifestyles and behaviour. This will increase the chances of infection of diseases including HIV/AIDs and Sexual Transmission Diseases (STDs). Also, the influx of workers in the area may increase level of crime and insecurity among community members.

The transport of workers and goods to and from the Project site will also impact traffic conditions. Heavy cargo will be transported via main road. With an increase in vehicles, particularly heavy haulage vehicles, comes the increased potential for accidents and inquiries to occur. This is exacerbated by the fact that people living in the local villages typically reside immediately adjacent to roads. However, villagers are not accustomed to the presence of large vehicles and heavy traffic.

The existing local healthcare facilities have limited capacity to respond to an increase in the transmission of communicable diseases, leaving the local villagers vulnerable.

However, the construction of transmission towers will only take a couple of months. Thus, the presence of workers in a particular area will be local and temporary. .Given the existing management measures, the local extent and scale of the impact, the impact was assessed as Minor and negative.

The project will require security. Security personnel will be employed during construction phase.

Mitigation Measures

- Training for all workers on the transmission routes and common symptoms of communicable diseases as well as sensitization of enforcement of

HIV/AIDS law and regulations. This can help reduce the potential for workers to unknowingly transmit communicable diseases.

- Establish amenities at the worker camp to that help minimize the interaction between the workforce (particularly temporary construction workers) and local villagers.
- Establish a workforce code of conduct. Include in the code specific measures on anti-social behaviour.
- Vector management procedures, including consideration of whether pesticides will be utilized to reduce the presence of vectors onsite.
- Provision of onsite health care, to ensure that medical attention can be sought should a worker present with the symptoms of a communicable disease, including Sexually Transmitted Infection (STI) diagnosis and monitoring in collaboration with National HIV/AIDS Authorities.
- Emergency management procedures, should a health issue escalate and require a rapid response.
- Implement a grievance mechanism

Table 6-19 Significance of Impact on Community Health, Safety and Security during construction

Impact	Impact on community health, safety and security during construction				
Impact Nature	**Negative**	Positive	Neutral		
	Increase of risk in community health, safety and security is negative.				
Impact Type	**Direct**	Indirect	Induced		
	The impact is direct.				
Impact Duration	Temporary	**Short-term**	**Long-term**	Permanent	
	Impact can range from short to long-term, if not properly addressed				
Impact Extent	**Local**	Regional	Global		
	The impact is limited to the local villages that are located close to the transmission line and along access roads.				
Impact Scale	The impact scale is Medium.				
Impact Frequency	The impact is likely to occur during the construction phase, at certain inevitable occasions.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	Influx of workers and impacts of construction activities may increase risk to community health. The impact magnitude is likely to be **Medium.**				
Vulnerability of Receptors	Low	**Medium**	High		
	The transmission line towers will be located as far from local residents as possible. However, there are nearby villages located close to the transmission line route and along access roads. Also, local healthcare facilities have limited capacity. Thus, the receptor sensitivity is considered **Medium.**				
Significance	**Negligible**	Minor	**Moderate**	Major	
	The significance is likely to be **Moderate.**				

Source: JICA Study Team, 2018

Operation Phase

The number of workers that will be employed during operation of the transmission line and substations will be very limited compared to during construction phase. Only Mtwara Substation will be manned and operation activities will be limited to maintenance of substations, ROW, and inspection of transmission lines and towers thus requiring limited manpower (approximately 50 workers). Thus, impact of worker influx is considered negligible.

However, there are safety issues with the establishment of new infrastructure such as community members being in contact with transmission towers and substations. There is a risk of non-workers wandering into project site (e.g. transmission towers and substations) and being exposed to the hazards and knowledge of the dangers of these sites. This can lead to onsite accidents and injuries.

Security personnel will also be employed during operation phase.

Mitigation measures

- Provide appropriate training for security personnel
- Monitor implementation of the training over time
- Create awareness on all security and safety issues and hazards associated with transmission line towers and substations.
- Construct fence around transmission line towers and substations
- Provide safety signs
- Implement a grievance mechanism

Table 6-20 Significance of Impact on Community, Health, Safety and Security during Operation

Impact	Impact on community health, safety, and security during operation				
Impact Nature	**Negative**	Positive	Neutral		
	Increase of risk to community safety is negative.				
Impact Type	**Direct**	Indirect	Induced		
	The impact is direct.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	The impact is long-term as long as the transmission line exists.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited to the local villages.				
Impact Scale	The impact scale is Medium.				
Impact Frequency	The impact is likely to occur during operation phase at rare occasions..				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	The impact magnitude is likely to be **Medium** since it may cause serious health impacts				
Vulnerability of Receptors	**Low**	Medium	High		
	The vulnerability of receptor is likely to be **Low** since contact to project components by unauthorized persons will be prohibited.				
Significance	**Negligible**	**Minor**	Moderate	Major	
	The significance is likely to be **Minor.**				

Source: JICA Study Team, 2018

6.5.3 Occupational Health and Safety

Construction

The construction of the transmission line and substations will require around 100,000 workers in cumulative total number are expected during the construction. During the peak period of construction, around 100 to 200 workers on daily basis would be required. These workers will be exposed to noise, dust, vibration at source and other occupational hazards related to site preparation and construction works. In particular, the construction of transmission towers would require work at considerable heights.

It is important to note that construction period will only last for approximately 22 months. Operation of construction machineries will also be intermittent. Thus, these impacts will be temporary and intermittent. In order to ensure the protection of health and safety of all the workers, mitigation and management measures will be implemented in accordance with applicable laws and regulations.

Mitigation measures

- Develop and implement a health and safety plan.
- Provide personal protective equipment (PPE)
- Provide appropriate training for workers on risks to health and safety in the workplace
- Create awareness on all security and safety issues and hazards at the site
- Provide safety signs

Table 6-21 Significance of impact on occupational health and safety during construction

Impact	Impact on occupational health and safety				
Impact Nature	**Negative**	Positive	Neutral		
	Potential health and safety risks to workers are negative				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct** to the workers' health and safety.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Impact has the potential to have a lasting effect.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited within the local villages.				
Impact	The impact scale is medium.				
Impact Frequency	Theimpactlikelyoccursduringtheconstructionphasewiththerarefrequency.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	The impact magnitude is likely to be **Medium** since the workers are directly exposed to the hazards.				
Vulnerability of Receptors	Low	**Medium**	High		
	The vulnerability of receptor is likely to be **medium** since thousands of workers will be involved in the project				
Significance	Negligible	Minor	**Moderate**	Major	
	The significance is likely to be **moderate.**				

Source: JICA Study Team, 2018

Operation

During operation phase, it is anticipated that approximately 50 people will be employed. These workers, particularly those who will be engaged in the maintenance of substations, ROW, and inspection of transmission lines and towers will be exposed in health and safety hazards (e.g. exposure to high voltage facilities).

In order to ensure the protection of health and safety of all the workers, mitigation and management measures will be implemented in accordance with applicable laws and regulations.

Mitigation measures

- Provision and enforcement of the proper use PPEs
- Provide health checks to the employees
- Provide appropriate training on occupational health and safety
- Monitor implementation of the training over time
- Provision of safety signs

Table 6-22 Significance of impact on occupational health and safety during operation

Impact	Impact on occupational health and safety				
Impact Nature	**Negative**	Positive	Neutral		
	Risks to health and safety of workers is **negative.**				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct** to the workers' health and safety.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact may be short-term but it has the potential to have lasting effect.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited to workers involved in the project.				
Impact Scale	The impact scale is Medium.				
Impact Frequency	The impact is likely to occur during the operation phase with rare frequency.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	The impact magnitude is likely to be **Medium.**				
Vulnerability of Receptors	**Low**	Medium	High		
	The vulnerability of receptor is likely to be **Low** since workers will be limited during operation phase and there will be mitigation and management measures in place.				
Significance	Negligible	**Minor**	Moderate	Major	
	The significance is likely to be **minor.**				

Source: JICA Study Team, 2018

6.5.4 Community infrastructure and public services

Construction Phase

During construction, the workforce is expected to peak at approximately 1,800 workers. A number of these workers is expected to be from outside the local area. It is the workers from outside the area as well as the influx associated with in-migration that contributes to the pressure that is experienced by community infrastructure and services such as roads and health centres.

However, during construction the workforce will be accommodated at a worker camp, which will have a range of on-site amenities. This will minimize the need for the workforce to utilize or rely on local infrastructure, minimizing the pressure that may be experienced by community infrastructure and services.

Traffic may still create an issue particularly during construction when transport needs are higher. An increase in traffic along the B2 trunk road will potentially displace current users to some extent. This means that road users may need to modify their activities (i.e. during specific points in the construction phase). This is expected to be a very temporary situation during the construction phase.

Mitigation Measures

- Provide appropriate amenities at the workers camp. This will help reduce the need for workers to utilize local infrastructure and services.

- Develop and implement a traffic management plan to minimize the impact experienced by road users as a result of the project.

Table 6-23 Impact Significance on community infrastructure and services during construction

Impact	Impact on Community Infrastructure and Services				
Impact Nature	**Negative**	Positive	Neutral		
	Increase of pressure that is experienced by community infrastructure and services in the local area is **negative.**				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct** to the community infrastructure and services.				
Impact Duration	**Temporary**	Short-term	Long-term	Permanent	
	Impact is likely to be temporary.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited within the local villages.				
Impact Scale	The impact scale is small.				
Impact Frequency	The impact likely occurs during the construction phase frequently, particularly during mobilization of materials and manpower.				
Impact Magnitud	Positive	Negligible	**Small**	Medium	Large
	The impact magnitude is likely to be **Small.**				
Vulnerability of Receptors	Low	**Medium**	High		
	The vulnerability of receptor is likely to be **medium.**				
Significance	Negligible	**Minor**	Moderate	Major	
	The significance is likely to be **minor.**				

Source: JICA Study Team, 2018

Operation Phase

In terms of the operation phase, it is anticipated that approximately 50 people will be employed. It is assumed that some of these workers will come from outside the local area. Considering the duration of the project, it is anticipated that some workers will bring their families with them. These workers may place some additional pressure on the local infrastructure. However, given the small workforce, it is anticipated that this additional pressure can be accommodated.

Also, there is potential to impact more widely on community infrastructure (e.g. schools, community centers). This assumes that workers will be brought in from other areas and bring with them their families. This may occur, but is expected to result in only a handful of families moving into the area. As a result, the extent and scale of the impact is likely to be local and the overall impact is likely to be small. For these reasons, the impact was assessed as negligible.

Table 6-24 Impact Significance on community infrastructure and services during operation

Impact	Impact on Community Infrastructure and Services during operation phase				
Impact Nature	**Negative**	Positive	Neutral		
	Increase of additional pressure on the local infrastructure is **negative.**				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct** to the community infrastructure and services.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact is likely to be short-term.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited within the local villages.				
Impact Scale	The impact scale is small.				
Impact Frequenc	The impact likely occurs during the operation phase with the rare frequency.				
Impact Magnitud	Positive	Negligible	**Small**	Medium	Large
	The impact magnitude is likely to be **Small.**				
Vulnerability of Receptors	**Low**	Medium	High		
	The vulnerability of receptor is likely to be **Low.**				
Significance	**Negligible**	Minor	Moderate	Major	
	The significance is likely to be **Negligible.**				

Source: JICA Study Team, 2018

6.5.5 *Cultural heritage*

Construction Phase

Potential impact on archaeological artifacts

The proposed project will involve digging the ground for various activities including angle towers. Based on an initial archaeological survey, there are 13 archaeological site test pits (1x1 m^2 STPs with depth ranging from 50-100 cm) along the proposed TL route (Section 6.9). It is possible that artefacts may be discovered during construction activities.

Mitigation measures

- Employ cultural heritage expert, as necessary
- Closely coordinate with necessary government agency upon discovery of an artefact
- Implement a Chance Finds Procedure according to IFC standard 8

Potential impact on graves and graveyard

The proposed project will involve clearing of TL ROW and excavation of soil to construct the foundation of transmission towers. . There may be a need to exhume and/or relocate existing graves/graveyard along the transmission line, to a designated site.

Mitigation measures

- Communicate closely with the affected families.
- Abide by the necessary cultural and legal procedures.
- Provide compensation as stipulated in the Resettlement Action Plan

Table 6-25 Impact Significance archaeological and cultural resources

Impact	Impact on archaeological and cultural heritage				
Impact Nature	**Negative**	Positive	Neutral		
	Impact on heritage sites and items during construction is **negative.**				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct** to the sites and objects with values.				
Impact Duration	Temporary	Short-term	Long-term	**Permanent**	
	Impact is likely to be long-term until the duration of the project.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited within the affected localities.				
Impact Scale	The impact scale is low but has the potential to be high depending on unplanned discoveries.				
Impact Frequenc	The impact likely occurs during the construction with the rare frequency.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	The impact magnitude is likely to be **medium.**				
Vulnerability of Receptors	Low	**Medium**	High		
	The vulnerability of receptor is likely to be **Medium** due to presence of culturally significant sites along the route.				
Significance	Negligible	Minor	**Moderate**	Major	
	The significance is likely to be **Moderate.**				

Source: JICA Study Team, 2018

Operation Phase

Once the transmission lines and substation have been built, there will be no excavation of new areas, thus no impact is foreseen.

6.5.6 *Land acquisition and resettlement*

Impact on Land, Assets and Crops/Trees

Land will be required to develop the Project. The total wayleave acquired by TANESCO is 52 meters wide (or 26 meters on each side). Since the entire 52m will be fully acquired and compensated, the use of this wayleave is restricted. No cultivation, even with short crops, is allowed apart from grazing. TANESCO will ensure regular clearance of tall vegetation in the right of way to ensure safety of the line and the communities along the corridor. Therefore, full land usage restrictions apply and landowners will be fully compensated for the land falling under the wayleave of 52 meters wide. This 52 meters wide wayleave is expected to be transferred to TANESCO after all rights upon this land have been compensated for and it is deemed not to have any residual value for the current owners.

Table 6-26 shows that the Mtwara-Somanga 400kV Transmission Line will take a total of 1,387.6 ha of land and will affect 62 houses, farms, grave yards and a football ground, as shown in ***Table 6-27***.

Table 6-26 Project Affected Land in m²

District	Length in meters	Width in meters	Affected Land size in m²	Affected Land size in hectare
Mtwara Rural	22,786.65	52	1,184,905.8	118.5
Lindi Rural	108,087.22	52	5,620,535.44	562.0
Lindi Urban		52		
Kilwa	135,979.22	52	7,070,919.44	707.1
		Total	**13,876,360.68**	**1,387.6**

Source: IRA 2018

Table 6-27 Affected People, Households and Assets

District	Number of estimated AHs	No of Houses	Other Identified Assets
Mtwara Rural	86	08	Farms
Lindi Rural	497	10	Farms, Graveyard
Lindi Urban	118	17	Farms
Kilwa	397	27	Farms, Graveyard, Football ground (as community properties)
Total	**1,098**	**62**	

Source: IRA 2018

Affected trees and crops based on interview with the land owners are shown in***Table 6-28*** . These figures are preliminary and will be finalized during the valuation process after finalization of transmission line wayleave.

Table 6-28 Affected Crops and Trees

Name	Number
Cashew nuts	850
Coconuts	1,075
Timber trees	488
Shade trees	448
Fruit tress (Mango, Orange and others)	1,632
	4,493

Source: IRA 2018

Mitigation measures

- Conduct land acquisition process in accordance with the Resettlement Policy Framework
- Provide income restoration for those who will lose their livelihood due to land acquisition.
- Keep constant and open communication with PAPs and other stakeholders
- Provide assistance to vulnerable groups on how to go through the compensation process
- Set up a grievance mechanism to address any concern

Table 6-29 Impact Significance of land acquisition and resettlement

Impact	Land acquisition and resettlement impact				
Impact Nature	**Negative**	Positive	Neutral		
	Acquiring land and properties would result in **negative** impact for those affected in terms of loss of land and properties.				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct** to the affected population (formal and informal owners and settlers).				
Impact Duration	Temporary	Short-term	Long-term	**Permanent**	
	The impact is permanent.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited within the local villages.				
Impact	The impact scale is medium.				
Impact Frequenc	The impact will occur once prior to commencement of the construction phase.				
Impact Magnitud	Positive	Negligible	Small	**Medium**	Large
	The impact magnitude is likely to be **Medium.**				
Vulnerability of Receptors	Low	**Medium**	High		
	The vulnerability of receptor is likely to be **medium.**				
Significance	Negligible	Minor	**Moderate**	Major	
	The significance is likely to be **moderate.**				

Source: JICA Study Team, 2018

Impact on Vulnerable households/population

These are people with special needs that would require special consideration and assistance from project implementers or community in general. They include the elderly, sick (HIV/AIDs afflicted persons), orphans, women with special needs (e.g. single parents, widows) and farmers likely to suffer loss of land due to construction of transmission line, substations and related facilities (whether owners, encroachers or tenants). These groups are being identified as particularly vulnerable so that special attention would be paid to them by identifying their needs from the baseline study. The household survey identified different categories of vulnerable people as shown in ***Table 6-30***.

Table 6-30 Vulnerable Households and Population

Type	**AHs**	
	Number	**%**
Women headed household	24	21.6
Elderly	59	53.2
Disabled - mental	04	3.6
Disabled - physical	13	11.7
Chronically ill	11	9.9
Total	**111**	**100.0**

Source: IRA 2018

Mitigation measures

- Provide Income Restoration Program for Vulnerable households
- Provide assistance on how to go through the compensation process.

Table 6-31 Impact Significance on vulnerable groups of land acquisition and resettlement

Impact	Land acquisition and resettlement impact on vulnerable households and people				
Impact Nature	**Negative**	Positive	Neutral		
	Acquiring land and properties would result in negative impact for affected vulnerable groups. .				
Impact Type	**Direct**	Indirect	Induced		
	The impact is **direct** to the affected population (formal and informal owners and settlers).				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact has the potential to have a lasting effect.				
Impact Extent	**Local**	Regional	Global		
	The impact is limited within the local				
Impact Scale	The impact scale is medium.				
Impact Frequency	The Impact will occur once prior to commencement of the construction phase.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	The impact magnitude is likely to be **Medium.**				
Vulnerability of Receptors	Low	**Medium**	High		
	The vulnerability of receptor is likely to be **medium.**				
Significance	Negligible	Minor	**Moderate**	Major	
	The significance is likely to be **moderate.**				

Source: JICA Study Team, 2018

6.6 *ANALYSIS OF ALTERNATIVES FOR THE PROJECT*

In order to be able to make better and informed decisions, it is important to consider alternatives that can enable achievement of the same or better results with less adverse effects including costs. The main factors considered in the selection of alternatives included potentiality of the option in terms of economic development, location, magnitude of loss and sensitivity of area. Based on identified project issues and foreseen impacts, the following alternatives are discussed in this EIA for the proposed thermal transmission line project.

6.6.1 *The "No Project" Alternative*

The no project alternative entails maintaining current status of power generation sources in Tanzania and that Tanzania continues to struggle with shortage of power, quality of power supplies and stability. The proposed thermal power plant in Mtwara is one of the several candidate thermal power project considered for development under the revised Power System Master Plan of 2016. The proposed project is intended to generate 300MW that is expected to be connected to the national grid to provide electricity. Implementation of the no project alternative will deny this amount of power to the national grid which is required to supply the expanding power demand as forecasted by the Power System Master Plan 2016. Therefore this alternative does not seem viable since the country need power to supply to the expanding demand as the country is implementing and industrialization scheme to middle income country by 2030.

6.6.2 Location alternatives

Alternatives of the transmission line route and the analysis of those alternatives are presented in ***Figure 6-1*** and ***Table 6-32*** below. Factors considered include route length, topography, access road condition, contamination (salt), and other environmental and social conditions.

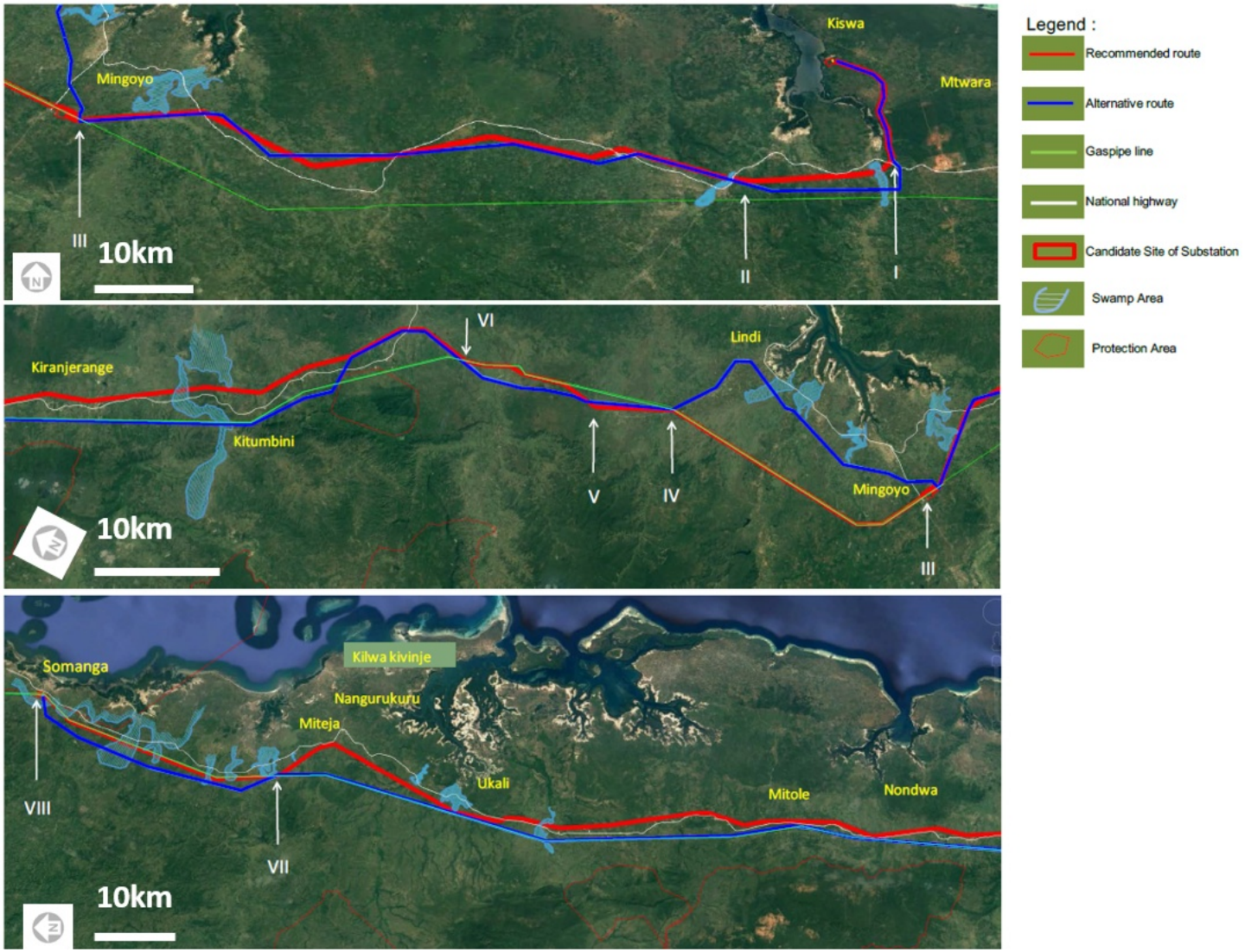


Figure 6-1 Alternative Routes for the Proposed Transmission Line

Source: JICA Study Team, 2018

Table 6-32 Comparison of the Routes for 400 kV New Mtwara Substation - Somanga Substation 400 kV Transmission Line

A Route Length and Number of Towers for angle point (over 30 degree)	C Access Road Condition Distance from Main Road	E Environmental Condition and Resettlement	
B Topographical Condition Section Length (Mountainous) · Highest Elevation Level	D Contamination Condition (Salt) · Length of Swamp Area	Results of Evaluation : ◎ : Good / Superior ○ : Acceptable △ : Marginal / Poor	

Section	Item	Route_1 Planned Route 400kV Double Circuit Transmission in reports made by USAID/TANESCO (March 2015)	Evaluation	Route_1A This is alternative route to minimize areas in mountainous in Route_1 and to make better crossing conditions with river, gas pipe line, housing areas and forest protection area.	Evaluation	Route_2 This is a new route at the East Side of National Road T7 to get easy access.	Evaluation	Route_3 Additional Route is basically parallel to the Gas Pipe Line. Land negotiation is easy.	Evaluation
I — II	A			10.0 km 27 towers (4 points)					
	B			(100 m - 150m) 1.0 km 150 m					
Substation (1 · 2)	C	Not applicable		Distance from the national Road T7 : 0.2 km to 1.0 km. The access roads are available by widening existing roads. The construction cost of permanent roads is cheap.	◎	Not applicable		Not applicable	
	D			(Salt) 10.0 km (Swamp) 0.2 km					
I — II	A	11.4 km 31 towers (3 points)						12.4 km 34 towers (3 points)	
	B	(100 m - 125m) 7.0 km 125 m						(100 m - 150m) 5.5 km 150m	
Substation (3)	C	Distance from the national Road T7 : 1.0 km to 1.6 km. There are few existing roads available. The cost of permanent roads is high.	○	Not applicable		Not applicable		Distance from the national Road T7 : 1.5 km to 3.0 km. There are few existing roads available. The cost of permanent roads is high.	◎
	D	(Salt) 11.4 km (Swamp) 0.4 km						(Salt) 12.4 km (Swamp) 0.2 km	
II — III	A	41.0 km 111 towers (7 points)		40.0 km 114 towers (10 points)				40.5 km 109 towers (1 points)	
	B	(200 m - 300m) 7.5 km 300 m		(200 m - 300m) 7.5 km 300 m				(200 m - 310m) 10.0 km 310 m	
	C	Distance from the national Road T7 : 0.6 km to 2.0 km. The access roads are available by widening existing roads. The construction cost of permanent roads is cheap.	○	Distance from the national Road T7 : 0.2 km to 0.8 km. The access roads are available by widening existing roads. The construction cost of permanent roads will be much less.	◎	Not applicable		Distance from the national Road T7 : 1.0 km to 5.5 km. There are few existing roads available. The cost of permanent roads is high.	△
	D	(Salt) 19.0 km (Swamp) 2.5 km		(Salt) 19.0 km (Swamp) 0.2 km				(Salt) 10.0 km (Swamp) 0.8 km	
	E	——— (Resettlement) 3 houses		——— Change route to avoid the Housing Area.				——— ———	
III — IV	A	25.0 km 68 towers (5 points)		25.0 km 68 towers (6 points)					
	B	(over 100 m) 0 km 80 m		(over 100 m) 0 km 80 m					
Substation (2 · 3)	C	Distance from the national Road T7 : 0.6 km to 1.8 km. The access roads are available by widening existing roads. The cost of permanent roads is cheap.	△	Distance from the national Road T7 : 1.0 km to 1.8 km. The access roads are available by widening existing roads. The construction cost of permanent roads will be much less.	◎	Not applicable		Not applicable	
	D	(Salt) 10.0 km (Swamp) 1.8 km		(Salt) 7.8 km (Swamp) 1.0 km					
	E	——— (Resettlement) 10 houses		——— Change route to avoid the Housing Area.					
III — IV	A			31.5 km 85 towers (9 points)				26.3 km 70 towers (6 points)	
	B			(over 100 m) 0 km 80 m				(200 m - 230m) 5.0 km 230 m	
Substation (1)	C	Not applicable		Distance from the national Road T7 : 1.0 km to 2.3 km. The access roads are available by widening existing roads. The construction cost of permanent roads is cheap.	○	Not applicable		Distance from the national Road T7 : 6.0 km to 7.0 km. There are few existing roads available. The Construction cost of permanent roads will be high.	◎
	D			(Salt) 7.8 km (Swamp) 1.0 km				——— ———	
IV — V	A	6.0 km 17 towers (2 points)		6.0 km 17 towers (2 points)				6.0 km 17 towers (2 points)	
	B	(over 150 m) 0 km 150 m		(over 150 m) 0 km 150 m				(over 150 m) 0 km 150 m	
	C	Distance from the main Road : 0.8 km to 1.3 km. There are few existing roads available. The construction cost of permanent roads is cheap.	○	Distance from the main Road : 0.4 km to 0.7 km. The access roads are available by widening existing roads. The construction cost of permanent roads will be much less.	◎	Not applicable		Distance from the national Road T7 : 0.9 km to 1.6 km. There are few existing roads available. The cost of permanent roads is high.	○
V — VI	A	10.0 km 27 towers (1 points)		10.0 km 27 towers (2 points)		11.8 km 32 towers (4 points)		12.0 km 33 towers (3 points)	
	B	(170 m - 260m) 7.0 km 260 m		(190 m - 280m) 7.5 km 280 m		(170 m - 260m) 7.0 km 260 m		(150 m - 250m) 6.0 km 250 m	
	C	Distance from the main Road : 0.8 km to 1.3 km. There are few existing roads available. The construction cost of perm. roads with the slope is high.	△	Distance from the main Road : 0.7 km to 3.2 km. There are few existing roads available. The cost of permanent roads is high.	△	Distance from the main Road : 0.2 km to 0.5 km. The access roads are available by widening existing roads. The construction cost of permanent roads is cheap.	○	Distance from the main Road : 0.2 km to 0.4 km. The access roads are available by widening existing roads. The construction cost of permanent roads will be much less.	◎
VI — VII	A	125.0 km 338 towers (9 points)		126.0 km 341 towers (13 points)		126.0 km 351 towers (17 points)		121.0 km 327 towers (4 points)	
	B	(150 m - 490m) 15.0 km 490 m		(150 m - 280m) 15.0 km 280 m		(over 150 m) 0 km 80 m		(150 m - 250m) 3.0 km 250 m	
	C	Distance from the national Road T7 : 2.0 km to 7.0 km. There are few existing roads available. The construction cost of perm. roads with the slope is high.	△	Distance from the national Road T7 : 2.0 km to 9.0 km. There are few existing roads available. The cost of permanent roads is high.	△	Distance from the national Road T7 : 0.2 km to 1.0 km. The access roads are available by widening existing roads. The construction cost of permanent roads is cheap.	◎	Distance from the national Road T7 : 0.4 km to 4.0 km. There are few existing roads available. The cost of permanent roads is high.	△
	D	(Salt) 18.0 km (Swamp) 2.0 km		(Salt) 18.0 km (Swamp) 2.0 km		(Salt) 19.0 km (Swamp) 1.5 km		(Salt) 15.0 km (Swamp) 2.0 km	
	E	A part of route will pass inside the Forest Protection Area "Ngarama".		——— ———		——— ———		A part of route will pass inside the Forest Protection Area "Ruawa".	
VII — VIII	A	37.0 km 100 towers (3 points)						37.0 km 100 towers (3 points)	
	B	(over 150 m) 0 km 80 m						(over 150 m) 0 km 70 m	
	C	Distance from the national Road T7 : 2.0 km to 4.0 km. There are few existing roads available. The construction cost of permanent roads will be high.	○	Not applicable		Not applicable		Distance from the national Road T7 : 0.5 km to 2.0 km. There are few existing roads available. The construction cost of permanent roads is cheap.	◎
	D	(Salt) 37.0 km (Swamp) 8.0 km						(Salt) 37.0 km (Swamp) 11.5 km	
Recommended Section		Not applicable (Initial Planning only)		I—II (Substation (1, 2)) II—III III—IV (Substation (2, 3)) IV—V		VI—VII		I—II (Substation (3)) III—IV (Substation (1)) V—VI VII—VIII	

Source: JICA Study Team, 2018

7 MITIGATION MEASURES

Potential impacts from the project have been assessed in terms of its significance. While some impacts are negligible in nature, other impacts were rated as minor and moderate. In order to reduce residual impacts that may be caused by the Project during the pre-construction, construction and operation phases have been considered, mitigation measures are described in this Chapter.

7.1 ENHANCEMENT OF POSITIVE IMPACTS

- Develop and implement a local recruitment and procurement management plan.
- Consult with relevant stakeholders, including government authorities and local villagers in developing the local recruitment plan.
- Review opportunities to establish a skills training program with an aim of training interested local villagers who can contribute to the project.
- Inform local villagers of job opportunities in a timely manner.
- Inform local businesses of contracting opportunities in a timely manner such as awareness on forthcoming investment and employment opportunities, including sensitization of farmers for production of required quality of foods such as vegetables.

7.2 MITIGATION OF NEGATIVE IMPACTS (CONSTRUCTION PHASE)

7.2.1 Terrestrial Ecology

- Vegetation clearance should be confined only to necessarily designated sites. The planned clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing.
- Implement landscaping and re-vegetation after completion of construction using native species where possible.
- Weed and pest management measures shall be implemented to avoid introduction of invasive weeds to natural and modified habitat areas.
- Oil, chemical and solid waste will be stored, and handled and disposed of by appropriately licenced waste management contractors.
- Construction materials and chemicals will be appropriately secured and locked down during flood season to avoid accidental release to the natural environment.
- Appropriate speed limits for construction vehicles will be enforced to limit noise and dust generation and to minimise potential for fauna strike.

7.2.2 Soil

Top Soil Disturbance from Site Preparation Activities

- Delineation of clearance boundaries to limit the areas to be cleared.

- Scheduling clearance activities, if possible to avoid extreme weather events such as heavy rainfall, extreme dry and high winds.
- Revegetation areas with temporary land use, conducting progressive rehabilitation.
- Demarcate routes for movement of heavy vehicles to minimise disturbance of exposed soils and compaction of sub-surface layers.
- Reuse topsoil as much as possible within rehabilitation activities.
- Control erosion through diversion drains, sediment fences, and sediment retention basins.

Soil and groundwater contamination

- Fuel tanks and chemical storage areas will be sited on sealed hardstand areas, provided.
- Secondary containment, with appropriate drainage connection and/or provision for removal of spilled liquids, will be provided around places of fuel and hazardous materials storage such as oil filled transformers, oil pumps and tanks, generators, chemical storage houses etc. to contain any hazardous spills and to exclude surface water run-off from entering the contained area.
- Provision of spill kits on site.
- A training program will be implemented to familiarise staff with measures to be taken to prevent spills and leaks, and for emergency procedures and practices related to contamination events.
- Unloading and loading protocols will be developed to ensure that staff are able to undertake these tasks in a manner that minimises the risks of spills occurring.
- Appropriate management, storage and disposal of all waste streams will be implemented.

7.2.3 Water resources

- Adequate sanitary facilities will be provided for the construction workforce. Septic tanks will be provided to treat sanitary discharge.
- Contaminated storm/rainwater runoff from the substation will pass through oil separator prior to discharge
- Design drainage for the controlled release of storm flows.
- Regularly, and particularly following rainstorms, inspect and maintain drainage and erosion control and silt removal measures to ensure proper and efficient management at all times.
- Mulch to stabilise exposed areas, where practicable and appropriate. Re-vegetate areas promptly, where practicable and appropriate.
- Construct sediment basins.
- Wastewater collected from canteen kitchens, including that from basins, sinks and floor drains, should be discharged into sanitary sewers via grease traps.
- Oil-contaminated water will be collected and handled by local licensed wastewater sub-contractors.

7.2.4 Wastes

- Pursue the policy of Four R's – Recover, Recycle, Reduce and Reuse – to manage its waste.
- Provide training to labourers for waste disposal in designated areas and use of sanitation facilities.
- Implement proper storage of the construction materials and wastes to minimise the potential damage or contamination of the materials.
- Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type.
- Store waste systematically to allow inspection between containers to monitor leaks or spills.
- Ensure that storage areas have impermeable floors and containment.
- Dispose of waste by licensed contractors.

7.2.5 Air

- Specifying transport networks and locating stockpiles as far away from the site boundary which is close to the air sensitive receptors, as practicable to minimize the impact of air pollutants and dust;
- Minimizing the size of exposed areas and material stockpiles and the periods of their existence;
- Temporary stockpiles of dusty materials will be either covered entirely by impervious sheets or sprayed with water to maintain the entire surface wet all the time;
- Covering the construction materials transported by trucks or vehicles entirely to prevent dust emissions;
- Cleaning wheels and the lower body parts of trucks at all exits of the construction site;
- Controlling the height of unloading the fill materials during filling as far as possible. Where possible, this should be well below the height of the hoardings along the Project site boundary;
- Prohibiting the burning of waste or vegetation on site;
- Compacting the reclaimed land immediately to avoid fugitive dust emissions;
- Maintaining and checking the construction equipment regularly;
- Switching off engines when idling

7.2.6 Noise and Vibration

- Maintaining equipment and vehicles to manufacturers' standards; and
- Limiting operating times to daylight hours;
- Information of blasting incidence, time should be available either written or disposed on local gathering areas.

7.2.7 *Community Health Safety and Security*

- Training for all workers on the transmission routes and common symptoms of communicable diseases as well as sensitization of enforcement of HIV/AIDS law and regulations. Counselling and testing will be done with Provincial Medical Directors semi-annually.
- Establish amenities at the worker camp to that help minimize the interaction between the workforce (particularly temporary construction workers) and local villagers.
- Establish a workforce code of conduct. Include in the code specific measures on anti-social behaviour.
- Vector management procedures, including consideration of whether pesticides will be utilized to reduce the presence of vectors onsite.
- Provision of onsite health care, to ensure that medical attention can be sought should a worker present with the symptoms of a communicable disease, including Sexually Transmitted Infection (STI) diagnosis and monitoring in collaboration with National HIV/AIDS Authorities.
- Develop emergency management procedures, should a health issue escalate and require a rapid response.
- Implement a grievance mechanism

7.2.8 *Occupational Health and Safety*

- Develop and implement a health and safety plan.
- Provide personal protective equipment (PPE)
- Provide appropriate training for workers on risks to health and safety in the workplace
- Create awareness on all security and safety issues and hazards at the site
- Provide safety signs

7.2.9 *Social Infrastructure and Services*

- Provide appropriate amenities at the workers camp.
- Develop and implement a traffic management plan to minimize the impact experienced by road users as a result of the project.

7.2.10 *Cultural Heritage*

Potential Impact on archaeological artefacts

- Employ cultural heritage expert, as necessary
- Closely coordinate with necessary government agency upon discovery of an artefact
- Implement a Chance Finds Procedure according to IFC standard 8

Potential impact on graves and graveyard

- Communicate closely with the affected families.
- Abide by the necessary cultural and legal procedures.

- Provide compensation as stipulated in the Resettlement Action Plan

7.2.11 *Land Acquisition and Resettlement*

Impact on land, assets and crops/trees

- Conduct land acquisition process in accordance with the Resettlement Policy Framework
- Provide income restoration for those who will lose their livelihood due to land acquisition.
- Keep constant and open communication with PAPs and other stakeholders
- Establish a grievance mechanism to address any concern

Impact on vulnerable households/population

- Provide Income Restoration Program for Vulnerable households
- Provide assistance on how to go through the compensation process.

Impact on loss of livelihood due to land acquisition

- Keep open communication with the affected people
- Study the alternative options for livelihood restoration
- Develop a livelihood restoration plan

7.3 *MITIGATION OF NEGATIVE IMPACTS (OPERATION PHASE)*

7.3.1 *Terrestrial Ecology*

- Weed and pest management measures shall be implemented to avoid introduction of invasive weeds to natural and modified habitat areas.
- Conduct bird survey and install marks/reflectors, as necessary, to reduce risk of wildlife collision with the transmission line and tower.
- Keep appropriate height of towers to allow elephants to pass safely; Install fence where necessary

7.3.2 *Soil*

- Delineation of clearance boundaries to limit the areas to be cleared.
- Scheduling clearance activities, if possible to avoid extreme weather events such as heavy rainfall, extreme dry and high winds.
- Demarcate routes for movement of heavy vehicles to minimise disturbance of exposed soils and compaction of sub-surface layers.
- Reuse topsoil as much as possible within rehabilitation activities.
- Control erosion through diversion drains, sediment fences, and sediment retention basins.

7.3.3 *Water Resources*

- The storage areas for batteries and waste in substations and other storage areas will be surrounded by containment/spill control measure to prevent spilled oil, fuel and chemicals from percolating into the ground or reaching the receiving waters.

- All drainage/tanks, etc. will be positioned on concrete hard standing to prevent any seepage into ground.
- Use of spill or drip trays to contain spills and leaks
- Guidelines and procedures should be established for immediate clean up actions following any spillages of oil, fuel or chemicals.
- Standard operation procedures (SOPs) will be prepared to manage any oil spills, leaks and/or seepages. SOPs will cover transport, handling, storage, use and disposal of oil/ oil wastes/ empty drums etc.
- Operating personnel will be trained on the SOPs.
- Regularly check and replace oil separators.

7.3.4 Wastes

- Education to workers on site shall be undertaken to avoid, reduce and reuse wastes generated.
- Waste storage facilities shall be sited and signposted in the project site. Solid waste generated by daily operations at the site should be collected using on-site bins before being disposed appropriately.
- All waste collected will be managed and disposed of in accordance with the required regulations.
- Dispose of waste by licensed contractors.

7.3.5 Community Health, Safety and Security

- Provide appropriate training for security personnel
- Monitor implementation of the training over time
- Create awareness on all security and safety issues and hazards associated with transmission line towers and substations.
- Construct fence around transmission line towers and substations
- Provide safety signs
- Implement a grievance mechanism

7.3.6 Occupational Health and Safety

- Provision and enforcement of the proper use PPEs
- Provide health checks to the employees
- Provide appropriate training on occupational health and safety
- Monitor of training over time
- Provision of safety signs

8.1 INTRODUCTION

Through a systematic assessment, the EIA has identified a number of significant environmental and social impacts which may potentially result from the construction and operation of the Project. In order to manage and mitigate these impacts, a range of measures have been developed to reduce the overall residual impacts to acceptable levels and as low as reasonably practicable. Implementing and tracking the effect of these management and mitigation measures is an essential element to ensuring that the assessed residual impact levels are confirmed.

The key objectives of this Environmental and Social Management Plan (ESMP) are to:

- Collate the various mitigation and management measures developed throughout the EIA into a single point;
- Identify implementation mechanism (e.g. responsible entities, financing sources, monitoring and reporting requirements) to ensure actual implementation of all mitigation and management actions throughout the various phases of the Project;
- Define monitoring requirements to determine the efficacy of all mitigation and management measures; and
- Provide clarity to all stakeholders as to what impacts have been identified, how they will be mitigated and managed, and through what means.

8.2 MODALITIES OF IMPLEMENTATION OF THE ESMP

TANESCO, together with its contractors, will be responsible for ensuring that mitigation measures in the ESMP are implemented throughout the life span of the project. The modalities of implementation of the proposed ESMP will have to be agreed with TANESCO.

Learning from experience in other project that TANESCO is undertaking, the monitoring activities have been partly contracted to supervising consultants. In this modality TANESCO and supervising consultant establishes a kind of consortium or collaborative organization involving key staff on engineering, environmental and social components working closely with counterpart staff from TANESCO. Data and reports on monitoring activities are reviewed and approved by TANESCO while requirements of the financiers is taken on-board.

8.3 *OVERALL ROLES AND RESPONSIBILITIES OF THE PARTIES*

The primary role and responsibility for implementation of the ESMP lies on TANESCO and its contractors. Regulators will have to make sure that the project proponent and the contractor are fully complying to the ESMP. In terms of the implementation of the recommended monitoring plan as described in Chapter 9, TANESCO staff will be responsible at the local implementation level, together with the Environmental Unit of TANESCO. TANESCO can as well hire consultant or any Institution to assist in implementation. Contractors will be responsible for implementation mitigation measures proposed in the plan and make sure they comply with the Tanzanian standards while considering requirements of financing agencies.

Based on the outcomes of the EIA, site specific detailed management plans are to be developed to guide TANESCO and its contractors in implementation of all mitigation and management measures. The detailed management plans will be leveraged by EPC contractors in developing their own management plans.

The role of the regulator, in this case NEMC, will be following up to ensure the conditions of the issued certificates as well as the issues pointed out in the ESMP are comprehensively implemented and addressed by the proponent. Similarly NEMC will be receiving self-monitoring reports covering compliance of the issues indicated in the ESMP.

8.4 *MANAGEMENT PLANS*

Mitigation planning involves undertaking activities during the design, implementation and operation phases of a project to eliminate, offset, or reduce adverse environmental impacts to acceptable levels. The proposed impact mitigation/enhancement plan for the project is summarized in Table 8-1. The developer has to set aside source of funds to deal with some of the mitigation measures before project implementation starts, as most of the mitigation activities need to be incorporated within the various stages of project implementation.

The developer must integrate the cost of implementing these mitigation measures into the overall project cost. However, since some of the measures are expected to be implemented by the relevant local and central government institutions, the cost for such measures will be borne by the relevant institutions and/or shared with the develop. For example, the need to improve and upgrade social services within the project area, provision of security organization and judiciary in order to allow the existing systems to cope with expected changes resulting from project implementation. The central government will be responsible for undertaking such measures.

Table 8-1 Environmental and Social Management Plan (ESMP) for the Proposed Mtwara –Somanga Transmission Line

Affected Aspect	Project Activity and Affected Area	Potential Impacts	Proposed Mitigation Measures (If applicable)	Overall responsible Entity	Cost
Site Preparation and Construction Phase					
Terrestrial Ecology	• Site preparation activities (e.g. vegetation clearing)	• Habitat loss, habitat fragmentation/degradation, disturbance of native species; fauna mortality	• Vegetation clearance should be confined only to necessarily designated sites. The planned clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing. • Implement landscaping and re-vegetation after completion of construction using native species where possible. • Weed and pest management measures shall be implemented to avoid introduction of invasive weeds to natural and modified habitat areas. • Maintenance of ROW (vegetation clearing) (Investigation & transplanting of 2VU species(Vitex zanzibarensis, and Dialium holtzii)) • Construction materials and chemicals will be appropriately secured and locked down during flood season to avoid accidental release to the natural environment. • Conduct bird survey and install reflectors/marks, as necessary, to reduce risk of bird collision with the transmission line. • Keep appropriate height to allow elephants to pass safely and install fence where necessary. • Information of Elephants will be shared with TAWA(Tanzania Wildlife Management Authority).	TANESCO	750,000 USD
Soil	• •Site clearance, site formation and levelling involving excavation and backfilling;	• Increase of soil erosion	• Delineation of clearance boundaries to limit the areas to be cleared. • Scheduling clearance activities, if possible to avoid extreme weather events such as heavy rainfall, extreme dry and high winds. • Revegetation areas with temporary land use, conducting progressive rehabilitation. • Demarcate routes for movement of heavy vehicles to minimise disturbance of	TANESCO	20,000 USD

Affected Aspect	Project Activity and Affected Area	Potential Impacts	Proposed Mitigation Measures (If applicable)	Overall responsible Entity	Cost
	• Construction of substations and transmission towers.		exposed soils and compaction of sub-surface layers. • Reuse topsoil as much as possible within rehabilitation activities. • Control erosion through diversion drains, sediment fences, and sediment retention basins.		
	• Accidental spillage, leakage	• Soil and groundwater contamination	• Fuel tanks and chemical storage areas will be sited on sealed hardstand areas, provided. • Secondary containment, with appropriate drainage connection and/or provision for removal of spilled liquids, will be provided around places of fuel and hazardous materials storage • Provision of spill kits on site • Unloading and loading protocols will be developed to ensure that staff are able to undertake these tasks in a manner that minimises the risks of spills occurring. • A training program will be implemented to familiarise staff with measures to be taken to prevent spills and leaks, and for emergency procedures and practices related to contamination events. • Appropriate management, storage and disposal of all waste streams will be implemented.	TANESCO	50,000 USD
Water Resources	• Wastewater and storm water runoff	• Impact on surface water quality	• Adequate sanitary facilities will be provided for the construction workforce. Septic tanks will be provided to treat sanitary discharge. • Contaminated storm/rainwater runoff from the substation will pass through oil separator prior to discharge • Design drainage for the controlled release of storm flows. • Regularly, and particularly following rainstorms, inspect and maintain drainage and erosion control and silt removal measures to ensure proper and efficient management at all times. • Mulch to stabilise exposed areas, where practicable and appropriate. Re-vegetate	TANESCO	25,000 USD

Affected Aspect	Project Activity and Affected Area	Potential Impacts	Proposed Mitigation Measures (If applicable)	Overall responsible Entity	Cost
			areas promptly, where practicable and appropriate. • Construct sediment collection basin. • Wastewater collected from canteen kitchens, including that from basins, sinks and floor drains, should be discharged into septic tanks. • Oil-contaminated water will be collected and handled by local licensed wastewater sub-contractors.		
Wastes	• Wastes generated from construction sites	• Solid waste management	• Pursue the policy of Four R's – Reduce, Reuse, Recycle, Recover – to manage its waste. • Provide training to labourers for waste disposal in designated areas and use of sanitation facilities. • Implement proper storage of the construction materials and wastes to minimise the potential damage or contamination of the materials. • Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type. • Store waste systematically to allow inspection between containers to monitor leaks or spills. • Ensure that storage areas have impermeable floors and containment. • Dispose of waste by licensed contractors.	TANESCO	30,000 USD
Air	• •Site clearance, site formation and levelling involving excavation and backfilling; • Construction of substations and transmission towers.	• Impact on local air quality	• Specifying transport networks and locating stockpiles as far away from the site boundary which is close to the air sensitive receptors, as practicable • Minimizing the size of exposed areas and material stockpiles and the periods of their existence; • Temporary stockpiles of dusty materials will be either covered entirely by impervious sheets or sprayed with water; • Covering the construction materials transported by trucks or vehicles entirely; • Cleaning wheels and the lower body parts of trucks at all exits of the construction	TANESCO	40,000 USD

Affected Aspect	Project Activity and Affected Area	Potential Impacts	Proposed Mitigation Measures (If applicable)	Overall responsible Entity	Cost
			site; • Controlling the height of unloading the fill materials during filling as far as possible; • Prohibiting the burning of waste or vegetation on site; • Compacting the reclaimed land immediately to avoid fugitive dust emissions; • Maintaining and checking the construction equipment regularly; • Switching off engines when not in use		
Noise and Vibration	• Operation of construction equipment and machineries	• Generation of noise and vibration	• Maintaining equipment and vehicles to manufacturers' standards; and • Limiting operating times to daylight hours; • Information of blasting incidence, time should be available either written or disposed on local gathering areas.	TANESCO	10,000 USD
Community and Occupational health and safety	• Introduction of workers into the area	• Potential increase in communicable diseases among works and local people	• Training for all workers on the transmission routes and common symptoms of communicable diseases as well as sensitization of enforcement of HIV/AIDS law and regulations. Regular BCC (Behaviour Change Communication) and Peer Education activities will be done on a weekly basis. Counselling and testing will be done with Provincial Medical Directors semi-annually. This can help reduce the potential for workers to unknowingly transmit communicable diseases. HIV prevention plan will be prepared. • Establish amenities at the worker camp to that help minimize the interaction between the workforce (particularly temporary construction workers) and local villagers. • Establish a workforce code of conduct. Include in the code specific measures on anti-social behaviour. • Vector management procedures, including consideration of whether pesticides will be utilized to reduce the presence of vectors onsite. • Emergency management procedures, should a health issue escalate and require a rapid response. • Create awareness on all security, safety issues, and hazards on site	TANESCO	100,000 USD

Affected Aspect	Project Activity and Affected Area	Potential Impacts	Proposed Mitigation Measures (If applicable)	Overall responsible Entity	Cost
			• Provide safety signs • HIV prevention awareness promotion for local communities.		
Social infrastructure and services	• Influx of workers	• Impact on existing social infrastructure and services	• Provide appropriate amenities at the worker camp. This will help reduce the need for workers to utilize local infrastructure and services. • Develop and implement a traffic management plan to minimize the impact of transporting construction materials and equipment	TANESCO	10,000 USD
Cultural Heritage	• Site preparation and construction activities	• Impact on potential artefacts, graves/ graveyard; • Changes on cultural values	• Employ cultural heritage expert, as necessary • Closely coordinate with necessary government agency upon discovery of an artefact • Implement a Chance Finds Procedure according to IFC standard 8 • Communicate closely with the affected families. • Abide by the necessary cultural and legal procedures. • Provide compensation as stipulated in the Resettlement Action Plan	TANESCO	30,000 USD
Land Acquisition and Resettlement	• Acquisition of land and properties	• Physical and economic displacement of people in the proposed project site	• Conduct land acquisition process in accordance with the Resettlement Policy Framework • Provide income restoration for those who will lose their livelihood due to land acquisition. • Keep constant and open communication with PAPs and other stakeholders • Provide assistance to vulnerable groups on how to go through the compensation process. • Setting up of a grievance mechanism to address any concern.	TANESCO	3million USD
Operation Phase					
Terrestrial Ecology	• Presence of transmission towers; ROW maintenance	• Potential bird strike or elephant collision	• Vegetation clearance should be confined only to necessarily designated sites. • Weed and pest management measures shall be implemented to avoid introduction of invasive weeds to natural and modified habitat areas.	TANESCO	100,000 USD

Affected Aspect	Project Activity and Affected Area	Potential Impacts	Proposed Mitigation Measures (If applicable)	Overall responsible Entity	Cost
	and inspection activities;		• Appropriate speed limits for maintenance vehicles will be enforced to limit noise and dust generation and to minimise potential for fauna strike • Information of Elephants will be shared with TAWA(Tanzania Wildlife Management Authority).		
Soil	• Maintenance of ROW (vegetation clearing)	• Soil erosion	• Delineation of clearance boundaries to limit the areas to be cleared. • Scheduling clearance activities, if possible to avoid extreme weather events such as heavy rainfall, extreme dry and high winds. • Demarcate routes for movement of heavy vehicles to minimise disturbance of exposed soils and compaction of sub-surface layers. • Reuse topsoil as much as possible within rehabilitation activities. • Control erosion through diversion drains, sediment fences, and sediment retention basins.	TANESCO	100,000 USD
Water	• Accidental releases from operational activities	• Impact on surface and groundwater qualities	• The storage areas for batteries and waste in substations and other storage areas will be surrounded by containment/spill control measure to prevent spilled oil, fuel and chemicals from percolating into the ground or reaching the receiving waters. • All drainage/tanks, etc. will be positioned on concrete hard standing to prevent any seepage into ground. • Use of spill or drip trays to contain spills and leaks • Guidelines and procedures should be established for immediate clean up actions following any spillages of oil, fuel or chemicals. • SOPs will be prepared to manage any oil spills, leaks and/or seepages. SOPs will cover transport, handling, storage, use and disposal of oil/ oil wastes/ empty drums etc. • Operating personnel will be trained on the SOPs. • Regularly check and replace oil separators.	TANESCO	20,000 USD

Affected Aspect	Project Activity and Affected Area	Potential Impacts	Proposed Mitigation Measures (If applicable)	Overall responsible Entity	Cost
Wastes	• Wastes from control room and substations	• Generate solid and hazardous wastes	• Education to workers on site shall be undertaken to avoid, reduce and reuse wastes generated. • Waste storage facilities shall be sited and signposted in the project site. Solid waste generated by daily operations at the site should be collected using on-site bins before being disposed appropriately. • All waste collected will be managed and disposed of in accordance with the required regulations. • Dispose waste through licensed waste contractors	TANESCO	5,000 USD/year
Community and Occupational Health and Safety	• Presence of new infrastructure	• Onsite accidents and injuries	• Provision and enforcement of the proper use PPEs • Provide appropriate training for security personnel and maintenance employees • Monitor implementation of the training over time • Create awareness on all security and safety issues associated with transmission line towers and substations • Construct fence around transmission towers and substations. • Provide safety signs	TANESCO	500,000 USD

Source: IRA

9 ENVIRONMENTAL AND SOCIAL MONITORING PLAN

9.1 INTRODUCTION

This chapter provide an environmental and social monitoring plan for the proposed transmission line in Lindi and Mtwara Regions. The mitigation plan and the monitoring plan together constitute the Environmental Management Plan (EMP) for the proposed development.

Monitoring refers to the systematic collection of data through a series of repetitive measurements over a period of time to provide information on characteristics and functioning of environmental and social variables in specific areas over time. Monitoring must include checking for effectiveness of mitigation and enhancement measures to deal with the predicted impacts of a particular project.

EMA No. 20 of 2004 defines roles for monitoring where the National Environment Management Council (NEMC) is empowered to enforce compliance to the environmental permits (Certificate) issued prior to development and follow in monitoring to ensure implementation of the Environmental Management Plans (EMP). NEMC therefore is required to conduct monitoring activities in collaboration with relevant sectors and other stakeholders.

There are different types of monitoring conducted in various project undertaking, these include;

- **Baseline monitoring:** the measurement of environmental parameters during a pre-project period and operation period to determine the nature and ranges of natural variations and where possible establish the process of change. Baseline monitoring for this project would entail observation of the types and rate of changes on the baseline conditions that has been identified in Chapter 5 and 6 which represent conditions prior to the start of the project.
- **Impact/effect monitoring:** involves the measurement of parameters (performance indicators) during construction, operation and decommissioning phase in order to detect and quantify environmental and social change, which may have occurred as a result of the project.
- **Compliance monitoring:** takes the form of periodic sampling and continuous measurement of levels of compliance with standards and thresholds – e.g. for waste disposal, air pollution, noise and vibration level. The monitoring for this project would mean collecting data on key parameters and compare them with national and international standards as provided in this report or other government notices.
- **Mitigation monitoring** aims to determine the suitability and effectiveness of mitigation measures and programmes, designed to diminish or compensate for adverse effects of the project. In this project, monitoring for this component would entail auditing the effectiveness of the mitigation

measures to ascertain whether changes are needed to enhance best practices.

9.2 MONITORING PLAN

Monitoring is a means verifying overall effectiveness of the management and mitigation measures contained within the management plans described in Chapter 8. Key objectives of the monitoring process are to:

- Confirm effectiveness of management and mitigation measures;
- Ensure compliance with Applicable Standards (i.e. Tanzanian standards, JICA Guidelines, World Bank Safeguard Policies and IFC EHS Guidelines);
- Monitoring the status of, and impacts on, identified sensitive receptors;
- Provide an early warning that any of the control measures or practices are failing to achieve their desired performance and ensure changes can be implemented to remedy these practices;
- Determine whether environmental and social changes are attributable to Project activities, or as a result of other activities or natural variation; and
- Provide a basis for continual review and improvements to Project design and execution.

Biophysical and social environmental management components of particular significance have been identified as indicators. A monitoring plan for each indicator has been prepared for all phases of the Project and is presented in Table 9-1 .

This includes the tentative parameters to be measured, methods to be utilised, sampling locations, frequency of measurements, detection limits, cost and responsibilities for implementation and supervision.

9.3 REPORTING ARRANGEMENTS

The reporting system will ensure regular flow of information from the Project site to the Project headquarters/TANESCO head office and, as necessary, to regulatory authorities and financing entities. The reporting system will provide a mechanism to ensure that the measures proposed in the Project's ESMP are implemented.

Prior to the commencement of the construction activities, the project proponent will finalise the format and frequency for reporting on the status and progress of environmental and social monitoring. Records of monitoring results should be kept in an acceptable format an easily accessible, and information reviewed and evaluated to improve the effectiveness of the environmental management plan. The results should be reported to the responsible authorities and relevant parties, as required by NEMC.

Table 9-1 Environmental and Social Monitoring Plan for the Proposed Mtwara-Somanga Transmission Line

Project Stage/ Affected Component	Potential Impact	Parameters to be monitored	Location	Measurements	Frequency	Overall Responsibility	Cost (USD)
Site Preparation and Construction Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and as specified in EPC Contractor document/manual	Project activity areas and construction workers camp	Visual inspection of all active work areas	Daily	TANESCO	10,000USD
Water	Impaired groundwater quality	pH, temperature, EC, TDS, turbidity, total hardness, Cl, SO4+, NO3-, BOD, COD, Total Coliforms and heavy metals (As and Pb)	Neighbouring wells and boreholes	Standard analytical methods	Upon request from villagers	TANESCO	10,000 USD
Ambient Air	Air pollutant and dust Generation	Dust/exhaust CO, SO2, NOx	· Village(s) close to access roads · Receptors located within 150m from the construction site, if there is any.	Dust: Visual Others: inspection Standard analytical methods	· Dust: Several times during construction · Others: Upon request · If there is any receptors within 150m from the construction site, daily.	TANESCO	5,000 USD
Noise	Noise generation	Noise levels	· Within the construction site · Site described in the request · Receptors located within 150m from the construction site, if there is any.	Noise level measurement	· Within the site: several times during construction · Other locations: Upon Request · If there is any receptors within 150m from the construction site, daily.	TANESCO	10,000 USD
Waste	Solid waste management	Adequacy of solid waste management measures (e.g. appropriate storage, collection and disposal)	Waste storage areas, workers camp	Visual inspection of all waste collection sites, and confirmation of proper disposal	Weekly	TANESCO	5,000 USD
Terrestrial Ecology	Loss of vulnerable species, local terrestrial biodiversity and wild life	Presence of spotted ground thrush	Project activity areas and the neighbouring areas	Bird survey	Once prior to commencement of construction	TANESCO	50,000 USD
Local Infrastructure	Increased pressure on social	Complains from communities	Affected communities	As per the grievance redress mechanism	As per the grievance redress mechanism	TANESCO	10,000 USD

Project Stage/ Affected Component	Potential Impact	Parameters to be monitored	Location	Measurements	Frequency	Overall Responsibility	Cost (USD)
	services/infrastructure (roads)						
Community Health and safety	Increase risks, hazards and accidents	Accidents, incidents and complaints	Affected communities	Incidents, accidents and community complaints	Based on occurrence	TANESCO	10,000 USD
Occupational Health and Safety	Increase risks, hazards and accidents	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	As defined in construction phase Health & Safety Plan to be prepared by EPC contractor	As defined in H&S Plan	TANESCO	10,000 USD
Operation Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and operational manual	Project activity areas	Visual inspection of all active work areas	Daily	TANESCO	5,000 USD/year
Waste	Solid waste management	Appropriate collection, transport and management	Waste collection sites in substations	Visual inspection of all waste collection sites and confirmation of proper disposal	Monthly	TANESCO	5,000 USD/year
Terrestrial ecology	Loss of vulnerable species, local terrestrial biodiversity and wild life (potential bird strike, or elephant collision)	Habitats and Disturbance to terrestrial species	ROW	Record of incident(s), details of impact/ collision	Upon incident	TANESCO	5,000 USD/year
Community Health and safety	Increase risks, hazards and accidents	Accidents, incidents and complaints	Affected communities	Incidents, accidents and community complaints	Based on occurrence	TANESCO	5,000 USD/year
Occupational Health and Safety	Increase risks, hazards and accidents	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	As defined in construction phase Health & Safety Plan to be prepared by EPC contractor	As defined in H&S Plan	TANESCO	5,000 USD/year

Source: IRA

10 COST AND BENEFIT ANALYSIS

The purpose of Cost-Benefit Analysis (CBA) is to determine whether a project will deliver net economic benefits to society.

10.1 OVERALL COST IMPLICATIONS

The costs of the proposed Mtwara-Somanga transmission line include the actual investment cost, operational cost, environmental and the socio-economic costs.

10.1.1 Project Costs

The Project cost will include the following:

- Capital expenditure on construction, materials and equipment, which is estimated to be of the order of USD 149 million;
- Operational and maintenance costs (fuel, maintenance material, security, office, etc.);
- Personnel costs (including consultants); and
- Health, Safety and Environment management costs.

10.1.2 Environmental and Socio-economic Costs

As described before, some potential environmental and social impacts are expected in relation to the project such as waste generation, ecosystem, land acquisition, and displacement of people due to land acquisition. The environmental and social costs are related to mitigation and management of such impacts. Details of these impacts and mitigation measures are highlighted in chapter seven and eight of this EIA report.

The financial resources needed to mitigate these impacts from planned activities are expected to be rather small in comparison to the investment costs. The Project Affected People (PAP) will be compensated before the commencement of the project.

10.2 OVERALL POTENTIAL BENEFITS

10.2.1 Environmental Benefits

The project is 400kV transmission line which can deliver electricity with relatively low loss compared to lower voltage transmission lines for a long distance.

10.2.2 Socio-economic Benefits

The project will contribute to strengthening the national grid for distribution to industries, companies and households in the country. This will assist TANESCO to meet current and future electricity demands in the country. Additionally, an increase in power use and subsequently productivity is anticipated to have a multiplier effect on revenue generation for the country.

10.2.3 Other Benefit

Industry, business, and local economy

The improved power transmission will help industries to increase their productivity and avoid running costs of private generators.

Reliable electricity will induce the establishment of small and medium enterprises. This has multiplier effect both in employment creation, income generation and revenue to the government in form of tax.

Offices will be able to continue with their work without disturbance and use their equipment such as computers hence improve the utilization of ICT (information and communication technology) in business operation.

Using electricity in milling machines will lower costs incurred by the community people when there is no electricity and mill owners use diesel fuel.

Health service

Hospitals and dispensaries will be in a position to provide 24 hours services more conveniently than the period when there is no electricity.

Education

Students in schools will utilize properly their preparation study in the nighttime and laboratory will be equipped with electric apparatuses. In addition practical needed reliable electricity will be exercised.

10.3 CONCLUSION

As a conclusion on the proposed transmission project, the environmental and social costs are expected to be outweighed by the benefits to be realized from the project.

The implementation of the project will involve large amount of financial resources. However, in the absence of the project, the current power supply problem are expected to continue and affect significantly economic performance of the industry and individuals, and the country in general. The consideration of "No-Project" or "Do-Nothing" option is not adopted due to the need and desirability to solve power supply/shortage problems in Tanzania.

11 DECOMMISSIONING PLAN

This EIA report has mainly focused on the potential impacts and associated mitigation measures during the construction and operation phase. This section deals with the decommissioning phase of the proposed project. Decommissioning is a stage the project or activity of the project is formally ending.

The proposed transmission line system is expected to operate for at least 40 years before it comes to end. The Regulations for Environmental Impact Assessment (URT, 2005) directs developers to address the implication of decommissioning process as part of the EIA process.

There will be some components of the project that will be closed as soon as their requirement has come to the end. Activities to be done during decommissioning include, demolition of power plant and hauling rubble and waste materials from the demolition. Several impacts (negative and positive) are likely to occur as result of the decommissioning.

In implementing decommissioning activities, TANESCO will prepare a detailed decommissioning plan to ensure that environmental and social impacts are minimized in order to comply with environmental legislations and policy requirements. In decommissioning phase, TANESCO will form a team of experts with a representative from the relevant national, regional and local government bodies to monitor the implementation of the decommissioning plan.

Impacts and mitigation measures which need to be considered during decommissioning include the following:

Soil Erosion

This is likely to occur during decommissioning as result of movement of vehicles heavy machines clearing the structures and leveling the project area. The following mitigation measures are proposed:

- TANESCO/Contractor must to all decommissioning activities are confined to core areas.
- TANESCO/Contractor to rehabilitate degraded areas with natural vegetation.

Surface run off and surface water quality

This is likely to occur during decommissioning and especially if it is done during the rain season. Surface run off may accelerate soil erosion and increase pollution of water bodies. The following mitigation measures are proposed:

- TANESCO/Contractor to ensure all decommissioning activities is confined to core areas.

- TANESCO/Contractor to schedule decommissioning to be scheduled during dry season.
- TANESCO/Contractor to ensure spoil material from demolished infrastructure is appropriately disposed away from wetlands, water sources.
- TANESCO/Contractor to undertake site landscaping in disturbed areas.

Noise and Vibration

Noise and vibration will occur as a result of movement of heavy vehicles and machines hauling rubble and waste materials from the demolition. Vibration may cause effect on nearby structures especially community's houses. The following mitigation measures are suggested:

- TANESCO/Contractor to ensure all decommissioning activities is confined to core areas.
- TANESCO to ensure there is no unnecessary movement of vehicle.

Waste generation

The decommissioning of the transmission line will result into generation of wastes from obsolete materials and unwanted materials. Mechanisms of identifying, collecting and disposal will be in place to ensure all wastes have been collected, removed and rightly disposed of. The following mitigation measure is proposed:

- Equipment and facilities of the substations, transmission towers and lines will have to be disposed-or removed from the project site.
- Assessing the contents of hazardous materials in control building and substations.
- Removing them prior to initiation of decommissioning activities, managing their treatment and disposal.
- Cleaning of zones where necessary.

In accordance with the requirements of the Environmental Management Act, Cap 191 of 2004 and the Environmental Impact Assessment and Audit Regulations of 2005, this ESIA Report has been prepared to identify, assess, and mitigate the potential environmental and social impacts associated with the proposed 400kV transmission line. This Report was based on the technical information provided by the developer, existing studies and reports relevant to the Project, site visit, baseline environmental monitoring and the initial stakeholder engagement.

The proposed Mtwara-Somanga 400kV transmission line route is located in the coastal areas of Mtwara and Lindi Regions. It will connect the proposed Mtwara 300MW power plant to the national grid by interconnecting three substations (S/S) in Mtwara S/S (new), Lindi S/S (new) and Somanga S/S (existing). Most sections of the proposed 270km transmission line are expected to run close to the major road between Mtwara and Dar es Salaam. The required Wayleave (Right-of-Way) for the transmission line is 52m (26m for each side).

The proposed transmission line will not pass through any protected area or ecologically important area. However, an endangered bird species was identified to have breeding sites in Lindi District Coastal Forest that is approximately 7km from the proposed transmission line route. Also, the proposed transmission line will pass through potential elephant wildlife corridoran. However, no signs of elephant movement was recorded during field survey.

The proposed development of power transmission line from Mtwara rural at Kisiwa village to Kilwa district at Somanga Ndumbo village traverses two regions, four districts, 15 wards and 42 villages. Agriculture is the main and important means of livelihood in all villages along the along the route. Although all districts have hospitals, health centers and dispensaries, only 60% of survey respondents have access to health services.

As a result of several engagement and consultation activities, it has been identified that there is overall support for the Project from various stakeholders. Different groups, particularly local communities, expressed expectations such as employment opportunities, access to stable electricity supply, and potential improvement in social services. However, stakeholders highlighted the need for the project developer to properly implement compensation for land acquisition, pollution control and mitigation measures and to support communities that will be affected by the Project.

Potential environmental and social impacts that will be caused by the Project have been identified and assessed. Based on the assessment, impacts during construction phase are expected to be more significant compared to during operation phase. During operation phase, significant impacts will be limited to

impacts on an endangered bird species and risks to community safety and security due to the presence of transmission line towers and electric wires.

The Environmental and Social Management and Monitoring Plan has been prepared to ensure mitigation and management of identified environmental and social impacts. With proper implementation of these plans, together with some embedded control measures in the Project design, it can be ascertained that the Project is unlikely to cause any significant environmental and social impacts, particularly during the operation phase.

Overall, the benefits to be realized from the proposed Mtawara transmission line project are expected to outweigh environmental and social costs. The Project presents opportunities for employment and improvement of the local economy. More importantly, it would contribute to increased improved stability of the national power supply and distribution.

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