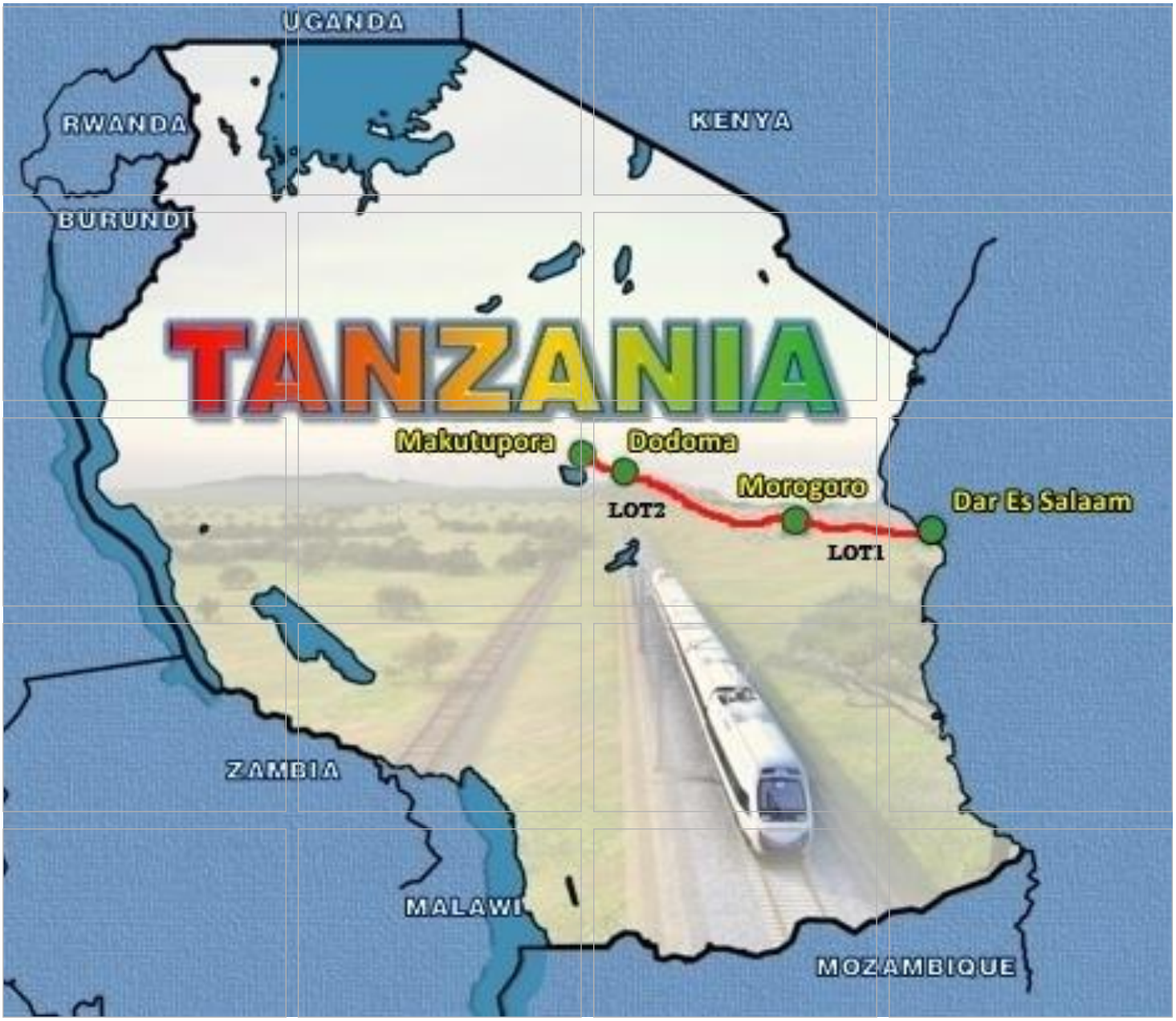


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# Standard Gauge Railway Line (SGR) Project
# Dar es Salaam – Makutopora, Tanzania

## Environmental and Social Impact Assessment

**Final Report**

April, 2019
www.erm.com



ERM

*STANDARD GAUGE RAILWAY LINE (SGR) PROJECT*
Dar es Salaam – Makutopora, Tanzania

# Environmental and Social Impact Assessment
## *Final Report*

Prepared for:
**Tanzania Railway Corporation (TRC)**
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P.O.Box 76959, Dar es Salaam,
Tanzania

**ERM Environmental Resources Management**
**April 2019**

Based on earlier Draft ESIAs prepared May/November 2018 by
Ardhi University Consultancy Unit (ACU)
Dar es Salaam

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# 1 INTRODUCTION

## 1.1 BACKGROUND AND JUSTIFICATION

The Government of the United Republic of Tanzania (GoT) through the Reli Assets Holding Company (RAHCO), currently rebranded as Tanzania Railway Corporation (TRC), is embarking on a major railway revitalization programme in the country through the rehabilitation and construction of new railway line links. The GoT intends to construct a Standard Gauge Railway (SGR) from Dar es Salaam to Mwanza via Isaka (1,219 km). This partly follows the African Union (AU) and East African Community (EAC) decision in 2006, which was that all new railway development projects on the continent would be to a standard gauge specification. TRC intends to lay a separate SGR line alongside the existing Metre Gauge Railway (MGR) along the entire length from Dar es Salaam to Mwanza, via Isaka.

The implementation of the SGR project is being undertaken in phases. Phase I (Dar es Salaam to Morogoro) and Phase II[1] (Morogoro to Makutopora) have a total length of approximately 541 km. The GoT, through TRC, awarded the contract to the firm Yapi Merkezi Insaat ve Sanayi (Yapi Merkezi) to provide design and construction services of the SGR for these two phases stretching from Dar es Salaam to Mukutopora (referred to hereafter as the "Project"). The SGR will subsequently be operated by the TRC.

The SGR Project is in line with the overall aim of the GoT to revitalize and reinvigorate the rail sector so as it can contribute more to the national economy. Moreover, currently over 95 percent of the traffic leaving the port of Dar es Salaam is transported by road to the detriment of the road network. It is thus expected that the upgrading of the rail sector, especially the Dar es Salaam-Isaka-Mwanza link, will increase freight and passenger capacity as well as release pressure on the road network. The SGR is also expected to reduce the travel times for both goods and passengers.

TRC, a publically owned company, mandated by the GoT to promote and manage the rail infrastructure in the country, commissioned the Ardhi University (ARU, Ardhi) to undertake the Environmental and Social Impact Assessment (ESIA) of the proposed SGR Project. The ESIA study was conducted in accordance with the Environmental Impact Assessment and Audit

[1] Note: the different Project segments are in some contexts referred to as "phases" or also as "lots"; whilst essentially interchangeable, in this ESIA the term "lots" is used more frequently.

regulations (2005), formulated under the Environmental Management *Act No. 20 of 2004* (Cap. 191). The Regulations provide for the National Environment Management Council (NEMC) to oversee the ESIA process, which culminates with an award of an Environmental Certificate by the Minister responsible for Environment. The Certificate is among other prerequisite approvals required before the project is implemented.

For the purpose of compliance to the Tanzania environmental legislation therefore, the Project was subjected to an ESIA process. The Project classification by the NEMC, rated it to a full EIA category. Following Project classification, a scoping study was conducted (see *Annex A*). Similarly, draft ESIA Terms of Reference (ToR) were prepared, which were then approved by NEMC. The approved ToR forms the point of reference and guidance for the entire ESIA study and reporting (see *Annex A*).

Yapi Merkezi engaged ERM to assist ARU (ARDHI) to upgrade this ESIA to meet the requirements of international lenders. This ESIA therefore, subscribes to the International Finance Corporation (IFC) Performance standards, where applicable.

## *1.2 PROJECT OBJECTIVES*

The Project aims at promoting sustainable mobility along the Central Corridor of Tanzania, through the construction of the railway line from Dar es Salaam to Mwanza, and new lines from Isaka to Kigali in Rwanda, and Musongati in Burundi. Such upgrades and construction shall lead to the unlocking of the central corridor of the East African Community (EAC), which has potential for agriculture and mining. The Project will also reduce transport costs and enhance economic development and people mobility by:

- Improving the connection of bordering countries, particularly Uganda, Rwanda, Burundi and DRC, to the world economy; and
- Providing an SGR line parallel to the existing meter gauge line with improved capacity, reliability, and cost effective transportation over the central corridor as a whole, and specifically for the line from Dar es Salaam to Mwanza.

## *1.3 PROJECT RATIONALE AND JUSTIFICATION*

The Project is considered amongst the top priorities to open-up socio economic opportunities in the hinterland of Tanzania, and between member states of the EAC region. The SGR Project will greatly contribute to Tanzania's economy as

well as other EAC states. The Project is viewed as a necessity in relieving the road networks, which are continually being subjected to higher loads than for which they were designed. The Project will thus reduce maintenance costs to roads, and will lower travel and transportation costs of people and goods. In addition, the transfer of current road travel to rail will improve the overall safety of transport.

## *1.4 RATIONALE OF ESIA STUDY*

The EIA[1] process in Tanzania is regulated by the Environmental Management Act (EMA) (No. 20 of 2004) and the EIA and Audit Regulations (EIA Regulations) (GN 349 of 2005). Construction or new expansion to existing railway lines is a listed activity under the Regulations, and accordingly, an EIA needs to be undertaken and an EIA Certificate must be granted prior to commencement of any construction activity. The Regulations provide the general objectives for conducting the EIA, namely:

- To ensure that environmental considerations are explicitly addressed and incorporated into the development decision making process;
- To anticipate and avoid, minimise or offset the adverse significant biophysical, social and relevant effects of developmental proposal;
- To protect the productivity and capacity of natural systems and ecological processes which maintain their functions;
- To promote development that is sustainable and optimises resources use and management opportunities;
- To establish impacts that are likely to affect the environment before a decision is made to authorise the project; and
- To enable information exchange, notification and consultations between stakeholders.

TRC has therefore undertaken an ESIA and produced this ESIA Report to address these objectives.

[1] Note: in this document the abbreviation "ESIA" is most commonly used, whereby "EIA" (as here) is often the abbreviation used in national laws/regulations. rdhi

## 1.5 SCOPE OF WORKS

The scope of work includes:

- To identify, predict, evaluate and mitigate the significant environmental impacts (positive and negative);
- To identify key social issues relevant to the Project objectives, and specify the Project's social development outcomes;
- To determine magnitude of adverse environmental and social impacts and identify the safeguards instruments as per IFC guidelines, Country laws and regulations;
- To predict and assess in quantitative terms as far as possible, the impacts from changes brought about by the Project on the baseline environmental conditions;
- To establish the mitigation measures that are necessary to avoid, minimize or offset predicted adverse impacts and, where appropriate incorporate these into Environmental and Social Management Plan (ESMP);
- To identify stakeholders who are directly affected and carry out stakeholder analysis to determine their role in achieving social development outcomes;
- To inform, consult and carry out dialogues with stakeholders on matters regarding project design alternatives, implementation of environmental and social mitigation measures and to provide recommendations on Project design that may require adjustments in project design;
- To provide an environmental and socio economic profile of the population and available infrastructure facilities for services and community resources; and
- To develop monitoring and evaluation mechanism to assess effectiveness of mitigation measures including, resettlement outcomes during and after Project completion.

## 1.6 METHODOLOGY

### 1.6.1 Initial Desk Study

The ESIA was carried out using different methodologies, to comply with specifications given in the approved Terms of Reference (ToR) and EIA Regulations, as well as with international lender requirements.

The first approach was a review of relevant literature pertaining to the SGR Project and Project Areas. Much of the background information on the project was collected from TRC– which included the project conception, plans, Project coverage etc. In addition, relevant district and regional profiles were used as sources of data and information that describe baseline conditions. Other information has been gathered from wider literature sources including the internet.

The study team used deskwork to update and enhance their understanding on national policies, legislation and institutional arrangements for environmental management in Tanzania and relevant international procedures to ascertain the optimal management of impacts. Requirements for adherence to environmental and social sustainability of international financiers were as well addressed through reviewing relevant Environmental and Social Safeguards.

### *1.6.2 Baseline Data Collection*

The original baseline data for this ESIA was collected by Ardhi and presented in the draft ESIA of May 2018.
ERM have in some cases restated and in other cases supplemented the May 2018 ESIA during the preparation of this 2019 ESIA.

More details are presented in the table below about which authors (Ardhi or ERM) were main contributors to which section of this 2019 ESIA, including baseline data as well as conducting the impact assessment and developing mitigation measures.

| ESIA / topic | Baseline data | | Impact Assessment (IA) and mitigation measures | |
|---|---|---|---|---|
| | **Ardhi** initial contribution | **ERM** additional contribution | **Ardhi** initial contribution | **ERM** additional contribution |
| *Physical Environmental* | | | | |
| Climate actual and projections. Climate change | Actual climate of districts traversed by the project. | New section with climate projection for 2030, 2050 and 2080 years; Identification of Potential Future Climate Risks and section of Climate change & potential impacts of climate change in Tanzania. | General information provided on climate change and an estimate of project emissions provided. | New GHG assessment, Climate Risk assessment and mitigation actions. |
| Topography and Agro-Ecological zones | Summary table with environmental characteristics along proposed alignment. | Summarised information in this table and included additional information on ecoregions and habitats in the Biological environment environmental baseline. | Limited and High level coverage in the impact assessment. | Included in the Impacts and mitigation to the biological environment. |
| Soil | Entire Soil baseline section (including soil structure, erosion potential, mineral resources, seismic activity) | Added a picture from the project area - Heaps of Sand/Soil recovered from a bridge in the existing MGR at Gulwe (Mpwapwa) as a result erosion upstream | Limited to few high-level paragraph taken from the Soil and Water IA during construction and during sections | New Impact on soil erosion and Mitigation measures |
| Surface water | Entire surface water section. No review of Hydrology Report and Flood Risk Report. | Conducted due diligence review of the Hydrology Report and Flood Risk Report for the proposed SGR from Dar es Salaam to Morogoro.<br><br>River crossing list and the kilometre points have been corrected and updated based on the information received from YM. | Limited and high level summary provided in the impact assessment and mitigation chapter. | New impacts identified - Impacts on the Ruvu floodplain (operational), Alteration of flow regime (operational), Sediment mobilisation & hydrocarbon spills at water crossings (construction) and Impact on surface water quality. Mitigation measures provided for each. |

| ESIA / topic | Baseline data | | Impact Assessment (IA) and mitigation measures | |
|---|---|---|---|---|
| | **Ardhi** initial contribution | **ERM** additional contribution | **Ardhi** initial contribution | **ERM** additional contribution |
| | | Major river crossing map has been included.<br><br>Surface water sampling (conducted by YM in March and April 2019) results have been included. | | New section "Impacts on the Community due to Usage of Water Resources by the Project" has been included.<br><br>The list of the surface water used for Project water supply has been included.<br><br>Mitigation measures to reduce impacts on groundwater and surface water resources have been revised.<br><br>Mitigation measures while working at wetlands and inside the watercourse have been included. |
| Groundwater | Entire groundwater section | Evaluation of Lot 2 boreholes pump test reports have been included.<br><br>Borehole locations map has been included.<br><br>Groundwater quality results of the boreholes have been included. | Impacts on groundwater not assessed in the impact assessment chapter however general mitigation measured provided. | A new table named "Impact Assessment on Groundwater resources to be used by the Project" has been included and further actions addressed.<br><br>*Mitigation measures to reduce impacts on groundwater and surface water resources have been revised.* |

| ESIA / topic | Baseline data | | Impact Assessment (IA) and mitigation measures | |
|---|---|---|---|---|
| | **Ardhi** initial contribution | **ERM** additional contribution | **Ardhi** initial contribution | **ERM** additional contribution |
| Air quality | Entire Air baseline section | No additions, only review | Limited information on air quality impacts and which sensitive receptors are likely to be impacted. General mitigation measures presented in the ESMP. | An air quality impact assessment for emissions and dust including mitigation measures provided in the impacts & mitigations to the physical environment & ESMP. |
| Noise and vibrations | Entire Noise and Vibrations section | No additions, only review | Limited information on noise and vibration impacts. General mitigation measures presented in the ESMP. | Noise and vibration impacts on sensitive receptors covering construction and operational phases assessed. Initial modeling conducted of various SGR operational scenarios to determine approximate noise-footprint in baseline. Maps created to show potential impacts to receptors. Mitigation measures provided in the impacts & mitigations to the physical environment & ESMP. |

| ESIA / topic | Baseline data | | Impact Assessment (IA) and mitigation measures | |
|---|---|---|---|---|
| | **Ardhi** initial contribution | **ERM** additional contribution | **Ardhi** initial contribution | **ERM** additional contribution |
| *Biological environment* | | | | |
| Terrestrial ecology | Limited terrestrial ecology baseline | Added details of terestial ecology including flora and fauna commmunities present e.g. numbers of vertebrate fauna listed with a threatened status in the project area and ecoregions. New field study done on wildlife corridors, as basis for BAP. | Generic impacts identified - Identified loss of vegetation, landscape and visiual impacts and generic mitigation measures | Added new impact – Loss of natural habitat and Impacts to Fauna. Impacts and MMs stemming from wildlife/BAP study. |
| Aquatic ecology | Limited aquatic ecology baseline | No addition | Generic impacts identified - Identified loss of vegetation, landscape and visiual impacts and generic mitigation measures | Added new impact – Loss of natural habitat and Impacts to Fauna |
| Natural protected areas | Limited information on natural protected areas within study area | Added list, map and details of all protected area along the proposed SGR Route and key biodiversity areas | Impact specific to protected areas not covered in ESIA | Added new impact – Impacts to protected areas |
| Critical habitats | Concluded that there are no critical habitats in the project area | Identified and defined available habitats and species within project area that could trigger critical habitat. | No critical habitats identified and not covered | Added new impact - Risk of Invasive Alien Species Infestation |

| ESIA / topic | Baseline data | | Impact Assessment (IA) and mitigation measures | |
|---|---|---|---|---|
| | **Ardhi** initial contribution | **ERM** additional contribution | **Ardhi** initial contribution | **ERM** additional contribution |
| *Socioeconomic* | | | | |
| Geography and Administrative Structure | Limited to subsections in some (but not all) the districts/town councils. | Added section on national level demographics; Added section for each of the districts/town council level. | n/a | n/a |
| Ethnicity, Religion and Language | Added ethnicity/religion/language Sub-section under some (but not all) of the districts sections | Added subsection on national level ethnicity/religion/language; Added subsection for each of the districts/town council level. | No specific assessment presented. __ | New Impact on Social cohesion including mitigation measures and a summary table of the pre- and –post mitigation measures. |
| Population and Demographics including Migration | Added sub-section under some (but not all) of the districts sections. | Added section on national level; Added sub-section under each of the districts sections. | No specific population related impacts discussed (i.e. influx). | No specific population related impacts discussed (i.e. influx). |
| Indigenous Peoples | Spread and very limited information of some (but not all) the districts | Added a new section on indigenous people at national level. New study done by IP expert to evaluate presence of IPs and applicability of PS7. | Impacts to indigenous are not discussed. It is not clear presence of indigenous groups and applicability of IFC PS7. | Conclusions from IP study incorporated |
| Gender Context | Subsections in some (but not all) the districts. | Added new section on national level gender context. | Impacts do not present specific gender focus. | No additional assessment. |
| Vulnerability | Very limited information included in *Special populations or areas more likely to be exposed to adverse impacts* Section | Added a new section on vulnerability with references to national level information only. | Only reference to vulnerability of migrant workers under occupational health and safety impacts. | Vulnerability of women and girls is also addressed under health IA (transmission of STD/HIV). |
| Governance, Security and Human Rights | Almost no information presented. | Added s new section on national level governance, security and human rights. | Limited to two separate short sections on Community, Health and Safety and; Occupational Safety and Health and associated mitigation measures | New Community Health Safety and Security Impact section including mitigation measures and a summary table of the pre- and –post mitigation measures |

| ESIA / topic | Baseline data | | Impact Assessment (IA) and mitigation measures | |
|---|---|---|---|---|
| | **Ardhi** initial contribution | **ERM** additional contribution | **Ardhi** initial contribution | **ERM** additional contribution |
| | | | | Community Health, Safety and Security Impact section has been re-written considering the operational phase as well. |
| Economy | Subsections in some (but not all) the districts;<br>Section on economic activities and livelihoods. | Added section on national level economy;<br>Added subsection with very limited information for the Kisarawe and Mpwapwa Districts | Limited to two short sections on employment and livelihoods positive impacts and associated enhancement measures | New Economy and Employment Impact including enhancement measures and a summary table of the pre- and –post mitigation measures<br><br>New Labour and working conditions Impact including mitigation measures and a summary table of the pre- and –post mitigation measures |
| Education and Literacy | Subsections in some (but not all) the districts. Results of sample of household survey in 10 villages (literacy rates) | Added section on national level education and literacy;<br>Added subsection for each of the districts sections. | No specific discussion on impacts to education and skills. | No specific discussion on impacts to education and skills. |
| Land Ownership and Tenure System. Land use | Very few subsections of land use in some (but not all) the districts;<br>Subsection of land tenure for the project area. | Added section on land ownership and Tenure at a national level;<br>Added subsection on land use for all of the districts | Limited to a land expropriation, loss of property and resettlement short section<br>on impacts and associated mitigation measures | New Land Acquisition and Physical and Economic displacement section including mitigation measures and a summary table of the pre- and –post mitigation measures |
| Livelihoods | Spread and inconsistent information in subsections for some (but not all) the districts. Limited information on livelihoods based on sample of 15 households in 10 villages. | Added section on agricultural and livestock at national level. | See Economy above. | See Economy above. |

| ESIA / topic | Baseline data | | Impact Assessment (IA) and mitigation measures | |
|---|---|---|---|---|
| | **Ardhi** initial contribution | **ERM** additional contribution | **Ardhi** initial contribution | **ERM** additional contribution |
| District and Local Context | Only information at a District and local level:<br>• Ilala District<br>• Kisarawe District<br>• Kihaba town council<br>• Morogoro rural-region<br>• Mpwapwa District<br>• Chamwino District | Added information on the national context; Added also more district and local level analysis, particularly for:<br>• Kilosa District<br>• Dodoma municipal | No discussion on district specific impacts (i.e employment etc.). | No additional impact assessment presented. |
| Health | Subsection in all the district levels except from Kisarawe district (major part of the information is about health infrastructure). | Added sub-section under each of the districts sections (basically health access and health infrastructure) | Limited to few HIV/AIDS and other sexual related diseases high-level paragraphs and associated mitigation measures<br><br>Limited to a high-level paragraph on vulnerable groups and associated mitigation measures. | New Section of the Impact on Transmission of Sexually Transmitted Infections including mitigation measures and a summary table of the pre- and –post mitigation measures<br><br>New Section of the Transmission of Vector Borne and Communicable Diseases including mitigation measures and a summary table of the pre- and –post mitigation measures |
| Public Infrastructure and Services | Subsection in all the district levels. Information quite inconsistent. | Added subsection in all the districts (mainly water, energy and traffic/transportation).<br>Not all of the subsections contain water and energy information. | Limited to a high-level paragraph on public infrastructure impacts and associated mitigation measures | New Displacement of Community Infrastructure impact including mitigation measures and a summary table of the pre- and –post mitigation measures |
| Utilisation of Natural Resources / Forest Products | Utilisation of Natural Resources / Forest Products | Subsections in some (but not all) the districts | No relevant adds | Limited to a high-level paragraph on loss impacts and associated mitigation measures |

| ESIA / topic | Baseline data | | Impact Assessment (IA) and mitigation measures | |
|---|---|---|---|---|
| | **Ardhi** initial contribution | **ERM** additional contribution | **Ardhi** initial contribution | **ERM** additional contribution |
| Traffic and Transportation | Subsection for each of the districts | No relevant additions. | See Public Infrastructure | New Impact on Restrictions to Access Routes and Severance and Mitigation measures and a summary table of the pre- and –post mitigation measures |
| Cultural Heritage Resources | Limited to a paragraph on the cemetery areas nearby or within the Project area of influence | Graveyards map has been included.<br>Sacred trees (Baobab trees) have been included. | Limited to a high-level paragraph on graves IA and associated mitigation measures | "Overall Mitigation / Management Measures on Impacts on Cultural Heritage Resources" section has been included and previous mitigation measures have been revised considering intangible resources and sacred trees as well. |

### *1.6.2 Stakeholder Consultations*

A Stakeholder Engagement Plan (SEP) has been prepared for the purpose of ensuring that a consistent, comprehensive, coordinated and culturally appropriate approach is taken to stakeholder engagement and Project disclosure throughout the ESIA. This SEP was also used as a tool to enable TRC to align with international best practice for engaging stakeholders. Moreover, TRC is committed to full compliance with all Tanzanian EIA Regulations, as well as aligning to the international standards namely the IFC Performance Standards and any other directly relevant policies of the IFC and World Bank. To achieve this goal, a well-planned procedure for stakeholders in the entire ESIA study was thus imperative.

In line with current international best practice, the SEP aims to ensure engagement that is free of manipulation, interference, coercion and intimidation. It also aims to ensure that stakeholder engagement is conducted on the basis of timely, relevant, understandable and accessible information, in a culturally appropriate format. In this way, the SEP seeks to ensure that stakeholder groups are given sufficient opportunity to voice their opinions and concerns, and that these concerns influence Project decisions. The SEP:

- Outlines the approach to be adopted to engagement, showing how this will be integrated into the rest of the ESIA process;
- Identifies stakeholders and mechanisms through which they will be included in the ESIA process; and
- Serves as a way to document engagement undertaken throughout the ESIA.

The SEP was developed after the Scoping exercise, and was continually updated throughout the course of conducting this ESIA study. The SEP was used in the course of engaging stakeholders during the detailed ESIA study. The SEP shall continue to be used during Project implementation and post-construction monitoring, and is presented in this ESIA.

As described in the SEP, consultation was undertaken through:

- Consultative Meetings with Regional District Authorities and Utilities Companies;
- Meetings with Communities, namely Village and Ward Leadership, in the settlements of Pugu, Soga, Ngerengere, Mkata, Gulwe, Bahi, Kintiku, Zuzu and Makutopora;

- Public Consultations with Villagers;
- Focus Group Discussions. These focus groups comprised of women, ward leaders, economic venture groups, influential elders, self-help groups, sports team leaders, teachers, income-generating groups, livestock keepers, farmers, women, disabled, businessmen and women etc.; and
- Through Household Questionnaires.

With respect to Stakeholder Engagement activities, the contributions of Ardhi and ERM are shown below.

*Table 1-1 Contributions to stakeholder engagement*

| Stakeholder Engagement activities – | Ardhi initial contribution | ERM additional contribution |
|---|---|---|
| Consultation with TRC, Regional and District Administration | List of the consultations in a summary table | Added the main goals of the consultation |
| Community consultation | Consultation with a sample of villagers | Added Project Information Disclosure (Informed Consultation and Participation), including<br>• Focus Group Discussions<br>• Household Questionnaires |
| Issues raised by the Stakeholders | Issues included in a summary table. | Added a general comment stating the feedback provided on consultation effectiveness. |

### *1.6.3 Fieldwork and Observations*

Interviews and documentation methods were supplemented by physical observations to identify features along the RoW. Several fieldwork trips were conducted by different teams; the results of which contributed to this report (fauna and flora team; social impact assessment team; environmental assessment team; RAP team; and valuation and compensation team).

The fieldwork essentially involved physical surveys, social-economic surveys, verification of secondary information, and consultation. It entailed the facilitation of the acquisition of information, and collection of data on physical, biological, cultural and social-economic aspects of the SGR Project corridor. Moreover, the physical survey collected data on the types of houses, landuse

(such as crops, trees), availability of infrastructure/utilities, and other critical environmental and social features.

### *1.6.4 Impact Assessment*

The main objective of the ESIA is to examine, analyse and assess the planned Project activities' effects on the baseline conditions. The impact assessment superimposes the proposed Project activities onto the baseline environmental and socio-economic conditions of the Project site and wider area of influence. The Project activities are described in *Chapter 2* and the sensitivities of the environmental and social components are outlined in *Chapter 4*.

Superimposing Project elements/activities onto the existing social and environmental natural conditions has identified the potential environmental impacts of the Project. An environmental impact correlation matrix method has been adopted to identify impacts of major concern.

The complete impact analysis procedure is described in *Chapter 6*; involving analysis of data for identification, prediction and evaluation of foreseeable impacts, both beneficial and adverse using checklists, simple matrices and expert judgement; and reference to national and international standards and guidelines.

A key guiding assumption in this study is that the Project will be designed, constructed, operated and maintained with due care for safety and environmental matters using current and practical engineering practice and/or Best Available Technology Not Entailing Excess Cost (BATNEEC).

Using expert judgment to assess impacts, mitigation measures were identified that aim to minimise potential negative impacts and enhancing positive ones. These are addressed and detailed in the Impact Assessment chapters. This is further summarized in the Project's Environmental and Social Management Plan (ESMP).

### *1.6.5 Public Disclosure of Draft ESIA*

As described above, the preparation of this ESIA occurred in the following key steps:

- May 2018 - Draft ESIA (authored solely by Ardhi)
- February 2019 - Draft ESIA (supplemented by ERM)
- April 2019 – Final ESIA (supplemented by ERM).

In accordance with requirements of the international financing institutions, the Draft ESIA (of February 2019) was publicly disclosed for a 30-day period to provide opportunity for public review and comment. In particular, a link to the Draft ESIA document was posted on the web-site of the Swedish Export Credit Agency EKN as of February 12th, 2019:

*https://www.ekn.se/en/what-we-do/sustainability/transactions-with-environmental-and-social-impact-assessment/dar-es-salaam-to-dodoma-railway-tanzania/*

As of the time of preparation of this Final ESIA (ie end of March, 2019), no comments on the Draft ESIA were received by EKN.

Any comments that may be received after completion of the Final ESIA can be addressed within the Project's Grievance Mechanism that is open at all times to any stakeholders or other interested parties.

# 2 PROJECT DESCRIPTION

## 2.1 INTRODUCTION

This *Chapter* provides a description of the proposed SGR Project, related activities and ancillary infrastructure. The Project Description formed the Terms of reference for specialist studies and for the Impact Assessments provided in *Chapter 6*.

The information presented in this *Chapter* was received from TRC and Yapi Merkezi through responses to information requests and through ongoing collaboration with the Yapi Merkezi Project teams.

### 2.1.1 Project Background

The background to the SGR Project dates back to April 2006 when the African Union (AU) and later the East Africa Community (EAC) declared to develop new railway lines from the meter to standard gauge.

In 2005, the tripartite states of Tanzania, Burundi and Rwanda launched studies for the "Dar es Salaam – Isaka – Kigali/Keza – Gitega - Musongati railway project" under the financing of African Development Bank (AfDB). The Feasibility Study for the Dar es Salaam-Isaka-Keza-Kigali/Musongati (DIKKM) railway project was done by M/s DB International and completed in December 2008. Further Feasibility Study was conducted in January 2009 by Burlington Northern Santa Fe (BNSF) Railway Company, a United States based firm, for upgrading the existing meter gauge railway line between the Port of Dar es Salaam and Isaka, which was financed by the United States Trade and Development Agency (USTDA). In 2012/13, another detailed study was carried out by CANARAIL of Canada in order to harmonize and review the two previous studies for the purpose of developing the project through PPP approach.

Subsequent to the three comprehensive and complete studies, the Government of Tanzania now desires to have the section from Dar es Salaam to Isaka and its extension to Mwanza built as a parallel SGR alignment adjacent to the existing meter gauge track (refer to *Figure 2-1*) to allow continuation of existing operations on the meter gauge during construction. This will further give a homogeneous track up to Kigali and avoid the limiting track parameters factors on the existing meter gauge formation such as gradient and curves.

The Project is considered among top priorities to open-up socio-economic opportunities in hinterland of Tanzania and between member states of EAC region.

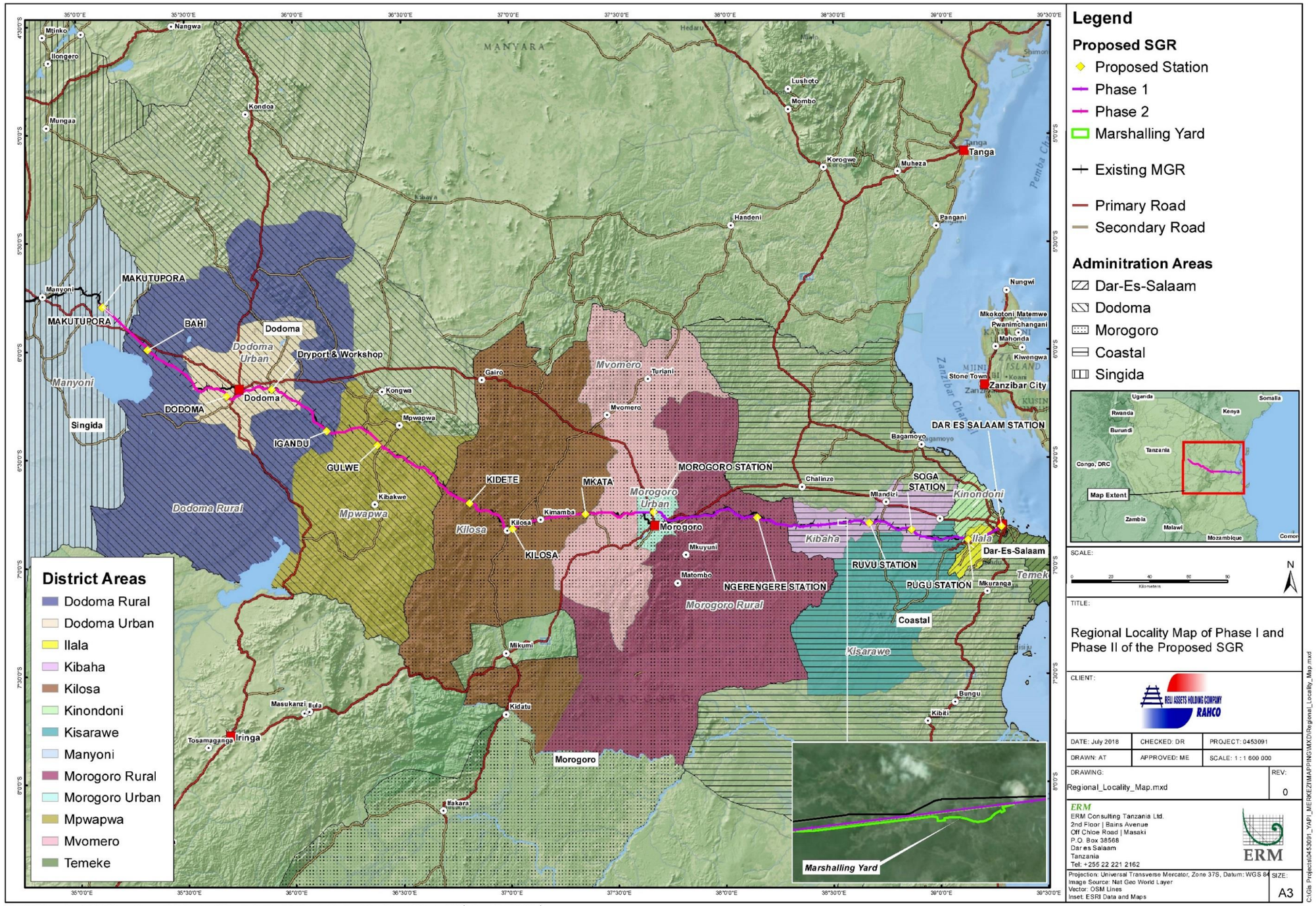
## 2.2 *PROJECT LOCATION*

The proposed SGR Project will be undertaken in the following two phases – Phase I (Dar es Salaam to Morogoro – 205 km) and Phase II (Morogoro to Makutupora – 336 km) (refer to *Figure 2-1*). Phase I and Phase II will traverse the Regions and Districts presented in *Table 2-1.* The proposed SGR from Dar es Salaam to Makutopora station (541 km) will run parallel to the existing Metre Gauge Railway (MGR). The existing MGR starts from Dar es Salaam and ends in Mwanza via Isaka and has a total length of 1,231 km. The proposed SGR will pass through the regional headquarters of Dar es Salaam, Morogoro and Dodoma which harbor the major train stations (*Figure 2-1*). There are also minor stations along the way including Dar es Salaam, Pugu, Soga, Ruvu, Ngerengere, Morogoro, Mkata, Kilosa, Kidete, Gulwe, Igunda, Dodoma, Bahi and Makutopora (*Figure 2-1*).

***Table 2-1 Regions and Districts Traversed by the Proposed SGR***

| SGR Phase | Region | District |
|---|---|---|
| Phase I | Dar es Salaam | Ilala |
| | Coast | Kisarawe |
| | | Kibaha |
| | Morogoro | Morogoro Rural |
| | | Morogoro Urban |
| Phase II | Morogoro | Morogoro Urban |
| | | Mvomero |
| | | Kilosa |
| | Dodoma | Mpwapwa |
| | | Dodoma Rural |
| | | Chamwino |
| | Singida | Manyoni |

*Figure 2-1 Regional Locality Map of Phase I and Phase II of the Proposed SGR*



## 2.3 CONSIDERATION OF PROJECT ALTERNATIVES

Consideration of Project alternatives is crucial in ensuring that the developer and decision-makers have a wider base from which they can choose the most appropriate option. However, it was not possible to asses all alternatives in detail due to the following reasons.

- The feasibility studies mentioned in *Section 2.1* above were not available and therefore the alternatives considered during feasibility study are not known.
- The Project is developed under design and build approach in which the contractor has been limited to design and to construct the Project according to the contract requirements (user requirements), and therefore there is no flexibility in considering alternatives.
- The new SGR alignment will be designed to largely pass on the existing Right of Way of the existing Metric Gauge Railway (MGR), which limits resettlement and other impacts. The alignment of the proposed SGR will deviate significantly away from the MGR line to bypass Morogoro Town and Dodoma Town. There are also multiple other divergences from MGR along the route in order to reduce curvature.

Due to the above reasons, the alternatives discussed below are general ones and it is not possible to conduct initial (preliminary) environmental and social assessments due to a lack of an alternatives option.

### 2.3.1 *No Project Alternative*

The no Project alternative entails retaining the current status quo (with the Metre Gauge) without developing the new SGR line. Adopting this option would mean avoiding most of the negative effects associated with the railway construction and missing all the positive benefits that would accrue such as increased capacity of the central railway by ferrying more freight and passengers, improved operation and financial returns, ease access to markets, employment opportunities, improved agriculture through accessing farm inputs etc.

### 2.3.2 *Change Alignment*

An alternative to realign the railway (apart from the MTR RoW) was considered. This entails the acquisition of land or cultivated land to be transformed into a railway line. This option would have significant impacts including high costs involved in compensation & resettlement, effects on

livelihoods, and biological destruction. Since this alignment has existed for the last 40 years, there is no good reason to re-align it. However, minor realignment is expected to improve the geometric layout of the railway to accommodate high-speed trains.

### *2.3.3 Refurbishing the Existing Railway Line*

Another alternative to the project that was considered was the refurbishment of the existing railway line. This alternative has not been dismissed and seen to have a number of benefits. Construction of the SGR Project is going concurrently with renovation of the MGR from Dar es Salaam to Isaka. The refurbishment of the MGR is expected to increase the capacity of wagons from 54 tonnes to 74 tonnes when completed and enable it to last for more than 10 to 15 years. It is also expected that the MGR will create a reliable open access railway infrastructure on the Dar es Salaam to Isaka section of the East African Central Corridor.

### *2.3.4 Construction of an Underground Railway Line*

Another alternative to the project that was considered was the construction of an underground railway system from Dar es Salaam to Makutupora. This will barely affect human activities, livestock, forestry cover and will lead to less accidents, noise and exhaust fumes. This option is more expensive to construct and takes a long time to be completed which may ultimately result in higher operating costs. This alternative may not be feasible for a developing economy of Tanzania and therefore dismissed.

### *2.3.5 Use of Air Transport*

Another alternative to the project for consideration was the use of air transportation. This type of transport is more expensive and is out of reach by many Tanzanians. It is also not practicable to transport most industrial goods through this means of transport. It would also be more hazardous to transport dangerous chemicals by air and transport of goods using this option would result in higher transport costs. This option is therefore dismissed.

### *2.3.6 Upgrading the Existing Dar es Salaam-Singida Road to a Super Highway*

Another alternative to the Project that was considered was the upgrade of the road system through construction of super-highways. The current cost of maintaining the Dar es Salaam -Singida highway is very high. Further to this, the cost of upgrading the super-highway will be very high and uneconomical. The road is heavily used by transport trucks therefore it is expected this would

result in increased road accidents leading to loss of human life, livestock and wildlife. It is also expected that the maintenance costs will escalate.

Therefore, this option is dismissed in favour of the proposed new railway line. Completion of the proposed railway has the potential to reduce congestion of the highway and fewer accidents. Though this option is dismissed, it should be considered in the long run to passenger services and local supply of goods and services in the region. However, it will be less economical to use it for goods because of high fuel and road maintenance costs.

## 2.4 *THE SELECTED ALIGNMENT (THE PROJECT)*

The Government of Tanzania following the recommendations arising from multi-criteria analysis and the feasibility studies conducted for the Project, selected the alignment shown in *Figure 2-1*, which is the objective of this Project.

## 2.5 *PROJECT PHASES*

The proposed SGR will be developed in the following set phases:

- Detailed Design Phase;
- Construction Phase; and
- Operational Phase.

Each of these three phases have a different combination of activities and the commencement of each phase is dependent on the outcome and success of its predecessor. It must be noted that the scope of the proposed SGR, and the associated Project ESIA, relates to all three phases.

The above-mentioned Project phases are discussed in this *Section*.

### 2.5.1 *Detailed Design*

*Introduction*

Detailed design of the proposed SGR will involve taking on and developing the approved concept approved by the Government of Tanzania. At the end of the detailed design phase the proposed SGR will be dimensionally correct, such that all the main components of the proposed SGR can be fully described. It is during this phase that the outcomes of the ESIA will influence how the proposed SGR develops.

Project planning, decision-making and refinement of the Project will continue throughout the detailed design phase, as a result of continued engineering studies, as well as per the findings of this ESIA (as described in *Chapters 7*, *8* and *9*, listed in the Project Environmental and Social Management Plan (*Chapter 10*) and Environmental and Social Monitoring Plan (*Chapter 11*)).

*Current Design*

The main design parameters are construction of a standard gauge railway system adjacent to the existing meter gauge railway (MGR) track. The SGR will be designed to have an axle load of 35t and a design speed of 160 km/ for passenger trains and 120 km/h for freight trains and rail width of 1,435 mm (4ft 8½ in). The type of rail will be of 60 UIC-maximum train length of 2000 m with passenger capacity of 1,100,000 passengers/year (*Table 2-2*). The SGR will be laid approximately 15 meters away from the existing MGR. The horizontal curves of the proposed SGR will be designed to account for the relatively higher speed of the new train. Generally, the existing MGR line will continue with operations during the construction period of the proposed SGR. Minimal disturbance to MGR operations will however be limited to those sections of the SGR that cross the existing MGR line.

The SGR is designed to meet the following standards:

- Railway Alignment, Hydraulics, Railway Bridges, Tunnels : AREMA;
- Overpasses, Roadway Bridges and Buildings : Eurocode;
- Roadway Design: Tanzania Road Geometric Design Manual; and
- General Building Specifications: Standard Specifications for Roadworks, 2000.

***Table 2-2 Technical Specification of the Selected Alignment***

| Design Parameter | Design Specification |
|---|---|
| Design speed | 160 km/h |
| Maximum speed (Passenger trains) | 160 km/h |
| Maximum speed (Freight trains) | 80 km/h |
| Maximum axle load | 35 t |
| Rail | 60 UIC |
| Rail cross inclination on turnouts | 1 : ∞ |
| Gauge of track | 1435 mm |
| Sleepers | Pre-stressed Mono-Block Concrete ≈280 kg |
| Sleeper length | ≈2.60 m |

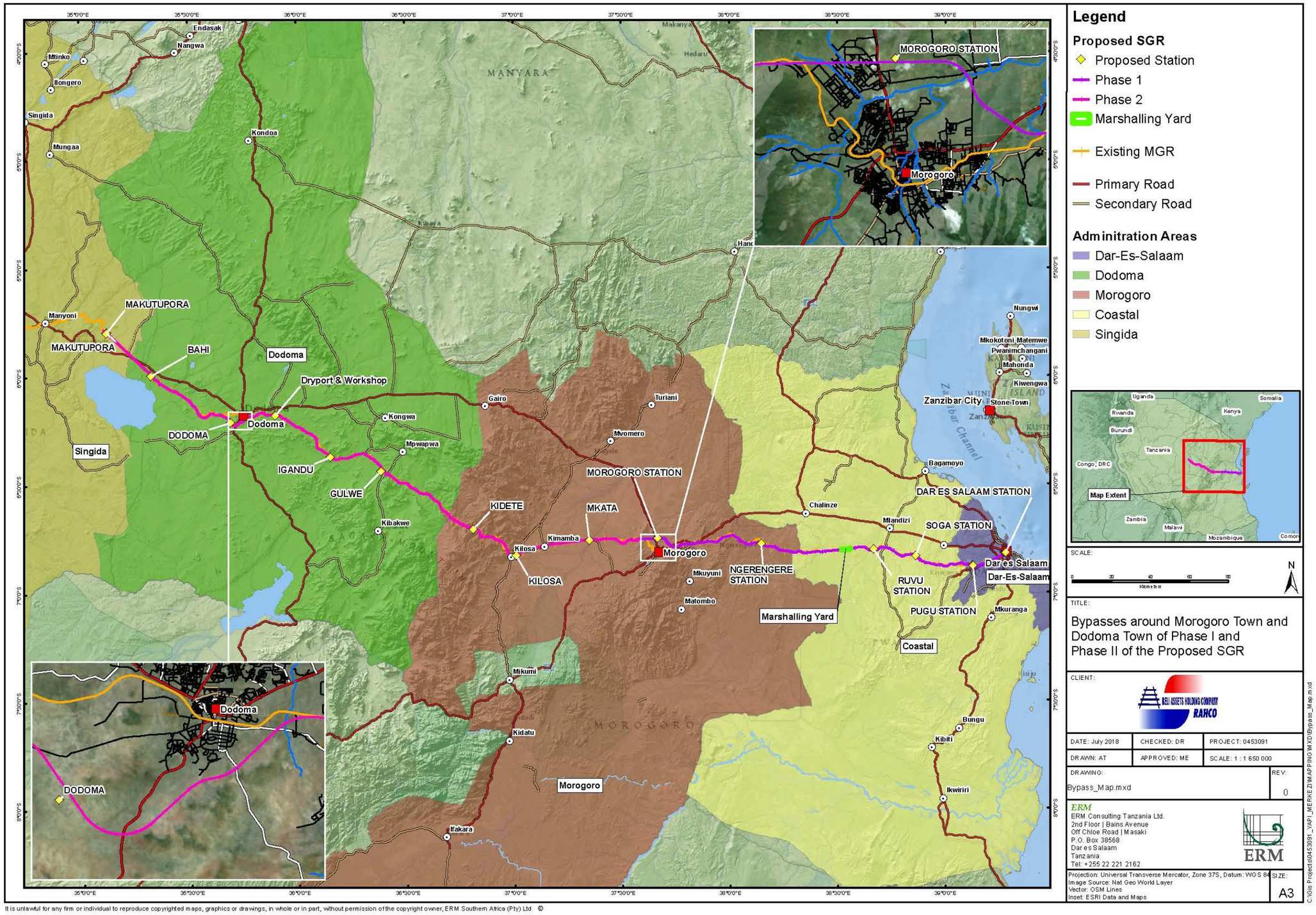
| Design Parameter | Design Specification |
|---|---|
| Sleeper spacing | 600 mm / 1.667 sleepers/km |
| Sleeper for turnouts | Pre-Stressed Mono-Block Concrete |
| Ballast thickness | 300 mm minimum |
| Ballast shoulder width | 400 mm minimum |
| Slope of ballast shoulder | 01:01,5 |
| Ballast volume | 2.50 $m^3$/m |
| Ballast size | Graded 25 mm to 63 mm |
| Rail fastening system | Elastic rail fastening-anti vandal |
| Track | Continuously Welded Rails (CWR) |
| Welding procedure | Flash-butt in workshop Thermit on site |
| Mainline turnouts | 1:24 60 UIC Tangential |
| Yard and siding turnouts | 1:9 60 UIC Tangential |
| Width of track platform | ≈ 7.10 m |
| Inclination of track platform | 01:20 |
| Minimum horizontal curve | 1900 |
| Maximum vertical grade | 16 percent |
| Maximum super elevation | 60 |

Source: Design Report, 2017

To prevent pedestrian access onto the SGR, about 51km of Lot 1 (Dar es Salaam to Morogoro) will be fenced and the entire length of Lot 2 (Morogoro to Makutupora) will be fully fenced along the alignment both left and right side. Fencing is also required in urban areas, around passenger stations, freight facilities and marshalling yards at Lot 1.

The alignment of the proposed SGR will deviate significantly away from the MGR line to bypass Morogoro Town (chainage 195+000 to 205+000) (refer to *Figure 2-2*) and Dodoma Town (chainage 443+000 to 452+000) (refer to *Figure 2-2*). These bypasses are required for speed manoeuvring and to avoid major towns for safety reasons. There are also multiple other divergences from MGR along the route in order to reduce curvature.

*Figure 2-2 Bypasses around Morogoro Town and Dodoma Town*



*Project Infrastructure*

The proposed SGR will require the construction of bridges (Table 2-3), overpasses (Table 2-4), underpasses (Table 2-5) and culverts. The general layout plans of these infrastructures are illustrated in Figure 2-3 to Figure 2-6 respectively. Overpasses and underpasses will be provided where the proposed SGR intersects with existing roads. A flood risk assessment covering the SGR alignment has been conducted to identify and classify river crossings according to size of the catchments. Based on the results of the flood risk assessment, Culverts are provided beneath embankments where natural watercourses occur or where required for drainage beneath the proposed SGR. Bridges will be required where the proposed SGR will cross over significant more large rivers.

Viaducts will also be required where the proposed SGR passes through well-established towns and or cities. Viaducts will allow the proposed SGR to be elevated through towns / cities. Four viaducts are proposed in Dar es Salaam and will vary in length from 102.7 m to 2,156.7 m.

In addition to the above, cattle and pedestrian crossing underpasses will also be constructed. The locations of these facilities have been defined according to the design requirements and stakeholder meetings.

***Table 2-3 Proposed Bridges along the Proposed SGR Alignment***

| No. | Kilometre Point | Length (m) | Span No. | Height |
|---|---|---|---|---|
| **Phase I – Dar es Salaam to Morogoro** | | | | |
| BR01 | 12 | 50.7 | 3 | 12 |
| BR02 | 13 | 76.7 | 4 | 11 |
| BR03 | 20 | 28.7 | 1 | 8 |
| BR04 | 24 | 40.7 | 2 | 12 |
| BR05 | 24 | 28.7 | 1 | 9 |
| BR06 | 28 | 61.7 | 3 | 12 |
| BR07 | 29 | 28.7 | 1 | 10 |
| BR08 | 37 | 28.7 | 1 | 9 |
| BR09 | 38 | 102.7 | 4 | 13 |
| BR10 | 42 | 50.7 | 2 | 10 |
| BR11 | 43 | 19.7 | 1 | 8 |
| BR12 | 48 | 61.7 | 3 | 13 |
| BR13 | 54 | 40.7 | 2 | 8 |
| BR14 | 55 | 40.7 | 2 | 8 |
| BR15 | 63 | 19.7 | 1 | 8 |
| BR16 | 65 | 19.7 | 1 | 8 |

| No. | Kilometre Point | Length (m) | Span No. | Height |
|---|---|---|---|---|
| BR17 | 70 | 61.7 | 3 | 12 |
| BR18 | 76 | 19.7 | 1 | 8 |
| BR19 | 76 | 61.7 | 3 | 8 |
| BR20 | 77 | 28.7 | 1 | 8 |
| BR21 | 77 | 28.7 | 1 | 8 |
| BR22 | 78 | 28.7 | 1 | 8 |
| BR23 | 78 | 19.7 | 1 | 8 |
| BR24 | 79 | 19.7 | 1 | 8 |
| BR25 | 79 | 40.7 | 2 | 8 |
| BR26 | 80 | 28.7 | 1 | 11 |
| BR27 | 103 | 28.7 | 1 | 11 |
| BR28 | 131 | 40.7 | 2 | 8 |
| BR29 | 142 | 19.7 | 1 | 9 |
| BR30 | 144 | 19.7 | 1 | 11 |
| BR31 | 149 | 28.7 | 1 | 13 |
| BR32 | 154 | 28.7 | 1 | 10 |
| BR33 | 157 | 28.7 | 1 | 8 |
| BR34 | 157 | 28.7 | 1 | 9 |
| BR35 | 158 | 28.7 | 1 | 8 |
| BR36 | 181 | 28.7 | 1 | 11 |
| BR37 | 183 | 61.7 | 3 | 10 |
| BR38 | 193 | 28.7 | 1 | 8 |
| BR39 | 196 | 28.7 | 1 | 11 |
| BR40 | 197 | 19.7 | 1 | 9 |
| **Phase II – Morogoro to Makutupora** | | | | |
| BR01 | 227 | 32.2 | 1 | 8 |
| BR02 | 228 | 32.2 | 1 | 8 |
| BR03 | 280 | 474.6 | 11 | 13 |
| BR04 | 311 | 103.4 | 3 | 16 |
| BR05 | 335 | 126.6 | 4 | 10 |
| BR06 | 343 | 65.5 | 2 | 15 |
| BR07 | 352 | 65.5 | 2 | 8 |
| BR08 | 411 | 32.2 | 1 | 6 |
| BR09 | 416 | 32.2 | 1 | 8 |
| BR10 | 419 | 32.2 | 1 | 8 |
| BR11 | 421 | 32.2 | 1 | 8 |
| BR12 | 424 | 32.2 | 1 | 10 |
| BR13 | 429 | 126.6 | 4 | 10 |
| BR14 | 430 | 32.2 | 1 | 10 |
| BR15 | 433 | 42.3 | 2 | 9 |

| No. | Kilometre Point | Length (m) | Span No. | Height |
|---|---|---|---|---|
| BR16 | 436 | 32.2 | 1 | 9 |
| BR17 | 439 | 32.2 | 1 | 9 |
| BR18 | 439 | 32.2 | 2 | 9 |
| BR19 | 441 | 42.3 | 2 | 9 |
| BR20 | 442 | 42.3 | 2 | 9 |
| BR21 | 443 | 20.6 | 1 | 9 |
| BR22 | 450 | 20.6 | 1 | 9 |
| BR23 | 458 | 32.2 | 1 | 9 |
| BR24 | 469 | 91.8 | 3 | 14 |
| BR25 | 475 | 32.2 | 1 | 8 |
| BR26 | 479 | 42.3 | 2 | 7 |
| BR27 | 494 | 42.3 | 2 | 10 |
| BR28 | 507 | 32.2 | 1 | 6 |
| BR29 | 508 | 32.2 | 1 | 7 |
| BR30 | 518 | 20.6 | 1 | 8 |

Source: Yapi Merkezi, 2018

## *Table 2-4 Proposed Overpasses along the Proposed SGR Alignment*

| No. | Kilometre Point | Length (m) | Span No. | Height |
|---|---|---|---|---|
| **Phase I – Dar es Salaam to Morogoro** | | | | |
| OP01a | 1 | 40.7 | 2 | 7 |
| OP02a | 1 | 40.7 | 2 | 7 |
| OP03a | 1 | 61.7 | 3 | 7 |
| OP04a | 1 | 61.7 | 3 | 7 |
| OP05 | 2 | 61.7 | 3 | 7 |
| OP06 | 6 | 19.7 | 1 | 8 |
| OP07 | 15 | 19.7 | 1 | 8 |
| OP08 | 22 | 13.7 | 1 | 11 |
| OP09 | 34 | 28.7 | 2 | 8 |
| OP10 | 61 | 19.7 | 1 | 8 |
| OP11 | 75 | 28.7 | 2 | 8 |
| OP12 | 85 | 19.7 | 1 | 8 |
| OP13 | 127 | 28.7 | 2 | 11 |
| OP14 | 135 | 28.7 | 2 | 8 |
| OP15 | 137 | 28.7 | 2 | 8 |
| OP16 | 140 | 28.7 | 2 | 8 |
| OP17 | 179 | 28.7 | 2 | 8 |
| OP18 | 180 | 19.7 | 1 | 8 |
| OP19 | 180 | 19.7 | 1 | 8 |

| No. | Kilometre Point | Length (m) | Span No. | Height |
|---|---|---|---|---|
| OP20 | 186 | 19.7 | 1 | 8 |
| OP21 | 192 | 28.7 | 2 | 8 |
| OP22 | 198 | 19.7 | 1 | 8 |
| OP23 | 199 | 19.7 | 1 | 8 |
| **Phase II – Morogoro to Makutupora** | | | | |
| OP01 | 207 | 20.6 | 1 | 8 |
| OP02 | 208 | 32.2 | 1 | 8 |
| OP03 | 208 | 20.6 | 1 | 8 |
| OP04 | 216 | 20.6 | 1 | 8 |
| OP05 | 225 | 20.6 | 1 | 8 |
| OP06 | 231 | 32.2 | 1 | 8 |
| OP07 | 254 | 32.2 | 1 | 8 |
| OP08 | 260 | 32.2 | 1 | 8 |
| OP09 | 267 | 65.5 | 2 | 8 |
| OP10 | 285 | 20.6 | 1 | 8 |
| OP11 | 307 | 20.6 | 1 | 8 |
| OP12 | 308 | 32.2 | 1 | 8 |
| OP13 | 315 | 20.6 | 1 | 8 |
| OP14 | 317 | 20.6 | 1 | 8 |
| OP15 | 329 | 20.6 | 1 | 8 |
| OP16 | 333 | 65.5 | 2 | 8 |
| OP17 | 368 | 65.5 | 2 | 10 |
| OP18 | 407 | 42.3 | 2 | 9 |
| OP19 | 414 | 32.2 | 1 | 9 |
| OP20 | 426 | 32.2 | 1 | 8 |
| OP21 | 445 | 32.2 | 1 | 8 |
| OP22 | 455 | 32.2 | 1 | 8 |
| OP23 | 462 | 20.6 | 1 | 10 |
| OP24 | 481 | 32.2 | 1 | 8 |
| OP25 | 482 | 32.2 | 1 | 8 |
| OP26 | 483 | 32.2 | 1 | 8 |
| OP27 | 484 | 32.2 | 1 | 8 |
| OP28 | 497 | 65.5 | 2 | 9 |
| OP29 | 506 | 65.5 | 2 | 8 |
| OP30 | 507 | 32.2 | 1 | 8 |
| OP31 | 514 | 32.2 | 1 | 8 |
| OP32 | 517 | 32.2 | 1 | 8 |
| OP33 | 521 | 32.2 | 1 | 8 |
| OP34 | 528 | 32.2 | 1 | 8 |

Source: Yapi Merkezi, 2018

*Table 2-5 Proposed Underpasses along the Proposed SGR Alignment*

| No. | Kilometre Point | Length (m) | Span No. | Depth |
|---|---|---|---|---|
| **Phase I – Dar es Salaam to Morogoro** | | | | |
| UP01 | 4 | 20 | 1 | 8 |
| UP02 | 9 | 20 | 1 | 8 |
| UP03 | 11 | 20 | 1 | 8 |
| UP04 | 19 | 50 | 1 | 7 |
| UP05 | 22 | 50 | 1 | 7 |
| UP06 | 23 | 50 | 1 | 7 |
| UP07 | 26 | 40 | 1 | 7 |
| UP08 | 30 | 30 | 1 | 7 |
| UP09 | 34 | 40 | 1 | 7 |
| UP10 | 41 | 30 | 1 | 7 |
| UP11 | 41 | 30 | 1 | 7 |
| UP12 | 44 | 20 | 1 | 7 |
| UP13 | 45 | 50 | 1 | 10 |
| UP14 | 49 | 30 | 1 | 7 |
| UP15 | 51 | 50 | 1 | 7 |
| UP16 | 57 | 30 | 1 | 7 |
| UP17 | 58 | 30 | 1 | 7 |
| UP18 | 66 | 20 | 1 | 7 |
| UP19 | 68 | 20 | 1 | 7 |
| UP20 | 81 | 20 | 1 | 7 |
| UP21 | 127 | 20 | 1 | 7 |
| UP22 | 131 | 30 | 1 | 7 |
| UP23 | 150 | 35 | 1 | 10 |
| UP24 | 163 | 20 | 1 | 7 |
| UP25 | 169 | 30 | 1 | 7 |
| UP26 | 173 | 70 | 1 | 11 |
| UP27 | 176 | 20 | 1 | 7 |
| UP28 | 183 | 20 | 1 | 8 |
| UP29 | 185 | 20 | 1 | 7 |
| UP30 | 187 | 20 | 1 | 8 |
| UP31 | 195 | 55 | 1 | 15 |
| UP32 | 195 | 55 | 1 | 9 |
| **Phase II – Morogoro to Makutupora** | | | | |
| UP01 | 205 | 30 | - | 8 |
| UP02 | 265 | 30 | - | 8 |
| UP03 | 271 | 100 | - | 8 |
| UP04 | 271 | 30 | - | 8 |

| No. | Kilometre Point | Length (m) | Span No. | Depth |
|---|---|---|---|---|
| UP05 | 271 | 30 | - | 8 |
| UP06 | 274 | 30 | - | 8 |
| UP07 | 274 | 40 | - | 8 |
| UP08 | 296 | 30 | - | 8 |
| UP09 | 303 | 30 | - | 10 |
| UP10 | 304 | 30 | - | 8 |
| UP11 | 305 | 30 | - | 8 |
| UP12 | 307 | 30 | - | 8 |
| UP13 | 311 | 50 | - | 12 |
| UP14 | 318 | 30 | - | 8 |
| UP15 | 323 | 30 | - | 8 |
| UP16 | 332 | 30 | - | 8 |
| UP17 | 338 | 30 | - | 8 |
| UP18 | 343 | 30 | - | 8 |
| UP19 | 348 | 30 | - | 8 |
| UP20 | 349 | 30 | - | 8 |
| UP21 | 352 | 30 | - | 8 |
| UP22 | 353 | 30 | - | 8 |
| UP23 | 365 | 30 | - | 8 |
| UP24 | 388 | 30 | - | 8 |
| UP25 | 416 | 30 | - | 8 |
| UP26 | 468 | 30 | - | 8 |
| UP27 | 538 | 40 | - | 10 |

Source: Yapi Merkezi, 2018

Moreover, the proposed SGR will require support facilities including stations and marshalling yards. The stations along the proposed SGR are to serve as passenger and freight facilities. The marshalling yard will include a maintenance and assembly workshop, tank washing point, shed for shunting locomotive, wheelsets deposit shed and air compressor workshop, living quarters, general office building, canteen, bathroom and other facilities.

*Table 2-6* and *Figure 2-1* shows the location and size of these proposed facilities. The general layout plans of stations are illustrated in *Figure 2-7*.

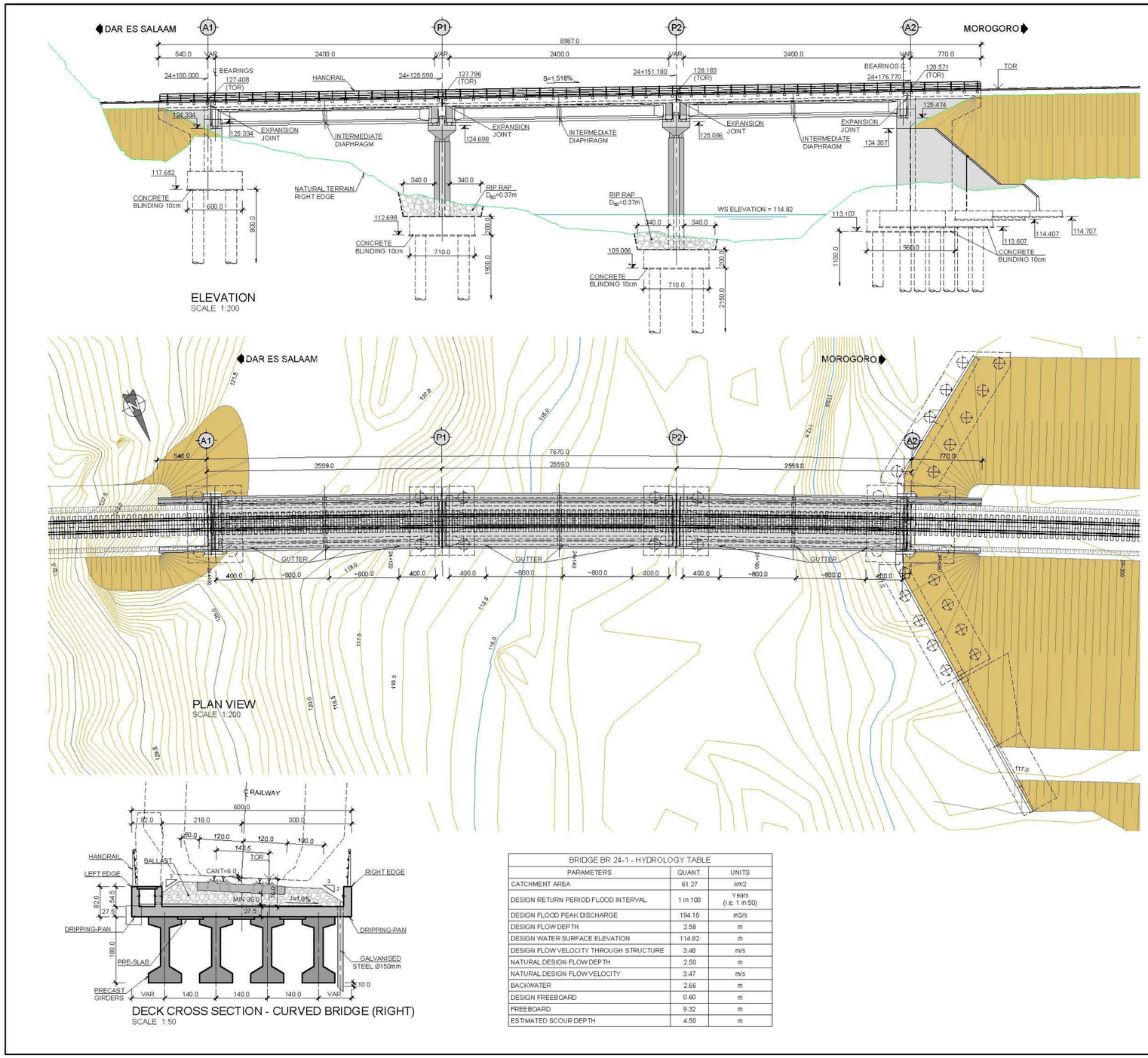
*Table 2-6 Proposed Facilities*

| Facility | Chainage | Name | Size of Station ($m^2$) | Gross Area Required ($m^2$) |
|---|---|---|---|---|
| Stations | 0+000 | Dar es Salaam | 370 | 15,000 |
| | 20+000 | Pugu | 365 | 5,000 |
| | 53+500 | Soga | 365 | 1,000 |
| | 79+800 | Ruvu | 365 | 5,000 |
| | 144+000 | Ngerengere | 365 | 5,000 |
| | 144+000 | Morogoro | 370 | 10,000 |
| | 230+264 | Mkata | 365 | 5,000 |
| | 268+740 | Kilosa | 365 | 5,000 |
| | 298+453 | Kidete | 365 | 5,000 |
| | 356+ 622 | Gulwe | 365 | 5,000 |
| | 390+023 | Igandu | 365 | 5,000 |
| | 453+164 | Dodoma | 370 | 10,000 |
| | 504+361 | Bahi | 365 | 5,000 |
| | 536+342 | Makutopora | 365 | 5,000 |
| Marsling Yard | 87+500 | Ruvu | - | 20,000 |

Source: Project Design, 2017

Dar es Salaam, Morogoro and Dodoma Stations will also include water supply infrastructure. Each of these three stations will include one new water source well, one water supply point, one 400 $m^3$ water tower and one 1,000 $m^3$ water tank. Within the new water supply, point at each water supply station, one chlorine dioxide sterilization unit and one centralized control unit and two fire pumps will be arranged. The centralized monitoring system of water supply and drainage will be arranged at each station according to the station area control and conforming to the technical condition of basic processing operation.

*Figure 2-3 General Layout Plan for a Bridge*




| BRIDGES CONCRETE AND COVER (EN1992-1-1; EN 206-1) | | | | |
|---|---|---|---|---|
| ELEMENT | CONCRETE GRADE | EXPOSURE CLASS | $f_{c,CYLINDER}$ (MPa) | MINIMUM COVER (mm) |
| CONCRETE BLIDING | C12/15 | X0 | 12 | --- |
| PILES | C25/30 | XC2 | 25 | 75 |
| PILECAPS / FOOTINGS | C25/30 | XC2 | 25 | 50 |
| ABUTMENTS / WALLS | C30/37 | XC4 | 30 | 50 |
| PIERS / PIER CAPS | C30/37 | XC4 | 30 | 50 |
| DIAPHRAGMS | C35/45 | XC4 | 35 | 50 |
| PRECAST GIRDERS | C45/55 | XC4 | 45 | 40 |
| PRE-SLABS | C30/37 | XC4 | 30 | 35 |
| DECK SLAB | C35/45 | XC4 | 35 | 50 (TOP REINF.) 40 (BOTTOM REINF.) |

NOTES:
1. ALL DIMENSIONS ARE IN CENTIMETERS UNLESS OTHERWISE SPECIFIED.
2. LEVELS ARE IN METERS.
3. DESIGN SERVICE LIFE OF 100 YEARS.
4. MINIMUM RIP-RAP DEPTH SHALL BE ≥ $3xD_{50}$. TOP OF RIP-RAP LAYER SHALL BE LEVELED WITH NATURAL TERRAIN.
5. WS - WATER SURFACE.
6. TOR - TOP OF RAIL.
7. FOR FOUNDATIONS COORDINATES, REFER TO FOUNDATION GEOMETRY DRAWINGS.

ENGINEERS REGISTRATION BOARD TANZANIA
COWI TANZANIA LTD.
P.O.Box 1007 - DAR-ES-SALAAM
Engineering Consultancy Firm No. 007 F
SIGN DATE 3/5/18

| BRIDGE BR 24-1 - HYDROLOGY TABLE | | |
|---|---|---|
| PARAMETERS | QUANT. | UNITS |
| CATCHMENT AREA | 61.27 | km2 |
| DESIGN RETURN PERIOD FLOOD INTERVAL | 1 in 100 | Years (i.e. 1 in 50) |
| DESIGN FLOOD PEAK DISCHARGE | 194.15 | m3/s |
| DESIGN FLOW DEPTH | 2.58 | m |
| DESIGN WATER SURFACE ELEVATION | 114.82 | m |
| DESIGN FLOW VELOCITY THROUGH STRUCTURE | 3.48 | m/s |
| NATURAL DESIGN FLOW DEPTH | 2.50 | m |
| NATURAL DESIGN FLOW VELOCITY | 3.47 | m/s |
| BACKWATER | 2.66 | m |
| DESIGN FREEBOARD | 0.60 | m |
| FREEBOARD | 9.32 | m |
| ESTIMATED SCOUR DEPTH | 4.50 | m |

| VER. | REMARKS | DATE |
|---|---|---|
| 1 | GENERAL REVISION | 24.05.2018 |
| 0 | FIRST ISSUE | 07.05.2018 |

REFERENCE DRAWINGS

COWI TANZANIA LTD.
P.O.Box 1007, Dar es Salaam
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APPROVAL

☐ A: ACTION REQUIRED ON THIS ISSUE ☐ B: ACTION REQUIRED FOR NEXT ISSUE ☐ C: ADVISORY COMMENT

EMPLOYER

TRC TANZANIA RAILWAYS CORPORATION

PROJECT

DAR ES SALAAM-MOROGORO RAILWAY PROJECT

EMPLOYER'S REPRESENTATIVE

KORAIL KOREA RAILROAD - JV

CONTRACTOR

yapi merkezi MOTAENGIL AFRICA

DESIGNER

yapi merkezi COWI SENER

STRUCTURES - BRIDGES

BRIDGE BR 24-1
GENERAL ARRANGEMENT

| DRAWN BY | DESIGNED BY | CHECKED BY | APPROVED BY | APPROVED BY | APPROVED BY | APPROVED BY |
|---|---|---|---|---|---|---|
| P.FONSECA | ELSA NUNES | J.CARREIRO | J.VALERIO | - | - | - |

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*Figure 2-4 General Layout Plan for an Overpass*

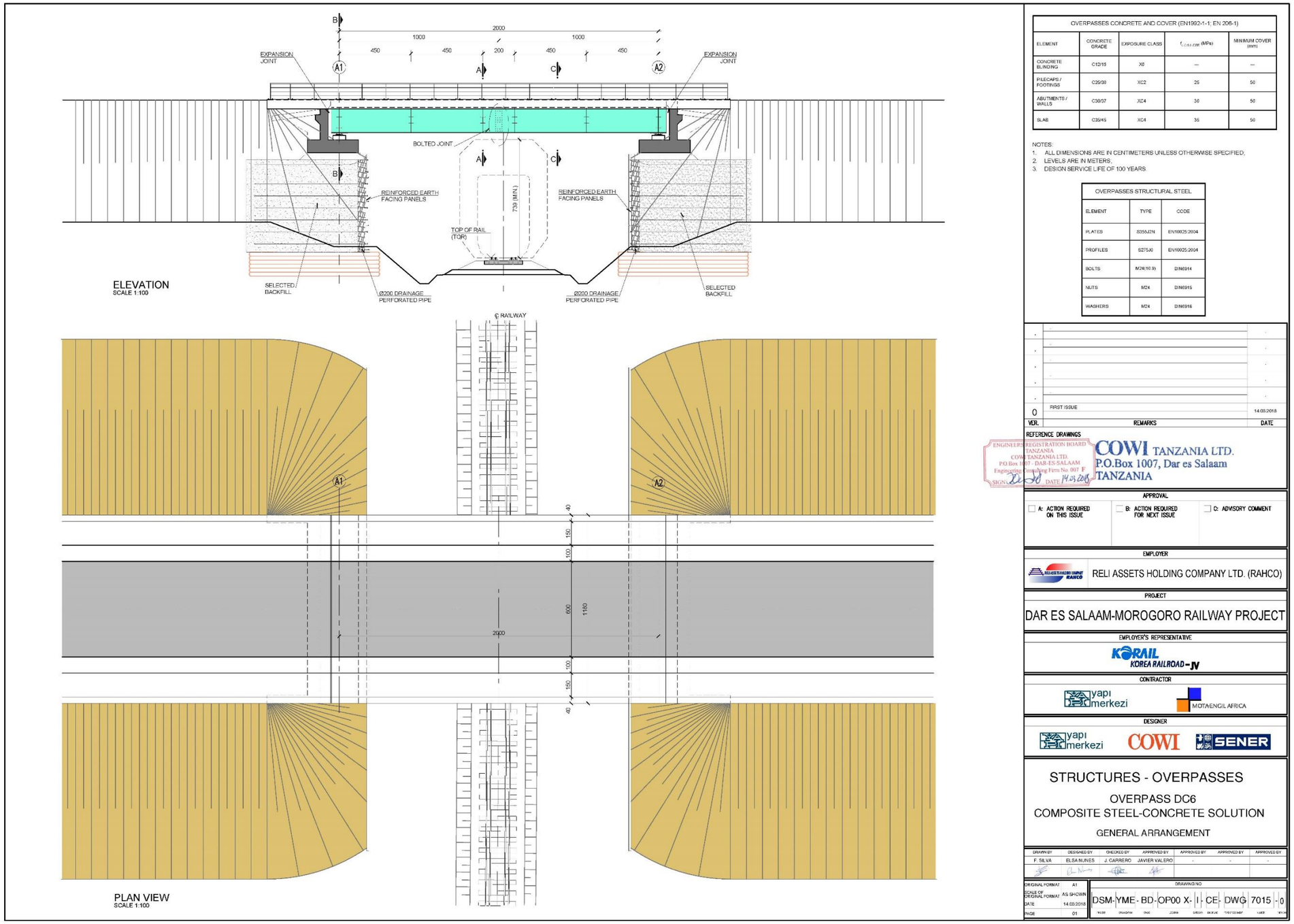
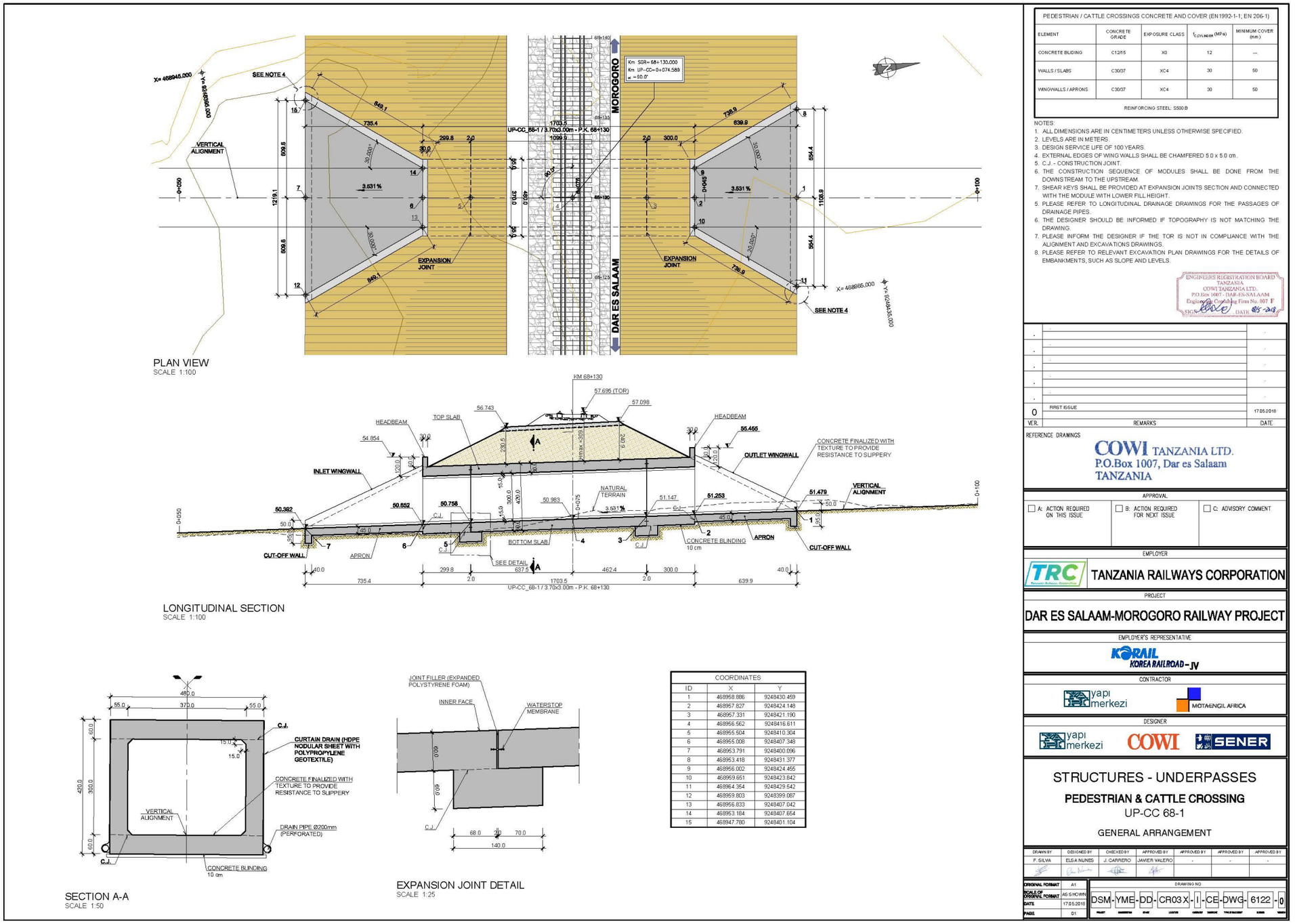


*Figure 2-5 General Layout for an Underpass*




| COORDINATES | | |
|---|---|---|
| ID | X | Y |
| 1 | 468958.886 | 9248430.459 |
| 2 | 468957.827 | 9248424.148 |
| 3 | 468957.331 | 9248421.190 |
| 4 | 468956.562 | 9248416.611 |
| 5 | 468955.504 | 9248410.304 |
| 6 | 468955.008 | 9248407.348 |
| 7 | 468953.791 | 9248400.096 |
| 8 | 468953.418 | 9248431.377 |
| 9 | 468956.002 | 9248424.455 |
| 10 | 468959.651 | 9248423.842 |
| 11 | 468964.354 | 9248429.542 |
| 12 | 468959.803 | 9248399.087 |
| 13 | 468956.833 | 9248407.042 |
| 14 | 468953.184 | 9248407.654 |
| 15 | 468947.780 | 9248401.104 |

| PEDESTRIAN / CATTLE CROSSINGS CONCRETE AND COVER (EN 1992-1-1; EN 206-1) | | | | |
|---|---|---|---|---|
| ELEMENT | CONCRETE GRADE | EXPOSURE CLASS | $f_{C,CYLINDER}$ (MPa) | MINIMUM COVER (mm) |
| CONCRETE BLIDING | C12/15 | X0 | 12 | --- |
| WALLS / SLABS | C30/37 | XC4 | 30 | 50 |
| WINGWALLS / APRONS | C30/37 | XC4 | 30 | 50 |
| REINFORCING STEEL: S500 B | | | | |

NOTES:
1. ALL DIMENSIONS ARE IN CENTIMETERS UNLESS OTHERWISE SPECIFIED.
2. LEVELS ARE IN METERS.
3. DESIGN SERVICE LIFE OF 100 YEARS.
4. EXTERNAL EDGES OF WING WALLS SHALL BE CHAMFERED 5.0 x 5.0 cm.
5. C.J. - CONSTRUCTION JOINT.
6. THE CONSTRUCTION SEQUENCE OF MODULES SHALL BE DONE FROM THE DOWNSTREAM TO THE UPSTREAM.
7. SHEAR KEYS SHALL BE PROVIDED AT EXPANSION JOINTS SECTION AND CONNECTED WITH THE MODULE WITH LOWER FILL HEIGHT.
5. PLEASE REFER TO LONGITUDINAL DRAINAGE DRAWINGS FOR THE PASSAGES OF DRAINAGE PIPES.
6. THE DESIGNER SHOULD BE INFORMED IF TOPOGRAPHY IS NOT MATCHING THE DRAWING.
7. PLEASE INFORM THE DESIGNER IF THE TOR IS NOT IN COMPLIANCE WITH THE ALIGNMENT AND EXCAVATIONS DRAWINGS.
8. PLEASE REFER TO RELEVANT EXCAVATION PLAN DRAWINGS FOR THE DETAILS OF EMBANKMENTS, SUCH AS SLOPE AND LEVELS.

ENGINEERS RUGISTRATION BOARD TANZANIA
COWI TANZANIA LTD.
P.O.Box 1007 - DAR-ES-SALAAM
Engineering Consulting Firm No. 007 F
SIGN: DATE: 05-2018

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PROJECT: DAR ES SALAAM-MOROGORO RAILWAY PROJECT

EMPLOYER'S REPRESENTATIVE: KORAIL KOREA RAILROAD - JV

CONTRACTOR: yapi merkezi | MOTA-ENGIL AFRICA

DESIGNER: yapi merkezi | COWI | SENER

STRUCTURES - UNDERPASSES

**PEDESTRIAN & CATTLE CROSSING**

UP-CC 68-1

GENERAL ARRANGEMENT

| DRAWN BY | DESIGNED BY | CHECKED BY | APPROVED BY | APPROVED BY | APPROVED BY | APPROVED BY |
|---|---|---|---|---|---|---|
| F. SILVA | ELISA NUNES | J. CARREIRO | JAVIER VALERO | - | - | - |

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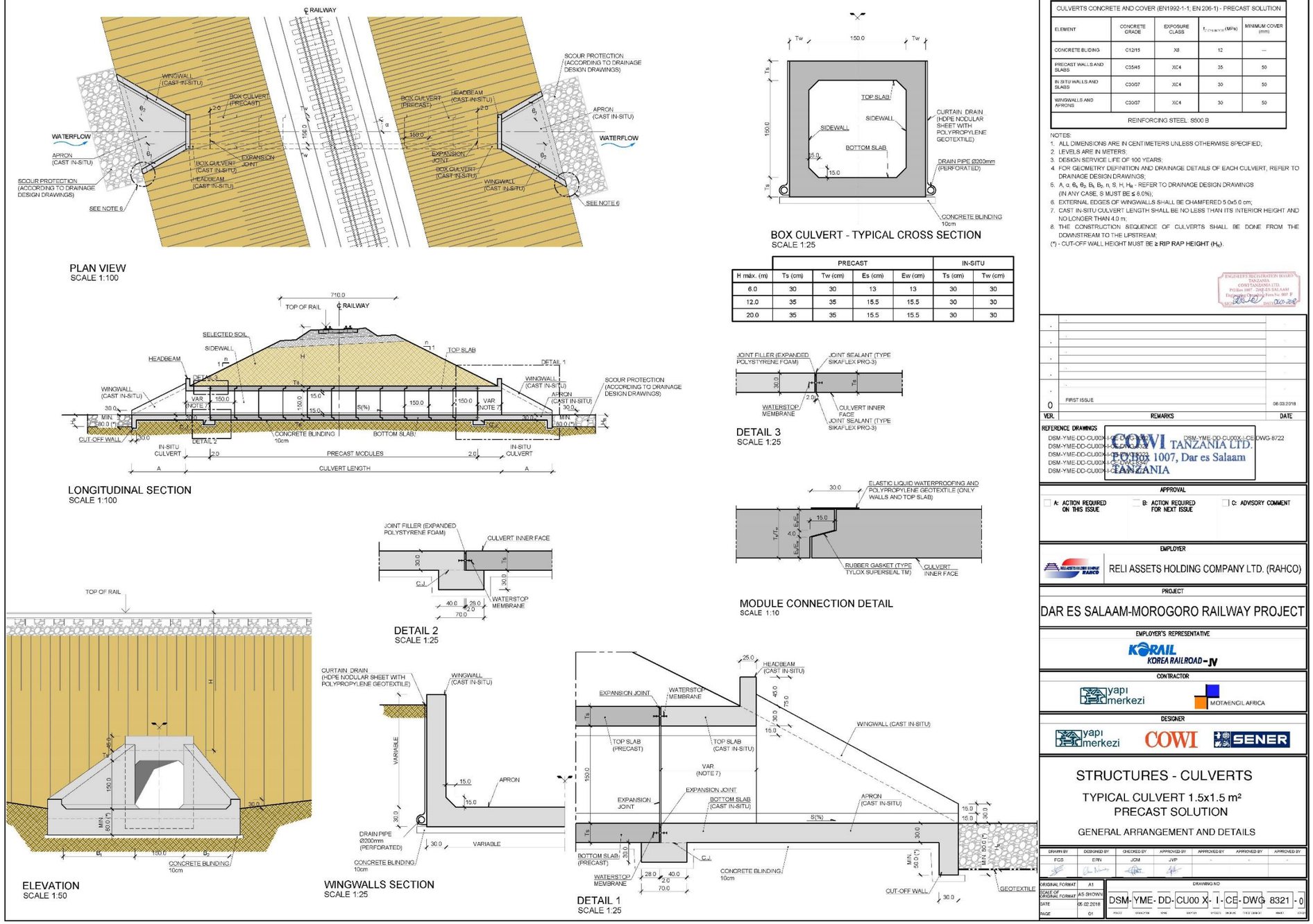
*Figure 2-6 General Layout Plan for a Culvert*




| CULVERTS CONCRETE AND COVER (EN1992-1-1; EN 206-1) - PRECAST SOLUTION | | | | |
|---|---|---|---|---|
| ELEMENT | CONCRETE GRADE | EXPOSURE CLASS | $f_{ck,cube}$ (MPa) | MINIMUM COVER (mm) |
| CONCRETE BLIDING | C12/15 | X0 | 12 | --- |
| PRECAST WALLS AND SLABS | C35/45 | XC4 | 35 | 50 |
| IN SITU WALLS AND SLABS | C30/37 | XC4 | 30 | 50 |
| WINGWALLS AND APRONS | C30/37 | XC4 | 30 | 50 |
| REINFORCING STEEL: S500 B | | | | |

NOTES:
1. ALL DIMENSIONS ARE IN CENTIMETERS UNLESS OTHERWISE SPECIFIED;
2. LEVELS ARE IN METERS;
3. DESIGN SERVICE LIFE OF 100 YEARS;
4. FOR GEOMETRY DEFINITION AND DRAINAGE DETAILS OF EACH CULVERT, REFER TO DRAINAGE DESIGN DRAWINGS;
5. A, α, $\theta_1$, $\theta_2$, $B_1$, $B_2$, n, S, H, $H_w$ - REFER TO DRAINAGE DESIGN DRAWINGS (IN ANY CASE, S MUST BE ≤ 8.0%);
6. EXTERNAL EDGES OF WINGWALLS SHALL BE CHAMFERED 5.0x5.0 cm;
7. CAST IN-SITU CULVERT LENGTH SHALL BE NO LESS THAN ITS INTERIOR HEIGHT AND NO LONGER THAN 4.0 m;
8. THE CONSTRUCTION SEQUENCE OF CULVERTS SHALL BE DONE FROM THE DOWNSTREAM TO THE UPSTREAM;

(*) - CUT-OFF WALL HEIGHT MUST BE ≥ RIP RAP HEIGHT ($H_R$).

| BOX CULVERT - TYPICAL CROSS SECTION SCALE 1:25 | | | | | | |
|---|---|---|---|---|---|---|
| | PRECAST | | | | IN-SITU | |
| H máx. (m) | Ts (cm) | Tw (cm) | Es (cm) | Ew (cm) | Ts (cm) | Tw (cm) |
| 6.0 | 30 | 30 | 13 | 13 | 30 | 30 |
| 12.0 | 35 | 35 | 15.5 | 15.5 | 30 | 30 |
| 20.0 | 35 | 35 | 15.5 | 15.5 | 30 | 30 |

| VER. | REMARKS | DATE |
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DSM-YME-DD-CU00X-I-CE-DWG-8722
DSM-YME-DD-CU00X-I-CE-DWG-8322
DSM-YME-DD-CU00X-I-CE-DWG-8323
DSM-YME-DD-CU00X-I-CE-DWG-8324
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PROJECT: DAR ES SALAAM-MOROGORO RAILWAY PROJECT

EMPLOYER'S REPRESENTATIVE: KORAIL KOREA RAILROAD - JV

CONTRACTOR: yapi merkezi | MOTAENGIL AFRICA

DESIGNER: yapi merkezi | COWI | SENER

| DRAWN BY | DESIGNED BY | CHECKED BY | APPROVED BY | APPROVED BY | APPROVED BY | APPROVED BY |
|---|---|---|---|---|---|---|
| FCS | EPN | JGM | JVP | - | - | - |

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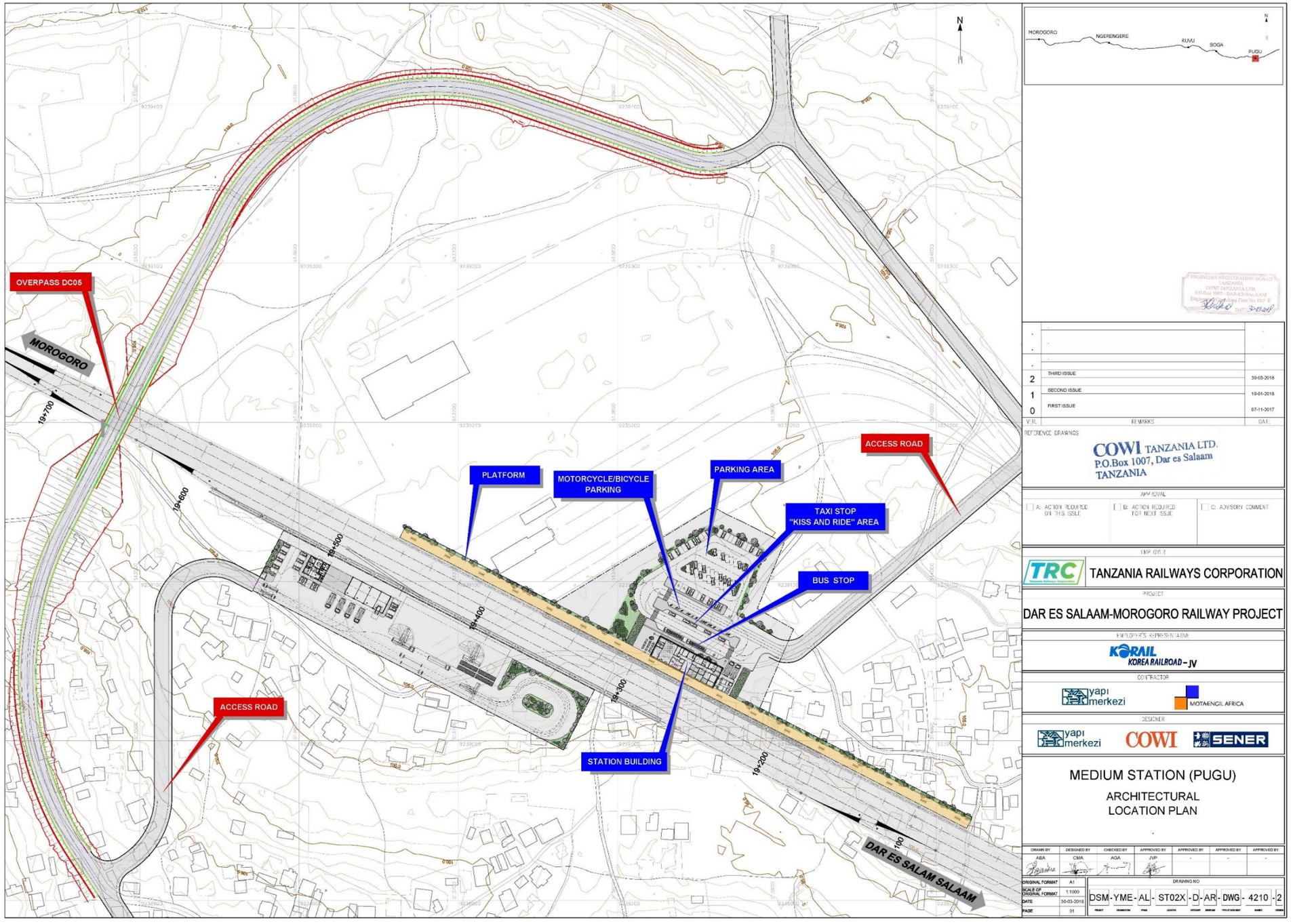
*Figure 2-7 General Layout Plan for a Station (layout provided is for Pugu Station)*



### *2.5.2 Construction Phase*

*Introduction*

The construction commenced in May, 2017. It is assumed that construction will continue for a duration of approximately 30 months (i.e. 2.5 years). Currently, the national ESIA study prepared by ARDHI University in Dar es Salaam and approved by the Tanzania National Environmental Management Council (NEMC).

*Construction Sequencing*

Activities during the construction phase are sequenced as follows:

- **Survey Works** – initially a lidar survey will be undertaken to understand the terrain. Based on the design, and data from lidar survey, the normal survey is carried out. The survey works will be carried out before the start and end of every activity to mark the alignments and the levels of all the layers on the railways. Survey is one of the most important activities of the Project, since all the activities depend on the survey results.
- **Geotechnical and Geophysical Works** – initially test pit investigations will be carried out along the alignment of the proposed SGR to determine soil profile. Test pits will be excavated and tests will be carried out in each test pit. Secondly, borehole investigation will be undertaken by means of an auger or core barrel equipment (depending on the type of soil or rock encountered). Soil/ rock samples will be selected at various depth intervals for laboratory test in each borehole. The samples will be identified according to borehole number and depth.

  If soft soils are discovered along the alignment, geophysical test should be conducted to enable design for earthworks on soft deposits. Laboratory testing will be conducted and soil and material report prepared.
- **Resettlement** – the government through TRC will acquire the land that is required for the construction of the proposed SGR. Permanent land acquisition has the potential to result in displacement of households, community assets, infrastructure and economic displacement. Moreover, construction of the proposed SGR will require the temporary acquisition of land for camps, laydown areas and other construction related activities. A resettlement Action Plan (RAP) is being be undertaken and implemented for the project.

- **Clearance of Existing Land and Vegetation** – the contractor will clear land and top soil required for the construction of the proposed SGR using the dozers and other earthworks machinery.
- **Earthworks and Civil Works (including underground works / tunnelling)** – earthworks will involve cut and fill works. The aim of cut and fill works, is to provide a levelled surface required for construction of the proposed SGR. Cutting activity is performed using excavators and loaders, and the cut material which is either suitable or unsuitable is loaded to the dump trucks. For fill works the grader is used to spread the fill material (from borrow area or corridor) and level the surface. Using a roller, the fill material is compacted to attain the required construction build rating.
- **Construction of Culverts** – prior to the installation of track works, culverts will be constructed. As previously mentioned, culverts are required for drainage beneath the proposed SGR.
- **Track Works** – track works consists of ballast laying, track laying, flash butt welding, stage tamping and completion works. Ballast aggregates are produced in the crusher plant, and then taken to the wet mix plant before the laying activity. Track laying, where the concrete sleepers are laid on the platform, is completed through use of an excavator with sleeper attachment. Sleepers are laid at distance of 60cm apart from one another. The rails are then placed on the rail seats on sleepers. Rails and sleepers are welded by flash butt welding method.
- **Catenary Works** – following the completion of track works, excavation of catenary pole foundations will be undertaken through use of a mobile drill rig. Catenary poles will be anchored by concrete being poured into the drilled foundation and under the catenary pole base plate.
- **Signalling & Telecommunication Works** – excavation of trenches will be done along the proposed SGR alignment, following which HDPE pipes will installed. Underground signalling and telecommunication cables will be installed within these pipes. Mobile communication towers will also be installed.
- **Building Works** – building infrastructure (including stations and marshalling yards) will be constructed.
- **Bridge Works** – during this activity, all bridges, overpasses, underpasses, viaducts, and cattle and pedestrian crossing underpasses (as described in *Section 2.5.1*) will be constructed.
- **Commissioning** – following completion of the above mentioned activities the proposed SGR will be commissioned.

*Actual Construction Progress*

Since the Project construction commenced in May, 2017 there has been significant progress on the above mentioned activities as defined below:

| Activity | Actual Progress (%) | |
|---|---|---|
| | **Phase 1** | **Phase 2** |
| Survey Works | 100% | 16% |
| Geotechnical and Geophysical Works | 95% | 40% |
| Clearance of RoW | 73% | 28% |
| Earthworks | 48% | 6% |
| Construction of Culverts | 34% | Not started |
| Track Works | 3% | Not started |
| Catenary Works | 51% | Not started |
| Signalling and Telecommunications Work | 2% | Not started |
| Building Works | 1% | Not started |
| Bridge Works | 9% | Not started |
| Commissioning | Not started | Not started |

*Continued Operation of the Existing MGR during the Construction Phase*

Operations along the existing MGR will continue for the entire duration of the construction phase of the proposed SGR. To ensure that continued operations of the MGR allow for safe working conditions, the following measures will be adopted:

- Adequate number of flagmen will be present at active construction sites in the vicinity of the existing MGR and when construction works are undertaken at existing rail crossing points;
- Trains along the existing MGR will not stop to collect passengers along active construction sites; and
- Ongoing communication between the Contractor and the Railway Traffic Controller.

*Raw and Construction Materials and Sources*

*Introduction*

During the construction phase of the proposed SGR raw materials (sand, gravel, crushed stone and water), specialised materials, machinery and equipment, and

concrete will be required. These materials will be required mainly for following construction activities:

*Table 2-7 Construction Activities*

| Earthworks | Civil Works | Permanent Way | Stations and Marshalling Yard | Signalling Telecommunications and Electrification |
|---|---|---|---|---|
| Cut and fill, excavation, embankments, sub-ballast and drainage works, cleaning and profiling of existing slopes. | Set up of viaduct foundations, columns, deck, tunnel excavation, anchoring, lining and finishing, and crossings above the motorway | Rail placement and ballasting (track work). | Building the platforms, passenger buildings, Marshalling yard, parking places and utility service | Installation of optic fibres, tools, spare parts and telecommunication systems, electrification on station tracks and substation |

Specialised materials will be required for the construction of the permanent way for the main tracks and station tracks, platform stations, civil structures, setting the signalization and telecommunication lines and utility services. Soil required for earthworks should be as per the Tanzania's Laboratory Testing Manual of 2000 (LTM 2000). Analysis and testing shall be carried out and provided as required on the construction materials, in accordance with the TRC Civil Engineering Manual 1999.

Excavated soil and rocks will be re-used as construction material. The ballast will consist of crushed natural stone. The grain (granulometry) size of ballast stone will range between 22.4 to 63 mm and will provide stability and elasticity of the track during passage of trains.

Concrete required for works on civil structures will generally be made using alkali Portland cement (with less than 0.6 percent sodium equivalents). Concrete sleepers will be produced from concrete that is produced with appropriate cement and unpolluted aggregates.

There are no design documents for signalling, telecommunications and electrification. More details on materials required for the Project will be defined during detailed design.

*Borrow Areas*

Gravels and fill materials shall be extracted from newly established borrow pits. The quantity of gravel needed for the duration of the construction phase of the Project is approximately 17,000,000 $m^3$. The locations of borrow areas is presented in *Table 2-8* and illustrated in *Figure 2-8*.

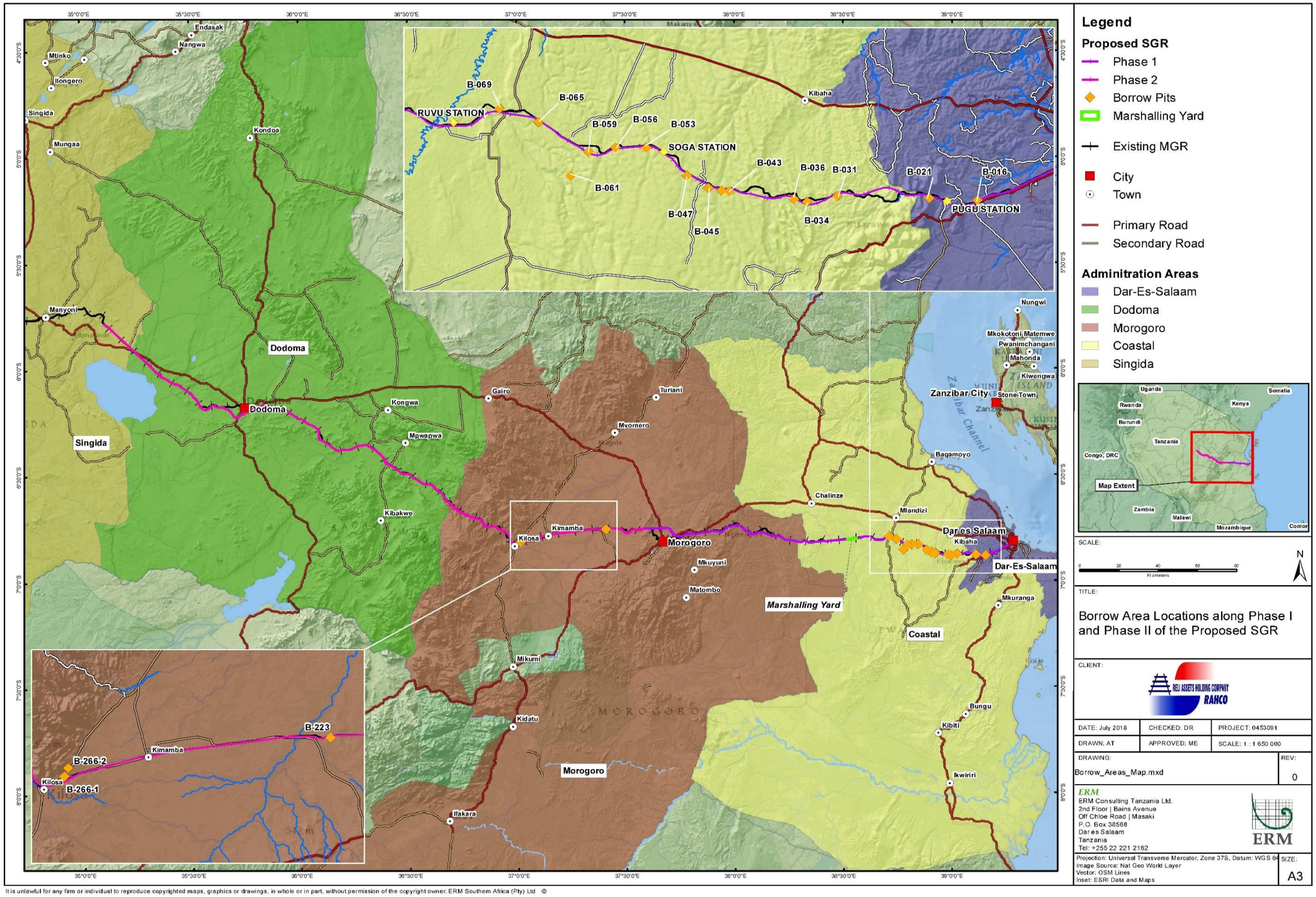
***Table 2-8 Borrow Areas along the Proposed SGR Alignment***

| No. | Kilometre Point | Total Area ($m^2$) | Estimated Quantity ($m^3$) |
|---|---|---|---|
| **Phase I – Dar es Salaam to Morogoro** | | | |
| B016 | 16 | 95,000 | 190,000 |
| B021 | 21 | 205,000 | 410,000 |
| B031 | 31 | 115,000 | 230,000 |
| B034 | 34 | 195,000 | 390,000 |
| B036 | 36 | 60,000 | 120,000 |
| B056 | 56 | 65,000 | 130,000 |
| B061 | 61 | 125,000 | 250,000 |
| B043 | 43 | 50,000 | 100,000 |
| B045 | 45 | 50,000 | 100,000 |
| B047 | 47 | 50,000 | 100,000 |
| B053 | 53 | 50,000 | 100,000 |
| B059 | 59 | 18,000 | 36,000 |
| B065 | 65 | 200 | 400 |
| B069 | 69 | 120,000 | 240,000 |
| | | **TOTAL** | **2,396,400** |
| **Phase II – Morogoro to Makutupora** | | | |
| B204 | 204 | 110,000 | 245,000 |
| B208 | 208 | 110,000 | 245,000 |
| B212 | 212 | 115,000 | 255,000 |
| B215 | 215 | 70,000 | 155,000 |
| B220 | 220 | 55,000 | 120,000 |
| B223 | 223 | 110,000 | 245,000 |
| B225 | 225 | 140,000 | 310,000 |
| B266 | 266 | 140,000 | 310,000 |
| B275 | 275 | 290,000 | 645,000 |
| B278 | 278 | 140,000 | 310,000 |
| B279 | 279 | 105,000 | 235,000 |
| B281 | 281 | 100,000 | 22,000 |
| B285 | 285 | 130,000 | 290,000 |
| B289 | 289 | 180,000 | 400,000 |

| No. | Kilometre Point | Total Area ($m^2$) | Estimated Quantity ($m^3$) |
|---|---|---|---|
| B292 | 292 | 60,000 | 135,000 |
| B297 | 297 | 135,000 | 300,000 |
| B305 | 305 | 105,000 | 235,000 |
| B316 | 316 | 65,000 | 145,000 |
| B335 | 335 | 130,000 | 290,000 |
| B339 | 339 | 120,000 | 270,000 |
| B352 | 352 | 55,000 | 125,000 |
| B359 | 359 | 85,000 | 190,000 |
| B369 | 369 | 25,000 | 55,000 |
| B372 | 372 | 105,000 | 235,000 |
| B378 | 378 | 65,000 | 145,000 |
| B399 | 399 | 105,000 | 235,000 |
| B403 | 403 | 55,000 | 125,000 |
| B409 | 409 | 110,000 | 245,000 |
| B420 | 420 | 200,000 | 445,000 |
| B425 | 425 | 205,000 | 455,000 |
| B434 | 434 | 135,000 | 300,000 |
| B438 | 438 | 280,000 | 620,000 |
| B444 | 444 | 160,000 | 355,000 |
| B450 | 450 | 180,000 | 400,000 |
| B462 | 462 | 110,000 | 245,000 |
| B484 | 484 | 85,000 | 190,000 |
| B502 | 502 | 140,000 | 310,000 |
| B513 | 513 | 45,000 | 100,000 |
| B527 | 527 | 25,000 | 55,000 |
| B533 | 533 | 170,000 | 380,000 |
| | | **TOTAL** | **9,817,000** |

Source: Yapi Merkezi, 2018

*Figure 2-8 Borrow Areas Locations along the Proposed SGR Alignment*



*Quarry Sites*

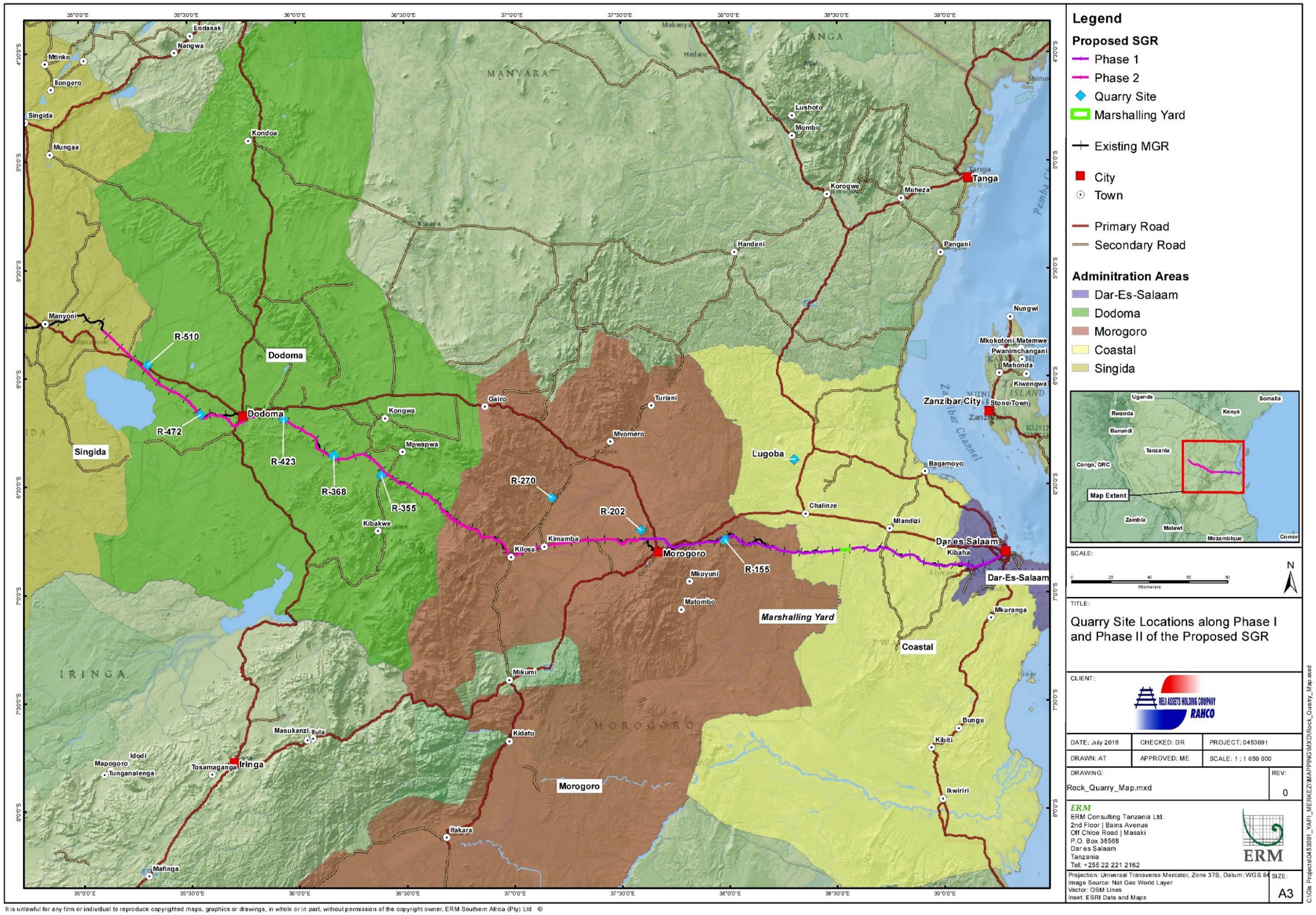
A total of nine quarry sites have been identified for use during construction of the project; 2 sites for Phase I and 7 sites for Phase II (refer to *Table 2-9* and *Figure 2-9*) The quantity of hardstone required for the Project including ballast and sub ballast is 6,800,000 $m^3$. Aggregate crushing facilities will be provided at Lugoba (*Figure 2-9*).

Activities associated with aggregate extraction and processing may potentially result in increased dust emissions, noise emissions and vibrations. Moreover, activities associated with quarrying will result in increased truck traffic between aggregate extraction and processing activities. The Project will include specific inbuilt controls to control, mitigate or keep dust emissions, noise emissions and vibrations at tolerable levels and restricted to the immediate vicinity of an aggregate extraction and processing activities by using internationally recognised good practice technologies.

***Table 2-9 Quarry Sites along the Proposed SGR Alignment***

| No. | Kilometre Point | Total Area ($m^2$) | Estimated Quantity ($m^3$) |
|---|---|---|---|
| **Phase I – Dar es Salaam to Morogoro** | | | |
| R120 | 120 | 510,000 | 1,530,000 |
| R155 | 155 | 525,000 | 1,575,000 |
| | | TOTAL | 3,105,000 |
| **Phase II – Morogoro to Makutupora** | | | |
| R 205 | 205 | 520,000 | 1,700,000 |
| R 206 | 206 | 510,000 | 1,600,000 |
| R270 | 270 | 520,000 | 1,700,000 |
| R355 | 355 | 500,000 | 1,500,000 |
| R386 | 386 | 525,000 | 1,700,000 |
| R423 | 423 | 510,000 | 1,600,000 |
| R472 | 472 | 520,000 | 1,700,000 |
| R510 | 510 | 510,000 | 1,600,000 |
| | | TOTAL | 11,400,000 |

*Figure 2-9* *Quarry Site Locations along the Proposed SGR Alignment*



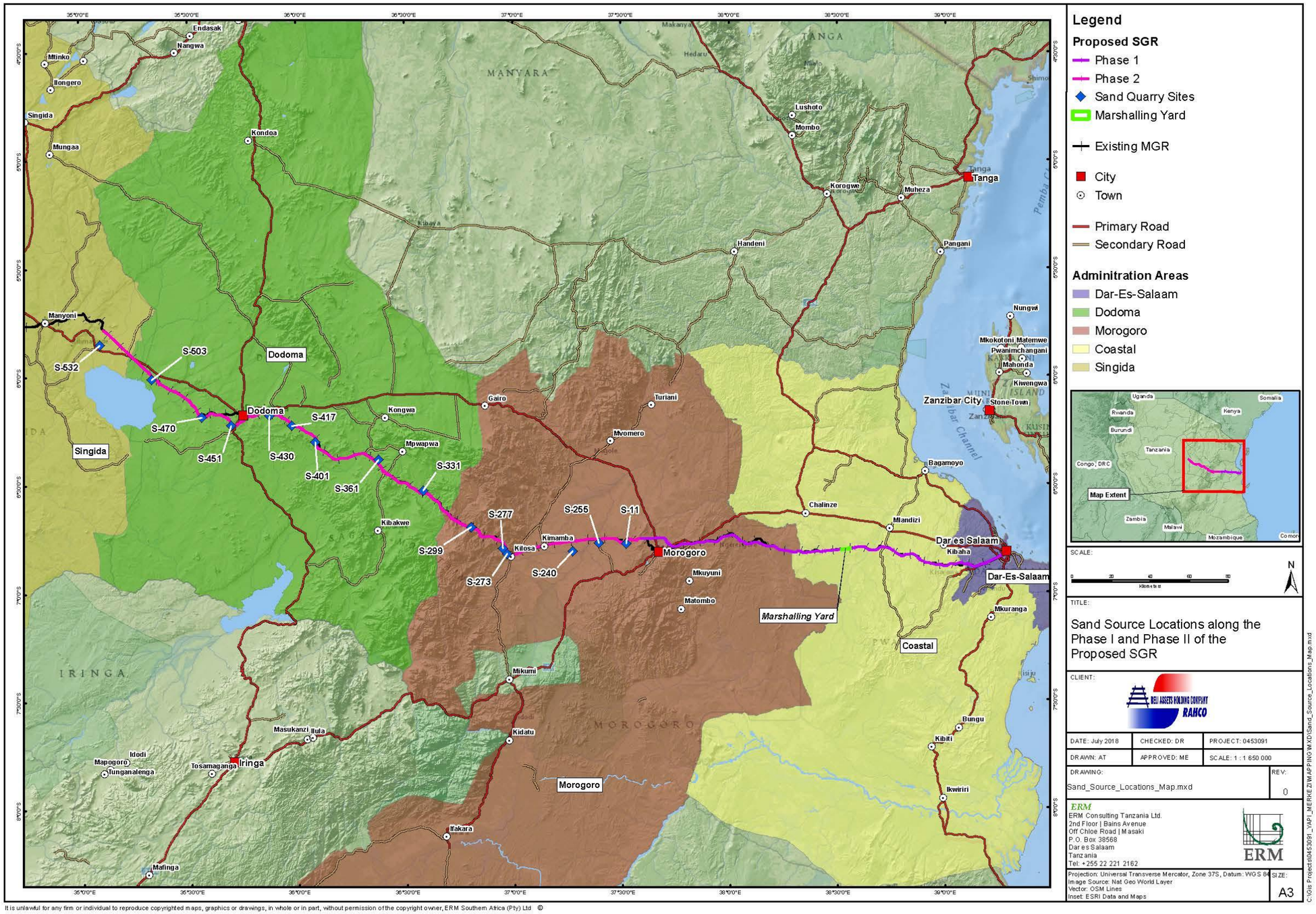
*Sand Sources*

Construction of the proposed SGR will require approximately 400,000 tons of sand. Sand will be used for concrete works. Sand will extracted in the locations presented in *Table 2-10* and illustrated on *Figure 2-10*.

***Table 2-10 Sand Sources along the Proposed SGR Alignment***

| No. | Kilometre Point | Total Area ($m^2$) | Estimated Quantity ($m^3$) |
|---|---|---|---|
| S211 | 211 | 330,000 | 650,000 |
| S225 | 225 | 165,000 | 300,000 |
| S240 | 240 | 625,000 | 1,125,000 |
| S273 | 273 | 90,000 | 150,000 |
| S277 | 277 | 130,000 | 250,000 |
| S299 | 299 | 35,000 | 70,000 |
| S331 | 331 | 360,000 | 700,000 |
| S361 | 361 | 250,000 | 500,000 |
| S401 | 401 | 320,000 | 650,000 |
| S417 | 417 | 80,000 | 150,0000 |
| S430 | 430 | 115,000 | 230,000 |
| S451 | 451 | 115,000 | 230,000 |
| S470 | 470 | 130,000 | 250,000 |
| S503 | 503 | 315,000 | 600,000 |
| S532 | 532 | 650,000 | 1,200,000 |
| | | TOTAL | 7,055,000 |

*Figure 2-10 Sand Source Locations along the Proposed SGR Alignment*



*Water Supply for the Project*

Water will be required for the following activities during construction:

- Water use by earthwork teams required for compaction;
- Water use for concrete production;
- Water use for dust suppression along service and access roads; and
- Water use in the camp sites.

Estimated water use for these activities is provided in *Table 2-11* below.

***Table 2-11 Estimates of Water Use per Activity***

| Activity | Required Water Use ($m^3$) |
|---|---|
| Compaction – Backfill | 160,000 |
| Compaction – Sub ballast | 40,555 |
| Concrete production | 167,000 |
| Dust suppression – Service and Access roads | 163,620 |
| Water use in camp sites<br>• Ngerengere:<br>• Soga<br>• Lugoba<br>• Marshalling Yard<br>• Ilala | 13, 335 |
| **Total** | **544,500** |

As per *Table 2-11*, the amount of surface water required for the different construction activities over the project construction period of 30 months, is estimated at 544,500 $m^3$. Over the operations period, water use is minimal, and will be limited primarily to domestic water use at the stations.

It is likely that the Project will drill boreholes at each of the campsites to supply the water demand for construction camps. Water for construction works will likely be abstracted from surface water. The project will need to apply to the Wami Ruvu Basin Water Board office to acquire the relevant Water Use, Groundwater and Discharge permits as required by the Water Resources Management Act, of 2009.

*Water Sources*

Construction water will be sourced from the rivers traversed by the proposed SGR alignment. Where surface water is not available or where quality is deemed inadequate, boreholes will be constructed. At the campsites, boreholes shall be drilled to utilise ground water as a water source.

The design has estimated the construction water demand to be 844,488 $m^3$. (Revised estimation see above in *Table 2-11)* The Contractor will acquire the necessary water use permit required for water abstraction prior to any abstraction. On average about 105,561 $m^3$ of water will be abstracted from each of the targeted river systems; however, variations are expected depending on the distance from the construction site to the nearest source of water. Table 2-12 shows the potential targeted water sources.

***Table 2-12 Potential Water Sources for SGR Construction Activities***

| SN | Name of the River | Chainage | Estimated Amount of water to be abstracted ($m^3$) | Remarks |
|---|---|---|---|---|
| 1 | Mpiji | 38+500 | 105,561 | Seasonal |
| 2 | Ruvu | 76+750 | 105,561 | Perennial |
| 3 | Ngerengere A | 131+320 | 105,561 | Seasonal |
| 4 | Ngerengere B | 197+000 | | |
| 5 | Mkata | 227+915 | 105,561 | Perennial |
| 6 | Mkondoa | 280+150 | 105,561 | Perennial |
| 7 | Kidete | 310+388 | 105,561 | Seasonal |
| 8 | Kidimo | 342+434 | 105,561 | Seasonal |
| 9 | Msaze | 352+000 | 105,561 | Seasonal |

Source: Design report, 2017

*Machinery and Equipment*

Table 2-13 presents the machinery and equipment that will be required during the construction phase of the proposed SGR.

*Table 2-13 Machinery and Equipment required for Construction of the Proposed SGR*

| Equipment Type | Total No. Required |
|---|---|
| **Phase I – Dar es Salaam to Morogoro** | |
| Air Compressor | 24 |
| Ambulance | 4 |
| Back-hoe Loader | 29 |
| Borehole machine | 4 |
| Bulldozer | 28 |
| Concrete Batching Plant | 6 |
| Concrete Mixing Machine | 1 |
| Concrete Pump (Mobile) | 11 |
| Crawler Crane | 1 |
| Crusher Plant | 5 |
| Dump Truck | 284 |
| Excavator | 49 |
| Excavator + hammer | 19 |
| Forklift | 7 |
| Fuel Tanker | 7 |
| Generator | 90 |
| Grader | 10 |
| Iron Cut and Bend | 10 |
| Jeep | 33 |
| Laboratory Equipment Set | 2 |
| Light Equipment | 1 |
| Loader | 31 |
| Lubrication, Maintenance and Rescue Truck | 20 |
| Maintenance Workshop | 2 |
| Mini Excavator | 6 |
| Mini Loader | 6 |
| Minibus | 58 |
| Mixing Plant | 3 |
| Mobile Crane | 68 |
| Mobile welding machine | 13 |
| Paver (Ballast Laying) | 3 |
| Pick - up (double deck) | 208 |
| Portal Crane | 4 |
| Precast Plant | 1 |
| Railway Troller | 2 |
| Refrigerated vehicle | 2 |
| Road Car | 15 |

| Equipment Type | Total No. Required |
|---|---|
| Rotary Driller | 1 |
| Sand Washing Plant | 1 |
| Scale | 6 |
| Screen Plant | 1 |
| Shotcrete Pump - Dry | 8 |
| Shotcrete Pump - Wet | 3 |
| Silobas + truck | 10 |
| Submersible pump | 27 |
| Survey Equipment Set | 1 |
| Survey Equipment Set for Machinery | 1 |
| Telehandler | 16 |
| TIR + Lowbed | 4 |
| TIR + Semiromork | 23 |
| Tower Crane | 2 |
| Tower Light | 30 |
| Tractor | 4 |
| Trencher | 1 |
| Truck Drill | 14 |
| Truckmixer | 43 |
| Tunnelling Equipment | 4 |
| Unimog | 8 |
| Vibro roller | 19 |
| Wagon | 6 |
| Wastewater tanker | 6 |
| Wastewater Treatment | 2 |
| Water tanker | 50 |
| Water Treatment System | 7 |
| **Phase II – Morogoro to Makutupora** | |
| Air Compressor | 25 |
| Ambulance | 4 |
| Back-hoe Loader | 31 |
| Borehole machine | 4 |
| Bulldozer | 25 |
| Concrete Batching Plant | 3 |
| Concrete Mixing Machine | 1 |
| Concrete Pump (Mobile) | 8 |
| Crawler Crane | 3 |
| Crusher Plant | 4 |
| Dump Truck | 216 |
| Excavator | 29 |

| Equipment Type | Total No. Required |
|---|---|
| Excavator + hammer | 13 |
| Forklift | 7 |
| Fuel Tanker | 6 |
| Generator | 77 |
| Grader | 7 |
| Iron Cut and Bend | 10 |
| Jeep | 21 |
| Laboratory Equipment Set | 2 |
| Light Equipment | 1 |
| Loader | 23 |
| Lubrication, Maintenance and Rescue Truck | 14 |
| Maintenance Workshop | 2 |
| Mini Excavator | 6 |
| Mini Loader | 6 |
| Minibus | 45 |
| Mixing Plant | 3 |
| Mobile Crane | 59 |
| Mobile welding machine | 15 |
| Paver (Ballast Laying) | 3 |
| Pick - up (double deck) | 139 |
| Portal Crane | 4 |
| Precast Plant | 1 |
| Railway Troller | 2 |
| Refrigerated vehicle | 2 |
| Road Car | 12 |
| Rotary Driller | 3 |
| Sand Washing Plant | 1 |
| Scale | 6 |
| Screen Plant | 1 |
| Silobas + truck | 6 |
| Submersible pump | 27 |
| Survey Equipment Set | 1 |
| Telehandler | 10 |
| TIR + Lowbed | 4 |
| TIR + Semiromork | 21 |
| Tower Crane | 2 |
| Tower Light | 30 |
| Tractor | 4 |
| Trencher | 1 |
| Truck Drill | 4 |

| Equipment Type | Total No. Required |
|---|---|
| Truckmixer | 20 |
| Unimog | 8 |
| Vibro roller | 16 |
| Wagon | 4 |
| Wastewater tanker | 6 |
| Wastewater Treatment | 2 |
| Water tanker | 37 |
| Water Treatment System | 7 |

*Concrete Batching Plants*

Concrete batching plants produce ready mixed concrete, which is delivered to the workplace/worksite. Transit mixers shall be used for transportation. The Contractor is expected to use stationary rather than mobile concrete batching plants. As presented in *Table 2-13*, six and three concrete batching plants will be established for Phase I and Phase II of the proposed SGR respectively. Batching plants will be located at the contractor's main campsites. Five batching plants shall be located within the contractor's main campsites located at Ilala, Soga, Ngerengere, Kilosa and Dodoma. The location of the remaining two batching plants have not yet been confirmed; however, these will be located in areas where they will not pose a hazard to the environment or the wellbeing of the local communities. Batching plants will be sited on land that is not prone to flood. Current and future proximity of sensitive land uses will also be considered.

*Access Routes to Site Locations*

An access road will be developed along the entire alignment of the proposed SGR and within the RoW (parallel to the existing MGR). This access road will be used during both the construction and operational phases of the SGR. Existing roads (main and feeder roads) shall be used to reach this access road.

Facilities such as campsites, marshalling yards, and stations shall be constructed within the RoW or just adjacent to the existing MGR line and therefore they can be served by the access road made by the contractor.

All borrow pits are located within 200 m from the access road that is to be developed along the alignment of the proposed SGR. Transportation of materials from quarry sites shall use existing roads to the respective quarries.

Measures to reduce the impact of haulage roads on local residents, local business and traffic will be addressed in the Construction Traffic Management Plan to be developed during the further stages of the Project. All access roads will be constructed with suitable grades and widths, and will avoid - sharp curves, blind corners, and dangerous cross traffic. The necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic and pedestrians will be provided. Dust control will be implemented on all access roads as necessary.

The final location, grade, width, and alignment of construction and haulage roads will be subject to approval by the Resident Engineer (Clients Representative).

*Labour, Facilities and Accommodation*

*Labour and Workforce Numbers*

Employment on the site will vary depending on the stage of construction and programme of works scheduled by the Contractor/s. The total estimated workforce number for Phases I and II of the proposed SGR is 7,000 (refer to *Table 2-14)*.

***Table 2-14 Estimated Number of Workforce during Construction Phase of the Proposed SGR***

| Personnel | Dar- Morogoro | Morogoro-Makutupora | Total |
|---|---|---|---|
| Expert Personnel | 545 | 856 | 1,401 |
| Local Personnel | 2,182 | 3,422 | 5,604 |
| TOTAL | 2,727 | 4,278 | 7,005 |

Source: Design Report

It is currently estimated that 80% of the workforce will be local Tanzanians and 20% expat. Local labour will (as far as possible) be sourced from villages along the alignment of the proposed SGR.

*Working Hours*

Construction activities will be undertaken over 24-hours a day / seven days a week for the duration of the construction phase. There will be two daily work shifts (07:00 to 18:00 and 19:00 to 06:00).

*Workforce Accommodation*

Camps will be disbursed along the proposed SGR alignment. Camps will not be constructed in protected/sensitive areas and any auxiliary facilities as far as possible would not be located in areas containing sensitive habitats / vegetation. The location and size of camps is provided in *Table 2-15*. Moreover, the locations are illustrated in *Figure 2-11*.

***Table 2-15 Location and Size of Contractors Accommodation***

| Name | Chainage | Description | Area (m²) | Actual Status |
|---|---|---|---|---|
| Ilala | 2+000 | Main (Stationery) Camp | 36,000 | Completed |
| Soga | 54+000 | Main (Stationery) Camp | 415,000 | Completed |
| Ngerengere | 142+500 | Main (Stationery) Camp | 182,000 | Completed |
| Kilosa | 268+000 | Main (Stationery) Camp | 600,000 | 30% |
| Ihumwa Dodoma | 453+000 | Main (Stationery) Camp | 650,000 | 20% |
| | | Total | 1,833,000 | |

All facilities for accommodation of workers will be designed and operated in accordance with the provisions of the IFC Workers Accommodation Guidance. Camps will typically include the preparation and installation of dormitories, canteen / mess halls, materials warehousing, water tanks, a clean water treatment plant, generators, workshop and maintenance area, laboratory, fuel storage areas, offices, clinic, recreational areas, parking areas and a precast and working area. The proposed layout of a Soga Camp, Ngerengere Camp, Kilosa Camp and Dodoma Camp is provided in *Figure 2-12* to *Figure 2-15*. The Ilala Camp is an existing camp that used for the Project.

Mobile (temporary) camps will also be required for specialist work tasks. The locations of these camps is illustrated in *Figure 2-11*.

*Figure 2-11 Camp Locations along the Proposed SGR Alignment*

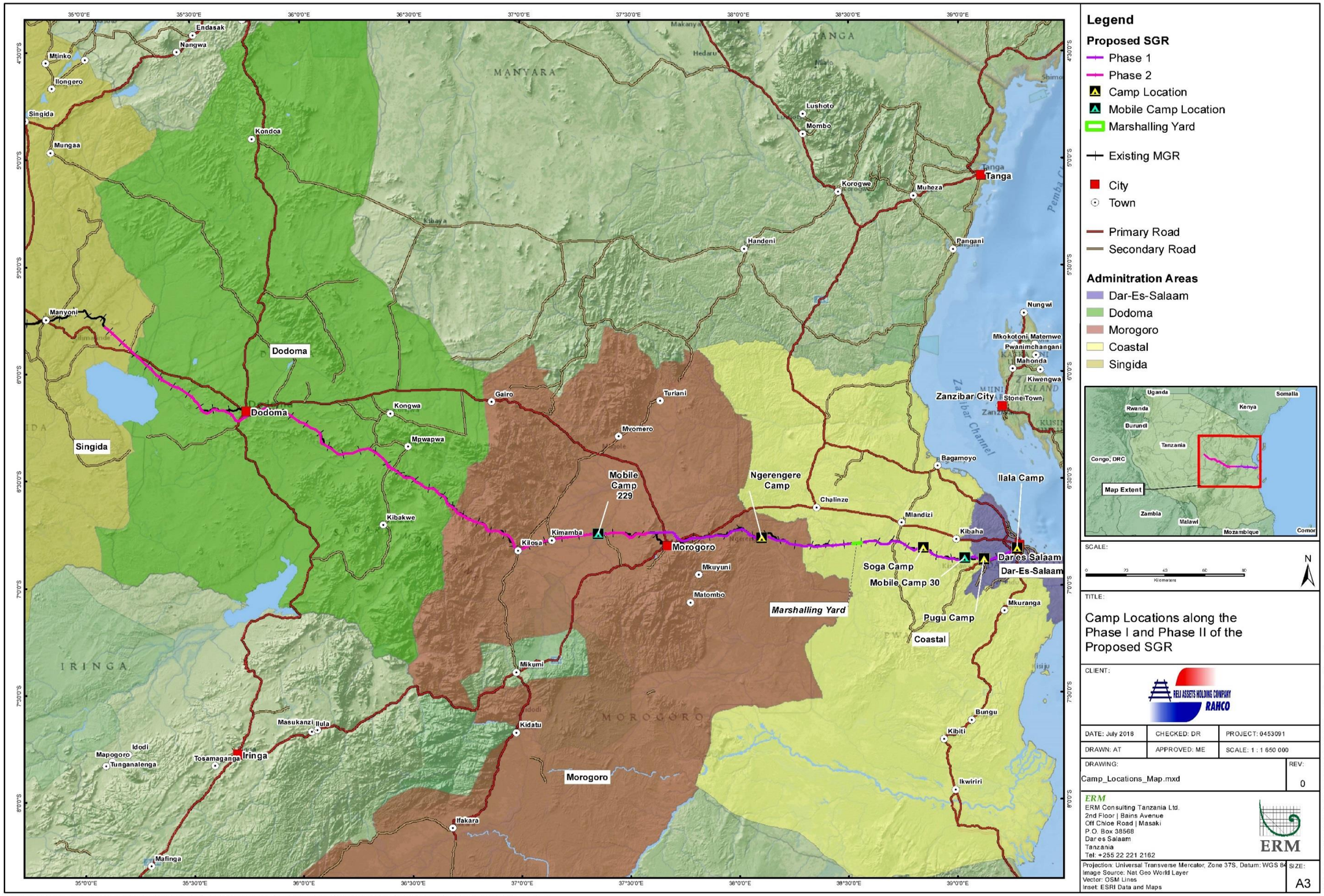


*Figure 2-12 Proposed Layout of Soga Camp*

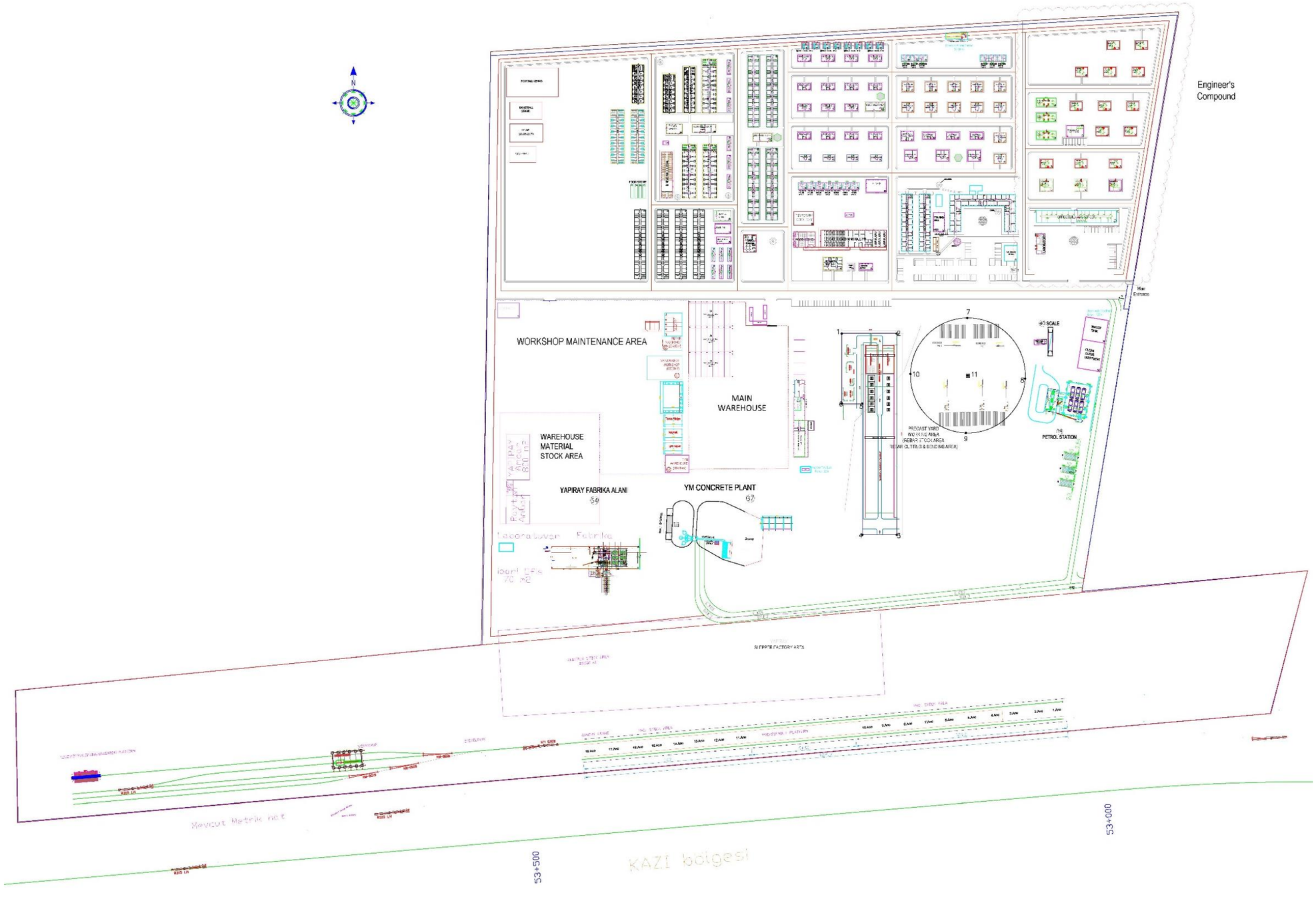


*Figure 2-13 Proposed Layout of Ngerengere Camp*

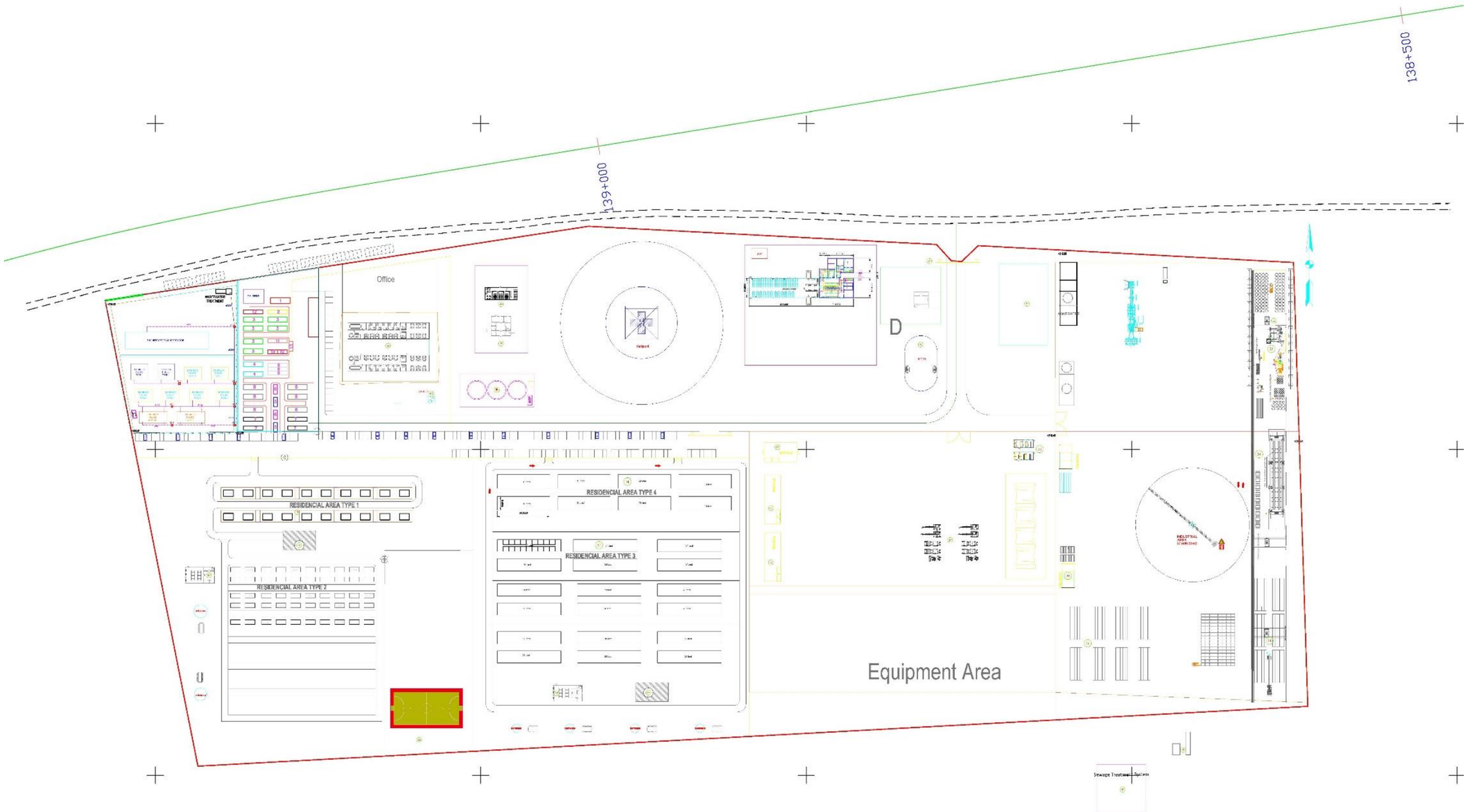


*Figure 2-14 Proposed Layout of Kilosa Camp*

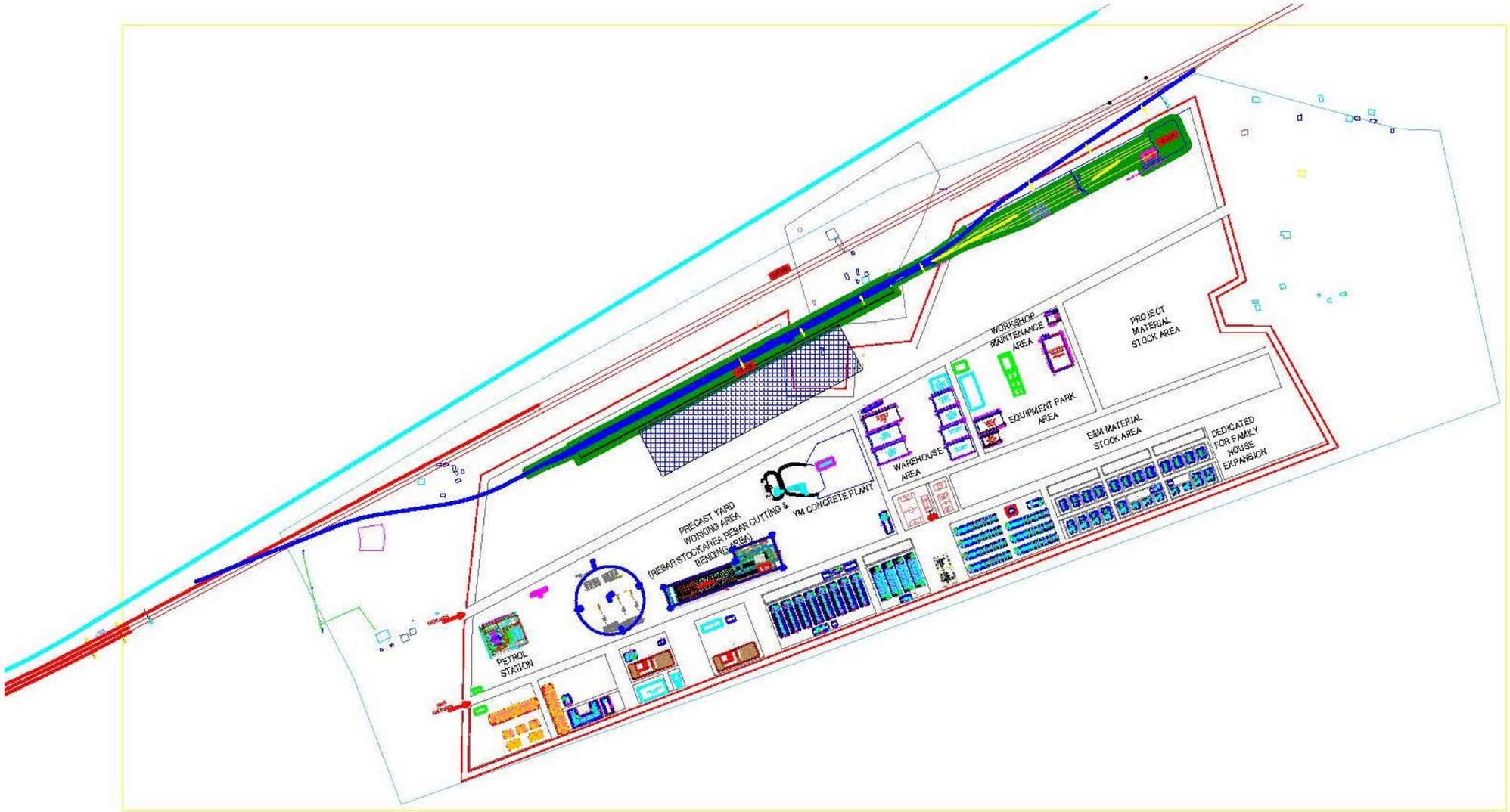
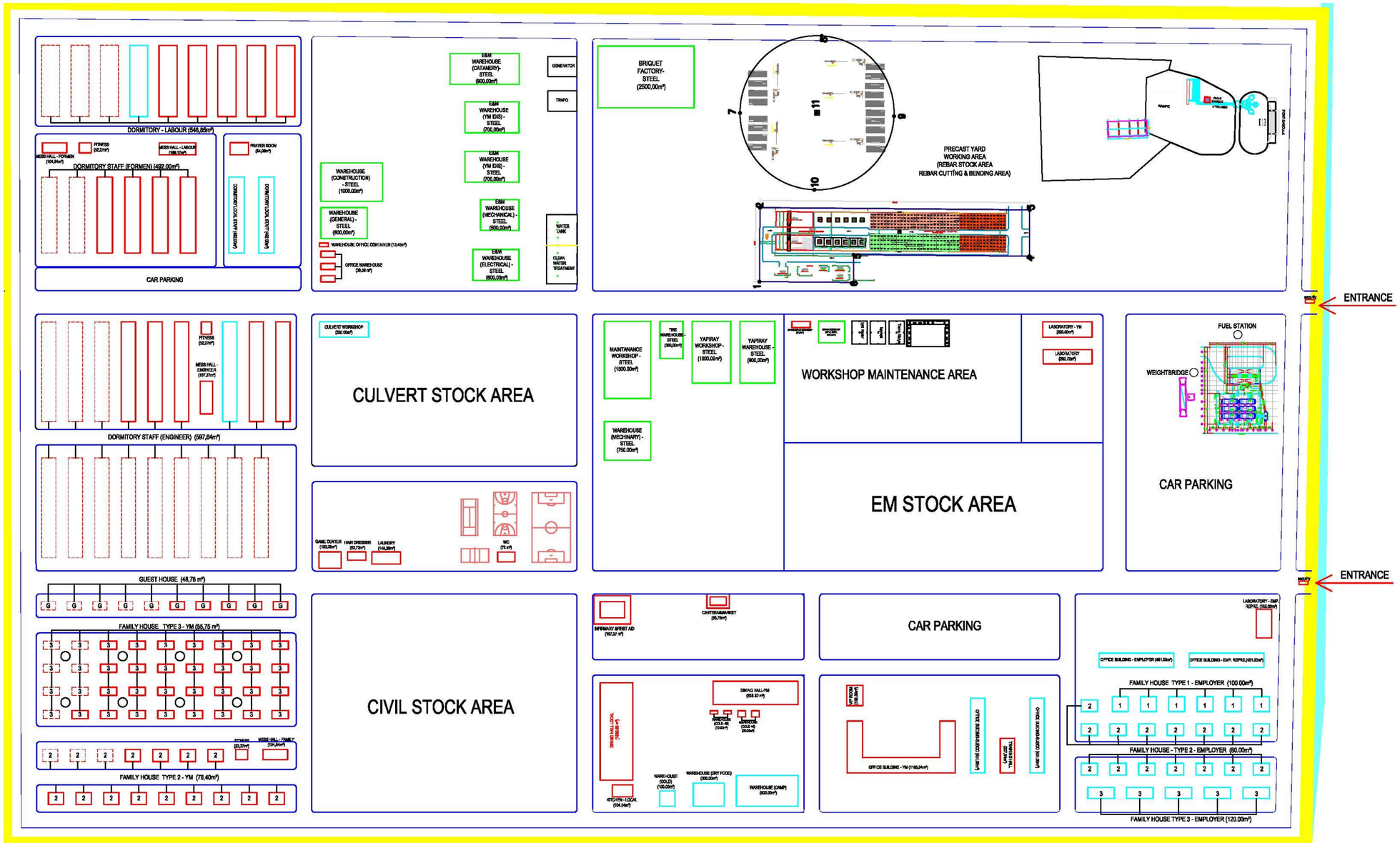


*Figure 2-15 Proposed Layout of Dodoma Camp*



*Sanitation at Active Work Areas*

Mobile toilets will be provided for the workforce at all active work areas. Sewage from mobile toilets will be removed and transported to the wastewater treatment plant at the construction camps.

*Fuel*

The primary fuel that will be used for machinery, vehicles and equipment will be diesel. Monthly consumption of diesel is estimated to be approximately 3,300,000 litres. Given that the construction phase is approximately 33 months, the total fuel demand is estimated to be approximately 108,900,000 litres for the duration of construction. Fuel will be stored at the construction camps as well as strategic locations along the right of way where heavy fuel usage is likely (*viz.* where major earthwork operations are required). Fuels will be stored on impervious surfaces and in bunded dedicated fuel storage areas.

In addition, small quantities of motor oil, hydraulic oil and grease will be required and stored at the construction camps for lubrication of equipment and use in hydraulic systems.

*Waste Management*

*Waste Streams and Management at Site*

The Contractor will subcontract a licensed and reputable waste management company for the collection, transport and disposal of waste produced at site. Wastes at the sites and the camp facilities shall be segregated and collected at the temporary waste collection areas (WCA). There will be waste collection and segregation area in each camp depending on the number of Project personnel and the anticipated volume of waste.

The WCA will have separate storage segments for prime recyclables (scrap metals, tyres, plastic, wooden material), and separate segment for other hazardous waste including waste oils, oil filters etc. Special care will be taken to ensure that liquid wastes are kept in a segment with secondary containment. Proper waste segregation will be maintained at all times. Environmental labelling including visual communication elements shall be applied to the area/ on the containers where appropriate. Table 2-16 shows the waste streams, sources and end use for all waste anticipated during the construction phase.

*Table 2-16 Waste streams, Quantities and Management during Construction Phase*

| Waste Type | Quantity | Source, Characterization and Management |
|---|---|---|
| Medical Wastes | 8-10 kg | All five camps shall have clinics which shall produce medical wastes. All medical wastes will be treated as hazardous waste, collected, transported and removed separately from domestic wastes. Medical wastes will be collected in specially coded containers in the clinic and also they will be stored in designated area in a safe place. Approved medical disposal waste form will be stored by HSE department and clinic. |
| Domestic Wastes (Solid wastes) | 0.45 tons of Solid wastes based on generation rate of 0.3 kg/day and 1,500 people | Camps will provide accommodation and other basic needs for the workers throughout the project stages. Domestic solid waste from the personnel would be collected in closed containers located at various points of the camp areas. Domestic solid waste generated in construction sites must be transferred to main/ mobile camp areas daily basis by site responsible. These solid wastes would be collected in containers and at certain intervals would be transported to the nearest authorized dumps site. |
| Domestic Sewage | 96 $m^3$/day of sewage based on per capita consumption of 80 litres/day, 80 percent becomes waste and 1500 people | This includes wastes from the bathrooms, toilets etc. This waste shall be collected and treated in the wastewater treatment plant at the camp sites. The treated effluent shall be reused to irrigate the gardens at the campsite. |
| Waste Oils | 7-10 $m^3$ per Month | The maintenance process of the vehicles to be used during project phases will be carried within the facilities located in camp areas.<br><br>Waste oil shall be collected in a closed temporary waste storage area with leak-proof floor and covered with a shelter constructed nearest location to the maintenance facility and/or also in WCA. The oil collected would be given to a licensed waste oil recovery company. Additionally, waste vegetative oil will occur in the cafeterias of the camp sites within the scope of the project. These wastes will be collected and stored separate from other wastes and stored in segregated segment in WCA till disposal by third party.<br>These segments differ from others with a structure (secondary containment) to avoid spilling and leakage, soil pollution accordingly. |

| Waste Type | Quantity | Source, Characterization and Management |
|---|---|---|
| Filters | 1,000-1,250 per month | The maintenance process of the vehicles to be used during Project phases will be carried within the facilities located in camp areas.<br>Waste oil filters shall be collected in waste bins with secondary containment and transferred to the WCA for final disposal by third party sub-contractor. Air filters also will be collected in waste air filter bins and then transferred to the WCA for final disposal by third party sub-contractor. |
| Waste Tyre | 5,000-6,000tyres per year | The maintenance process of the vehicles to be used during Project phases will be carried within the facilities located in camp areas. If there is a need to change the tires of these vehicles and machines, the end of life tires that come out would be sent to tires distribution companies or to the authorized third part companies. Until disposal, waste will be stored in WCA in designated segment. |
| Batteries, Accumulators, Tonners, Cartridges | 800-1000 batteries per year | Waste batteries will be stored in collection points located in office areas and will be delivered to third party subcontractors. Waste accumulators (vehicle batteries) will be stored in the temporary storage areas (WCA) until final disposal.<br>Tonners and cartridges will be stored in separated bins in WCAs by IT team. |
| Recyclable Wastes (Paper, Plastics, Cardboard, Metal Scraps) | 13-15tons per month | Paper and card wastes from offices and domestic type sources at the main construction camps will be segregated, if practicable and sent for recycling by third party contractor. Separately collected recyclable wastes will be taken to the WCA and be ready for transfer to recyclers. Recyclable wastes mainly resulting from construction activities (metal scraps, plastics, pipes etc) will be collected in designated areas in construction sites and transferred to the WCAs located in main/mobile camp sites. Recyclable wastes will be stored in WCA until taken by third party subcontractors. |
| Concrete Debris | 0.8-1ton per week | Waste concrete debris will be stored in designated areas temporarily and used as filling material during alignment works |
| Spoil Soil | 11,000,000-12,000,000 m3 | This is unwanted soils which does not have good bearing capacity, shall be removed from the footprint of the railway. The spoil soil shall be dumped in dumping areas located along the Project sites. |
| Wastewater from Concrete Batching Plants | 10 -20m3 per month | Concrete wash out pits will be used to allow sediments to settle and water will be re-used for dust control activities. If water is not able to re-use, acidic chemicals will be added to balance pH into the range for discharge standards and will be discharged to the environment. Daily pH Control shall be undertaken to ensure compliance to discharge standards. |

*Disposal Facilities*

All general wastes which cannot be recycled or reused shall be transported to existing licensed dumpsites/landfills along the alignment of the proposed SGR, including Pugu dumpsite at Dar es Salaam, Kibaha dumpsite at Kibaha, Mafisa dumpsite in Morogoro, Kilosa dump site in Kilosa and Dodoma Landfill (the only landfill along the alignment of the proposed SGR).

*Spoil Dumping Areas*

It is anticipated that 4,268,000 $m^3$ and 7,117,000 $m^3$ of excess spoil (i.e. – which cannot be used for fill) will be generated along Phase I and Phase II of the proposed SGR alignment respectively. This excess spoil will be deposited in the locations presented in *Table 2-17* and illustrated in *Figure 2-16*.

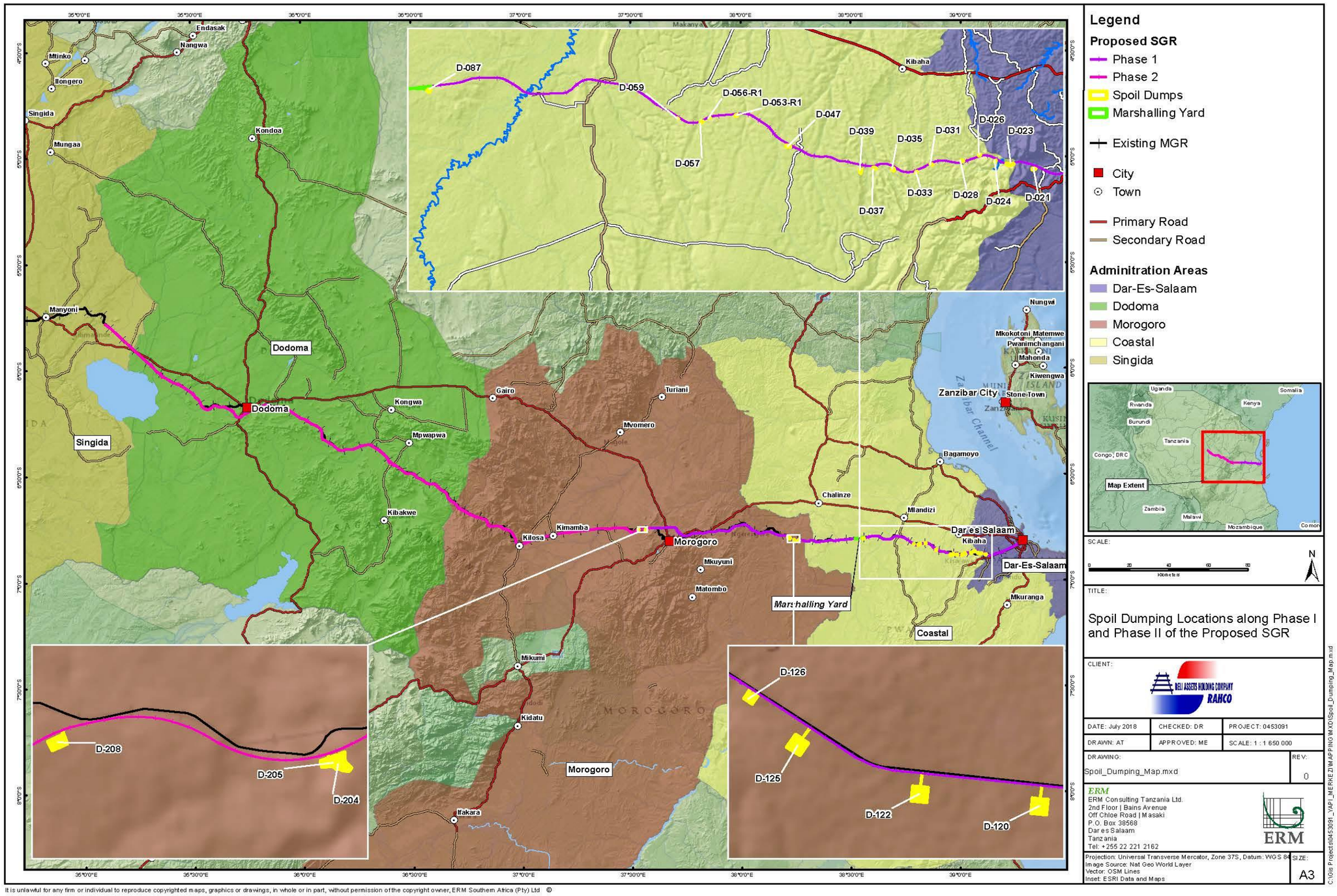
***Table 2-17 Spoil Dumping Areas along the Alignment of the Proposed SGR***

| No. | Kilometre Point | Total Area ($m^2$) | Estimated Quantity ($m^3$) |
|---|---|---|---|
| **Phase I – Dar es Salaam to Morogoro** | | | |
| D053-R1 | 53 | 45,000 | 135,000 |
| D056-R1 | 56 | 20,000 | 60,000 |
| D057 | 57 | 55,000 | 165,000 |
| D024 | 24 | 40,000 | 12,000 |
| D026 | 26 | 45,000 | 135,000 |
| D028 | 28 | 60,000 | 150,000 |
| D031 | 31 | 40,000 | 100,000 |
| D033 | 33 | 35,000 | 105,000 |
| D035 | 35 | 70,000 | 210,000 |
| D037 | 37 | 75,000 | 225,000 |
| D039 | 39 | 90,000 | 270,000 |
| D120 | 120 | 90,000 | 270,000 |
| D122 | 122 | 90,000 | 270,000 |
| D125 | 125 | 90,000 | 270,000 |
| D047 | 47 | 90,000 | 270,000 |
| D021 | 21 | 135,000 | 405,000 |
| D020 | 20 | 85,000 | 255,000 |
| D023 | 23 | 20,000 | 60,000 |
| D056 | 56 | 18,000 | 540,000 |
| D053 | 53 | 20,000 | 50,000 |
| D059 | 59 | 20,000 | 50,000 |
| D055 | 55 | 11,000 | 33,000 |

| No. | Kilometre Point | Total Area ($m^2$) | Estimated Quantity ($m^3$) |
|---|---|---|---|
| D126 | 126 | 40,000 | 120,000 |
| | | TOTAL | 4,268,000 |
| **Phase II – Morogoro to Makutupora** | | | |
| D204 | 204 | 68,000 | 238,000 |
| D208 | 208 | 13,000 | 39,000 |
| D211 | 211 | 100,000 | 300,000 |
| D215 | 215 | 135,000 | 405,000 |
| D218 | 218 | 85,000 | 255,000 |
| D222 | 222 | 100,000 | 300,000 |
| D225 | 225 | 100,000 | 300,000 |
| D230 | 230 | 100,000 | 300,000 |
| D233 | 233 | 70,000 | 210,000 |
| D237 | 237 | 75,000 | 225,000 |
| D277 | 277 | 65,000 | 255,000 |
| D278 | 278 | 85,000 | 195,000 |
| D279 | 279 | 110,000 | 330,000 |
| D284 | 284 | 95,000 | 285,000 |
| D303 | 303 | 145,000 | 435,000 |
| D312 | 312 | 75,000 | 225,000 |
| D318 | 318 | 35,000 | 105,000 |
| D336 | 336 | 80,000 | 240,000 |
| D344 | 344 | 105,000 | 315,000 |
| D447 | 447 | 60,000 | 180,000 |
| D460 | 460 | 150,000 | 450,000 |
| D467 | 467 | 170,000 | 510,000 |
| D486 | 486 | 130,000 | 390,000 |
| D514 | 514 | 90,000 | 270,000 |
| D538 | 538 | 120,000 | 360,000 |
| | | TOTAL | 7,117,000 |

Source: Yapi Merkezi, 2018

*Figure 2-16 Spoil Dumping Locations along the Proposed SGR Alignment*



*Blasting*

Blasting will be required during the construction phase of the Project. Blasting will be associated with quarrying and some blasting will also be associated with earthwork activities. Blasting will be undertaken by an internationally certified service provider. The service provider will obtain all the necessary permitting required for blasting in Tanzania, and will conform with both local Tanzanian blasting legislated requirements and international good practice requirements.

*Sources of Atmospheric Emissions from the Project*

*Introduction*

The Project will result in the following atmospheric emissions – Carbon Monoxide (CO), Nitrogen Dioxide ($NO_2$), Sulphur Dioxide ($SO_2$) and volatile compounds; and particulate matters (dust). The pollutants are classified into stationary sources, fugitive /mobile sources and small combustion facilities. According to The World Bank Group EHS Guidelines for atmospheric emissions, the relevant stationary sources of air pollutants to the proposed Project include industries and factories. Emissions from these sources will be generated during working hours (8 hours per day). Fugitive emissions have the potential for much greater ground-level impacts per unit than stationary source emissions, since they are discharged and dispersed close to the ground.

*Stationary Sources*

These include all fixed sources of air pollutants such as generators and batching plants. These sources are characterised by the release of air pollutants typically associated with the combustion of fossil fuels, such as NOx, $SO_2$, CO, and PM, as well as other air pollutants including certain VOCs.

*Mobile / Fugitive Sources*

Fugitive source air emissions refer to emissions that are distributed spatially over a wide area and not confined to a specific discharge point. They originate in operations where exhaust emissions are not captured and passed through a stack. In this particular Project, the mobile sources of pollutants are motor vehicles (cars and trucks), locomotives, and other engines and equipment that can be moved from one location to another during Project operations. The two main types of fugitive emissions are VOCs, NOx, $SO_2$ and PM.

### 2.5.3 *Operational Phase*

Once the construction phase of the proposed Project is complete, the Project will be commissioned and become operational.

*Rolling Stock (Passenger and Freight) Movements and Types*

The period of operation is designed to continue for around 100 years, after which re-laying of new rail will become necessary. It is initially planned that 24 trains (20 freight and 4 passenger trains) will be using the SGR line during normal operations over 300 days in a year. During the remaining 65 days per year, traffic will be reduced slightly to 20 trains (16 freight and 4 passenger) to enable TRC to carry out routine maintenance activities on the line.
The proposed SGR will accommodate the following locomotive movements:

- **Passenger Train Locomotive Routing**: Electric Locomotive (3,000 HP) to take on the passenger train locomotive routing between Dar es Salaam and Makutupora.
- **Freight Train Locomotive Routing**: Electric locomotive (6,500 HP) to take on the freight locomotive routing between Dar es Salaam and Makutupora.

*Table 2-18* below shows the proposed types of locomotives to be used along the SGR alignment.

***Table 2-18 Rolling Stock Types and Descriptions***

| Rolling Stock | Description/type | Number Required |
|---|---|---|
| Freight Trains | Electric Locomotive 6,500HP | 14 |
| | Diesel Locomotive 6,500HP | 2 |
| Departmental Trains | Electric Locomotive 6,500HP | 3 |
| | Diesel Locomotive 6,500HP | 2 |
| Electrical Multiple Units | Capacity1800 Passengers | 5 |
| Passenger Coaches | Coaches Class 1 | 15 |
| | Coaches Economy Class | 45 |
| Freight Wagons | Flat wagons<br>Box wagons | 600<br>500 |
| | Oil Tankers | 200 |
| | Double Stack Containers | 50 |
| | Bulk wagon | 50 |
| | Gondola Wagon | 70 |
| | Ballast Hoppers | 60 |

The rolling stock depot (Marshalling yard) will be located at Ruvu. Taking the maintenance & assembly workshop of rolling stock to be built as the centre, other auxiliary buildings and facilities will be arranged around the workshop.

*Power for locomotives and rail facilities*

The railway will be electrified. Locomotives will be powered by 25 kV MV. For this purpose 7 Traction Power Substations (TPS) and 28 Auto Transformer Substations (ATS), whose locations are not determined yet, shall be installed along the line. The necessary 220 kV High Voltage Transmission lines supplying power to these substations will be provided by TANESCO.

*Telecommunications and signalling*

Global System for Mobile Communications – Railway (GSM-R) base stations and Signaling system with Fiber Optic cables shall be installed throughout the SGR line.

*Operations workforce / labour requirements*

Operation of the SGR and the workforce required during the operation phase will belong to Tanzania Railway Corporation (TRC).

*Freight to be transported*

The SGR is expeced to transport Containers, bulk and liquid loads carried via freight trains.

*Sanitation during the Operational Phase*

Sewage from the trains shall be discharged at the main stations (Dar es Salaam, Morogoro and Dodoma). These stations will be connected to the local sewerage system.

*Railway Maintenance*

Maintenance of the proposed SGR can be categorised as follows:

**Regular Maintenance** – aims to remove smaller defects and shortages on the permanent RoW. Regular maintenance aim is to delay attrition of the track material and within regulated tolerance aims to keep the width, height and direction of track. Regular maintenance works include: dewatering of ballast, protection of tracks from outwear, lubrication and protraction of track accessories and checking of the accuracy of the same, maintenance of built in tracks (shackling, bunging and coating), regulation of the tracks, returning of misbalanced tracks, checking of profiles, replacement of tracks, replacement of tracks accessories and etc.

- **Investment Maintenance** –consists of all works which cannot be done under regular maintenance. For all works under investment maintenance, project for reconstruction needs to be prepared as well separate ESIA.
- **Unplanned Maintenance** – is attributed with unplanned attrition of material, force majeure floods, landslide, gully, sliding, emergency situations or are caused by some works in vicinity of railway, beside the railway or at the railway.

## *2.6 INVESTMENT DELIVERY PHASES*

The Project is to be delivered in two main phases of investment, which are referred to within the ESIA as Phase 1 and Phase 2:

- Phase one: Comprises the construction of Dar es Salaam - Morogoro section (205 km) with electrification and with signaling and telecommunication equipment. The envisaged construction period is from 30 months. The operational period is expected to be from the early 2020 comprising electric traction, local passenger services, and freight services.
- Phase two: Comprises the construction of the Morogoro - Makutupora section (336 km) with electrification and with signalling and telecommunication equipment. The envisaged construction period is 30 months with the commencement of railway operations by the March 2020.

## *2.7 EXISTING FACILITIES IN THE PROJECT AREA*

The existing MGR line comprises of the railway track, road-railway crossings, railway stations and workshop. The railway RoW varies depending on the status of the area it crosses.

### *2.7.1 The Existing MGR Track*

The existing MGR track consists of two parallel steel rails attached to perpendicular crossties (sleepers) made of steel (and wood/timber at/near crossings and stations). Ballast is appropriately placed on the terrace for stabilization purposes. The current status of the railway line (Dar es Salaam to Mwanza) is composed of 141 km of light rails of 56.12 Lb/yd, 662 km of 60 Lb/yd and 431 km of 80 Lb/yd.

*Figure 2-17 A Section of Railway Track*

### 2.7.2 *Road-Railway Crossings*

The existing MGR line cross several roads from Dar es Salaam to Makutupora, some are formal legal roads and some are informal illegal roads. For legal roads-railway crossings, the reserve area increases, where it takes 100 m from the centre of the railway line and from the centre of the road joining the ends, thus extending the reserve area in the crossings. Major road crossings located are shown in *Table 2-19* below.

*Table 2-19 Major Road Crossings*

| Chainage | Junction/Road name |
|---|---|
| 1+515 | Kamata |
| 4+000 | Ilala |
| 5+000 | Ilala |
| 10+000 | Buguruni |
| 14+307 | Vingunguti |
| 15+000 | Stakishari |
| 17+482 | Pugu |
| 184+000 | Kingolwira |
| 192+241 | Morogoro |
| 197+000 | Morogoro |
| 448+000 | Dodoma |
| 526+100 | Kigwe (Singida Road cross) |

### 2.7.3 *Bridges and Culverts*

Existing bridges can carry between 10 to 25 tons per axle with only about 18 percent of them built to carry 25 tons per axle. Along the entire alignment of the existing MGR steel sleepers are predominantly used; however, on some bridges and turnout, wooden sleepers are used. The total number of bridges and culverts structures along the entire network is about 2,351, with load profile breakdown below (TRC, 2013).

*Table 2-20 Number of Bridges/ Culverts and Axle Load Profile*

| Axle Load | Number of Bridges/ Culverts | Percentage |
|---|---|---|
| 10-12 | 1,683 | 71.59 |
| 13-15 | 442 | 18.80 |
| 16-18 | 1 | 0.04 |
| 19-22 | 1 | 0.04 |
| 23-25 | 224 | 9.53 |
| **Total** | **2,351** | **100** |

Source: RAHCO/TRC, 2013

### 2.7.4 *Railway Stations*

There is a total of 31 stations along the existing MGR line between Dar es Salaam and Makutupora. Each of these stations have single or multiple loops. The area belonging to TRC in the main stations and substations extends by an average of 75 m from the centre line of the railway line on both sides of the railway line. The stations includes Dar es Salaam Central station, Shaurimoyo and Pugu (Dar es Salaam), Mpiji, Soga, Ruvu, Kwala, Magindu (Coastal Region) Kidugalo, Ngerengere, Mikese, Kingolwira, Morogoro, Kimamba, Mkata, Kilosa, Munisagala, Msaganza, Kidete (in Morogoro), Godegode, Gulwe, Munisagali, Igunda, Kikombo, Ihumwa, Dodoma, Zuzu, Kigwe, Bahi (Dodoma) and Kitinku and Makutopora (Singida).

### 2.7.5 *Workshops*

TRC has two major workshops alignment the existing MGR line between Dar es Salaam and Makutupora, one in Morogoro for locomotive's heavy repair and overhaul and another one in Dar es Salaam for maintenance and repair of Wagons, tanks and Coaches. There are four running depots at Dar es Salaam, Morogoro, Tabora and Moshi (currently closed) for locomotive repairs. CXR and Fitter Incharge in Dar es Salaam, Morogoro, Dodoma, Kigoma, Tabora, Mwanza and Tanga for minor maintenance.

### *2.7.6 Existing and Future Development Plans*

There are many planned activities in the area of influence of the proposed SGR line from Dar es Salaam to Mwanza. There are also on-going projects in the SGR development corridor, ranging from small to large projects. An understanding of the existing and planned developments in the broader Project Area is key, as these could result in cumulative impacts.

The impacts from on-going and planned activities will constitute cumulative impacts on various environmental receptors (land, air and water). However, during their implementation a consideration on the existence of SGR will be made so as to determine the levels of cumulative impacts. Cumulative impacts are those impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project. Cumulative impacts are therefore generally impacts that act with others in such a way that the sum is greater than the parts. This is, however, not always the case – sometimes they will simply be the sum of the parts, but that sum becomes significant. Cumulative impacts are considered in *Chapter 6*.

TRC, herself plans to undertake the following activities in the broader Project Area over the next 50 years:

- Rehabilitation of the existing meter gauge railway (MGR) line from Dar es Salaam to Mwanza.
- TANESCO transmission line will be constructed in parallel with SGR alignment and will be providing power via 11 substations to be built (details provided in the Associated Facilities chapter of ESIA).
- Upgrading of the railway line from Makutupora-Tabora-Isaka from the existing 'meter gauge' to 'standard gauge'.
- Construction of about 620 km of new railway line from Isaka – Kigali (Rwanda) / Keza / Gitega – Musongati (Burundi).
- Upgrading 1094 km of railway line from Isaka – Mwanza and Tabora – Kigoma and arterial lines (Kidatu and Taveta, Singida and Mpanda) from 'meter gauge' to 'standard gauge'.
- Construction of 12 km of a railway line from Kange to the proposed port at Mwambani in Tanga and about 25 km of a railway line from Kidomole (Link line) to the proposed port at Mbegani in Bagamoyo.

- Construction of about 664 km of a new standard gauge railway line from Arusha to Musoma. The line will include two branch lines to the already operational fertilizer plant at Minjingu and the other to the proposed soda ash plant at Wosiwosi near Lake Natron.
- Upgrading of 435 km from Tanga – Arusha railway line so as to be compatible with new Arusha – Musoma railway line.
- Construction of Mtwara – Songea to Mbambabay railway line with spurs to Liganga and Mchuchuma mineral areas.
- In collaboration with stakeholders to undertake the construction of fibre optic connecting all stations with modern communication technology (Train control system and station-to-station system).

There are also several planned industries in Dar es Salaam, Coast, Morogoro and Dodoma Regions. For example, there is an on-going abattoir construction in Soga area while there are also plans to establish another one in Chalinze, Coast Region. A new ceramic industry has just been constructed in Chalinze and more than 1,000 industries will be constructed in the EPZ area in Mbegani, Bagamoyo District. In Dar es Salaam, the Ilala Municipality plans to re-construct the Vingunguti slaughter house into a modern abattoir. In Morogoro, the SGR crosses Kihonda industrial area and many more industries are planned in Dodoma municipality.

TANROADS plans to construct several bitumen trunk roads that will cross or come near to the proposed SGR. This includes the Morogoro-Matombo-Kisaki Road and the Dodoma Outer Ring. Future rehabilitation of the existing roads like Dar es Salaam-Morogoro-Tunduma Road, Morogoro-Dodoma and Iringa-Dodoma will may also contribute to cumulative impacts.

Extension of water supply infrastructure in rural and urban areas along the proposed SGR alignment is evident. The proposed SGR will need to accommodate water infrastructure that crosses the proposed SGR alignment. In Morogoro for example, water supply infrastructure to new residential areas of Mazimbu will entail crossing the SGR.

## *2.8 ASSOCIATED FACILITIES*

### *2.8.1 Overview*

In accordance with international ESIA practice, the Area of Influence of a project includes not only the core project components but also any Associated Facilities related to the project. Associated Facilities are defined by the IFC as "…facilities that are not funded as part of the project and that would not have been

constructed or expanded if the project did not exist and without which the project would not be viable ".

In the context of this SGR Project, the relevant Associated Facility per the above definition is considered to be the 220 kV transmission line from Dar es Salaam to Morogoro for the electrification of SGR line (the "TL Project"), which will be constructed and operated by TANESCO.

Tanzania Electric Supply Company Limited (TANESCO) is a parastatal organization under the Ministry of Energy in Tanzania, which owns most of the electricity Generating, Transmitting and Distributing facilities in Tanzania.

In such cases where a third party is responsible for an Associated Facility, IFC PS1 states that the client should address E&S risks and impacts in a manner that is commensurate with the client's degree of control and influence over the third party. In the case of the SGR Project, the Government of Tanzania (GoT) for Tanzania Railway Corporation (TRC) is the borrower. Since both TRC and TANESCO are both state owned companies, the GoT is in the position to control or dictate actions to TANESCO. Therefore, with the GoT support, TRC has requested TANESCO to formally confirm managing E&S risks or impacts for the 220 Kv Dar es Salaam- Morogoro TL in line with international standards such as IFC PS.

In line with information provided by TRC to date, TANESCO is receiving funding from WorldBank for the implementation of the TL Project ; therefore it is assumed that the project will be developed with consideration of the WorldBank Safeguards and related WB/IFC Guideline on Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution.

The above Associated Facility is further discussed below, including a brief description of known/expected risks/impacts and potential mitigation measures reflecting good international practice. The final subsection summarizes further action-commitments to be undertaken by YM and TRC within the constraints of it role in the Project organisation.

### *2.8.2 220 KV Transmission Line from Dar Es Salaam to Morogoro for the Electrification of the SGR Line*

*Background and Facility Description*

The SGR system is designed to use electricity for powering its trains, therefore it is necessary to have reliable power to feed the railway system along its entire length. Thus, in order to ensure the SGR project is properly implemented and smoothly run, TRC has submitted a request to TANESCO concerning the power

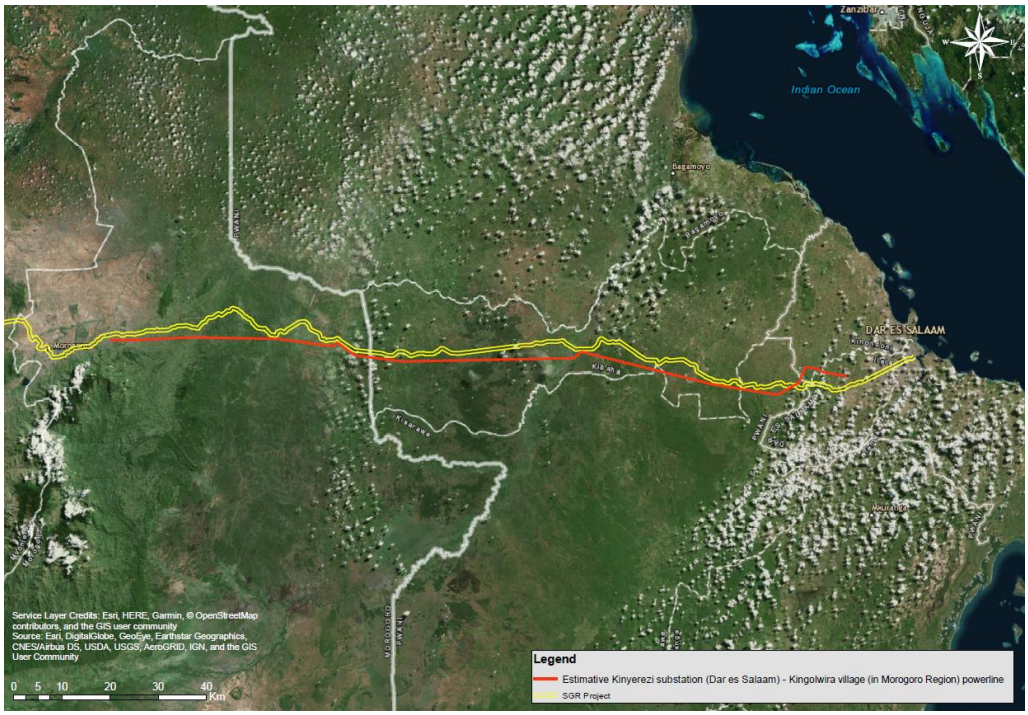
supply of the SGR line system. As a request, TANESCO intends to construct a 220 KV transmission line single circuit from Kinyerezi substation (in Dar es Salaam) to Kingolwira village in Morogoro region.

The line's source will be the existing Kinyerezi powerplant and the power will be discharged in four substations along the route, namely Pugu, Ruvu, Kidugalo and Kingolwira. This proposed power line is designed to cover the first Lot of the SGR (Dar es Salaam- Morogoro). The line will have a total wayleave corridor (right of way) of 35m, with 17.5m from each side of the centre line. The powerline will cross the following villages:

- Kinyerezi, Kipera, pugu, Kifuru and Kibaga in Kinyerezi and Pugu wards, ilala municipality;
- Kwembe Kipera, Kingázi and Kilungule in Kwembe and Kilungule wards, Ubungo municipality;
- Ruvu, Minazikinda, Mpera/Mkino, Msua, Kwara, Magindu, Kidugalo, Mihande in Kongowe, Ruvu and Madindu wards, Kibaha distric council;
- Kinonko, Ngerengere, Nyamnhwambwe, Ulundo, Fulwe, Msemakweli, Pangawe, Mtego wa simba, Muhungamkola, Magurudumu and Kingolwira in Morogoro district councils.

The estimative transmission line route is shown in the figure below, based on information available on the coordinates of the angle and termination points for the different sections:

*Figure 2-18 Indicative route of the 220 kV Dar es Salaam- Kingolwira power line by TANESCO*




*Source: ERM based on coordinates provided by YM (ToR for EPC for powerline)*

The TL Project involves hiring approximate 100 employees during the construction peak period, while during operation, approximately 40 people will be engaged in maintenance works, control room operation, office assistance, driving and security. Employment process will give priority to the local workforce.

A local consultant team hired by TANESCO has issued the Environmental Impact Assessment (EIA) Study in January 2019, after a comprehensive consultation campaign along the powerline route as well with key authorities and interested entities (e.g. Kisarawe, Morogoro, Kibaha District Councils, Ubungo, Ilala and Morogoro Municipal Councils, Regional Commissioners Office, Ministry of Energy, TANROADS, TANESCO regional offices etc.).

The main key stakeholders concerns referred to compensation for the land take and crops damages, medical education & awareness programs, graves & graveyards compensation costs in case of relocation, employment opportunities, loss of trees and crops, grievance mechanism, accident prevention to workers and villagers, project benefits to the villages. According to the EIA results, the TL Project is highly accepted by the stakeholders as long as the compensation for the crops and properties will be fair and transparent.

### *2.8.3 Analysis of Project Alternatives*

The EIA analyzed various alternatives, such as:

- No project alternative, which would have resulted in the impossibility to proceed with the SGR line. In such case, people in Morogoro and Dodoma will continue using the existing diesel-based trains and thus have delays of transportation of raw materials, food, goods and people. Moreover, the north-western regions will not benefit from the proposed SGR Project as the investors will continue using tracks and old diesel train for goods shipment. Maintaining a diesel-based railway transportation is very costly for the government and any such savings due to SGR project could be transferred to education, health or road infrastructure development. The project area would continue lacking reliable electricity, which will limit further agro-processing industries.
- Alternative of feeding SGR with other energy sources. This could be represented by using diesel-fuel. However, this would require ensuring the necessary diesel stocks, and overall the diesel alternative is too expensive and could not justify the feasibility and opportunity of the SGR project (part of the whole advantage of SGR is the electrification);
- Alternative of selection of other feasible route. The EIA assessors analyzed five potential routes, as following:
    1) Tapping from nearest point of existing 132 kV TL to each of the SGR substations
    2) Tapping from nearest point of existing 220 kV Ubungo- Morogoro TL to each of the SGR substations
    3) Tapping from nearest point of existing 220 kV Kinyerezi-Morogoro TL to each of the SGR substations
    4) Dedicated 132 kV Kinyerezi – SGR- Msamvu transmission line
    5) Dedicated 220 kV Kinyerezi – SGR- Msamvu transmission line

Based on the power network analysis, data & information collected, line routes surveys and stakeholders consultations, the 220 Kv Kinyerezi- Pugu-Ruvu-Kidugalo – kingolwira has been proposed as the optimum supply option for electrification of the Dar es Salaam Morogoro SGR line. The option involves connecting the power from Kinyerezi substation on the 220 kV voltage level to the first SGR substation. Thereafter, the new line will run along the SGR by considering the shortest distance and the most environmentally friendly route.

### *2.8.4 Description of Key E&S Risks/Impacts and Mitigation Measures*

The local EIA Study identifies the following E&S impacts caused by the TL Project:

- • Potential positive impacts:

- Reliable, cost and time-effective means of power transport;
- Increased employment opportunities created by the project and indirect employment opportunities resulting from providing services to the project
- Income generation in form of taxes and service levies to government and district councils
- Capacity building of local labours engaged in the project activities
- Improvement of the social services in the project area as part of the Corporate Social responsability initiatives and from the use of reliable electricity
- Speeding up the industrialization in the western and lake zone regions
- Expansion of the business opportunities in the project areas ranging from providing services to supply of materials and equipment.

- Potential negative impacts:

- Loss of farming and grazing
- Loss of trees and crops
- Loss of vegetation due to clearance of the wayleave corridor
- Temporary air pollution from fugitive dusts, suspended particles matters and smoke
- Noise and vibration nuisance
- Influx population in the project area
- Loss of biodiversity and natural habitats due to vegetation clearance
- Interface of wildlife movement corridor
- Risk of soil erosion and land degradation
- Risk of increased crimes due to joblesness and increased income of some individuals in the project area
- Increased risks of landlessness and food insecurity to some PAPs
- Risks to Heath and Safety of the communities around the project area and spread of HIV/AIDS and other communicable diseases
- Occupational H&S of workers

- Impairment of water quality and soil due to pollution (liquid and solid waste)
- Project related accidents
- Loss of cultural heritage /properties
- Electrocution
- Pollution of water sources

These negative impacts could be avoided or mitigated to acceptable levels while positive impacts or benefits derived from the TL Project could be enhanced by adopting good engineering practices and appropriate enhancement during design, construction and operation of the transmission line. Therefore, relevant mitigation measures to the above adverse impacts include:

- Conduct effective monitoring on the adherence to Environmental Monitoring Plan
- Conduct risk assessments regularly, ensure use of safety equipment, PPE, ensure the First Aid Kit and Aiders throught the construction route;
- Cover vehicles hauling construction materials in order to avoid air pollution and emission of dusts;
- Control and limit the vehicles speed and movement within the project area and working hours
- Apply lubricants to machines and vehicles to lessen the noise pollution
- conduct regular training and awareness programs on HIV/AIDS and supply with condoms where necessary
- Hire H&S and Environmental officers to oversee the HSE aspects during the construction phase
- Prepare and implement the waste management plan in order to control the effects of the solid and liquid waste
- Give local employment priorities and consult with local leaders; hire unskilled personnel from local villages
- Require the contractor to provide working manuals and limitations to construction team to avoid accidents and interferences with traditional and native ways of life including respecting others faith and tradition
- Conduct awareness campaign on safety risks of contacting the power lines (eg dangers of illegal tapping into the lines)
- Conduct valuation and compensation in a fair and transparent way and ensure prompt payment

- Ensure watering of dusty areas/materials to reduce the fugitive dusts during construction.

Assuming that the TL Project is performed in accordance with WorldBank safeguards, it is expected that the implementation of the EIA obligations and recommendations will be anchored in the loan conditions. The conformance with the implementation commitments would be subject to independent assessment and monitoring so that overall, the project would be in line with the international WorldBank standards.

# 3 POLICY, LEGAL, AND INSTITUTIONAL FRAMEWORK

## 3.1 THE CONSTITUTION OF THE UNITED REPUBLIC OF TANZANIA

The Constitution of the United Republic of Tanzania came into operation on the 26th April 1977. It is a fundamental law and considered the foundation of all other legislation enacted in the Republic of Tanzania. The right to give and receive information is enshrined in the Constitution, which includes the giving and receiving of information on environment and natural resource management.

## 3.2 POLICY OVERVIEW

### *National Environmental Policy (NEP) of 1997*

Tanzania currently aims to achieve sustainable development through the rational and sustainable use of natural resources and to incorporate measures that safeguard the environment in any development activities. The environmental policy document seeks to provide the framework for making the fundamental changes needed to bring consideration of the environment into the mainstream of the decision-making processes in the country.

The key objectives of the National Environmental Policy (NEP) are to:

- Ensuring sustainability, security and the equitable use of resources for meeting the basic needs of the present and future generations without degrading the environment or risking health or safety.
- To prevent and control degradation of land, water, vegetation and air that constitute our life support system.
- To conserve and enhance our natural and manmade heritage, including the biological diversity of the unique ecosystem of Tanzania.
- To improve the condition and productivity of degraded areas including rural and urban settlement in order that all Tanzanians may live in safe, healthful, productive and aesthetically pleasing surroundings.
- To raise public awareness and understanding of the essential linkages between environment and development and to promote individual and community participation in the environmental action.
- To promote international co-operation on the environment and expand our participation and contribution to relevant bilateral, sub-regional, regional,

and global organizations and programs, including implementation of treaties.

For the transport sector, Section 51 of the NEP focuses on the following:

- Improvement in mass transport systems to reduce fuel consumption, traffic congestion and pollution;
- Control and minimization of transport emission gases, noise, dust and particulates; and
- Disaster/spills prevention and response plans and standards shall be formulated for transportation of hazardous/dangerous materials.

Critically, the National Environmental Policy emphasize the following aspects of natural resources management:

- Wildlife resources should be protected and utilized in a sustainable manner; and on the basis of careful assessment of natural heritage in flora and fauna, fragile ecosystem, site under pressure and endangered species, with participation of, and benefits to, the local communities. Environmentally adverse impacts of development project in wildlife conservation area e.g. (tourist hotels, road construction) will be minimized by Environmental Impact Assessment studies.
- It encourages the development of sustainable regimes for soil conservation and forest protection, taking into consideration the links between desertification, deforestation, freshwater availability, climatic change and biological diversity.

On addressing the issues of poverty alleviation, the policy recognizes its impact to the environment. The policy focuses on the satisfaction of basic needs of citizens with due cognizance to protecting the environment.

The NEP advocates the adoption of Environmental Impact Assessment (EIA) as a tool for screening development projects, which are likely to cause adverse environmental impacts.

*This Environmental Impact Assessment (EIA) is in line with the NEP because of its adherence to the principles in the Policy with respect to public consultations, use of environmentally sound technologies, legislative and standard requirements and monitoring indicators.*

*National Transport Policy (2003)*

The vision of this Policy is "to have an efficient and cost-effective domestic and international transport service to all segments of the population and sectors of the national economy with maximum safety and minimum environmental degradation".

The mission of this Policy is to "Develop safe, reliable, effective, efficient and fully integrated transport infrastructure and operations which will best meet the needs of travel and transport at improving levels of service at lower costs in a manner which supports government strategies for socio-economic development whilst being economically and environmentally sustainable".

This Policy acknowledges that in the rural areas of Tanzania the transport situation is highly affected by poor infrastructure. Hence, the key objective of the transport policy are to:

- Improve the transport infrastructure to enable easier movement of agricultural and livestock inputs and outputs to and from rural and urban areas. Agricultural and Livestock inputs need to be transported into villages and surplus outputs need to be transported to markets, which are normally located in urban areas.
- Improve infrastructure whilst minimizing wasteful exploitation of natural resources and enhancing environmental protection. Improving infrastructure assists in poverty reduction and eradication, which is a major goal in Tanzania.

In order to promote environmental protection whilst reducing poverty in rural areas, the Policy direction is to:

- Influence use of alternative energy sources such as biogas and solar available at the residential localities instead of travelling long distances in search of firewood as a source of power; and
- Raise environmental awareness.

The SGR Project will, in the success scenario, contribute towards delivering efficient and cost-effective domestic transport service to all segments of the population along the alignment and sectors of the national economy with maximum safety and minimum environmental degradation.

### *National Mineral Policy (2012)*

The National Mineral Policy requires that mining activities be undertaken in a sustainable manner. Reclamation of land after mining activities is recommended.

Section 3.3.12 provided that "To ensure Sustainability of mining there is a need to Integrate Environmental and Social concerns into Mineral development programmes. Sustainable mining development requires balancing the protection of flora and fauna and Natural Environment with the need for social and economic development."

*The SGR Project involves mining activities such quarrying, sand and gravel extraction activities from both existing and new borrow pits and quarries located within the project area of influence.*

### *National Construction Industry Policy (2003)*

The railway sector is among the key areas covered by this policy. Among the major objectives of the policy, include the promotion and application of cost effective and innovative technologies and practices to support socio-economic development activities.

BY implanting the SGR Project, TRC is demonstrating the adherence to the principles in the Policy.

### *National Land Policy*

The National Land Policy states that, "the overall aim of a National Land Policy is 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 upsetting or endangering the ecological balance of the environment". This EIA responds to envisaged policy requirement.

### *National Energy Policy (2003)*

The first energy policy for Tanzania was formulated in April 1992. Since then, the energy sector has undergone a number of changes, necessitating adjustments to this policy. These changes include changes in the role of the government from a service provider to a facilitator, liberalization of the market and encouragement of private sector investment. The overall objective of the this Policy is to contribute to the development process by establishing efficient energy production, procurement, transportation, distribution and end-user

systems in an environmentally sound manner and with due regard to gender issues.

The continuing decline in industrial and agricultural production during the period between 1980 and 1985 led to increased inflation and a decline in the standard of living. In order to stop this decline, the government gave priority to the upgrading of basic economic infrastructure, especially communication, so that they can fully support the production sector.

*The operation phase of the proposed SGR is expected to use electricity and therefore adherence to this policy principle.*

***National Gender Policy (2002)***

The key objective of this policy is to provide guidelines that will ensure that gender sensitive plans and strategies are developed in all sectors and institutions. While the policy aims at establishing strategies to eradicate poverty, it puts emphasis on gender quality and equal opportunity of both men and women to participate in development undertakings and to value the role-played by each member of society.

*The construction and operation al phase of the SGR project will employ both men and women hence this policy requirement are applicable.*

***The National Water Policy (2002)***

The overall objective of this policy is to develop a comprehensive framework for the sustainable management of the national water resources. The policy seeks to ensure that water plays an important role in poverty alleviation. The SGR project will use water for various activities and will ensure the sustainable use and management of water including the enhancement of water resources management within the project influence area.

***National Forestry Policy (1998)***

The national forest policy is based on macro-economic, environmental and social framework. Its overall aim is to manage Tanzania's forest resources as a national heritage on an integrated and sustainable basis to optimize their environmental, economic, social and cultural values. The policy drives towards implementing the directives contained in the National Environmental Policy (1997) in regard with forest resources management.

The SGR route passes alongside and marginally through the Pugu Hills and Ruvu South Forest Reserves. The forest policy advocates for a permit and directs the conduct of EIA for development projects that will affect forest reserves including services crossing them (e.g. railways). *The proposed SGR project will ensure that policy provisions are adhered to throughout project implementation.*

***National Agricultural Policy (2013)***

The objective of the policy is to develop an efficient, competitive and profitable agricultural industry that contributes to the improvement of the livelihoods of Tanzanians and attainment of broad based economic growth and poverty alleviation.

The policy highlights the challenges facing the agricultural sector in Tanzania and opportunities that would lead to increased production and productivity if utilized effectively. Related to this project, one of the key challenges in facing the sector is poor infrastructure.

*The SGR project in a success scenario, will promote the expansion of domestic, regional and international market opportunities for various agricultural commodities through safe, fast, reliable and cost effective movement of agricultural products between markets. In addition, it will promote the growth of agribusinesses and medium to large-scale farms and hence the increase in rural jobs market.*

***National Policy on HIV/AIDS (2001)***

The National Policy on HIV/AIDS (2001) was formulated by the Government of Tanzania (GOT) under technical support from the World Health Organization Global Programme on AIDS (WHO-GPA) that led to the establishment of National HIV/AIDS Control Programme (NACP) under the Ministry of Health. However, due to its multi-sectoral nature there was a need to involve all sectors and community participation was found to be crucial. One of the government strategic initiatives was to establish Tanzania Commission for AIDS (TACAIDS) under the Prime Minister's Office. The Commission provides leadership and coordination of national multi-sectoral response to the HIV/AIDS epidemic. The management functions, institutional and organizational arrangement of TACAIDS are outlined in the National Policy.

The policy identifies HIV/AIDS as a global disaster, hence requiring concerted and unprecedented initiative at national and global levels. It recognizes HIV/AIDS as an impediment to development in all sectors, in terms of social and economic development with serious and direct implication on social

services and welfare. Thus, the policy recognizes the linkage between poverty and HIV/AIDS, as the poor section of the society are the most vulnerable.

The main policy objective is reflected well in the establishment of TACAIDS.

*The SGR project can be a precursor of incidents of HIV/AIDS due to the high influx of people into the project area to seek for jobs and income. The situation can result in increase in the incidence of diseases including STI, and HIV/AIDS.*

***The Wildlife Policy of Tanzania (2007)***

The vision of the wildlife sector for the next 20 years conforms to the Development Vision 2025 on sustainable environmental and socio-economic transformation. Inter alia, the vision of the wildlife sector is to:

- Promote conservation of biological diversity;
- Administer, regulate and develop wildlife resources;
- Involve all stakeholders in wildlife conservation and sustainable utilization, as well as in fair equitable sharing of benefits;
- Promote sustainable utilization of wildlife resources; and
- Contribute to poverty alleviation and improve the quality of life.

The Wildlife Policy envisages addressing several national challenges. For instance, conserving representative areas of the key habitats with great biological diversity; continuing to support and where necessary, enlarge the protected area network as the core of conservation activities; integrating wildlife conservation with rural development; and minimizing human-wildlife conflicts whenever it occurs.

***The National Livestock Policy (2006)***

The rationale of the National Livestock Policy is to commercialize the industry and stimulate its development while conserving the environment. The aim is to support the livelihoods of livestock farmers through increased incomes and self-sufficiency in food of animal origin and thus addressing the goals set in the National Strategy for Growth and Reduction of Poverty (NSGRP) of 2004.

The Policy has taken into account the comparative advantage the country has as regards to the large livestock population compared to most African countries. It has also considered current developments in trade liberalization, globalization, privatization and divestiture of state enterprises, enhancement

public-private partnership, advances in science and technology, which have direct impact on the development of the livestock industry. The Policy further emphasizes on the importance of value addition in order to access competitive markets and to prolong shelf life of livestock products.

*There are a number of pastoralists along the railway alignment that crosses the both the existing MGR and new SGR. The SGR may have both benefits and impacts on the livestock sector and therefore this policy becomes relevant.*

***The National Employment Policy (1997)***

The National Employment Policy identifies two categories of employment namely wage employment and self-employment. The policy revisits the state of employment in Government, Parastatals, Private sector and Informal Sector. This policy is the vision leading to utilization of available labour force and tapping available natural resources.

The policy also identifies strategies for exploiting existing wealth, especially in sectors dealing with Industry and trade, Agriculture and livestock, Fisheries, Service sector and small-scale mining. On top of that, it identify special groups that require special treatment while seeking employment and proposes responsibilities of different authorities to deal with different aspects of the policy.

The SGR project is expected to provide employment to local people during construction and operation and therefore it adheres with this policy.

***National Health Policy (URT, 2003)***

The Health Policy is aimed at improving the health status of all people wherever they are, in urban and rural areas, by reducing mobility and mortality and raising life expectancy. Good health, i.e. physical, mental and social wellbeing, is a major resource and economic development. Relevant section of the policy include Part IV which deals with primary health care in which the policy advocates for community involvement and provision of health education in order to prevent occurrences of disease. Part V elaborates the health service delivery structure from national to village level. The project is expected to contribute significantly to the objectives of this policy as it will enhance accessibility.

*Community Development policy (1997)*

The policy puts in place measures that enables communities to realise their potential through wise utilisation of natural resources. Although there are many sections that are relevant to the project, sections 15 and 16 elaborate on the objectives of the policy. Since land is a resource that is mainly depended upon by local communities for their development, losing land may have severe consequences on community development.

*Cultural Heritage Policy (2008)*

The Cultural Heritage Policy provides guidance on the implementation of the Tanzania Antiquities Act (Act No. 10 of 1964; amended 1979, Act No. 22) for government and non-government stakeholders. Key elements of the policy include the following:

- Defines the roles and responsibilities of different cultural heritage stakeholders;
- An analysis of the ways in which cultural heritage activities are managed and administered by the government;
- Clarifies measures by which cultural heritage resources will be protected, managed, preserved, conserved, and developed; and
- An analysis of best practices for conducting research and conservation of cultural heritage resources.

A key element of the policy is the stipulation that cultural heritage impact assessments should be mandatory prior as part of private and public development projects (MNRT 2018).

## *3.3 LEGAL FRAMEWORK*

***Environmental*** Management Act No. 20 of (2004), Cap. 191

The Environmental Management Act (EMA) is an umbrella law on environmental management in Tanzania. This major legislation oversees the overall management of the environment in the country. Its enactment repealed the National Environment Management Council Act. 19 of (1983) while providing for the continued existence of the National Environment Management Council (NEMC). It is supported by a number of regulations that provide guidance on the implementation of the Act.

*TRC commissioned the EIA in compliance with the Environmental Management Act, they shall be required to commit to implementing the Environmental and Social Management, and Monitoring Plan (ESMMP) laid out in this Report and any other conditions prescribed by NEMC, prior to being issued a licence.*

*The SGR project will comply with EMA directives by following the EMA requirements and related regulations and standards.*

***The Land Act No. 4 of 1999 and the Village Land Act No. 5 of (1999)***

*Land Tenure System*

The existing land ownership system has a history of more than forty years. At present the Land Act (1999) and the Village Land Act (1999) provide guidance to land ownership in Tanzania. The laws vest all land in the President and grant occupancy rights to individuals, legal persons and territorial communities. The President holds land in trust for all citizens and can acquire land for public use and benefit, for instance, to resettle people from densely populated areas to sparsely populated areas, settle refugees and so forth. The President can also acquire land for other national projects, like road construction.

*Compensation Rules*

Under the Government Standing Order on expropriation for public utility, the holder of a Right of Occupancy is guaranteed a free enjoyment of the land and is entitled to compensation if dispossessed by the Government for public use. In many cases whilst the holders agree to leave their land, they are not happy with the amount and/or delay in getting compensation. Often, for example, improvements that they have made to the land are omitted or underrated. The expropriation should match the price that improvements can fetch if sold in the open market. Replacement value (defined as the cost of putting up a structure equivalent to the evaluated one) makes allowance for age, state of repair and economic obsolescence.

The compensation must therefore include:-

- The replacement value of the un-exhausted improvements
- Disturbance and transport allowance
- Loss of income
- Cost of acquiring or getting an equivalent land
- Actual value of the present property/utility available in the land and

- Any other immediate costs or capital expenditure incurred in the development of the land.

*The SGR project involves resettlement of people and their properties; the project is committed to follow the whole process of valuation and compensation in alignment with the requirements of this law.*

***The Railway Act, 2017***

The Act was passed in 2017 to replace the Railways Act No.4 of 2002. This act facilitated the establishment of the new railway company, Tanzania Railway Corporation (TRC). The new law proposes the disbandment of the Tanzania Railway Authority (TRL) and Reli Assets Holding Company (TRC).

***The Water Resources Management Act No. 11 of 2009***

The Act provides the institutional and legal framework for sustainable management and development of water resources; outlines principles for water resources management; for prevention and control of water pollution; and provides for participation of stakeholders and the public in implementation of the National Water Policy.

Water demand for the SGR Project is anticipated to be extensive for construction, dust suppression and for use in the works camps, although appropriate permits will be obtained and their conditions met for water used by the Project.

*The SGR Project will extract water from a number of surface water and groundwater sources. The project will acquire all the relevant permits and will strive to meet all the permit conditions, eg. water use will need to be monitored and reported to the relevant Water Authority to ensure permit conditions are adhered to.*

***The Public Health Act 2009***

This Act provide for the promotion, preservation and maintenance of public health with the view to ensuring the provision of comprehensive, functional and sustainable public health services to the general public and to provide for other related matters. Section 54 of this law states that "*A person shall not cause or suffer from nuisance, likely to be injurious or dangerous to health, existing on land, premises, air or water*".

*The EIA study has taken into consideration the potential impacts that the Project may have on the public health and the appropriate mitigations have been outlined.*

***Land Use Planning Act (2007)***

The Act provides for the procedures for the preparation, administration and enforcement of land use plans; to repeal the National Land Use Planning Commissioning Act and to provide for related matters. Among the objectives of the Act as given in Section 4 are to facilitate the orderly management of land use and to promote sustainable land use practices.

*The SGR project entails defining a 30m (either side of the centreline) right of way resulting in acquisition of additional land for the project. The Lands Act regulates all issues of land acquisition.*

***Occupation Safety and Health Act (2003)***

This law requires employers to provide a good working environment for workers in order to safeguard their health.

*The EIA has taken into consideration the potential for occupational health issues associated with the Project and appropriate mitigation measures have been outlined in this report. The project will contractually oblige its contractors and suppliers to adhere to the Operational Safety and Health Act 2003.*

***Local Government Laws (Miscellaneous Amendment) Act, 2006***

The Local Government Act directs the registrar of villages to register an area as a village and issue a certificate of incorporation 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 a village is capable of holding and purchasing or requiring in any other way any movable or immovable property.

The Act gives authority to local governments to regulate matters that are local. A pertinent example of such authority to the project is that the local government may opt to regulate extraction of minerals or building material, through their by-laws. Despite the authority of local governments the by-laws should not derogate any principal legislation e.g. in the case of extraction of material, the Mining Act.

*The SGR project traverses a number of districts in Dar es Salaam, Pwani, Morogoro, Dodoma and Singida. The project will ensure compliance with the relevant local government requirements during throughout project life cycle.*

*The Standards Act No. 2 of 2009*

An Act to provide for the promotion of the standardization of specifications of commodities and services, to re-establish the Tanzania Bureau of Standards (TBS) and to provide better provisions for the functions, management and control of the Bureau, to repeal the standards Act, Cap.130 and to provide for other related matters.

This act is relevant to this project as the quality of the Bitumen/Asphalt, and other products to be imported by Contractor during construction will have to abide to the standards set by TBS.

*National Forest Act, 2002*

This Act deals with the protection of forests and forest products in forest reserves, the restrictions and prohibitions in forest reserves. Forest Management plans are administered under the Forest ordinance (1957).

The current Forest Act No 14 of 2002 requires that for any development within a Forest Reserve, Private Forest or Sensitive Forest, the proponent must prepare an Environmental Impact Assessment for submission to the Director of Forestry. The law also requires licenses or permits for certain activities undertaken within the national or local forest reserves, such as, among others, felling or removal of trees, harvesting forest produce, entering a forest reserve for the purpose of tourism or camping, mining activities, occupation or residence within the reserve, cultivation, erecting any structures.

The SGR route passes alongside and marginally through the Pugu Hills and Ruvu South Forest Reserves. The SGR project will engage with the forestry stakeholders and acquire all the necessary permits to ensure that provisions of this act are adhered to throughout project implementation.

*Explosives Act, 56/63*

This Act gives the Commissioner for Mines responsibility for regulating explosives. First, section 3 stipulates that no import, manufacture, possession, acquisition, or disposition of explosives shall be allowed without approval from the Commissioner. Sections 7-9 stipulate that a person must have a license from the Commissioner for Mines to legally manufacture explosives. Part V of the Act further requires a permit for transport of explosives. Part VI requires a permit for acquisition, possession, and disposal of explosives. Part VII requires a permit for storage of explosives. Part VIII requires a permit for use of explosives. An explosives permit can give conditions.

*The SGR project will engage with the relevant stakeholders and acquire all the necessary permits to ensure that provisions of this act are adhered to throughout project implementation.*

***Regional and District Act No 9, 1997***

The Act provides for Regional Commissioners to oversee Regional Secretariats, with District Commissioners directly supervising the District Councils. Local authorities oversee the local planning processes, including establishing local environmental policies.

The National Environmental Policy establishes a policy committee on Environment at Regional level chaired by the Regional Commissioner, mirrored by environmental committee at all lower levels, i.e. at the District, Division, Ward and Village or Mtaa Councils.

*The Regional and District Commissioners have been consulted as part of the EIA for this project with their views and opinions addressed in this Report.*

***Mining Act No 4 (2010)***

This Act states that "building material" includes all forms of rock, stones, gravel, sand, clay, volcanic ash or cinder, or other minerals being used for the construction of buildings, roads, dams, aerodromes, or similar works but does not include gypsum, limestone being burned for the production of lime, or material used for the manufacture of cement.

This act make sure minerals are well controlled and Section 6(1) states that "no person shall, on or in any land to which this act refers, prospect for minerals or carry on mining operations except under the authority of Mineral Right granted, or deemed to have been granted under this Act." In additional section **50.-**(1) (v) of the act states that "The Minister shall grant an application for a mining licence for minerals which has been properly made under section 49 and a successful application for a mining licence made under section 71 unless the applicant has not included the relevant environmental certificate issued under the Environment Management Act".

*The SGR project shall apply for relevant mining permits before starting sand, gravel and/or other mining activities. Where these materials are sourced from suppliers, the project will ensure that they are licensed and compliant prior to using their services.*

***The Land Acquisition Act 1967***

Under the Land Acquisition Act, 1967, the President may, subject to the provisions of this Act, acquire any land for any estate or term where such land is required for any public purpose.

Land shall be deemed to be acquired for a public purpose where it is required, for example, for exclusive Government use, for general public use, for any Government scheme, for the development of agricultural land or for the provision of sites for industrial, agricultural or commercial development, social services, or housing or; where the President is satisfied that a corporation requires any land for the purposes of construction of any work which in his opinion would be of public utility or in the public interest or in the interest of the national economy, he may, with the approval, to be signified by resolution of the National Assembly and by order published in the Gazette, declare the purpose for which such land is required to be a public purpose and upon such order being made such purpose shall be deemed to be a public purpose; or in connection with the laying out of any new city, municipality, township or minor settlement or the extension or improvement of any existing city, municipality, township or minor settlement; etc.

Upon such acquisition of any Land, the President is compelled on behalf of the Government to pay in respect thereof, out of moneys provided for the purpose by Parliament, such compensation, as may be agreed upon or determined in accordance with the provisions of the Land Acquisition Act, 1967.

The President may also revoke a right of occupancy if in his opinion it is in public interest to do so. Accordingly, the land for which a right of occupancy has been revoked reverts back to the Government for re-allocation pursuant to the existing need (s). It should also be noted here that, though the land belong to the government some changes on the land act has taken place. Land has value to the owner; therefore, any land taken from the user has to be compensated. Based on this act the villagers affected by the project are claiming that they should be compensated for the lost farms and land used for residential purposes.

*TRC shall ensure compliance with the requirements of this Act during the the whole resettlement and comepnsation process.*

***The Wildlife Conservation Act No 5/09 of 2009***

This Act establishes Wildlife Protected Areas, Wildlife Management Areas and Species Management Areas. It also makes a declaration of protected species and

Tanzania's duty to abide by international obligations with regard to species afforded protection through international laws and treaties.

The prime purpose of this Act are:

1. To make better provisions for the conservation, management, protection and sustainable utilization of wildlife and wildlife products
2. To repeal the Wildlife Conservation Act Cap. 283 and
3. To provide for other related matters

Section 74 of the Act states that "A human activity, settlement or any other development that will adversely affect wildlife shall not be permitted within five hundred meters from the wildlife protected area borderline without the permission of the, Director."

*The EIA will consider the extent to which the Project will interact with species that are afforded protection through international laws and treaties. TRC and its contractors will comply with the requirements of this Act where applicable.*

***Employment and Labour Relations Act No. 6 0f 2004***

The Act makes provisions for core labour rights; establishes basic employment standards, provides a framework for collective bargaining; and provides for the prevention and settlement of disputes. The act provides fundamental rights and protection e.g. prohibition of Child Labour, forced labour and discrimination in the workplace. It also sets employment standards.

*TRC shall ensure that recruitment and human resources aspects of the project are adheres to employment standards and requirements set out in this Act.*

***Engineers Registration Act and its Amendments 1997 and 2007***

The Act regulates the engineering practice in Tanzania by registering engineers and monitoring their conduct. It establishes the Engineering Registration Board (ERB). The Law require any foreigner engineer to register with ERB before practicing in the country. Foreign engineers working with this Project shall abide to the law requirements.

*TRC will ensure compliance with this requirement during the recruitment of engineers for Project implementation.*

***The Contractors Registration Act (1997)***

The Contractors Registration Act requires contractors to be registered by the Contractors Board (CRB) before engaging in practice. It requires foreign contractors to be registered by the Board before gaining contracts in Tanzania.

*TRC will ensure compliance with the requirements of this Act during the recruitment of contractors for Project implementation.*

***The HIV and AIDS (Prevention and Control) Act of 2008***

The law provides for public education and programmes on HIV and AIDS. Section 8(1) of the law states that "The Ministry (Health), health practitioners, workers in the public and private sectors and NGOs shall for the purpose of providing HIV and AIDS education to the public, disseminate information regarding HIV and AIDS to the public". Furthermore, Section 9 states that "*Every employer in consultation with the Ministry (Health) shall establish and coordinate a workplace programme on HIV and AIDS for employees under his control and such programmes shall include provision of gender responsive HIV and AIDS education*".

*TRC will develop and implement an HIV/AIDS policy and information document for all workers directly related to the Project.*

***The Industrial and Consumer Chemical (Management and Control) Act, 2002***

The Act provides for among other issues, importation, transportation, storage, use and disposal of chemicals in Tanzania. The contractor is required to obtain certificate from the Chief Government Chemist for importation, storage or disposal of any chemicals (e.g. Asphalt, Lime etc.). Furthermore, Railway Contractor like any other individual dealing with chemical is required to comply with all provisions/regulations regarding packaging, handling, storage, use and disposal of chemicals, as set by the this Act. The minister appoints an inspector from time to time to ensure compliance. Failure to compliance might lead to revocation of the certificate.

*TRC shall engage with the relevant authority (GCLA) too obtain the relevant certificate and ensure that contractors fully comply with the condition of the certificate and the requirements of this Act.*

***The Petroleum Act, 2001***

This act make provisions for Importation, Exportation, Transportation, Transformation, Storage and wholesale and retail distribution of petroleum

products in a liberalized market and to provide for related matters. Section 7 of the act restricts persons/Institutions from performing petroleum supply operations without having obtained a license in accordance with the provision of this act. Section 8 (1) states that "*Prior to the issuance of the license, the applicant must comply with all necessary Environmental requirements as provided for under the Environmental Management Act.*"

*The project is expected to store in camps and transport petroleum products between camps and sites. The Project shall ensure that appropriate licences are acquired for the storage of petroleum products and that transport of these product throughout project implementation complies with the requirement of this Act.*

***The Surface and Marine Transport Regulatory Authority Act Cap 413 (2001)***

This Act establishes a regulatory authority in relation to the surface and marine transport sectors, and to provide for its operation. The Act Requires the Project Proponent to do the following:

- To ensure that he has a valid licence from SUMATRA for transportation business (Part II, Section 6)
- To use fare and rates set by SUMATRA (Part - III, Section 16)
- To understand the existing mechanism for handling Consumer complaints (Part VI)
- To adhere to rules and regulations set by SUMATRA (Part VII, Section 38) - To pay appropriate fees to SUMATRA (Part VIII, Section 14)

***The Railways (Licensing of Railway Operators) Regulations, 2006***

The Regulations requires every operator to have a license in order to carry out the following activities (a) Passenger train service (b) Freight train service (c) Operation and maintenance of rail infrastructure (Part II, Section 6).

***The Tanzania Railways Civil Engineering Manual (1998)***

This manual provides general instructions on what should be done in case of accidents. Chapter 15 provides general instructions to different people, provides guidance on Immediate Actions Required at the Site of Accidents or Obstructions, Protection of the Track at the Site of Accidents; Fire Precautions; Employee Responsibilities; Power to Enter upon Non- Railway Land; Pilferage from Damaged Wagons; Restoration of Traffic; Provision for Staff; Records and Reporting; Watchmen and Precautions Before and During Rains. This manual

therefore covers major components of accident preparedness and response. Details of the manual are presented in Part III of Volume II.

***Antiquities Act (Act No. 10 of 1964) as amended (Act No. 22 of 1979)***

The Antiquities Act is the principal cultural heritage legislation in Tanzania. The purpose of the act is to provide legal statutes for the preservation and protection of sites and articles of palaeontological, archaeological, historical, or natural interest. The act provides legal protection for relics, monuments, and protected objects.

- Relic: any movable object made, shaped, painted, carved, sculptured, inscribed or otherwise produced or modified by human agency before the year 1863, whether or not it shall have been modified, added to, or restored at a later date, and any human or other vertebrate faunal or botanical fossil remains or impressions found in Tanganyika.
- Monument: (i) any building, fortification, internment, midden, dam or structure erected, built, or formed by human agency in Tanganyika before the year 1863; (ii) any rock painting or any immovable object painted, sculptured, carved, incised, or modified by human agency in Tanganyika before the year 1863; and (iii) any earthwork, trench, edit, well, cave, tunnel, or other modification of the soil or rock, dug, excavated, or otherwise engineered by human agency before the year 1863.
- Protected object: an ethnographic object[1] or any wooden door or door frame carved in Tanganyika in any African oriental style, before the year 1940, and includes any object declared to be a protected object.

The Act and its subsequent amendments and implementing rules and regulations establishes the Antiquities Division within the Ministry of Natural Resources and Tourism as the cultural heritage regulator within Tanzania. The act empowers the Director of the Antiquities Division (the Director) to declare any place or structure of historical interest as a monument and acquire monuments and relics in accordance with other applicable legislation such as the Land Acquisition Act. The Director is responsible for listing protected monuments, relics, and objects in the national Gazette.

[1] The 1979 amendment to the National Antiquities Act defines an ethnographic object as any movable object made, shaped, painted, carved, inscribed or otherwise produced or modified by human agency in Tanganyika after the year 1863 for use in any social or cultural activity whether or not it is still being used by any community in Tanganyika, but does not include any object made, shaped, painted, carved, inscribed or otherwise produced or modified by human agency in Tanganyika for sale as a curio.

The Act includes penalties for destroying or damaging protected monuments, relics, and objects listed in the national Gazette or any resource that could reasonably be assumed eligible for protection as a monument, relic, or protected object. The Act also requires any individual or organization that discovers a monument, relic, or protected object to report the discovery to an administrative officer, the Antiquities Division, and the Conservator or the Curator of the National Museum of Tanganyika.

## *3.4 RELEVANT REGULATIONS AND GUIDELINES*

### *The Tanzania 2025 Development Vision*

The Tanzania Vision 2025 aims at achieving a high quality livelihood for its people, attain good governance through the rule of law and develop a strong and competitive economy. Specific targets include:

1. A high quality livelihood characterized by sustainable and shared growth (equity), and freedom from abject poverty in a democratic environment. Specifically the Vision aims at: food self-sufficiency and security, universal primary education and extension of tertiary education, gender equality, universal access to primary health care, 75% reduction in infant and maternal mortality rates, universal access to safe water, increased life expectancy, absence of abject poverty, a well-educated and learning society.
2. Good governance and the rule of law moral and cultural uprightness, adherence to the rule of law, elimination of corruption.
3. A strong and competitive economy capable of producing sustainable growth and shared benefits a diversified and semi-industrialized economy, macro-economic stability, a growth rate of 8% per annum, adequate level of physical infrastructure, an active and competitive player in regional and global markets.

Safe, reliable and cost effective railway transport is one of the most important agents to enable Tanzania achieve its Development Vision objectives (both social and economic), such as eradicating poverty, attaining food security, sustaining biodiversity and sensitive ecosystems. *The implementation of the SGR project contributes to the attainment of the 2025 Vision.*

### *The Explosives Regulations of 1964, GN 56/64*

The Explosives Regulations of 1964, GN 56/64, establish conditions for licensing stores, magazines and general precautions for explosives. They also

stipulate the nature of work that is permissible when blasting, and the requirement that storage places for explosives be at a certain distance from other buildings. A condition on all of the licenses is that the explosives must be stored in a licensed magazine or store or approved storage boxes.

***Land (Assessment of the Value of Land for Compensation) Regulations, 2001***

These regulations provide criteria for the assessment of compensation on land, as per market value for real property; disturbance allowance is calculated as a percentage of market value of the acquired assets over twelve months; and transport allowance calculated at the cost of 12 tons hauled over a distance not exceeding 20 km.

The other criteria includes loss of profit on accommodation based on business audited accounts and accommodation allowance equivalent to the rent of the acquired property per month over a 36 month period.

***Mining (Environmental management and Protection) Regulations, 1999***

These regulations apart from other things give the Minister responsible for mining the mandate to exempt or ask for environmental information during application for mining licence. Section (4) of this regulations states that "*Except in cases where an exemption has been to require EIA granted under section 64 (2) of the Act, an environmental impact statement and environmental management plan must accompany applications for Mineral Rights in all special mining license applications*". These regulations require the contractor to apply for mining license for new borrow pits/quarry sites.

The SGR project will apply for mining licenses for new quarry/borrow pits, and will use licensed suppliers or operators when using existing suppliers.

***Environmental Impact Assessment and Auditing Regulations (2005)***

These regulations set procedures for conducting EIA and environmental audit in the country. The regulations also require EIA and environmental audits to be undertaken by registered EIA and audit experts respectively.

***National Strategy for Growth and Reduction of Poverty (2005)***

One of NSGRP objective is to improve the quality of life and social wellbeing. The Strategy reaffirms that infrastructure development is at the center stage of economic development process. Functioning infrastructure reduces cost of doing business, attracts private investment, enables production and service

delivery, links markets, and helps sustain improvement of the quality of life through redistribution of wealth. Infrastructure augments factors of production in enhancing economic growth by increasing the productivity of labour and capital thereby raising profitability, production, income and employment. Thus, critical infrastructures (including railways) will continue to be priority areas for rapid economic growth and development. The strategy will also ensure that the health facilities are improved and accessible and drugs are made available throughout the year (NSGRP, 2003).

***The Environmental Management (Air Quality Standards) Regulations, 2007***

The objectives of these regulations are to set baseline parameters on air quality and emissions and enforce minimum air quality standards. They are also meant to help developers including industrialists to keep abreast with environmentally friendly technologies and ensure that the public health as well as the environment is protected from various air pollution emissions sources. These Regulations stipulate the role and powers of the National Environmental Standards Committee. According to the regulations, the approval of a permit for emission of air pollutants shall be guided by ambient, receptor, emission and specification standards approved by the Minister. Offences and penalties for contraveners are also provided for in the regulations.

Emission limits of sulphur and nitrogen dioxides, carbon monoxide, lead, ozone, black smoke and suspended particulate matter together with their test methods are specified. Tolerance limits and test methods for dust, sulphur dioxide and nitrogen oxides from cement factories into the air as well as from motor vehicles are also given.

***The Environmental Management (Water Quality Standards) Regulations, 2007***

Among others, the object of the regulations is to enforce minimum water quality standards prescribed by the National Environmental Standards Committee, enable the National Environmental Standards Committee to determine water usages for purposes of establishing environmental quality standards and values for each usage and ensure all discharges of pollutants take into considerations the ability of the receiving water to accommodate contaminants for protection of human health and conservation of marine and aquatic environments. The Regulations elucidate the role of the National Environmental Standards Committee of Tanzania Bureau of Standards in setting minimum quality standards for water, sewerage, etc. They also give prohibitions and prescribed minimum water quality standards. The applicant of water right is obliged to indicate the likely impact on the environment and comply with prescribed

effluent or receiving water standards, which are not below the standards specified in these regulations if the water right or permit is granted.

The regulations give NEMC the power to designate main water polluting activities for which prior grant of permit must be obtain from the Council. It can be observed from the regulations that, the NEMC plays a crucial role in water quality compliance and enforcement. Recording and reporting requirements, Offences and penalties for non-compliance as well as how appeals against aggrieved decisions should be handled are stipulated.

***Solid Waste Management Regulations, 2009 GN. NO. 263***

- The regulation has been made under section 114, 115, 116, 117, 118, 119, 120, 121, 122 and 230 of Environmental Management Act, 2004. These regulations apply to all matter pertaining to solid waste management. They aimed among other things at setting standard for permit to dispose solid waste and license to own or operate solid waste disposal site.

***The Environmental Management Regulations (Hazardous Waste Control), 2009***

These regulations have been made under section 110(4) and (5), 128, 133 (4), 135 and 130 of the Environmental Management Act, 2004. These regulations apply to all categories of hazardous waste and from generation, storage, disposal and their movement into and out of mainland Tanzania. These regulations require that any person dealing with hazardous waste in Tanzania be guided by following principles of environment and sustainable development:

- The precautionary principle
- Polluter pays principle, and
- The producer extended responsibility

***Environmental Management (Soil quality standards) Regulations (2007)***

These Regulations require the project proponent:

- To comply with soil quality standards that may be prescribed by the National Environmental Standards Committee (Part II, Section 5).
- To abstain from polluting soils (Part III, Section 15)
- To abstain from discharging hazardous, waste, materials and chemicals on soils (Part III, Section 16)

***Environmental management (Quality Standards for Control of Noise and Vibration Pollution) Regulations (2011)***

These Regulations require the project proponent to:

- Make or cause to be made any loud, unreasonable, unnecessary or unusual noise that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and that of the environment (Part III, Section 6).
- Use the best practicable means to ensure that the emission of noise from that machinery, facility or premises does not exceed the permissible noise levels as specified in Schedule 1 (Part V, Section 8).

***Environmental Management (Fees and Charges) (amendment) Regulations (2018)***

These Regulations require the project proponent to pay prescribed fees and charges that NEMC is mandated to impose on the developer.

## *3.5 WORLD BANK OPERATIONAL POLICIES*

The World Bank Environmental and Social Safeguard Policies are:

- Environmental Assessment (OP4.01, BP 4.01, GP 4.01)
- Natural Habitats (OP 4.04, BP 4.04, GP 4.04)
- Forestry (OP 4.36, GP 4.36)
- Pest Management (OP 4.09)
- Physical Cultural Resources (OP 4.11)
- Indigenous Peoples (OP 4.10)
- Involuntary Resettlement (OP/BP 4.12)
- Safety of Dams (OP 4.37, BP 4.37)
- Projects on International Waters (OP 7.50, BP 7.50, GP 7.50)
- Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)

For the SGR project, safe guard policies triggered are shown in *Table 3-1*.

*Table 3-1 Triggered World Bank Safeguard Policies*

| Safeguard Policies Triggered by the Project | Yes | No |
|---|---|---|
| Environmental Assessment (OP/BP/GP 4.01) | [x] | [ ] |
| Natural Habitats (OP/BP 4.04) | [x] | [ ] |
| Pest Management (OP 4.09) | [ ] | [x] |
| Cultural Property ( OP 4.11) | [x] | [ ] |
| Involuntary Resettlement (OP/BP 4.12) | [x] | [ ] |
| Indigenous Peoples (OP 4.10) | [x] | [ ] |
| Forests (OP/BP 4.36) | [x] | [ ] |
| Safety of Dams (OP/BP 4.37) | [ ] | [x] |
| Projects in Disputed Areas (OP/BP/GP 7.60) | [ ] | [x] |
| Projects on International Waterways (OP/BP/GP 7.50) | [ ] | [x] |

***OP 4.01 Environmental Assessment***

The Bank requires environmental assessment (EA) of projects proposed for Bank support to ensure that they are environmentally sound and sustainable, and thus to improve decision-making. EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, sitting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. EA takes into account the natural environment (air, water and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples and physical cultural resources); and trans-boundary and global environmental aspects. The borrower is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements. The Bank classifies the projects into three major categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

- **Category A**: The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.
- **Category B**: The proposed project's potential adverse environmental impacts on human population or environmentally important areas-

including wetlands, forests, grasslands, or other natural habitats- are less adverse than those of "Category A" projects. These impacts are site specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than Category A projects.

- **Category C**: The proposed project is likely to have minimal or no adverse environmental impacts.

In accordance with World Bank policies, the proposed SGR project falls under **Category A** that entails a comprehensive environmental and social study.

***OP 4.04 Natural Habitats***

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

Following findings from baseline study, the SGR route passes through five ecoregions defined by WWF. Starting from the east, these are: Northern Zanzibar-Inhambane Coastal Forest Mosaic; Eastern Miombo Woodlands; Zambezian Flooded Grasslands; and Southern Acacia-Commiphora Bushlands and Thicket. In addition, The IUCN has compiled a global map of Key Biodiversity Areas (KBA), which include Important Bird and Biodiversity Areas (IBAs) and Alliance for Zero Extinction (AZE) Sites. An analysis of the project area reveals that all IBAs and AZE sites in the proximity of the project correspond to various gazetted protected areas, and mostly overlap with one another. This triggers OP 4.04.

***OP 4.12 Involuntary Resettlement***

Bank's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production systems are dismantled; people face impoverishment when their productive assets or income sources are lost;

people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks.

As stated in 3.5.2 above, the new railway curvature has necessitated acquisition of more land along the entire corridor from Dar es Salaam-Morogoro - Makutupora. Therefore, some people will be resettled and their property affected. This triggers OP 4.12.

***OP 4.10 Indigenous Peoples***

This policy contributes to the Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects the dignity, human rights, economies, and cultures of Indigenous Peoples. For all projects that are proposed for Bank financing and affect Indigenous Peoples, the Bank requires the borrower to engage in a process of free, prior, and informed consultation. The Bank provides project financing only where free, prior, and informed consultation results in broad community support to the project by the affected Indigenous Peoples. Such Bank-financed projects include measures to (a) avoid potentially adverse effects on the Indigenous Peoples' communities; or (b) when avoidance is not feasible, minimize, mitigate, or compensate for such effects. Bank-financed projects are also designed to ensure that the Indigenous Peoples receive social and economic benefits that are culturally appropriate and gender and intergenerational inclusive.

Moreover, the Bank recognizes that the identities and cultures of Indigenous Peoples are inextricably linked to the lands on which they live and the natural resources on which they depend. These distinct circumstances expose Indigenous Peoples to different types of risks and levels of impacts from development projects, including loss of identity, culture, and customary livelihoods, as well as exposure to disease.

Topics related with Indigenous Peoples are detailed in Section 4.3.

***OP 4.10 Cultural Property***

The United Nations term "cultural property" includes sites having archaeological (prehistoric), paleontological, historical, religious, and unique natural values. Cultural property, therefore, encompasses both remains left by

previous human inhabitants (for example, shrines, and battlegrounds) and unique natural environmental features such as canyons and waterfalls. The rapid loss of cultural property in many countries is irreversible and often unnecessary. The World Bank's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. The Bank would normally decline to finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage. The Bank will also assist in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance.

In some cases, the project is best relocated in order that sites and structures can be preserved, studied, and restored intact in situ. In other cases, structures can be relocated, preserved, studied, and restored on alternate sites. Often, scientific studies, selective salvage, and museum preservation before destruction is all that is necessary. Most such projects should include the training and strengthening of institutions entrusted with safeguarding a nation's cultural patrimony. Such activities should be directly included in the scope of the project, rather than being postponed for some possible future action, and the costs are to be internalized in computing overall project costs.

The main cultural property that will be infringed SGR project, are the graveyards. There are several spot locations where the railway passes through private and public graveyards such as Gongo la Mboto and FFU in Dar es Salaam Region; Pugu in Coast Region; Ihumwa, Mnase and Kigwe in Dodoma Region. In this case, the OP 4.11 is triggered.

***OP 4.36 Forests***

The management, conservation, and sustainable development of forest ecosystems and their associated resources are essential for lasting poverty reduction and sustainable development, whether located in countries with abundant forests or in those with depleted or naturally limited forest resources. The objective of the Bank's policy is to assist borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests. Where forest restoration and plantation development are necessary to meet these objectives, the Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank also assists borrowers with the establishment and sustainable management of environmentally appropriate, socially beneficial, and economically viable forest plantations to help meet growing demands for forest goods and services.

The current railway and the proposed SGR route passes traverses through the Pugu Hills and South Ruvu Forest Reserves. There are a number of larger protected areas in the greater vicinity, which potentially influences the biodiversity affected by the route. The SGR project passes through the northern border of the Kazimzumbwi gazetted Forest Reserve, in the Pugu area of the Kisarawe District, Coast Region. The Project will acquire some land from Forest Reserves. Thus, OP 4.36 (Forests) is triggered by the project activities.

## *3.6 IFC ENVIRONMENTAL, HEALTH AND SAFETY (EHS) GUIDELINES*

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The EHS Guidelines contain the performance levels and measures that are generally considered achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines are meant to be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, assimilative capacity of the environment, and other project factors, are taken into account. The applicability of specific technical recommendations will be based on the professional opinion of qualified and experienced persons. This ESIA study is in line IFC EHS guidelines requirements.

## *3.7 ENVIRONMENTAL, HEALTH, AND SAFETY GUIDELINES FOR RAILWAYS*

The EHS Guidelines for Railways are applicable to activities typically conducted by rail infrastructure operators dedicated to passenger and freight transport. The document is organized into two main areas, namely rail operations, covering construction and maintenance of rail infrastructure as well as operation of rolling stock, such as locomotives and rail cars; and, locomotive maintenance activities, including engine services, and other mechanical repair and maintenance of locomotives and railcars.

The guideline provides additional health and safety issues specific to railway operations (not addressed in general EHS guideline) include the following Rail operational safety, transport of dangerous goods, level crossing safety and pedestrian safety, train/worker accidents, noise and vibration, diesel exhaust, fatigue, electrical hazards, electric and magnetic fields.

It also provides community health and safety impacts during the construction, rehabilitation, and maintenance of railways. These impacts include, among others, dust, noise, and vibration from construction vehicle transit, and communicable diseases associated with the influx of temporary construction labour.

The guideline also provides performance indicators and monitoring guideline for both environment and occupational health and safety.

### *3.8 IFC EHS GUIDELINES FOR CONSTRUCTION MATERIALS EXTRACTION*

This guideline includes information relevant to construction materials extraction activities such as aggregates, limestone, slates, sand, gravel, clay, gypsum, feldspar, silica sands, and quartzite, as well as to the extraction of dimension stone. It addresses stand-alone projects and extraction activities supporting construction, civil works, and cement projects.

The guideline also provides a summary of EHS issues associated with construction materials extraction that occur during the operational, construction, and decommissioning phases, along with recommendations for their management.

It also provide community health and safety issues specific to construction materials extraction projects primarily including land instability, water, explosives safety and decommissioning. Additional potential risks to community health and safety include risks from uncontrolled access to construction sites, exposure to waterborne, water-washed, and water-associated diseases from creation of water impoundments, and exposure to increased traffic of materials transport vehicles.

The guideline also provides performance indicators and monitoring guideline for both environment and occupational health and safety.

### *3.9 IFC AND EBRD WORKERS' ACCOMMODATION: PROCESSES AND STANDARDS*

This guidance note looks at the provision of housing or accommodation for workers by employers and the issues that arise from the planning, construction and management of such facilities.

Generally, workers are housed by their employers in cases where, either the number or the type of workers required cannot be sourced from or accommodated within local communities. Thus, provision of workers' accommodation is often associated with the importation of an external

workforce into an area. This can occur because the local labour supply or skills base is inadequate, because the workers are simply not available due to the remote location of the worksite or the particular skills required or because migrant workers due to the nature of the work or the working conditions can only satisfy labour requirements.

Provision of worker housing may relate to a temporary phase of a project (for example an exploration or construction camp) or may be more permanent (for example a factory dormitory or plantation camp). Depending on the type of accommodation, there are a range of considerations relating to both the living conditions of the workers themselves, and to the impact that workers' housing facilities may have on surrounding communities.

Both the EBRD and IFC apply environmental and social performance standards in relation to their investments that include provisions on labour and working conditions. The EBRD has included a specific provision in its Environmental and Social Policy addressing workers' accommodation; paragraph 16 of Performance Requirement 2 (PR2) stipulates: *"Where a client provides accommodation for workers, the accommodation shall be appropriate for its location and be clean, safe and, at a minimum, meet the basic needs of workers. In particular, the provision of accommodation shall meet national legislation and international good practice in relation, but not restricted, to the following: the practice for charging for accommodation; the provision of minimum amounts of space for each worker; provision of sanitary, laundry and cooking facilities and potable water; the location of accommodation in relation to the workplace; any health, fire safety or other hazards or disturbances and local facilities; the provision of first aid and medical facilities; and heating and ventilation. Workers' freedom of movement to and from the employer-provided accommodation shall not be unduly restricted."*

IFC Performance Standard 2 (PS2) aims to promote "safe and healthy working conditions, and to protect and promote the health of workers." This covers living conditions as well when these are the responsibility of employers. IFC Guidance Note 2 on Labour and Working Conditions specifically mentions the potential danger of forced labour when housing is provided to workers in lieu of payment or where inappropriate charges for housing are levied.

## *3.10 INTERNATIONAL FINANCE CORPORATION'S (IFC) SUSTAINABILITY FRAMEWORK*

The IFC's Sustainability Framework articulates the Corporation's strategic commitment to sustainable development, and is an integral part of IFC's approach to risk management. The Sustainability Framework comprises IFC's Policy and Performance Standards on Environmental and Social Sustainability. The Policy on Environmental and Social Sustainability describes IFC's

commitments, roles, and responsibilities related to environmental and social sustainability. The Performance Standards are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced. IFC uses the Sustainability Framework along with other strategies, policies, and initiatives to direct the business activities of the Corporation in order to achieve its overall development objectives. Together, there are eight established Performance Standards that the client is to meet throughout the life of an investment by IFC, these are;

- *Performance Standard 1*: Assessment and Management of Environmental and Social Risks and Impacts
- *Performance Standard 2*: Labour and Working Conditions
- *Performance Standard 3*: Resource Efficiency and Pollution Prevention
- *Performance Standard 4*: Community Health, Safety, and Security
- *Performance Standard 5*: Land Acquisition and Involuntary Resettlement
- *Performance Standard 6*: Biodiversity Conservation and Sustainable
- Management of Living Natural Resources
- *Performance Standard 7*: Indigenous Peoples
- *Performance Standard* 8: Cultural Heritage

The IFC Performance Standards (PS) that are relevant or will be triggered by the proposed SGR project includes PS1, PS2, PS3, PS4, PS5, PS6, PS7 and PS8.

(i) ***Performance Standard 1 (PS1):*** Assessment and Management of Environmental and Social Risks and Impacts. This requires a thorough environmental and social assessment that includes undertaking adequate stakeholder engagement and disclosure of project information. The PS1 is consistent with the national legal requirement in Tanzania that requires all projects to pass through an Environmental Impact Assessment process. According to the Environmental Management Act of 2004 (Cap. 191), it is mandatory to conduct Environmental and Social Impact Assessment (ESIA) for all development projects to be implemented in Tanzania. The law also

establishes system for environmental and social impact assessment system and administration that includes screening of projects, guidelines to conduct ESIA; review, monitoring etc. The law gives mandate to the National Environment Management Council (NEMC) to oversee ESIA process administration and give certification and relevant condition on project implementation. This ESIA study is undertaken in line with Tanzanian legal requirements.

(ii) ***Performance Standard 2 (PS2):*** Labour and Working Conditions: The PS2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. IFC believes that for any business, the workforce is a valuable asset, and a sound worker-management relationship is a key ingredient in the sustainability of a company. Failure to establish and foster a sound worker-management relationship can undermine worker commitment and retention, and can jeopardize the project. The applicability of PS2 is established during the environmental and social risks and impacts identification process in PS1. According to IFC, the implementation of the actions necessary to meet the requirements of PS2 is managed through the client's Environmental and Social Management System (ESMS).
In Tanzania, there are three principal legislations that address the issues of labour and work conditions, these are; (i) Occupation Safety and Health Act (2003) (ii) Employment and Labour Relations Act No. 6 of 2004; and (iii) Workers Compensation Scheme Act No. 20 of 2008. The legislation ensures that the workers are treated well and that their rights are protected including the right to work in a healthy environment. It also includes other issues pertaining to working hours, remuneration schemes, prohibition of child labour etc. All these issues have been addressed in the ESIA Report.

(iii) ***Performance Standard 3 (PS3):*** Resource Efficiency and Pollution Prevention: IFC recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. There is also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. At the same time, more efficient and effective resource use and pollution prevention and GHG emission avoidance and mitigation technologies and practices have become more accessible and achievable in virtually all parts of the world. These are often implemented through continuous improvement methodologies similar to those used to enhance quality or productivity, which are generally well known to most industrial, agricultural, and service sector companies. The applicability of PS3 is established during the environmental

and social risks and impacts identification process in PS1. According to IFC, the implementation of the actions necessary to meet the requirements of PS3 is managed through the client's Environmental and Social Management System (ESMS).

In Tanzania, there are several legislation which address the issues of resources use efficiency and pollution prevention. These include;

- The Environmental Management Act of 2004 – Carrying out ESIA, dealing with pollution issues; waste management, environmental standards, etc.;
- The Water Resources Management Act No. 11 of 2009 – issues water quality and sanitation;
- Public Health Act 2009 – issues of control of communicable diseases and ensuring hygienic handling of food in market places;
- The Environmental Management (Air Quality Standards) Regulations, 2007;
- The Environmental Management (Water Quality Standards) Regulations, 2007;
- Solid waste Management Regulation, 2009 GN. NO. 263 - addresses issues of solid waste management; and
- The Environmental Management Act (Hazardous Waste Control), 2009.

The ESIA for the SGR shall respond to the requirements of these legislations. In addition, Tanzania is a signatory to several international treaties and conventions including climate change. The ESIA shall also respond to relevant international aspects of the project in respect to environmental and social sustainability.

(iv) ***Performance Standard 4 (PS4):*** Community Health, Safety, and Security. The PS4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to project activities. While acknowledging the public authorities' role in promoting the health, safety, and security of the public, PS4 addresses the investor's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related activities, with particular attention to vulnerable groups. The implementation of the actions necessary to meet the requirements of PS4 is managed through the client's Environmental and Social Management System (ESMS).

In Tanzania, the EIA and Audit Regulations (2005), will require project development to take appropriate actions and mitigation measures to ensure that the project is safe to the workers and the surrounding communities during mobilization, construction and operation phases of the project. In addition, the PS4 will be complied to through adhering to the requirements of other relevant legislation such as;

- The HIV and AIDS (Prevention and Control) Act of 2008 - control of HIV/AIDS spread in Tanzania;
- Public Health Act 2009 – issues of control of communicable diseases and ensuring hygienic handling of food in market places;
- Occupation Safety and Health Act (2003) - health and safety during construction and operation phases; and
- National Gender Policy (2002).

(v) ***Performance Standard 5 (PS5):*** Land Acquisition and Involuntary Resettlement.

Performance Standard 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood1) as a result of project-related land acquisition and/or restrictions on land use. Resettlement is considered involuntary when affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in physical or economic displacement. This occurs in cases of (i) lawful expropriation or temporary or permanent restrictions on land use and (ii) negotiated settlements in which the buyer can resort to expropriation or impose legal restrictions on land use if negotiations with the seller fail.

Unless properly managed, IFC recognises that involuntary resettlement may result in long-term hardship and impoverishment for the Affected Communities and persons, as well as environmental damage and adverse socio-economic impacts in areas to which they have been displaced. For these reasons, involuntary resettlement should be avoided. However, where involuntary resettlement is unavoidable, it should be minimized and appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.

The applicability of PS5 is established during the environmental and social risks and impacts identification process in PS1. According to IFC, the implementation of the actions necessary to meet the requirements of PS3 is managed through the client's Environmental and Social Management System (ESMS). According to IFC, the PS5 applies to physical and/or economic displacement resulting from the following types of land related transactions:

- Land rights or land use rights acquired through expropriation or other compulsory procedures in accordance with the legal system of the host country in question;
- Land rights or land use rights acquired through negotiated settlements with property owners or those with legal rights to the land if failure to reach settlement would have resulted in expropriation or other compulsory procedures
- Project situations where involuntary restrictions on land use and access to natural resources cause a community or groups within a community to lose access to resource usage where they have traditional or recognizable usage

rights Certain project situations requiring evictions of people occupying land without formal, traditional, or recognizable usage rights; or Restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas.

In Tanzania, the EMA (2004) and EIA and Audit Regulations (2005), require project development to take appropriate actions and mitigation measures to avoid or minimize resettlement. Where resettlement is necessary, authorized valuation and proper compensation procedures must be executed in accordance with the law. Among the applicable legislation include:

- Land (Assessment of the Value of Land for Compensation) Regulations, 2001;
- The Land Acquisition Act 1967;
- Local Government Laws (Miscellaneous Amendment) Act, 2006;
- Land Use Planning Act (2007);
- The Land Act No. 4 of 1999 and the Village Land Act No. 5 of (1999);
- National Human Settlements Development Policy (2000); and
- National Land Policy (1995).

(vi) ***Performance Standard 6 (PS6):*** Biodiversity Conservation and Sustainable Management of Living Natural Resources

The PS6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems." The ecosystem services are the benefits that people, including businesses, derive from ecosystems. Ecosystem services are organized into four types: (i) provisioning services, which are the products people obtain from ecosystems; (ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes; (iii) cultural services, which are the nonmaterial benefits people obtain from ecosystems; and (iv) supporting services, which are the natural processes that maintain the other services. Ecosystem services

valued by humans are often underpinned by biodiversity. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services.

The PS6 categorizes environment into three habitats which are (i) modified habitat, (ii) natural habitat and (iii) critical habitats.

- Modified habitats are areas that may contain a large proportion of plant and/ or animal species of non-native origin, and/ or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands. This Performance Standard applies to those areas of modified habitat that include significant biodiversity value, as determined by the risks and impacts identification process required in Performance Standard 1.
- Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
- Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered11 species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregator species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

The applicability of this PS6 is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System (ESMS), the elements of which are outlined in Performance Standard 1. Based on the risks and impacts identification process, the requirements of this Performance Standard are applied to projects (i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry). The IFC PS6 recognises critical habitats based on certain types of protected areas. Gazetted protected areas that are classified by the IUCN as Management Category I and II, and internationally recognised areas that are recognised by the IUCN as Key Biodiversity Areas

(KBAs) qualify as critical habitat. Various protected areas and KBAs are also described. Based on the above criteria, the following gazetted protected areas and KBAs that are potentially impacted by the project and qualify as critical habitat features. These include Pugu Hills Forest Reserve and Ruvu South Forest Reserve (which together form the Kisarawe District Coastal Forest IBA), Uluguru Nature Reserve, AZE site and IBA Mikumi National Park. PS6 is therefore triggered by the proposed SGR.

However, in Tanzania, there are several applicable legislation to protect biodiversity apart from Tanzania being a signatory to the 1992 Rio Convention on Biodiversity Diversity. Among the applicable legislation include:

- National Land Policy (1995);
- The Wildlife Policy of Tanzania (2007);
- National Agricultural Policy (2013);
- National Forestry Policy (1998);
- The National Water Policy (2002);
- National Human Settlements Development Policy (2000);
- Environmental Management Act No. 20 of (2004), Cap. 191;
- The Wildlife Conservation Act No 5/09 of 2009;
- National Forest Act, 2002;
- The Environmental Management (Water Quality Standards) Regulations, 2007;
- Environmental Impact Assessment and Auditing Regulations (2005);
- The Water Resources Management Act No. 11 of 2009; and
- National Environmental Policy (NEP) of 1997.

(vii) Performance Standard 8 (PS5): Cultural Heritage

Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

For the purposes of this Performance Standard, cultural heritage refers to (i) tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls;
and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles

The applicability of this PS8 is established during the environmental and social risks and impacts identification process. The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System (ESMS), the elements of which are outlined in Performance Standard 1. During the project life-cycle, the client will consider potential project impacts to cultural heritage and will apply the provisions of this Performance
Standard.

In addition to complying with applicable law on the protection of cultural heritage, including national law implementing the host country's obligations under the Convention Concerning the Protection of the World Cultural and Natural Heritage, the host country will identify and protect cultural heritage by ensuring that internationally recognized practices for the protection, field-based study, and documentation of cultural heritage are implemented.

In Tanzania, the EMA (2004) and EIA and Audit Regulations (2005), require project development to take appropriate actions and mitigation measures to avoid or minimize impacts to cultural resources. Among the applicable legislation, having bearing on cultural resources includes:

- The antiquities Act Cap 333 of 2002 and the Antiquities Rules of 1990;
- The Grave (Removal Act), 1968;
- The land (Assessment of the Value of Land for Compensation) Regulations, 2000;
- The compensation and Resettlement Guideline (CRG)-February 2008; and
- The Land Act No. 4 of 1999 and the Village Land Act No. 5 of (1999).

## 3.11 INTERNATIONAL CONVENTIONS

### *United Nations Framework Convention on Climate Change (1992)*

The objective of UNFCCC is to stabilize the concentration of greenhouse gas (GHG) in the atmosphere, at a level that allows ecosystems to adapt naturally and protects food production and economic development. The project shall use fossil fuels during construction. Since Tanzania is a Party to the UNFCCC the Project Proponent shall endeavour to minimise the generation of greenhouse gases (GHG). ILO Convention: C138 Minimum Age Convention, 1973 The United Republic of Tanzania ratified the Convention on 16:12:1998. It prohibits Child labour. The Project Proponent shall ensure no child is employed in the project activities.

### *ILO Convention: C182 Worst Forms of Child Labour Convention, 1999*

Ratified by United Republic of Tanzania on 12:09:2001; The Project Proponent shall ensure no child is employed in the project activities.

### *Convention on Biological Diversity (Rio de Janeiro 1992)*

This Convention, which calls for the sustainable use biological diversity, was ratified by Tanzania in 1996. Tanzania is a country with rich diversity. The Project Proponent shall ensure that no endemic or threatened species in the project corridor that will be impacted. Furthermore, best practices of flora and fauna protection will be observed by contactors.

### *Convention in International Trade in Endangered Species (CITES), 1973*

The CITES of Wild Fauna and Flora, also known as the Washington Convention) is a multilateral treaty to protect endangered plants and animals. It was drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). Tanzania ratified it in 09/12/2004. The Project Proponent will cooperate with designated authority to make sure that no trading in endangered species throughout the project phase.

### *Montreal Protocol on the Substances Depleting Ozone Layer, 1987*

This is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion. Tanzania accessed this protocol on 07.04.1993 and has ratified several of its amendments. While TRC will ensure no ODS are used in its

activities e.g. in refrigerators, Air Conditioners etc., it will cooperate with designated authority to make sure that ODS are not imported in the country illegally.

***ILO C148, Working Environment (Air Pollution, Noise and Vibrations) Convention, 1977***

The convention was ratified by Tanzania in 1984. It aims at ensuring safe working environment for workers. The implementation of project will ensure that it prevents the exposure of its workers and the public from any occupational hazards by providing appropriate security and safety equipment.

## *3.12 INSTITUTIONAL FRAMEWORK*

***Overall Management Responsibility***

The institutional arrangement for environmental management in Tanzania is well spelt out in the EMA (2004). There are seven (7) institutions mentioned by the act, of which the Minister Responsible for the Environment is the overall in-charge for administration of all matters relating to the environment.

Part III, Section 13(1) of EMA (2004) states that the Minister responsible for environment shall be the overall in charge of all matters relating to the environment and shall in that respect be responsible for articulation of policy guidelines necessary for the promotion, protection and sustainable management of environment in Tanzania.

The legal institutions for environmental management in Tanzania include:

- National Environmental Advisory Committee;
- Minister responsible for Environment;
- Director of Environment;
- National Environment Management Council (NEMC);

### *3.12.1 National Environmental Advisory Committee*

The National Advisory Environmental Committee is comprised of members with experience in various fields of environmental management in the public and private sector and in civil society. The committee advises the Minister on any matter related to environmental management.

Relevance: Technical Advisory Committee (TAC) review and advice the minister regarding this EIA if it complies with the law.

### *3.12.2 Minister Responsible for Environment*

The Minister is responsible for matters relating to environment, including giving policy guidelines necessary for the promotion, protection and sustainable management of the environment in Tanzania. The Minister approves an EIA and may delegate the power of approval for an EIA to the DoE, Local Government Authorities or Sector Ministries.

Relevance: Shall issue certificate for this EIA.

### *3.12.3 Director of Environment*

The Director of Environment heads the Office of the Director of Environment and is appointed by the President of the United Republic of Tanzania.

Relevance: TAC review and advice the minister regarding this EIA if it complies with the law.

### *3.12.4 National Environment Management Council (NEMC)*

The NEMC's purpose and objective is to undertake enforcement, compliance, review and monitoring of EIA's and to facilitate public participation in environmental decision-making.

Relevance: Register and oversee the whole EIA process; Controls the implementation of the Environmental Management Plan (EMP) during and after construction of the SGR; Monitors the effects of activities on the environment during & after construction and during operation.

### *3.12.5 The Overall Management of the Project*

From an institutional point of view, TRC has the following responsibilities:

- Project concept, EIA study, project implementation
- Day-to-day environmental management and monitoring
- Environmental auditing.

*Table 3-2 Project Permitting Plan*

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| **Environmental** | | | | | |
| Environmental Certificate | NEMC | TRC | Prior to construction | 8 April 2019 | Obtained |
| Permit to construct railway in forest reserve | TFS | TRC | Prior to construction | Ongoing | TRC have prepared letter for submission to TFS |
| **Water and boreholes** | | | | | |
| Surface water for dust control (Kibaha) | Soga Ward office | Yapi Merkezi | Prior to construction | 07 July 2018 | Obtained/Not Applicable |
| Permit to sink borehole (KM201 – Lukobe) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 05 October 2018 | 21300081 |
| Permit to sink borehole (KM211 – Kimambila) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 05 October 2018 | 21300038 |
| Permit to sink borehole (KM215 – Kimambila) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 05 October 2018 | 21300072 |
| Permit to sink borehole (KM229 – Mkata) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 05 October 2018 | 21300062 |
| Permit to sink borehole (KM241 – Kimamba) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 05 October 2018 | 21300073 |
| Permit to sink borehole (KM249 – Kimamba) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 05 October 2018 | 21300080 |
| Permit to sink borehole (KM265 - Main Gate) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 05 October 2018 | 21300039 |
| Permit to sink borehole (KM265 - Minazi – WTP) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 05 October 2018 | 21300037 |
| Water use permit (KM201 – Lukobe) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | 25 January 2019 | 21101231 |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| Water use permit (KM211 – Kimambila) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | 21 December 2018 | 21100750 |
| Water use permit (KM215 – Kimambila) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | 21 December 2018 | 21100755 |
| Water use permit (KM229 – Mkata) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | 21 December 2018 | 21100754 |
| Water use permit (KM241 – Kimamba) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | 21 December 2018 | 21100752 |
| Water use permit (KM249 – Kimamba) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | 25 January 2019 | 21101232 |
| Water use permit (KM260 – Chanzuru) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | 25 January 2019 | 21101232 |
| Water use permit (KM265 - Main Gate) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | In progress | Applied/In progress |
| Water use permit (KM265 - Minazi ) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | 04.02.2019 | 21101233 |
| Water use permit (KM424 – Uhumwa-2) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | In progress | Applied/In progress |
| Water use permit (KM424 – Uhumwa-4) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to construction | In progress | Applied/In progress |
| Borehole Permit (Soga) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 05 November 2018 | 21300067 |
| Surface Water Use Permit (Soga) | Kibaha District Office | Yapi Merkezi | Prior to construction | 12 February 2019 | 21101406 |
| Surface Water Use Permit (Soga) | Kibaha District Office | Yapi Merkezi | Prior to construction | 12 February 2019 | 21101415 |
| Surface Water Use Permit (Soga) | Kibaha District Office | Yapi Merkezi | Prior to construction | 12 February 2019 | 21101417 |
| Surface Water Use Permit (Soga) | Kibaha District Office | Yapi Merkezi | Prior to construction | 12 February 2019 | 21101420 |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| Surface Water Use Permit (Soga) | Kibaha District Office | Yapi Merkezi | Prior to construction | 12 February 2019 | 21101406 |
| Borehole Permit (Ilala) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 12 February 2019 | 21101418 |
| Borehole Permit (Ilala) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 12 February 2019 | 21101422 |
| Borehole Permit (Lugoba) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 12 February 2019 | 21101416 |
| Mikese Water Use | Mikese Village Executive Office | Yapi Merkezi | Prior to well drilling | 12 February 2019 | Obtained/Not Applicable |
| Borehole Permit (Ngerengere) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 12 February 2019 | 21101419 |
| Borehole Permit (Ngerengere) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 12 February 2019 | 21101421 |
| Borehole Permit (Ngerengere) | Wami/Ruvu Basin Water Board | Yapi Merkezi | Prior to well drilling | 12 February 2019 | 21101423 |
| Water use permit (Mikese village) | Mikese Village Executive Office | Mota Engil | Prior to construction | 27 March 2018 | Letter dated 27 March 2018 |
| Surface water use permit (Kinonko 145+800) | Kinonko Village Executive Office | Mota Engil | Prior to construction | 27 March 2018 | Letter dated 27 March 2018 |
| Surface water use permit (Kinonko 148+600) | Kinonko Village Executive Office | Mota Engil | Prior to construction | 12 April 2018 | Letter dated 12 April 2018 |
| Surface water use permit (Kinonko 150+560) | Kinonko Village Executive Office | Mota Engil | Prior to construction | 01 February 2018 | Letter dated 01 March 2018 |
| Surface water use permit (Kinonko 150+600) | Kinonko Village Executive Office | Mota Engil | Prior to construction | 21 March 2018 | Letter dated 21 March 2018 |
| Surface water use permit (Kinonko 152+400) | Kinonko Village Executive Office | Mota Engil | Prior to construction | 09 May 2018 | Letter dated 09 May 2018 |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| **Hydroseeding** | | | | | |
| Cenchrus Ciliaris Import Permit | Ministry of Agriculture Food Security and Cooperatives | Yapi Merkezi | Prior to slope rehabilitation | 09 April 2018 | 9749 |
| Chlorys Gayana Import Permit | Ministry of agriculture food security and cooperatives | Yapi Merkezi | Prior to slope rehabilitation | 09 April 2018 | 9753 |
| Cynodon Dicatylon Import Permit | Ministry of Agriculture food security and cooperatives | Yapi Merkezi | Prior to slope rehabilitation | 09 April 2018 | 9748 |
| Erograstis Tef Import Permit | Ministry of agriculture food security and cooperatives | Yapi Merkezi | Prior to slope rehabilitation | 09 April 2018 | 9752 |
| Erograstis Curvula Import Permit | Ministry of agriculture food security and cooperatives | Yapi Merkezi | Prior to slope rehabilitation | 09 April 2018 | 9750 |
| Panicum Maximum Import Permit | Ministry of agriculture food security and cooperatives | Yapi Merkezi | Prior to slope rehabilitation | 09 April 2018 | 9751 |
| Cenchrus Ciliaris Import Permit | Tanzania Official Seeds Certification Institute (TOSCI) | Yapi Merkezi | Prior to slope rehabilitation | 29 March 2018 | 2186 |
| Chlorys Gayana Import Permit | Tanzania Official Seeds Certification Institute (TOSCI) | Yapi Merkezi | Prior to slope rehabilitation | 29 March 2018 | 2190 |
| Cynodon Dicatylon Import Permit | Tanzania Official Seeds Certification Institute (TOSCI) | Yapi Merkezi | Prior to slope rehabilitation | 29 March 2018 | 2185 |
| Erograstis Tef Import Permit | Tanzania Official Seeds Certification Institute (TOSCI) | Yapi Merkezi | Prior to slope rehabilitation | 29 March 2018 | 2187 |
| Erograstis Curvula Import Permit | Tanzania Official Seeds Certification Institute (TOSCI) | Yapi Merkezi | Prior to slope rehabilitation | 29 March 2018 | 2189 |
| Panicum Maximum Import Permit | Tanzania Official Seeds Certification Institute (TOSCI) | Yapi Merkezi | Prior to slope rehabilitation | 29 March 2018 | 2188 |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| **Fuel Stations** | | | | | |
| Permit to construct fuel station at Soga | EWURA | Yapi Merkezi | Prior to construction | 04 August 2017 | YM&ME-EW-L-0001 |
| Permit to construct fuel station at Ilala | EWURA | Yapi Merkezi | Prior to construction | 04 August 2017 | YM&ME-EW-L-0001 |
| Permit to construct fuel station at Mkata | EWURA | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Permit to construct fuel station at Klosa | EWURA | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Permit to construct fuel station at Ihumwa | EWURA | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| **Waste Management** | | | | | |
| Landfill Area Use Permit | Chalinze District Council | Yapi Merkezi | Prior to construction | 18 September 2018 | HWC/M.35/3/42 |
| Landfill Area Use Permit | Kibaha District Council | Yapi Merkezi | Prior to construction | 29 June 2018 | KDC/M.20/22/47 |
| Landfill Area Use Permit | Kibaha District Council | Yapi Merkezi | Prior to construction | 07 November 2018 | KDC/20/22/31 |
| Landfill Area Use Permit | Kibaha District Council | Yapi Merkezi | Prior to construction | 02 November 2018 | KDC/20/22/65 |
| Landfill Area Use Permit | Mgude Village Executive Office | Yapi Merkezi | Prior to construction | 23 November 2018 | Approval via letter dated 23 November 2017 |
| Permit for Collect Scrap Metals | Vice President's Office | Kamal Steel | Prior to construction | 01 November 2018 | BA/185/280/01 |
| License to Collect, Store and Transport Hazardous Waste | Vice President's Office | Guruka Kwala | Prior to construction | 07 September 2018 | 91 |
| Permit to Collect Used Batteries, Tyres, Plastics and e-waste | National Environmental Management Committee (NEMC) | Mwanza Environmental Sympathisers | Prior to construction | 21 March 2018 | BC 185/280/03 |
| Permit to collect and transport scrap metals | National Environmental Management Committee (NEMC) | Mwanza Environmental Sympathisers | Prior to construction | 26 February 2018 | BA/185/280/02 |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| Wastewater Discharge Permit (discharge into Waste Stabilization Ponds) | Kibaha Education Center | Yapi Merkezi | Prior to Construction | 20 February 2018 | AC/330/370/02 |
| Grant of Temporary Discharge Permit (Soga) | Wami Ruvu Basin Water Office | Yapi Merkezi | Prior to Construction | 08 March 2018 | 212000047 |
| KM 258 Chanzuru Waste and Sewage Disposal Permit | Kilosa Environmental Department | Yapi Merkezi | Prior to Construction | 07 August 2018 | Obtained/Not Applicable |
| KM 229 Mkata Waste and Sewage Disposal Permit | Kilosa Environmental Department | Yapi Merkezi | Prior to Construction | 03 August 2018 | Obtained/Not Applicable |
| KM 65 Kilosa Waste and Sewage Disposal Permit | Waziri Usagara Dispensary | Yapi Merkezi | Prior to Construction | 03 August 2018 | Obtained/Not Applicable |
| KM 424 Ihumwa Waste Disposal Permit | The City Council of Dodoma | Yapi Merkezi | Prior to Construction | 01 August 2018 | Obtained/Not Applicable |
| KM 424 Ihumwa Sewage Disposal Permit | DUWASA | Yapi Merkezi | Prior to Construction | 15 October 2018 | W.10/125VOL.V/37 |
| **Dump areas** | | | | | |
| Dar Es Salaam (D-011) | TRC | Yapi Merkezi | Prior to construction | 05 March 2018 | 856-STG-DS-MG-ao-856 |
| Pugu (D-020) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Pugu(D-021) | TRC | Yapi Merkezi | Prior to construction | 16 February 2018 | 1310-STG-DS-MG-cm-1310 |
| Pugu (D-023) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kibaha (D-024) | TRC | Yapi Merkezi | Prior to construction | 03 March 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-026) | TRC | Yapi Merkezi | Prior to construction | 03 March 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-028) | TRC | Yapi Merkezi | Prior to construction | 03 March 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-031) | TRC | Yapi Merkezi | Prior to construction | 03 March 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-033) | TRC | Yapi Merkezi | Prior to construction | 03 March 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-035) | TRC | Yapi Merkezi | Prior to construction | 03 March 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-037) | TRC | Yapi Merkezi | Prior to construction | 03 March 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-039) | TRC | Yapi Merkezi | Prior to construction | 03 March 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-047) | TRC | Yapi Merkezi | Prior to construction | 03 March 2017 | 1310-STG-DS-MG-cm-1310 |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| Kibaha (D-053) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kibaha (D-053-R1) | TRC | Yapi Merkezi | Prior to construction | 25 October 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-055) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kibaha (D-056) | TRC | Yapi Merkezi | Prior to construction | 30 August 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-057) | TRC | Yapi Merkezi | Prior to construction | 25 October 2017 | 1310-STG-DS-MG-cm-1310 |
| Kibaha (D-059) | TRC | Yapi Merkezi | Prior to construction | 25 October 2017 | 1310-STG-DS-MG-cm-1310 |
| Kisarawe (D-073) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kisarawe (D-080) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kisarawe (D-087) | TRC | Yapi Merkezi | Prior to construction | 06 April 2018 | 1310-STG-DS-MG-cm-1310 |
| Ngerengere (D-090) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (D-091) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (D-092) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (D-120) | TRC | Yapi Merkezi | Prior to construction | 14 November 2017 | 1310-STG-DS-MG-cm-1310 |
| Ngerengere (D-122) | TRC | Yapi Merkezi | Prior to construction | 14 November 2017 | 1310-STG-DS-MG-cm-1310 |
| Ngerengere (D-125) | TRC | Yapi Merkezi | Prior to construction | 14 November 2017 | 1310-STG-DS-MG-cm-1310 |
| Ngerengere (D-126) | TRC | Yapi Merkezi | Prior to construction | 17 October 2017 | 1310-STG-DS-MG-cm-1310 |
| Morogoro (D-171) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (D-172) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (D-173) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (D-173) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (D-174) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (D-190) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (D-193) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (D-201) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Lukobe (D-204) | TRC | Yapi Merkezi | Prior to construction | 07 August 2018 | STG/MG-MKT/cm/160 |
| Lukobe (D-208) | TRC | Yapi Merkezi | Prior to construction | 07 August 2018 | STG/MG-MKT/cm/161 |
| Kimambila (D-211) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkata (D-222) | TRC | Yapi Merkezi | Prior to construction | 07 August 2018 | STG/MG-MKT/cm/164 |
| Mkata (D-225) | TRC | Yapi Merkezi | Prior to construction | 07 August 2018 | STG/MG-MKT/cm/165 |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| Mkata (D-230) | TRC | Yapi Merkezi | Prior to construction | 07 August 2018 | STG/MG-MKT/cm/166 |
| Mkata (D-233) | TRC | Yapi Merkezi | Prior to construction | 15 August 2018 | STG/MG-MKT/korail-jv/178 |
| Mkata (D-237) | TRC | Yapi Merkezi | Prior to construction | 15 August 2018 | STG/MG-MKT/korail-jv/179 |
| Kimamba (D-241) | TRC | Yapi Merkezi | Prior to construction | 15 August 2018 | STG/MG-MKT/korail-jv/180 |
| Kimamba (D-243) | TRC | Yapi Merkezi | Prior to construction | 15 August 2018 | STG/MG-MKT/korail-jv/181 |
| Kimamba (D-247) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kimamba (D-249) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kimamba (D-253) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kilosa (D-262) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkondoa (D-272) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkondoa (D-273) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkondoa (D-274) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkondoa (D-275) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkondoa (D-276) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkondoa - 1 (D-277) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkondoa -2 (D-277) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkondoa (D-278) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkondoa (D-280) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Tunnel 2 Entrance (D-280) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Tunnel 2 Exit (D-280) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Uhumwa (D-417) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Uhumwa (D-419) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Uhumwa (D-421) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| **Lugoba Quarry** | | | | | |
| Blasting Certificate | Ministry of Minerals | Yaate | Prior to construction | 20 November 2014 | 2855 |
| Blasting Certificate | Ministry of Minerals | Yaate | Prior to construction | 20 November 2014 | 2853 |
| Blasting Certificate | Ministry of Minerals | Yaate | Prior to construction | 18 October 2017 | 15904 |
| License to purchase or acquire explosives | Ministry of Minerals | Yaate | Prior to construction | 24 May 2018 | 24180 |
| License to purchase or acquire explosives | Ministry of Minerals | Nitro | Prior to construction | 16 June 2018 | 24213 |
| License to purchase or acquire explosives | Ministry of Minerals | Nitro | Prior to construction | 13 June 2018 | 24221 |
| License to purchase or acquire explosives | Ministry of Minerals | Nitro | Prior to construction | 22 June 2018 | 24246 |
| License to purchase or acquire explosives | Ministry of Minerals | Nitro | Prior to construction | 28 June 2018 | 25259 |
| License to purchase or acquire explosives | Ministry of Minerals | Nitro | Prior to construction | 03 July 2018 | 25267 |
| Temporary Explosive Store | Ministry of Minerals | Nitro | Prior to construction | 03 October 2018 | 02/2018 |
| Quarry Permit | TRC | Yapi Merkezi | Prior to construction | 04 April 2018 | 278/293/020J |
| Quarry Permit | Ministry of Minerals | Mota Engil | Prior to construction | 30 March 2018 | Letter dated 13 March 2018 |
| **Borrow Pit Permits** | | | | | |
| Pugu (B-016) | TRC | Yapi Merkezi | Prior to construction | 09 October 2017 | 374-STG-DS-MG-cm-374 |
| Dar es salaam (B-021) | TRC | Yapi Merkezi | Prior to construction | 30 August 2017 | 1308-STG-DS-MG-cm-1308 |
| Kisarawe (B-031) | TRC | Yapi Merkezi | Prior to construction | 10 November 2017 | 1308-STG-DS-MG-cm-1308 |
| Kisarawe (B-034) | TRC | Yapi Merkezi | Prior to construction | 10 November 2017 | 1308-STG-DS-MG-cm-1308 |
| Kisarawe (B-036) | TRC | Yapi Merkezi | Prior to construction | 10 November 2017 | 1308-STG-DS-MG-cm-1308 |
| Ngerengere (B-039) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kibaha (B-043) | TRC | Yapi Merkezi | Prior to construction | 08 January 2018 | 682-STG-DS-MG-cm-682 |
| Kibaha (B-044) | TRC | Yapi Merkezi | Prior to construction | 05 April 2018 | 1308-STG-DS-MG-cm-1308 |
| Kibaha (B-045) | TRC | Yapi Merkezi | Prior to construction | 08 January 2018 | 682-STG-DS-MG-cm-682 |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| Kibaha (B-047) | TRC | Yapi Merkezi | Prior to construction | 08 January 2018 | 682-STG-DS-MG-cm-682 |
| Kibaha (B-053) | TRC | Yapi Merkezi | Prior to construction | 08 January 2018 | 682-STG-DS-MG-cm-682 |
| Kisarawe (B-056) | TRC | Yapi Merkezi | Prior to construction | 10 November 2017 | 1308-STG-DS-MG-cm-1308 |
| Kisarawe (B-058) | TRC | Yapi Merkezi | Prior to construction | 15 August 2018 | 1308-STG-DS-MG-cm-1308 |
| Kibaha (B-059) | TRC | Yapi Merkezi | Prior to construction | 15 January 2018 | 1308-STG-DS-MG-cm-1308 |
| Kibaha (B-065) | TRC | Yapi Merkezi | Prior to construction | 13 February 2018 | 1308-STG-DS-MG-cm-1308 |
| Kibaha (B-069) | TRC | Yapi Merkezi | Prior to construction | 21 February 2018 | 1308-STG-DS-MG-cm-1308 |
| Kibaha (B-080) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kibaha (B-082) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-105-1) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-105-2) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-105-3) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-105-4) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-107) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-108) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-115-1) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-115-2) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-119) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-121-2) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-121-2) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-141) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-145) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-146) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-147) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-148) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-150) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-151) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-152) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-153-0) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| Ngerengere (B-153-1) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-154) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-156) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-159) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-160) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-163-0) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-163-1) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ngerengere (B-163-2) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (B-164) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (B-165) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (B-166) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (B-167) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (B-168) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (B-190) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Morogoro (B-193) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Lukobe (B-204) | TRC | Yapi Merkezi | Prior to construction | 07 August 2018 | STG/MG-MKT/cm/158 |
| Lukobe (B-208) | TRC | Yapi Merkezi | Prior to construction | 15 August 2018 | STG/MG-MKT/cm/182 |
| Kimambila (B-211) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kimambila (B-212) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kimambila (B-215) | TRC | Yapi Merkezi | Prior to construction | 24 September 2018 | STG/MG-MKT/cm/245 |
| Mkata (B-220) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkata (B-223) | TRC | Yapi Merkezi | Prior to construction | 03 August 2018 | STG/MG-MKT/cm/159 |
| Mkata (B-225) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkata (B-231) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Mkata (B-233) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kilosa 1 (B-266) | TRC | Yapi Merkezi | Prior to construction | 11 September 2018 | STG/MG-MKT/cm/228 |
| Kilosa 2 (B-266) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Gulwe (B-395) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Gulwe (B-399) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |

| Permit | Authority | Responsibility | Timing | Date Received | Status / Permit No. |
|---|---|---|---|---|---|
| Kikombo (B-402) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kikombo (B-407) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kikombo (B-412) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Kikombo (B-413) | TRC | Yapi Merkezi | Prior to construction | Applied | Applied/In progress |
| Ihumwa (B-424) | TRC | Yapi Merkezi | Prior to construction | 19.10.2018 | STG/MG-MKT/cm/295 |

# 4 BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

## 4.1 SCOPE

This *Chapter* provides a description of the baseline environmental, economic and social characteristics of the Project-affected areas. Apart from the baseline for the Project Core Area (DAI - Direct Area of Influence), the baseline for the Indirect and Wider Area of Influence has been described as these areas may be impacted by Project activities. This is required to provide benchmarks against which future Project environmental and social performance can be monitored.

Information provided in this chapter will be superimposed onto the Project description components for impact identification, evaluation and development of mitigation measures.

The information provided in this chapter draws on a combination of publicly available information reviewed during a desk-based study, previous impact assessments prepared by third parties and observations recorded by the Ardhi University (ARU, Ardhi) during site visits, and as contained in the original Draft ESIA of May 2018.

The original baseline data for this ESIA was collected by Ardhi and presented in the draft ESIA of May 2018. ERM have in some cases restated and in other cases supplemented the May 2018 ESIA during the preparation of this 2019 ESIA.

In addition, ERM collected certain additional baseline information during February and March 2019 as part of the preparation of this Final ESIA Report:

- *Water Resources:* Additional assessments and evaluations have been conducted with regard to surface and groundwater baseline data. Surface water sampling (conducted by YM in March and April 2019) and existing borehole pump test reports have been evaluated. Surfacewater and groundwater quality sampling results have been included.
- *Terrestrial Ecology:* New field study done on wildlife corridors, as basis for Biodiversity Action Plan.

Some information added to the baseline update was also gathered from parallel ongoing Resettlement Action Plan (RAP) data collection:

- *Livelihoods and Ecosystem Services*: A high level Ecosystem Services and Livelihoods assessment considering selected settlements in the AoI has been undertaken for the purpose of updating the draft RAPS for Lot 1 and Lot 2. It is expected that this additional assessment will support a more robust assessment of land based impacts and impacts to natural resources.
- *Indigenous people*: An additional high-level assessment has been undertaken to further assess the situation and status of indigenous communities along the railway line (ie. confirm presence and profiling) and confirm the applicability of IFC PS7 and Free Prior Informed Consent (FPIC). The study relied mostly on desktop information with a limited three-day ground truthing visit and engagement activities.

## 4.2 LIMITATIONS OF BASELINE

The baseline data collection was originally performer by the ARDHI University, the local ESIA author, while ERM stepped in to the ESIA process as of early 2019 to support the update of the ESIA in line with international lender requirements (see also Introduction Chapter). A number of limitations were identified in relation to the availability and reliability of information collected, which were addressed to the extent possible in the present ESIA update.

The socioeconomic baseline in the disclosed draft ESIA (February 2019) is structured in a way that presents the socioeconomic context at the national level and district level. However, only eight districts were initially identified as being crossed by the line whereas the updated analysis shows that the actual number is 13. Thus, data is missing for Temeke, Morogoro Urban, Mvomero, Bahi and Manyoni Districts.

However, data is provided for Ilala District, which is representative of Temeke District, as they are both districts of the same city of Dar es Salaam. Similarly, Ilala is also representative for Morogoro Urban District, as they both are characterized by urban features (i.e. densely built up and higher migration). Mvomero, Bahi and Manyoni are comprised in Phase II, and are assumed to have similar livelihoods as Mpwapwa, Morogoro Rural and Dodoma, as they present mostly rural features. Considering this, the information provided for the eight districts is considered applicable to the remaining districts.

Although the baseline enables a general assessment of the impacts and mitigation measures required for the ESIA, it is expected that land and livelihoods will be addressed in more detail through the updated RAP.

It is also noted that socioeconomic surveys undertaken for the purpose of the ESIA and RAP development have not specifically assesed the characteristics of sites where Project facilities will be established outside the 500 m corridor along the rail line. However, the areas where these facilities (borrow pits, sand/rock quarries and camps) will be established share the same characteristics of the areas with the 500 m corridor that was object of all socioeconomic studies. In this regard data for the AoI and additional desk top assessment has been used to assess potential impacts.

In this regard, the further improvement that will be addressed through development of environmental and social management plans post ESIA phase are listed in ESMMP.

TRC and YM is absolutely committed to ensuring these areas of further improvement.

## 4.3 EXISTING SITUATION OF RAILWAY SERVICES IN TANZANIA

### 4.3.1 Overview of Railway Services in Tanzania

The existing railway services include the Central railway line and the railway managed by the Tanzania–Zambia Railway Authority (TAZARA).

- The Central Line starts from Dar es Salaam region to Kigoma region and has six branch lines (to Mwanza, Mpanda, Singida, Kidatu, Arusha, and Tanga).
- The Tanzania–Zambia Railway Authority (TAZARA) railway line starts from Dar es Salaam to Mbeya region and to Zambia. The Governments of Tanzania and Zambia jointly own this railway line.

### 4.3.2 Railway Network

The existing central line railway network runs on a track gauge of 1,000 mm (Meter Gauge Railway, MGR) with a total route length of 2,725.9 km. It has 16 major stations (eight major stations between Dar es Salaam to Kigoma and another eight major stations along its branches). The rail line has 104 minor railway stations throughout its route length (including its branches).

The TAZARA railway line operates with a track gauge of 1,067 mm (Cape Gauge), with a total distance of 1,860 km, of which 975 km is in Tanzania. The TAZARA line borders with the central network in Dar es Salaam Port, and at Kidatu in Morogoro Region.

### 4.3.3 Track and Structure

The track condition of the existing network is generally poor with about 40 percent of the rail used on the network rated as 56.12 lb/yd or below, part of which is even 45 lb/yd rail laid in the early 1900. The maximum allowable axle load for the 80lb/yd segments is 16 tons/axle while the allowable limit for lighter rail segments is lower. The heaviest locomotives currently in use are Class 88 with 13.7 tons/axle, which can be used for the segments with 56.12 lb/yd or heavier rail. However, the use of lighter rail segments is restricted to locomotives with lower axle loads, such as Class 73 (12 tons/axle).

The existing rail lines experience serious track irregularities that can could potentially lead to accidents, especially on the 60 and 56.12 lb/yd rails. The entire system is equipped with old steel sleepers with some segments dating back 100 years.

*Figure 4-1 Distribution of Route-km by Rail Weight on TRC Network, 2013*

| Line (Section) | Rail weight (lb/yd) | | | | | | Total km |
|---|---|---|---|---|---|---|---|
| | 45 | 50 | 55 | 56.12 | 60 | 80 | |
| Central line (DSM-Kigoma) | | | | 451 | 283 | 520 | 1,254 |
| Mwanza Line (Tabora- Mwanza) | | | | | 379 | | 379 |
| Williamson Diamond | | | | | 13 | | 13 |
| Mikumi Line (Kilosa –Kidatu) | | 84 | | 24 | | | 108 |
| Mpanda Line (Kaliua- Mpanda) | 82.9 | 71 | | 59 | | | 212.9 |
| Link Line (Ruvu Junction –Mruazi) | | | 43 | 9 | 101 | 35 | 188 |
| Tanga Line (Tanga- Moshi) | | | | | 352 | | 352 |
| Arusha Line (Moshi- Arusha) | 86 | | | | | | 86 |
| Kahe Line (Kahe-Kenya boarder) | | 18 | | | | | 18 |
| Singida Line (Manyoni –Singida) | | 22 | | 93 | | | 115 |
| Total | 168.9 | 195 | 43 | 636 | 1128 | 555 | 2,725.9 |
| % of route-km | **6.2%** | **7.2%** | **1.6%** | **23.3%** | **41.4%** | **20.4%** | **100%** |

Source: PADECO Co., Ltd. al 2014

### *4.3.4 Passengers and Freight*

The freight traffic in the central railway network has been dropping dramatically since the year 2000. The decline is attributed to a number of reasons including severe shortage of locomotives and wagons; high levels of speed restrictions because of a serious lack of track rehabilitation and maintenance; and service disruptions due to flooding in flood prone areas such as Kilosa and Gulwe in the Morogoro region.

In 2007, the Government started efforts to revive the railway services in Tanzania. An international tender was announced and Rail India Technical and Economic Services (RITES) was granted a concession for operation. Under this agreement, RITES owned 51 percent of TRL and the rest remained with the Government of Tanzania. During the concession period, rail traffic did not improve as expected and continued dropping. This led to the cancellation of the concession. By the year 2011, the Government of Tanzania had acquired 100 percent ownership of TRL from RITES (PADECO Co., Ltd *et al*, 2014).

## *4.4 PHYSICAL ENVIRONMENTAL BASELINE*

### *4.4.1 Climate*

*National Climate (Tanzania)*

In Tanzania, the average annual temperature has increased by 1.0 °C since 1960 and annual rainfall has decreased by 2.8 mm per month per decade, since 1960. High pressures on biodiversity and ecosystems have occurred as a result of severe droughts. Recurring and extended droughts have resulted in the drying out of water bodies such as reservoirs, rivers, lakes and wetlands with a further

consequence on biodiversity. This has also resulted in impacts to hydropower and a loss in grazing lands.[1]

In the last 40 years, Tanzania has experienced severe and recurring droughts with devastating effects to agriculture, water and energy sectors. Currently more than 70 percent of all natural disasters in Tanzania are climate change related and are linked to recurrent droughts and floods.[2]

*Local and Site Specific Climate*

Rainfall across the entire stretch of the proposed SGR from Dar es Salaam to Makutupora is variable. This is based on monthly rainfall data over 36 years from 1981 to 2016, at stations found along the railway stretch. All stations experience bimodal rainfall patterns with the exception of Mpwapwa, Chamwino and Bahi District councils that experience a unimodal rainfall pattern.

The specific climatic conditions along the proposed railway stretch is described below.

*Dar es Salaam Climate*

**Rainfall**

Rainfall in Dar es Salaam is distributed in two seasons: the wet season from March to May and the long dry and cooler season from June to October. The annual rainfall for Dar es Salaam averages just over 1000 mm in two seasons. This is composed of the short rains from November to December which contributes a monthly average rainfall of 75 - 100 mm and the long rains from March to May, which contributes a monthly average rainfall of 150 - 300 mm.

**Temperature**

Temperature in Dar es Salaam does not vary much from one area to another. The hottest season is from October to March during which maximum temperatures can reach up to 35 $^{o}$C. It is relatively cool between May and August with average temperature being around 25 $^{o}$C. The mean annual temperature is 26 $^{o}$C with a mean daily range of ± 4 $^{o}$C. Seasonal variations are slight with a mean seasonal range being ± 4 $^{o}$C, (TMA, 2012).

[1] https://www.climatelinks.org/sites/default/files/asset/document/20180629_USAID-ATLAS_Climate-Risk-Profile-Tanzania.pdf

[2] https://www.irishaid.ie/media/irishaidpublications/TZA-Country-Climate-Action-Reports-Tanzania-2015.pdf

**Humidity**

Humidity is related to the rainfall pattern and is highest during the long rains. Daily maximum humidity occurs at dawn, averaging 96 percent while minimum humidity is experienced in the afternoons, averaging 67 percent (TMA, 2012).

**Wind**

The wind system in Dar es Salaam is typical of the wind regime of the Western Indian Ocean. During the northern summer months of April to September, the winds are predominantly south-easterly (SE monsoons) and the southern summer is marked by NE winds (monsoons). Winds in the region are quite weak, generally of F3-F4 (Beaufort scale). The peak speeds occur in the months of February (NE monsoon period), April and July (SE monsoon). This wind system is coupled with an almost complete clockwise current system that changes character with the changing wind (TMA, 2012).

*Kibaha District Council Climate*

**Rainfall**

The average amount of precipitation for the year in Kibaha is 988.1 mm. One average, most precipitation is recorded in the month of April with average 215.9 mm of precipitation. The least average precipitation is recorded in the month of July with an average of 20.3 mm. There are an average of 107.6 days of precipitation, with the most precipitation occurring in April with 16.5 days and the least precipitation occurring in September with 4.7 days.

**Temperature**

Kibaha experiences average annual temperature of 25.5 °C. At an average temperature of 27.4 °C, February is the hottest month of the year. The lowest average temperatures in the year occur in August, when it is around 23.4 °C. Between the driest and wettest months, the variation in temperatures throughout the year is 4.0 °C.

**Humidity**

Humidity of air is related to the rainfall pattern. In Kibaha, the highest humidity is recorded during the long rains. Daily maximum humidity occurs at dawn, averaging 96 percent while minimum humidity is experienced in the afternoons, averaging 67 percent.

**Wind**

The wind system in Kibaha is typical of the wind regime of the Western Indian Ocean. Bordering Dar es Salaam and being close to the Coastline, the wind pattern in most parts resembles that of Dar es Salaam.

*Morogoro District Council Climate*

**Rainfall**

The Morogoro Rural District where the proposed railway passes experiences a bimodal rainfall pattern with an average annual rainfall above 1000 mm. The long wet season is from March to May and the short wet season spans between October and December. The closest weather stations to the Project Area are located at Kisaki and Bwakira Sisal Estates.

**Temperature**

The closest temperature measurement station from the Project Area is located in Morogoro town. The station has been recording maximum and minimum temperature for the Region from 1973 to 2009. The data obtained indicates that the average high and low monthly temperatures vary between 15 $^{o}$C and 32 $^{o}$C. The regional temperature is remarkably stable with distinct cool and warm seasons.

**Humidity**

Relative humidity is measured at the Morogoro Meteorological Station. Measurements recorded between the years 2000 to 2005 indicates lower relative humidity during the morning hours compared to the evening hours caused by sunny heat during the daytime. The day and night-time relative humidity ranges from 55 to 80 percent respectively.

**Wind Patterns**

Wind data available was collected for the period between the years 2000 – 2007 at the Morogoro Meteorological Station. The station recorded average wind speed of 6 m/s around midday compared to average speed of 3 m/s during morning hours. The general direction of the wind is westward.

*Kilosa District Council Climate*

**Rainfall**

Rainfall distribution in Kilosa District is bi-modal. Short season rains starts in the month of November and end in January while the long season rains starts in March and end in May recording peak precipitation around the month of April. The average annual rainfall varies from year to year and between ecological zones.

Average annual rainfall ranges from 1000 mm to 1400 mm for the Southern flood plains and ranges from 800 mm to 1100 mm for the Northern part of the

district. On the other hand, mountain forest areas receive up to 1600 mm of rainfall annually.

**Temperature**

Temperature in the district varies with altitude. Average annual temperature in the district is 25 °C with coldest month being July (19 °C) and hottest month being March (30 °C).

*Mpwapwa/Chamwino/Bahi District Council Climate*

**Rainfall**

Mpwapwa, Chamwino and Bahi District Councils have a dry Savannah type of climate that is characterized by low and unpredictable unimodal rainfall. The average annual rainfall falls in the range of 200 – 800 mm. The heaviest rainfall occurs during the months of December and February. January usually has very unpredictable rainfall while March and April have low rainfall. The months of May, June, July, August, September and November are usually dry. On the average, about 85 percent of the total rainfall in the district is received within the first four months of the rain season ie from months of December and March.

**Temperature**

The average temperature ranges from 21 °C to 23 °C. Chamwino, Mpwapwa and Bahi District Councils experience a long dry season from late April to early December and short single wet season occurring during the remaining part of the year.

**Wind and Humidity**

Mpwapwa, Chamwino and Bahi District Councils experience persistent desiccating winds and low humidity especially during dry seasons (TMA, 2012).

### *4.4.2 Future Climate Projections*

*National Climate (Tanzania)*

Tanzania is the 26th most vulnerable country to climate risks due to rising temperatures, longer dry spells, more intense heavy rainfall and sea level rises. The population is estimated to increase to 130 million by 2050 from the current 56 million. Thirty percent of the population lives in urban areas, and 75 percent of that population lives in informal settlements. The rural areas are increasingly at risk from flooding, water scarcity and heat extremes. In rural areas, there is high dependence on rain fed agriculture. Yields from crops are projected to decrease in the coming decades, hence potentially affecting livelihoods and

food security. Livelihoods and food supply also depend on coastal and inland fisheries. These are affected by warming ocean and freshwater temperatures, and sedimentation after heavy rains.[1]

In Tanzania, the "projected changes by the 2050s" include:

- Increased average annual temperature of 1.4 to 2.3 °C; greatest warming in the west/southwest;
- Increased duration of heat waves (by 7–22 days) and dry spells (by up to 7 days);
- Likely increase in average annual rainfall (range of -3 to +9 percent), with greatest increase in the northeast; likely rainfall decline July–September;
- Increased heavy rainfall event frequency (7–40 percent) and intensity (2–11 percent);
- Rise in sea levels of 16 to 42 cm; and
- Disappearance of glaciers from Kilimanjaro.

*Local and Site Specific Climate*

Data from the IPCC's representative concentration pathway (RCP) 8.5 is shown in *Table 4-1*. RCP 8.5 is the business as usual or 'high emissions' scenario, reaching up to c.5-6 degree temperature rise by 2100. The projections deliver returns relating to key climate variables including temperature and precipitation, with expected changes in several climate variables from a current baseline out to 2030, 2050 and 2080. Note that the models do not project impacts such as flooding and landslides, which occur in response to changes to basic climate parameters and are typically dependent on location. However, risks can be inferred from the baseline, looking at historic information and projected precipitation patterns. The models also do not include natural hazards relating to tectonic activity such as volcanoes and earthquakes.

The proposed SGR railway will be laid out over seven different IPCC regions. Data for all seven of regions show a range of results reflecting different local environments and characteristics. The upper and lower level of the outputs for each parameter are shown in *Table 4-1* below.

[1] https://www.climatelinks.org/sites/default/files/asset/document/20180629_USAID-ATLAS_Climate-Risk-Profile-Tanzania.pdf

*Table 4-1 Climate Projections (RCP 8.5) for along the SGR Route for 2030, 2050 and 2080*

| Variable | Unit | Season | Projected Change (from baseline) | | |
|---|---|---|---|---|---|
| | | | 2030 | 2050 | 2080 |
| *Precipitation change per season* | *mm* | *DJF* | **23.11 to 33.05** *(5.0% to 11.0%)* | **33.73 to 57.08** *(7.0% to 18.0%)* | **62.43 to 91.30** *(14.0% to 31.0%)* |
| | | *MAM* | **2.59 to 6.28** *(-5.0% to -7.0%)* | **2.38 to 5.97** *(-5.0% to -7.0%)* | **8.37 to 26.27** *(-4.0% to -16.0%)* |
| | | *JJA* | **-1.39 to -6.89** *(1.0% to 3.0%)* | **-1.55 to -6.53** *(1.0% to 3.0%)* | **-1.05 to -16.44** *(3.0% to 11.0%)* |
| | | *SON* | **-2.10 to -12.32** *(-2.0% to -6.0%)* | **-0.21 to -12.79** *(0.0% to -7.0%)* | **-18.08 to 17.04** *(-9.0% to 5.0%)* |
| *Change in annual count of days with at least 10 mm of precipitation* | *days* | | **0.81 to 1.93** *(3.0% to 7.0%)* | **2.18 to 3.34** *(8.0% to 13.0%)* | **1.88 to 3.98** *(10.0% to 23.0%)* |
| *Change in annual count of days with at least 1 mm of precipitation* | *days* | | **-0.77 to 3.69** *(-1.0% to -3.0%)* | **-3.77 to 0.27** *(0.0% to -3.0%)* | **-1.60 to -7.57** *(-1.0% to -5.0%)* |
| *Change in annual count of days with less than 1 mm of precipitation* | *days* | | **2.24 to 4.69** *(-2.0% to 5.0%)* | **5.57 to 8.68** *(5.0% to 9.0%)* | **7.39 to 12.40** *(6.0% to 14.0%)* |
| *Change in annual total precipitation when daily precipitation exceeds the 95$^{th}$ percentile of historical Wet Day precipitation* | *mm/day* | | **14.52 to 27.54** *(8.0% to 15.0%)* | **28.13 to 75.23** *(16.0% to 42.0%)* | **50.98 to 83.33** *(29.0% to 47.0%)* |
| *Change in annual total precipitation when daily precipitation exceeds the 99$^{th}$ percentile of historical Wet Day precipitation* | *mm/day* | | **8.51 to 13.07** *(14.0% to 23.0%)* | **17.07 to 43.44** *(28.0% to 81.0%)* | **37.86 to 51.06** *(63.0% to 95.0%)* |

| Variable | Unit | Season | Projected Change (from baseline) | | |
|---|---|---|---|---|---|
| | | | 2030 | 2050 | 2080 |
| *Evaporation change per season* | *mm* | *DJF* | **4.49 to 13.00** *(1.0% to 5.0%)* | **5.64 to 18.99** *(1.0% to 7.0%)* | **6.36 to 32.97** *(2.0% to 13.0%)* |
| | | *MAM* | **3.44 to 10.61** *(1.0% to 2.0%)* | **5.54 to 10.46** *(2.0% to 6.0%)* | **12.36 to 27.94** *(3.0% to 7.0%)* |
| | | *JJA* | **1.19 to 3.88** *(1.0% to 5.0%)* | **2.23 to 7.51** *(2.0% to 6.0%)* | **3.18 to 11.19** *(5.0% to 12.0%)* |
| | | *SON* | **-4.02 to 1.09** *(-3.0% to 1.0%)* | **-6.04 to 1.34** *(0.0% to -4.0%)* | **-10.61 to 6.04** *(-7.0% to 3.0%)* |
| *Precipitation change per season - Evaporation change per season* | *mm* | *DJF* | **14.35 to 28.56** | **25.11 to 51.43** | **45.94 to 79.38** |
| | | *MAM* | **-0.85 to -4.33** | **-2.47 to -10.95** | **-13.41 to 12.59** |
| | | *JJA* | **-2.59 to -10.77** | **-3.78 to -14.04** | **-5.26 to -27.63** |
| | | *SON* | **-3.19 to -8.30** | **-0.90 to -6.75** | **-10.54 to 11.00** |
| *Average annual temperature change by season* | *°C* | *DJF* | **1.02 to 1.16** *(4.0% to 6.0%)* | **1.76 to 1.98** *(7.0% to 10.0%)* | **3.12 to 3.46** *(13.0% to 17.0%)* |
| | | *MAM* | **1.11 to 1.28** *(5.0% to 6.0%)* | **1.92 to 2.16** *(8.0% to 10.0%)* | **n/av** *n/av* |
| | | *JJA* | **1.11 to 1.26** *(5.0% to 7.0%)* | **1.87 to 2.13** *(9.0% to 11.0%)* | **3.41 to 3.94** *(16.0% to 20.0%)* |
| | | *SON* | **n/av** *n/av* | **n/av** *n/av* | **3.36 to 3.79** *(15.0% to 17.0%)* |
| *Mean maximum temp change by season* | *°C* | *DJF* | **0.89 to 1.05** *(3.0% to 4.0%)* | **1.62 to 1.85** *(6.0% to 7.0%)* | **2.91 to 3.22** *(10.0% to 13.0%)* |
| | | *MAM* | **1.08 to 1.23** *(4.0% to 5.0%)* | **1.89 to 2.07** *(7.0% to 8.0%)* | **3.30 to 3.59** *(12.0% to 14.0%)* |
| | | *JJA* | **1.15 to 1.25** *(-6.0% to -7.0%)* | **1.96 to 2.10** *(-10.0% to -11.0%)* | **3.46 to 3.92** *(-19.0% to -21.0%)* |
| | | *SON* | **1.15 to 1.26** *4%* | **1.86 to 2.13** *(7.0% to 8.0%)* | **3.41 to 3.76** *(12.0% to 13.0%)* |
| *Mean minimum temp change by season* | *°C* | *DJF* | **1.17 to 1.30** *(6.0% to 8.0%)* | **1.99 to 2.20** *(10.0% to 13.0%)* | **3.48 to 3.85** *(17.0% to 23.0%)* |
| | | *MAM* | **1.19 to 1.35** *(6.0% to 8.0%)* | **2.05 to 2.27** *(10.0% to 14.0%)* | **3.57 to 4.02** *(20.0% to 24.0%)* |
| | | *JJA* | **1.13 to 1.27** *(7.0% to 9.0%)* | **1.95 to 2.19** *(12.0% to 16.0%)* | **3.51 to 4.07** *(21.0% to 30.0%)* |
| | | *SON* | **1.13 to 1.24** *(6.0% to 7.0%)* | **1.91 to 2.16** *(10.0% to 13.0%)* | **3.43 to 3.92** *(18.0% to 24.0%)* |

| Variable | Unit | Season | Projected Change (from baseline) | | |
|---|---|---|---|---|---|
| | | | 2030 | 2050 | 2080 |
| *Cold spell duration (at least six consecutive days below the 10th percentile for that day of the year)* | *days* | | **-3.2 to -3.7** | **-3.5 to -4.1** | **-4.10 to -4.76** |
| *Warm spell duration (at least six consecutive days above the 90th percentile for that day of the year)* | *days* | | **44.53 to 59.44** | **96.15 to 119.50** | **196.94 to 215.46** |
| *Soil moisture content* | *kg/m2* | *DJF* | *-60.0% to -76.0%* | *-61.0% to -76.0%* | *-59.0% to -76.0%* |
| | | *MAM* | *-1.0% to -27.0%* | *-66.0% to -79.0%* | *-65.0% to -78.0%* |
| | | *JJA* | *-14.0% to -43.0%* | *-63.0% to -76.0%* | *-60.0% to -76.0%* |
| | | *SON* | *-70.0% to -81.0%* | *-70.0% to -81.0%* | *-45.0% to -62.0%* |

*Abbreviations in table: DJF = December/January/February; MAM = March/April May; JJA = June/July/August; SON = September/October/November.*
*Values are positive unless otherwise stated.*

### *4.4.3 Identification of Potential Future Climate Risks*

*Rainfall*

Precipitation change per season shows that in general precipitation will have the greatest increase from December to February which is a shift from the current secondary rainy season from October to December. The current October to December rainy season is mainly short bursts of rain with the heavy rainfall occurring in the March to May season. The current period of the primary rainy season of March to May will remain and will also have a slight decrease in rainfall in reference to the baseline numbers. This will consequently result in a period of six straight months of heavy rainfall. This in turn will lead to increased, more intense and more frequent flooding as the amount of rainfall in mm/day will also increase.

There will be a decrease in precipitation from June to November. This will then affect the length of the dry season and additionally there will be more days with less rain. Currently the dry season is from June to September. The projected

estimates show that there will be an increase in the consecutive dry spell months from the current four months to the projected six months. Subsequently, the longer spells of dry seasons will increase the frequency and severity of droughts. This will impact the amount of water in rivers and hence water supply.

Other precipitation indicators give a greater understanding of how the patterns of rainfall will change. By 2080, there is projected to be a 23 percent increase in days with at least 10 mm of precipitation, with a gradual increase over time to this point. This means there is a chance there will be an increase in storm-related activity. Increases in precipitation over the 95$^{th}$ and 99$^{th}$ percentile also suggests more extreme precipitation events, which are both projected to increase in 2080 to 47 percent for 95$^{th}$ and 95 percent for the 99$^{th}$ percentile. Additionally, there is expected to be an increase in days with less than 1mm of precipitation, up to 12.40 days more by 2080, which could imply more chance of dry conditions and droughts.

Changes in evaporation give an indicator of reduction in surface water, which can lead to water stress and drought in extreme circumstances. Evaporation is expected to increase over time over nine months (December untill August). From December to February being the highest levels of evaporation and the lowest levels of evaporation from September to November.

Comparing the difference between evaporation and precipitation helps to show the overall projected change in surface water volume. The projections show this varies considerably across location and season. March to May are the only months when evaporation is expected to be more than precipitation in all locations and periods. June to February is projected to have more precipitation than evaporation in all locations and periods.

The difference between seasonal change in evaporation and seasonal change in precipitation is a better indicator of drought and water stress than analysing evaporation change independently. By projecting change in soil moisture, this also gives information about drought and water availability. Soil moisture decreases in all locations, seasons and timeframes. The period where the soil moisture content decreases the least, where the most moisture is retained ion the soil is during the heavy rainfall period of March to May. Overall, the most likely areas to be impacted by drought are the arid and semi-arid areas.

*Temperature*

Temperature change per season indicates that in all locations and periods the average annual temperature change is projected to increase by up to 3.94 °C by

2080 respectively. This means extreme warm temperatures could be expected, which could result in heatwaves.

In reference to maximum temperature change, it is projected that maximum temperatures will increase in all locations and across all periods for nine months of the year (October to May). In the three months of June until August (winter period), the maximum temperature is projected to decrease.

The projected changes in minimum temperature is that minimum temperatures are expected to increase across all time frames and all locations. The highest increase would be up to 4.07 °C by 2080 in the winter season (June until August). The increase in the minimum temperatures may result in greater than before droughts and water shortages or restrictions.

The above changes in increase in minimum temperature and the above stated shift of the secondary rainfall season may result in a longer dry spell of six months. As stated above, this will reiterate that the dry spell will lead to an increase in the severity and frequency of droughts and affect water supply. The greatest impact will be felt in the central hot and arid parts of the site. Nearly half of the railway will be located in the dry climate.

Warm spell durations are expected to increase by up to 59 days by 2030, up to 119 days by 2050, and up to 215 days by 2080. A warm spell is defined as at least six consecutive days above the 90$^{th}$ percentile for that day of the year. This shows the extent of the extreme temperatures is likely to occur for long time periods opposed to periodically, and an increased chance of heatwave conditions. In contrast, cold spell durations are expected to decrease, but not to the same extent.

If a combination of temperature and precipitation conditions occur, this can result in different climate risks. Soil moisture reduction if accompanied by periods with little to no rain can result in wildfires, especially in arid and semi-arid climates. Landslides can occur from saturated soils following extreme precipitation, alternatively, low soil moisture can result in the soil breaking up and becoming unstable, also resulting in landslides.

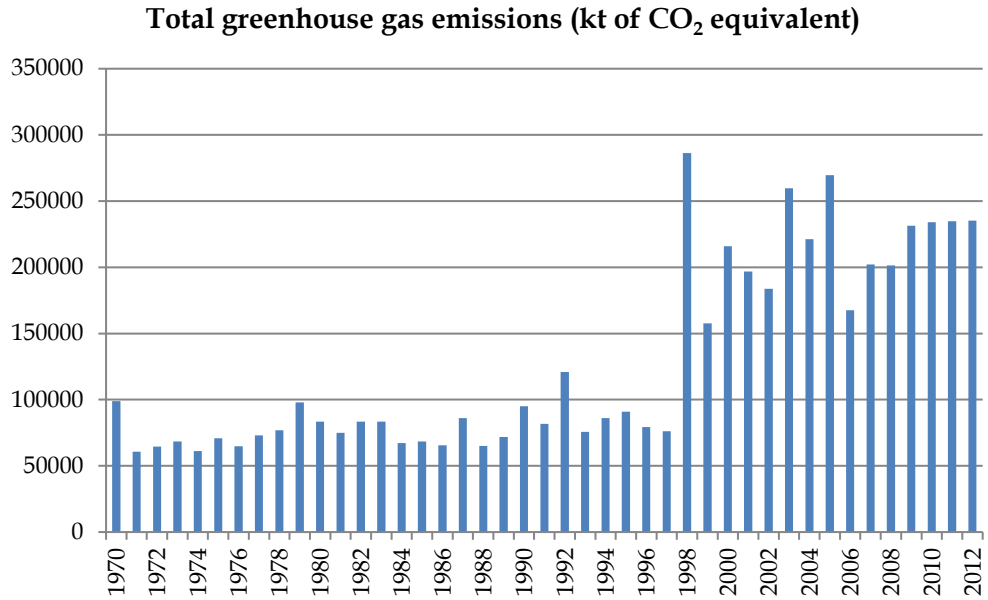
### *4.4.4 Climate Change*

*Greenhouse Gas (GHG) Emissions in Tanzania*

Despite having the Kyoto Protocol in place, GHGs emissions continue to increase and many countries have not taken adequate measures to reduce

emissions in line with scientific findings and recommendations of the Protocol and related climate discussion (NCCS, 2012). Tanzania has ratified the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol in 1996 and 2002 respectively and has participated in the annual Conference of the Parties (CoP). The outcomes of these CoP meetings include decisions to put in place national policies, strategies and programmes to reduce greenhouse gas emissions and respond to the impacts of climate change (TNCCFA, 2013). Tanzania has low emissions of GHG, in total per capita and an estimated total population of over 55 million people. The World Bank (2018) quantified the total greenhouse gas emissions (kt of $CO_2$ equivalent[1]) from 2011 survey data as 235,353 (*Figure 4-2*).

***Figure 4-2 Total Greenhouse Gas Emissions for Tanzania (kt of CO2 equivalent)***




Source: World Bank, 2018

*Potential Impacts of Climate Change*

Climate change is now recognized to have a significant impact on disaster management efforts in Tanzania and pose a significant threat to the efforts to meet the growing needs of the most vulnerable populations. Climate change is

[1] Total greenhouse gas emissions in kt of $CO_2$ equivalent are composed of $CO_2$ totals excluding short-cycle biomass burning (such as agricultural waste burning and Savannah burning) but including other biomass burning (such as forest fires, post-burn decay, peat fires and decay of drained peatlands), all anthropogenic $CH_4$ sources, $N_2O$ sources and F-gases (HFCs, PFCs and SF6)..

a cross cutting issue affecting a number of sectors including forestry, agriculture, water, lands, energy, infrastructure and others (*Table 4-2*).

***Table 4-2 Anticipated Impacts of Climate Change to Key sectors in Tanzania***

| Sector | Example of Climate Change Impact |
|---|---|
| Energy | Changes in demand levels; hydro-electricity supply weakened by changing river flows/lake levels. |
| Transport | Physical damage to existing infrastructure; higher maintenance costs. |
| Water and sanitation | Changes in water quantity and quality; greater water demand. |
| Trade | Decline in production, worsening terms of trade resulting from high product prices. |

Source: TNCCFA, 2013

A detailed Climate Risk Assessment applicable to the SGR, using the data presented here as background, is described in *Chapter 6*.

### *4.4.5 Topography and Agro-Ecological Zones*

The topography of the Project Area and its agro-ecological zones are described in *Table 4-3* below.

*Table 4-3 Summary of Environmental Characteristics*

| From | To | Distance (Km) | Intermediate Stations | Key Environmental Characteristics |
|---|---|---|---|---|
| Dar es Salaam | Msua | 105 | Pugu (Ilala)<br>Ruvu (Kibaha) | **Topography:**<br>This section is nearly level to gently rolling plains and plateaux. It is developed on Quaternary, Neogene, Jurrasic and Cretaceous sediment.<br><br>**Agro-ecological Zones:**<br>The zones alternates, from East to West, nearly level to gently rolling plains and plateaux. The zone is characterized as Northern Zanzibar–Inhambane Coastal Forest Mosaic ecoregion; which together with the Eastern Arc Montane Forests, harbour densities of plant species that are among the highest in the world.<br>This zone originates from Somalia and Kenya coast, and continues along the coast of northern Tanzania to Dar es Salaam where outliers of the ecoregion extend inland at the base of the Uluguru, Nguru and Udzungwa Eastern Arc Mountains. |
| Magindu | Masimbu | 136 | Ngerengere<br>Kingolowira<br>Morogoro | **Topography:**<br>The Physiographic units of this area range from well drained, level to rolling plains at low altitude (200-500m) to strongly dissected uplands and low hills transitional to mountains at an altitude 500-1,000m; mainly developed on intermediate metamorphic rocks.<br><br>**Agro-ecological Zone:**<br>This eco-region is defined as Eastern Miombo Woodlands. The zone is dominated by savanna ecosystems covering wide areas of gentle hills and low valleys formed by the Ngerengere River. It is confined to the lower elevations of the East African Plateau, ranging from 200m along the eastern coastal regions to 800 to 900m in the interior. Tributaries of the Ruvu River traverse this area in a predominantly west-east direction. The miombo trees are usually 12 to 18m tall, with a broadleaf shrub and grass understory beneath. This vegetation supports greater floral richness and includes almost all the miombo dominants, such as *Brachystegia floribunda and B. glaberrima.* |

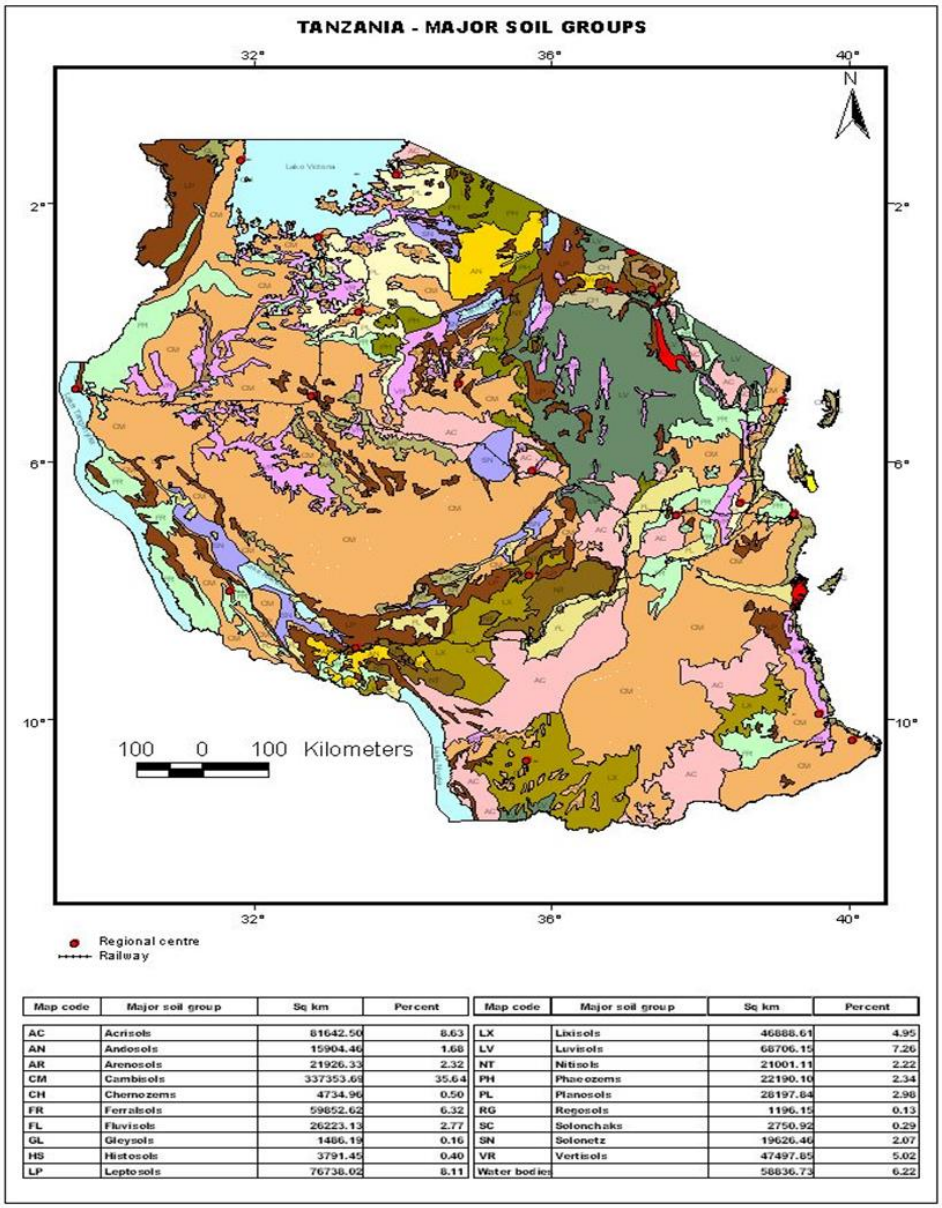
| From | To | Distance (Km) | Intermediate Stations | Key Environmental Characteristics |
|---|---|---|---|---|
| Mkata | Kilosa | 42 | None | **Topography:**<br>This section is well drained, flat to rolling plains and has low altitude. It is also developed on intermediate metamorphic rocks.<br><br>**Agro-ecological Zones:**<br>In this section, the dominant ecological region is Zambezian Flood Plain Grassland. This eco-region consist of dry deciduous forest, thicket, mopane and Mkata River's (within Wami Watershed) riverine woodlands and secondary grassland.<br>The area falls within the Zambezian centre of endemism and coincide largely with Zambezian dry deciduous forest and scrub forest. |
| Igandu | Kazikazi | 279 | Kikombo<br>Humuwa<br>Dodoma<br>Kigawe<br>Bahi<br>Kintiku<br>Makutopora<br>Manyoni<br>Itigi | **Topography:**<br>This section is gently undulating to plains formed on 'continental deposits' overlying granites. In some areas, this section has flat plains at medium altitude developed mainly on alluvium. Soil erosion is prevalent in the Makatupora River watershed.<br><br>**Agro-ecological Zones:**<br>The ecoregion is characterized as Southern Acacia-Commiphora bushlands and thickets. Acacia trees predominate, joined by thorny commiphora trees with thriving grasses. |

### *4.4.6 Soil Structure*

According to the World Reference Base for Soil Resources (WRB), Tanzania has 19 dominant soil types.

The proposed SGR alignment passes through numerous soil types from Dar es Salaam to Makutopora. The right of way for the Project is anticipated to be dominated by Cambisols, Luvisols, Phaeozems, Planosols and Solonetz soil groups as shown in *Figure 4-3* below.

***Figure 4-3 Tanzania Major Soil Groups***




| Map code | Major soil group | Sq km | Percent | Map code | Major soil group | Sq km | Percent |
|---|---|---|---|---|---|---|---|
| AC | Acrisols | 81642.50 | 8.63 | LX | Lixisols | 46888.61 | 4.95 |
| AN | Andosols | 15904.46 | 1.68 | LV | Luvisols | 68706.15 | 7.26 |
| AR | Arenosols | 21926.33 | 2.32 | NT | Nitisols | 21001.11 | 2.22 |
| CM | Cambisols | 337353.69 | 35.64 | PH | Phaeozems | 22190.10 | 2.34 |
| CH | Chernozems | 4734.96 | 0.50 | PL | Planosols | 28197.84 | 2.98 |
| FR | Ferralsols | 59852.62 | 6.32 | RG | Regosols | 1196.15 | 0.13 |
| FL | Fluvisols | 26223.13 | 2.77 | SC | Solonchaks | 2750.92 | 0.29 |
| GL | Gleysols | 1486.19 | 0.16 | SN | Solonetz | 19626.46 | 2.07 |
| HS | Histosols | 3791.45 | 0.40 | VR | Vertisols | 47497.85 | 5.02 |
| LP | Leptosols | 76738.02 | 8.11 | Water bodies | | 58836.73 | 6.22 |

Source: Ardhi University, 2018

### *4.4.7 Erosion Potential*

The SGR alignment crosses both perennial and seasonal watercourses and spans regions with differing rainy seasons and mean annual precipitation.
Some sections of the existing MGR have experienced flooding and erosion especially during the rainy season *(Figure 4-4)*. Other areas include riverbanks like Mkondoa River at Kilosa and areas between Kilosa and Gulwe. Other sections such as between Mpwapwa and Makutopora have unstable formations, which makes the soil more susceptible to soil in erosion.

***Figure 4-4 Heaps of Sand/Soil recovered from a bridge in the existing MGR at Gulwe (Mpwapwa) as a result erosion upstream***

Source: ERM site visit, 2017

### *4.4.8 Mineral Resources*

There are several mineral resources and deposits in different regions traversed by the Project rail line. Two groups of mineral resources within the regions traversed by the proposed railway line Project are found close to the Project Area of Influence. These include kiln kaolin (ceramic and refractory minerals) in Dar es Salaam region and coloured stones (amethyst, quartz, citrine, aventurine etc.) in Morogoro and Dodoma regions. The direct area of influence for this Project does not have mineral resources.

### *4.4.9 Surface Water Resources*

*Surface Water Resources*

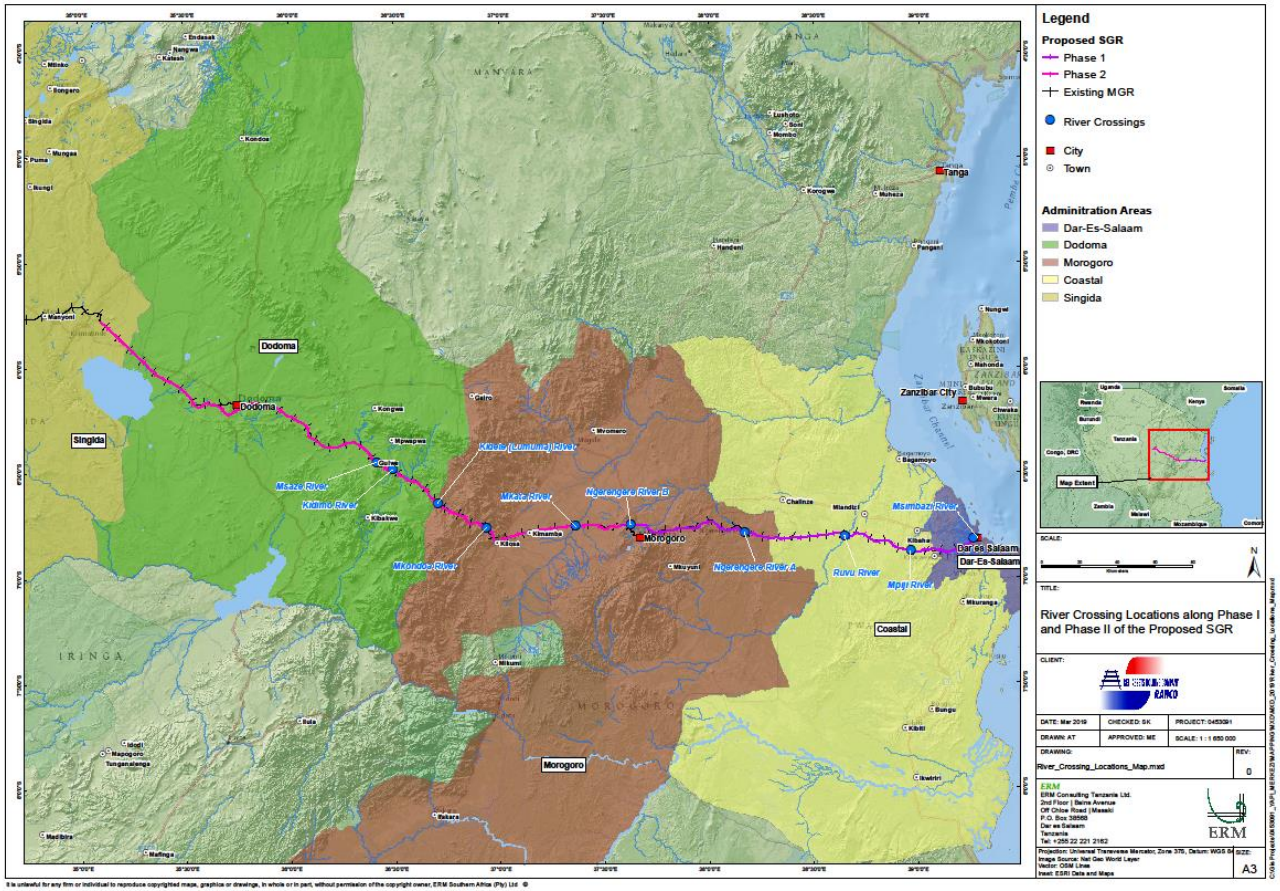
The proposed SGR alignment crosses several watercourses and passes through the Wami/ Ruvu Water Basin. There are a total of 104 major catchments of the Ruvu River across which the proposed SGR will pass; these catchment areas range in size from 0.25 km² to 14,600 km². (The proposed SGR line has by-passed several catchments crossed by the existing metre gauge railway line (MGR) and therefore many old bridge crossings have been by-passed). The Ruvu River floodplain is an important part of the river system; it provides storage for water during high flows and acts as a storage area for sediment and nutrients. The Ruvu River is a key water source for Dar es Salaam and the Coast Region (Pwani).

There are three perennial and six seasonal rivers that cross the Project Area in various sections of the SGR, as shown in *Table 4-4*.

***Table 4-4 Rivers Crossing the Railway and Other***

| S/N | Name of the River/reservoir/lake | Location (Region) | Chainage | Remarks |
|---|---|---|---|---|
| 1 | Mpiji river | Coastal | 38+500 | Seasonal |
| 2 | Ruvu river | Coastal | 76+750 | Perennial |
| 3 | Ngerengere A river | Morogoro | 131+320 | Seasonal |
| 4 | Ngerengere B river | Morogoro | 197+000 | Seasonal |
| 5 | Mkata river | Morogoro | 227+915 | Perennial |
| 6 | Mkondoa river | Morogoro | 280+150 | Perennial |
| 7 | Kidete (Lumuma) river | Morogoro | 310 +388 | Seasonal |
| 8 | Kidimo river | Dodoma | 342+434 | Seasonal |
| 9 | Msaze river | Dodoma | 352+000 | Seasonal |

*Figure 4-5 Map of Major River Crossing*



*Surface Water Quality*

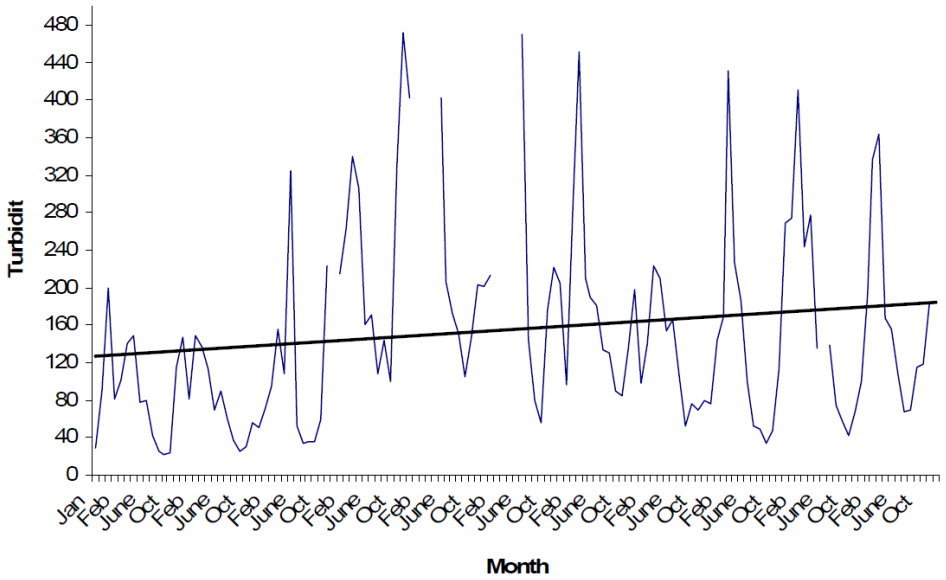
Water quality results taken from secondary sources for water bodies in the Wami/ Ruvu Water Basin are presented in ***Annex D***. Results for various water quality parameters are provided for a range of rivers and streams, with data sourced primarily from the Wami/Ruvu Water Basin offices. There are no known continuous monitoring programs for water quality in the two basins, thus there is no continuous water quality data available. Some data exists but were only measured at a given location and time on specific request; this fact is also confirmed by Zanda and Munishi (2007)[1].

What is particularly evident in almost all water samples is the high levels of *E.Coli* (up to 75,000 CUF/100ml) present in surface water. Likely sources of such faecal contamination include untreated sewage, and contamination from livestock. Surface water samples also generally indicate high turbidity levels, reflecting high suspended sediment loads, due primarily to erosion due to poor farming practices and river riparian zone degradation.

Zanda and Munishi (2007) report on turbidity data obtained from the Dar es Salaam Water Supply Company (DAWASCO) for the Ruvu River measured at the Morogoro Road Bridge for the period 1992 – 2002. Data analysis shows that water turbidity in the Ruvu River increased from 130 NTU in 1992 to 185 NTU in 2002. This is an increase in turbidity in the river of 5 NTU per year reflecting increases in sediment loading into the river over the same time (*Figure 4-6*). Drinking water quality standards in Tanzania provide limits for turbidity of between 5 and 25 NTU's.

1) Yanda and Munishi (2007) Hydrologic and Landuse/Cover Change Analysis for the Ruvu River (Uluguru) and Sigi River (East Usambara) Watersheds

*Figure 4-6* ***Mean monthly turbidity trend in the Ruvu River (1992 to 2002) at the Morogoro Bridge***




Such trends of increasing water turbidity are associated with vegetation degradation which results in erosion and higher sediment delivery into the streams. According to Zanda and Munishi (2007), discussions with local communities also indicated that there has been an increase in sediment loading into streams which they attribute to unsustainable agriculture practices involving vegetation clearing. The majority of community members interviewed also expressed their concern that water in streams and rivers is becoming more dirty especially during the rainy season, and that sedimentation in rivers has become so high that most of the rivers are changing their courses.

Similarly highly turbid rivers were observed for the Mkondoa River (*Figure 4-7*)**.**

*Figure 4-7 Sediment loads in the Mkondoa River (at chainage km 280+150)*

*Source:* Yapi Merkezi (photo taken on the 27/02/2019)

In major towns and cities in the Dar es Salaam, Morogoro and Dodoma regions, possible water pollution sources in the area of influence include wastewater discharges from residential areas and discharges from industries. For example, the Msimbazi river in Dar es Salaam has a pH of about 12, elevated Cr6+ levels of 75 times of the WHO limit and faecal contamination levels far above the WHO limits for safe use of wastewater in agriculture (Joseph[1] , 2018). Water quality effluent data from the wastewater treatment plants in DSM, Morogoro and Dodoma regions (*Annex D*) indicate that final treated effluents discharged have elevated levels of BOD and COD significantly above permissible Tanzanian discharge limits. Refer *Annex D* Water and Wastewater Quality Results.

Away from populated cities and towns, rivers have generally better water quality, but concentrations of parameters are generally above WHO requirements for drinking water, especially for faecal contamination and turbidity. The Ruvu River for example, has Dissolved Oxygen (DO) ranging between 4.0–8.10 mg/l, Turbidity between 24-112 NTU (against a drinking water standard of 0-1 NTU)), Nitrate concentrations of between 1.02–1.8 mg/l

[1] Jane Joseph (2018) accessed from https://static1.squarespace.com/static/5627894ce4b0a834a45c5cec/t/573daff9b09f952d7c1e4d2b/1463660569081/Msimbazi+Bulletin+FINAL.pdf, [viewed in January 2018]

(against a drinking water standard of 0 to 6 mg/l), BOD (10-50 mg/l) and coliforms counts up to 1000 CFU/100 ml (against a drinking water quality requirement of Zero); (Glows – Fiu, 2014). Further data on the water quality of water sources in the Project Area is as shown in *Annex D*.

Against this background, further water samples were collected by Yapi Merkezi between 27th February and 7th March, 2019 from the rivers listed in *Table 4-4*[1], with results provided in *Table 4-5* and included in ***Annex D***.

***Table 4-5 Analysis Results of the Rivers along SGR Route***

| | Sampling Date | pH | EC (mg/l) | Turbidity (NTU) | DO (mg/l) | Temp (°C) | Oils & Grease (mg/l) |
|---|---|---|---|---|---|---|---|
| Mpiji river | 01.03.2019 | 7.61 | 151.30 | 781.00 | 7.61 | 29.2 | <1.0 |
| Ruvu river | 27.02.2019 | 7.61 | 97.00 | 252.00 | 7.18 | 28.1 | <1.0 |
| Ngerengere A | 01.03.2019 | 8.34 | 1475.00 | 16.00 | 6.76 | 27.8 | <1.0 |
| Ngerengere B | 01.03.2019 | 7.87 | 908.00 | 14.00 | | 27.3 | <1.0 |
| Mkata river | 01.03.2019 | 7.86 | 256.20 | 846.00 | 6.65 | 27.6 | <1.0 |
| Mkondoa river | 27.02.2019 | 8.10 | 1114.00 | 2030.00 | 6,.2 | 27.4 | <1.0 |
| Kidete river | 04.03.2019 | 8.36 | 948.48 | 1245.00 | 7.34 | 27.8 | <1.0 |

The data supports the previous statements made with respect to turbidity, with values of turbidity in all rivers crossed by the SGR in excess of the Tanzanian drinking water guidelines, with the exception of the Ngerengere River crossings. Also to note, is the absence of traces of oils and greases in all rivers sampled.

*Future Use of Water in the Project Area*

Future use of water sources in the Project Area is expected to increase dependent on the nature of development activities that will take place, and the availability (both quality and quantity) of water available. With population increasing, the demand for water for domestic use, and for irrigation and livestock is also expected to increase. Abstraction of water from the existing rivers and groundwater sources is permitted by the Wami Ruvu Water Basin Office to ensure that the use of water is used sustainably, and existing sources are protected from pollution. It is therefore a requirement that all water users (including the Project) should acquire the relevant Water Use permits, Groundwater permits and Discharge permits, and implement sustainable

[1] It should be noted that samples could not be taken from Kidimo River and Msazae River since they were dry.

measures to protect water sources and to meet the conditions as prescribed in each permit, as per the requirements of the Water Resources Management Act (No 11 of 2009). Permit applications for all water resources planned to be used by the Project have been submitted and most permits with respect to abstraction from surface water bodies and abstraction from boreholes have been acquired by the Project. All such permits are listed in *Chapter 3*.

*Description of Flooding and Sedimentation events along the proposed SGR project*

**Flooding Events along the Proposed SGR Project**

The existing MGR line has experienced impacts from flooding and sedimentation events at Kilosa, Kidete and Gulwe sections. A total of 40 flood events occurred between Kilosa and Dodoma during 2011–2014, out of which 22 (55 percent) flood events occurred at two specific locations of Km 349 and at Km 365.6 which fall at Gulwe and Godegode areas (JICA *et al*., 2016). The Kilosa, Kidete and Gulwe sections have experienced repeated flooding events in 1962, 1968, 1992, 1997/1998, 2009/2010, 2011, 2014 and the most recent event in January, 2018. The impacts of these floods have included railway damage in terms of scouring around substructure piers and/or embankments and outflows of track and/or rail-bed. The occurrence of these floods is attributed to the fact that the railway crosses the Kilosa to Dodoma section consisting of two major rivers; the Kinyasungwe and Mkondoa Rivers (*Figure 4-8*).

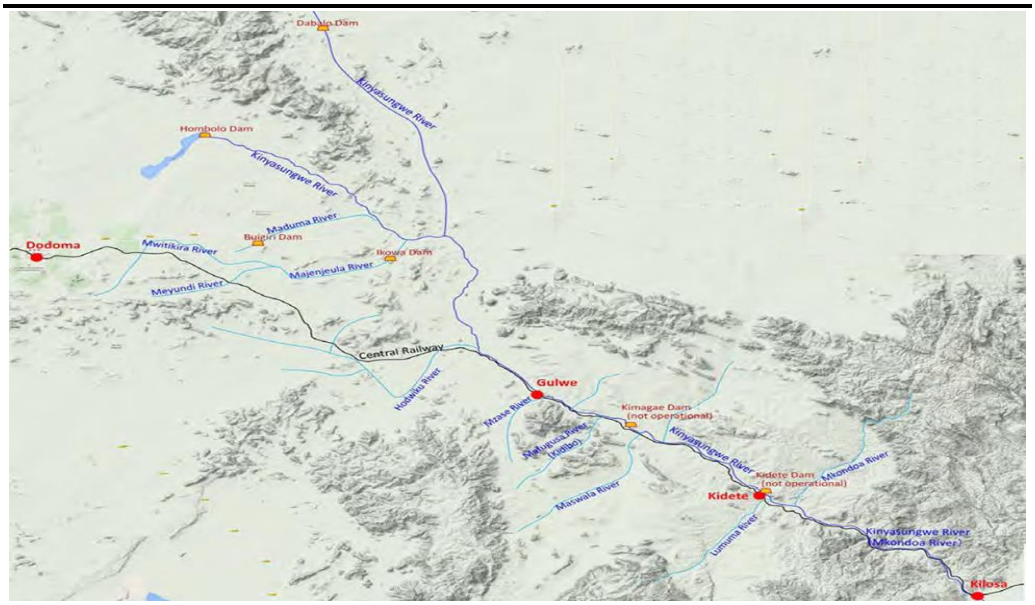
TRC has implemented several recovery emergency response measures to ensure quick reopening of railway operations but not serious preventative measures due to limited funds. The detailed descriptions of the main topographical features of Kilosa-Dodoma section are summarized in *Table 4-6*.

***Table 4-6 Description of Topographical Features from Kilosa-Dodoma Section***

| Section | Topographical Features |
|---|---|
| Kilosa (Km 283)-Kidete (Km 326): | Route in parallel close to the Kinyasungwe River, in the valley |
| Kidete (Km 326)-Gulwe (Km366): | Route in parallel close to the Kinyasungwe River in the region of gentle slope (three large-scale tributaries crossing the railway) |
| Gulwe (Km366)-Msagali (Km 382): | Route in parallel close to the Kinyasungwe River in the region of gentle slope |
| Msagali(Km382)-Dodoma(Km456): | Route in the region of gentle slope (three tributaries crossing the railway) |

Source: Adopted from JICA *et al*., 2016

*Figure 4-8 Kilosa-Dodoma Section with Main Rivers and Tributaries*




Source: JICA et al., 2016

**Sedimentation Events along the Proposed SGR Project**

The existing MGR line has also experienced sedimentation events in some hotspot areas. The most noteworthy sedimentation incident reported and witnessed was in the section between Kidete and Gulwe. Three rivers namely Maswala, Kidibo and the Mzase rivers flows through this section. These rivers erode significant sediments upstream and discharge along this section affecting the MGR line.

The ESIA team observed that the existing MGR alignment runs along a developing alluvial fan near the confluence of the Maswala and the Kinyasungwe Rivers, between Kilosa and Dodoma. This section experiences frequent overtopping sediment discharge causing washout of ballast material, collapse of railway embankments and sometimes complete burying of the MGR line. The railway authority deploy their work gangs from neighbouring sections to restore the damaged sections for urgent recovery of railway operations (Figure 4-9). The ESIA team witnessed the installation of Gabions and construction of water channels to control water flow to mitigate the impacts along these sections.

*Figure 4-9* ***Heaps of Sediments Recovered from a Bridge at Existing MGR and Gabions being installed at Gode Gode***

Source: ERM Site Visit, 2017

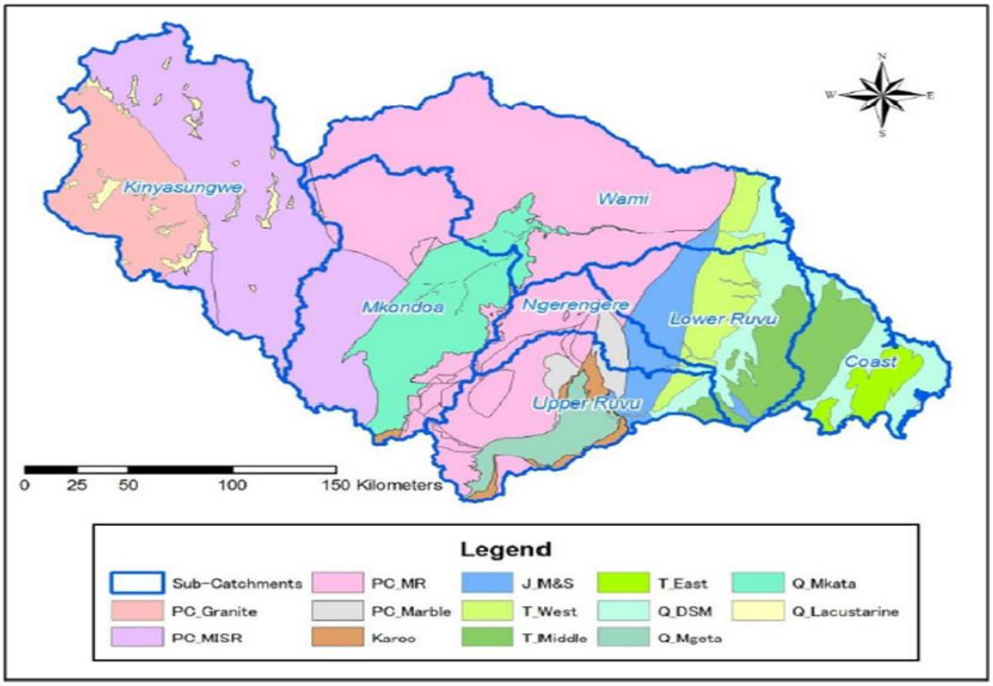
### *4.4.10 Groundwater Resources*

*Groundwater Occurrence*

Groundwater is abundant in almost all the villages along the railway line. There are a number of shallow wells in most of the villages which are used as a source of water for domestic use. Groundwater aquifers within the Wami/Ruvu basin are shown in *Figure 4-10*.

The geological structure of Tanzania is characterized by the Great Rift Valley. The geology and geological structure in the Project Area is characterized by Meta-igneous, Meta-sediments, gneiss, granulite, Migmatite and granite in Precambrian. These structures are over two billion years old (>2,000 Ma) and are distributed in the watershed of the Project Area. Therefore, a lot of lineaments which express faults are observed along the Rift Valley (JICA, 2016). Existence of lineaments faults facilitate seepage and direct movement of surface water to groundwater which increase the vulnerability of the groundwater to pollution. Based on the data shown for boreholes drilled for Project use (refer to *Table 4-7 and Figure 4.11)*, the water table in the Project Area ranges from 15 m to 120 m. The major aquifers from Dar es Salaam to Dodoma (within the Wami/Ruvu Water Basin) are shown in *Figure 4-10.*

*Figure 4-10 Map of Wami Ruvu Basin Showing the Groundwater Aquifers*




Source:TRC, 2016.

*Figure 4-11 Map of Project Boreholes*

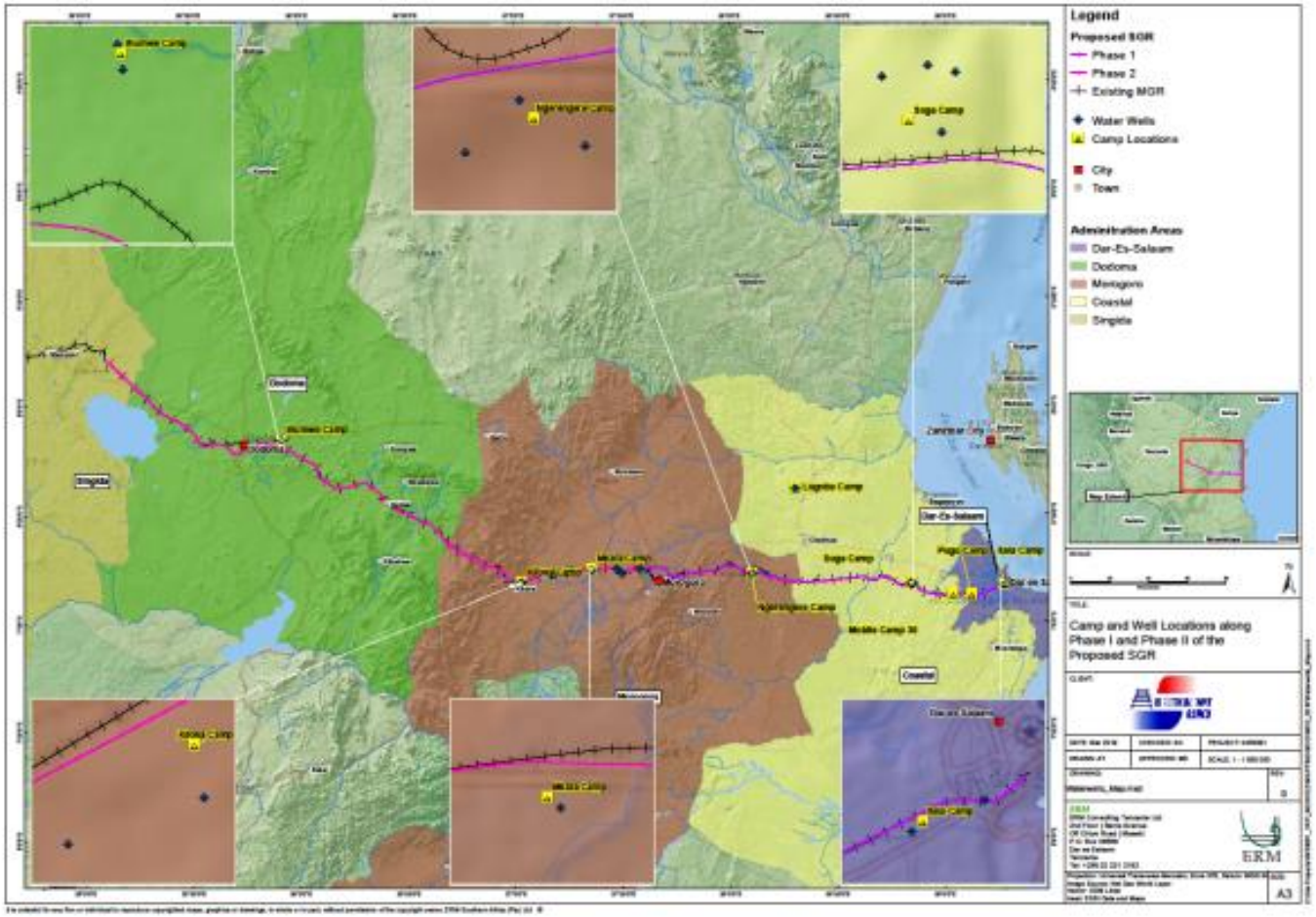


*Table 4-7 Borehole Characteristics of Boreholes to be used by the Project*

| Location | Pump Test Results |
|---|---|
| KM 201 - Lukobe | • The well is 80 m deep, screened for a total of 27 meters throughout the well depth starting at 22 m onwards. Water strike was noted as ranging between 25 – 65 m;<br>• Predominant geology profile is sandstone to 21 m depth where after granite with some hornblende (48 – 69 m depth);<br>• Two types of pump test were conducted on the borehole in April 2018: 24 hour duration constant discharge test and 1 hour recovery tests with recoveries at 100% within the first hour.<br>• The static water level was ~ 10.2 m bgl with the max dynamic water level at 54.2 m bgl. |
| KM 211 - Kimambila | • The well is 150 m deep, screened for a total of 45 meters throughout the well depth with screen intervals starting at 45 m onwards. Water strike was observed to range between 55 – 65 m;<br>• Predominant geology profile is weathered gneiss to 70 m depth where after granite with intermittent quartz fragments (70 – 150 m depth);<br>• Two types of pump test were conducted on the borehole in January 2018: 22 hour duration constant discharge test and 1 hour recovery test with recoveries at 84% within the first hour.<br>• The static water level was ~ 26 m bgl; |
| KM 215 - Kimambila | • The well is 100 m deep, screened for a total of 33 meters throughout the well depth with screen intervals starting at 45 m onwards. Water strike was identified at various intervals and ranged between 39 – 42 m, 57 – 60 m, 70 - 72 m;<br>• Predominant geology profile is weathered gneiss to 70 m depth followed by weathered granite;<br>• Two types of pump test were conducted on the borehole in October 2018: 24 hour duration constant discharge test and 55 min. recovery test with recoveries at 98% within 55 min.<br>• The static water level was ~ 22.5 m bgl; |
| KM 229 (228+600 Mkata Camp) | • The well is 120 m deep, screened for a total of 36 meters throughout the well depth with screen intervals starting at 34 m onwards. Water strike was identified between 45 – 65 m;<br>• Predominant geology profile is sandstone to a depth of 49 m, followed by a limestone layer ranging from 50 – 55 m, granite rich with quartz and hornblende until 99 m with the remaining 20 meters gneiss metamorphic rock.<br>• Two types of pump test were conducted on the borehole in June 2018: 22 hour duration constant discharge test and 2 hour recovery test with recoveries at 100% within the designated timeframe.<br>• The static water level was ~ 28 m bgl; |
| KM 241 - Kimamba | • The well is 85 m deep, screened for a total of 30 meters throughout the well depth with screen intervals starting at 16 m onwards. Water strike was identified to start at 25 m continuing throughout to 80 m;<br>• The geologic profile is variation of sand profiles to 35 m, with a weathered gneiss layer from 36 – 50 m, a weathered magnetite |

| Location | Pump Test Results |
|---|---|
| | layer to 59 m, coarse sand and weather amphibolites and hard rock until 85 m;<br>• Two types of pump test were conducted on the borehole in June 2018: 23 hour duration constant discharge test and 55 min recovery test with recoveries at 100% within the designated timeframe.<br>• The static water level was ~ 30 m bgl; |
| KM 249 - Kimamba | • The well is 88 m deep, screened for a total of 30 meters throughout the well depth with screen intervals starting at 19 m onwards. Water strike was identified to start at 15 m continuing throughout to 88 m;<br>• Prevalent geology profile is sandstone to a depth of 29 m, fine sand layer from 30 – 31 m followed by quartz sandstone layer until 38 m, a limestone layer ranging from 39 – 49 m, whereafter sandy clay to coarse sand with limestone from 66 – 88 m.<br>• Two types of pump test were conducted on the borehole in March 2018: 24 hour duration constant discharge test and 1 hour 10 min recovery test with recoveries at 100% within the designated timeframe.<br>• The static water level was ~ 13.1 m bgl; |
| KM 264 – Ihumwa Camp | • The two wells are located 300 m apart from one another;<br>• The well depths are 48 m and 68 m in depth respectively, with borehole design and geologic profile unknown;<br>• Two types of pump test were conducted on the borehole in December 2018: 24 hour duration constant discharge tests and 1.5 hours recovery test with recoveries at 100% within the designated timeframe.<br>• The static water level was ~ 2.4 m and 3.3 m bgl respectively; |
| KM 249 - Kimamba | • The two wells are located 700 m apart from one another;<br>• The well depths are 70 m and 80 m in depth respectively, screened for a total of 30 meters throughout the well depth with screen intervals starting at 22 m onwards. Water strike was identified from 6 – 65 m;<br>• The two boreholes geologic profiles are very similar with sand profiles to 30 m, with a weathered gneiss layer from ~ 40 – 50 m, a weathered magnetite layer to 60 / 70 m respectively and weather amphibolites and hard rock until depth;<br>• Two types of pump test were conducted on the borehole in July 2018: 24 hour duration constant discharge test and 1.5 hours recovery test with recoveries at 100% within the designated timeframe.<br>• The static water level was ~ 4.48 and 6.18 m bgl respectively; |
| KM 422 – Kilosa Camp | • The two wells are located 700 m apart from one another;<br>• The well depths are 70 m and 80 m in depth respectively, screened for a total of 30 meters throughout the well depth with screen intervals starting at 22 m onwards. Water strike was identified from 6 – 65 m;<br>• The two boreholes geologic profiles are very similar with sand profiles to 30 m, with a weathered gneiss layer from ~ 40 – 50 m, a weathered magnetite layer to 60 / 70 m respectively and weather amphibolites and hard rock until depth; |

| Location | Pump Test Results |
|---|---|
| | • Two types of pump test were conducted on the borehole in July 2018: 24 hour duration constant discharge test and 1.5 hours recovery test with recoveries at 100% within the designated timeframe.<br>• The static water level was ~ 4.48 and 6.18 m bgl respectively; |

The impacts of abstraction from these boreholes on the surrounding communities have been evaluated based on the pump test reports, and are addressed in the ESIA *Chapter 9* "Impacts on Social Environment".

*Groundwater Quality*

The quality of ground water collected in DSM, Morogoro and Dodoma regions and indicated in *Annex D*, is fresh water, but in in Dar es Salaam and for samples collected at Soga in the Coast Region, two boreholes that have been drilled by Yapi Merkezi (BH No.1, 126 m deep and BH No.2, 78 m deep), show groundwater to be saline (chloride values of 1023 mg/l – 1320 mg/l, which is higher than the Tanzania Drinking Water Standard of 600 mg/l) and hard (Total hardness of 1031 mg/l, compared to the Tanzania Drinking Water Standard of 600 mg/l).

The groundwater quality is different in sources of water analyzed for the Dodoma region. The groundwater source from Makutopora Basin (Mzakwe area) is not saline and is fit for domestic and other municipal uses, and bacteriological analyses revealed that these boreholes were free of coliform bacteria (*Annex D).*

Groundwater quality of those boreholes described in *Table 4-7* have been analyzed, with full results provided in ***Annex A***. A summary of the suitability of groundwater for use as a potable source of water for each of the boreholes is provided in *Table 4-8*. Water quality in these boreholes is primarily suitable as a source of drinking water but at the Soga Camp and at the borehole located at km 215, groundwater quality contains elevated levels of chloride, calcium or magnesium, rendering that water too saline or hard respectively for use as drinking water.

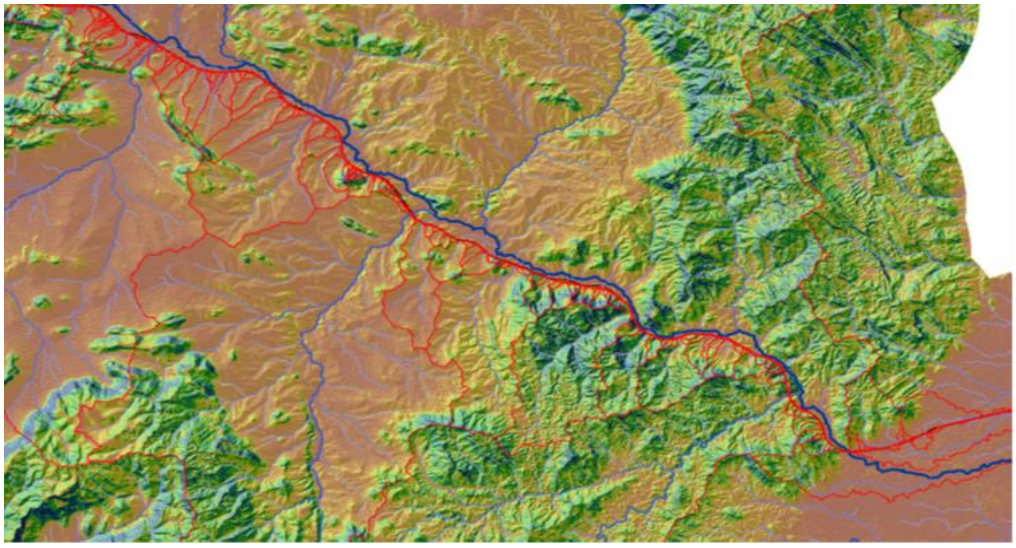
*Table 4-8 Groundwater Quality*

| Location of Well | Result |
|---|---|
| Soga Camp | Not suitable for drinking purposes due to high hardness |
| Km 201 - Lukobe | Suitable for drinking purpose |
| Km 211 - Kimambila | Suitable for drinking purpose |
| Km 215 - Kimambila | Not suitable for drinking purposes due to high chloride |
| Km 229 - Mkata | Suitable for drinking purpose |
| Km 241 - Kimamba | Suitable for drinking purpose |
| Km 249 - Kimamba | Suitable for drinking purpose |
| Km 264 - Kilosa | Suitable for drinking purpose |

*Groundwater Movement in the Project Area*

The Uluguru Mountains and Pugu Hills areas have been identified as key recharge areas for the groundwater in most parts of Dar es Salaam (Mato, 2002; Chikira, 2006; JICA, 2006). Groundwater movement is affected by the geological formations underneath. The aquifer fractures (lineaments) partly influenced by the rift valley in Dodoma and Singida regions do affect the groundwater movement. For instance, in the Mzakwe well field (Dodoma area) the groundwater movement is towards the north-eastern alignment. However, local groundwater flows are affected by the geomorphology. High altitude areas are a recharge base for the low areas; as such the river valleys become potential for groundwater storage. The Kilosa and Uluguru highlands are important recharge areas for adjoining local and regional aquifers. There are a number of local depression areas with sufficient groundwater storage capacity and therefore are important groundwater sources. With the prevailing geomorphology, the local groundwater movement may be bisected by the central Kilosa and Uluguru high lands, and thus causing groundwater flow to the east (Dar es Salaam) and western (Dodoma) parts (*Figure 4-12*).

*Figure 4-12 Surface Geo-morphology in the Project Area*



Source: Hydrologic and hydraulic Report, Yapi Merkezi, 2017

### *4.4.11 Air Quality*

The proposed SGR alignment crosses Dar es Salaam, Coast, Morogoro, Dodoma and Singida regions. Air quality of the Project Area is expected to be influenced by pollutants from existing stationary sources, fugitive /mobile sources and small combustion facilities. Existing stationary sources of air pollutants include industries and factories mostly found in Pugu road in Dar es Salaam and Morogoro town. Most communities along the railway stretch use firewood for cooking and heating are also classified as stationary sources of air pollutants. The air pollutants associated with stationary sources include nitrogen oxides ($NO_x$), sulfur dioxide ($SO_2$), carbon monoxide (CO), and particulate matter (PM), as well as other air pollutants including certain volatile organic compounds (VOCs). Metals may also be associated with industrial activities.

The fugitive sources of pollutants includes cars and trucks crossing the railway and the diesel powered locomotives (existing trains). Others sources include turbines located at Ruvu and boilers in various industries located in Dar es Salaam and Morogoro. The fugitive emissions Include VOCs, $NO_x$, $SO_2$ and CO mainly generated from combustion processes in vehicle engines, turbines and boilers. The spatial distribution for sources of air pollutants along the proposed railway stretch covers a very small area since the proposed project passes across undeveloped land-forests and bushlands.

Baseline data measurements done during the wet season at Kisaki station in Morogoro are presented in *Table 4-9*. The results indicate that all values with the exception of Carbon monoxide were below their respective standards. Carbon monoxide is a product of incomplete combustion of organic materials and recorded elevated levels may be linked to the use of firewood and charcoal. $PM_{10}$ concentrations measured at Kisaki, Morogoro rural area range between 6µg/m$^3$ and 27µg/m$^3$ which are below the General WHO/IFC guideline and Tanzania Emission Limits of 50µg/m$^3$ and 60 - 90µg/m$^3$ respectively.

Similarly, air quality measurements taken between Kilosa and Dodoma stations (ie Kilosa, Munisagara, Kidete, Godegode and Gulwe) in December 2015, indicate low level of ambient atmospheric pollutant concentrations as shown in *Table 4-9* and *Figure 4-13*.

***Table 4-9 Ambient Air Quality for Kisaki Station***

| **Measured Ambient Pollutant Gases** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **$CO_2$** | **CO** | **NO** | **$NO_X$ as $NO_2$** | **$SO_2$** | **$O_3$** | **$H_2S$** | **$C_2H_2$** | **$NH_3$** |
| Units | % | mg/m$^3$ | mg/m$^3$ | mg/m$^3$ | mg/m$^3$ | mg/m$^3$ | mg/m$^3$ | mg/m$^3$ | mg/m$^3$ |
| **ST1** | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **ST2** | 0.03 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **ST3** | 0.20 | 1.00 | 0.10 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **ST4** | 0.10 | 0.69 | 0.10 | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| **ST5** | 0.04 | 0.08 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **ST6** | 0.04 | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **ST7** | 0.01 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **ST8** | 0.02 | 0.02 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **ST9** | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **WHO/IFC Guidelines** | - | - | - | 0.2 | 0.02 | 0.1 | - | - | - |
| **Tanzanian Emission Limits** | - | 0.01 | - | 0.15 | 0.1 | 0.1 | - | - | - |

Source:TRC, 2016

*Figure 4-13 Air Quality Data Measured along the MGR between Kilosa and Dodoma Stations in December 2015*

| DATE | TIME LOCATION | MAXIMUM READING | | | MINIMUM READING | | | AVERAGE | | | RECOMMENDED AIR QUALITY STANDARD | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | LEL | NO 2 (PPM) | CO (PPM) | LEL | NO 2 (PPM) | CO (PPM) | LEL | NO2 (PPM) | CO (PPM) | LEL | NO 2 (PPM) | CO (PPM) |
| 01/12/15 | Kilosa Station | 0.0 | 0.0 | 5.0 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 5.0 | 0.25 at 20°C for methane | 53 (EPA) | 35 (EPA) |
| 02/12/15 | Munisangara station | 0.0 | 0.0 | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | | | |
| 03/12/15 | Kadete Station | 0.0 | 0.0 | 5.0 | 0.0 | 0.0 | 3.0 | 0.0 | 0.0 | 4.0 | | | |
| 04/12/15 | Godegode station | 0.0 | 0.1 | 12.0 | 0.0 | 0.0 | 4.0 | 0.0 | 0.05 | 8.0 | | | |
| 05/12/15 | Gulwe Station | 0.0 | 0.1 | 14.0 | 0.0 | 0.0 | 6.0 | 0.0 | 0.05 | 10.0 | | | |

NB: The air quality on a particular day depends on the activities.

Source: TRC, 2016

### *4.4.12 Noise and Vibrations*

The main source of current noise pollution in the proposed SGR alignment are the locomotives currently using the existing MGR. Noise monitoring completed by TRC at Kisaki, Morogoro rural area show that the daytime noise levels ranged between 37.16 dB(A) and 67.72 dB(A) and for night-time ranged between 37.84 dB(A) and 43.44 dB(A). This is in comparison to the IFC Guidelines and National Environmental Standards Compendium General Tolerance Limits for Environmental Noise(1) of 55 dB(A) for the day and 45 dB(A) during the night, set for mixed residential landuse. Day time exceedances of the noise limits therefore do occur.

Noise monitoring completed by TRC at Kilosa station, Morogoro Region, taken on the 4th December 2015 between 13h00 to 15h00 (representing day time noise levels) and 05h00 and 06h00 (representing night time noise levels), indicated low average noise levels (40.2 to 44.2 DB(A)), with intermittent noise levels peaking at up to 66 dB(A) (train with no whistle) to 88 dB(A) (train with whistle).

Secondary data collected on vibrations indicate increased vibrations at the stations when the training is passing. The data indicates lower vibration at the railway line foundation than off-points close to the station. According to measurements done at Kilosa station in 2015 (as reported by TRC, 2016), an approaching train in the MGR recorded high vibration values of 8.3 mm/s

(1) National Environmental Standards Compendium (Tanzania Bureau of Standards), EMDC 6 (1733) P 3: Acoustics - General Tolerance Limits for Environmental Noise

*Table 4-10 Sound Level at Kilosa Station Taken on 4th December 2015, at 1:00 to 15:00 hrs and 5:00 to 6:00 hrs*

| LOCATION | NOISE LEVEL (dBA) |
|---|---|
| Kilosa Station | |
| With no passenger shouting | 40.2-44.2 |
| With passenger Talking/Shouting/Laughing | 55-61 |
| Approaching Train without whistling | 65-66 |
| With Train Whistle | 84 |
| Stationary Train | 65-66 |
| Train Moving away from the station | 65-66 |

Source: TRC , 2016

Secondary data collected on vibrations indicate increased vibrations at the stations when the training in passing (*Table 4-11)*. The data indicate lower vibration at the railway line foundation compared to points close to the station. According to measurements done at Kilosa station in 2015 (as reported by TRC, 2016), an approaching train causes the highest vibration at the station, with maximum vibration levels recorded of 8.3 mm/s.

*Table 4-11 Vibration Levels at Kilosa Station Taken on 4th December 2015, at 1:00 to 15:00 hrs and 5:00 to 6:00 hrs*

| Location | Station Foundation[mm/s] | Open Field Close to Station Office[mm/s] |
|---|---|---|
| Kilosa Station | | |
| No train | 0 | 0 |
| Approaching train | 4.0 | 8.3 |
| Stationary Train | 0.5 | 2.4 |
| Train Moving away from the station | 3.5 | 6.5 |

Source:TRC, 2016

*Sensitive Resource / Receptors*

Receptors include primarily residential buildings, but also other noise sensitive receptors such as health facilities, educational institutions, homes for disabled etc. in surrounding villages. The distances from the construction sites and the ROW to such receptors vary throughout the entire SGR alignment.

The recent field surveys by YM/ERM in March 2019 identified 59 noise sensitive receptors along the SGR alignment as given in the below Figure 4-13, Figure 4-14 and Table 4-15.

*Figure 4-14 Noise Sensitive Receptors along SGR Alignment*

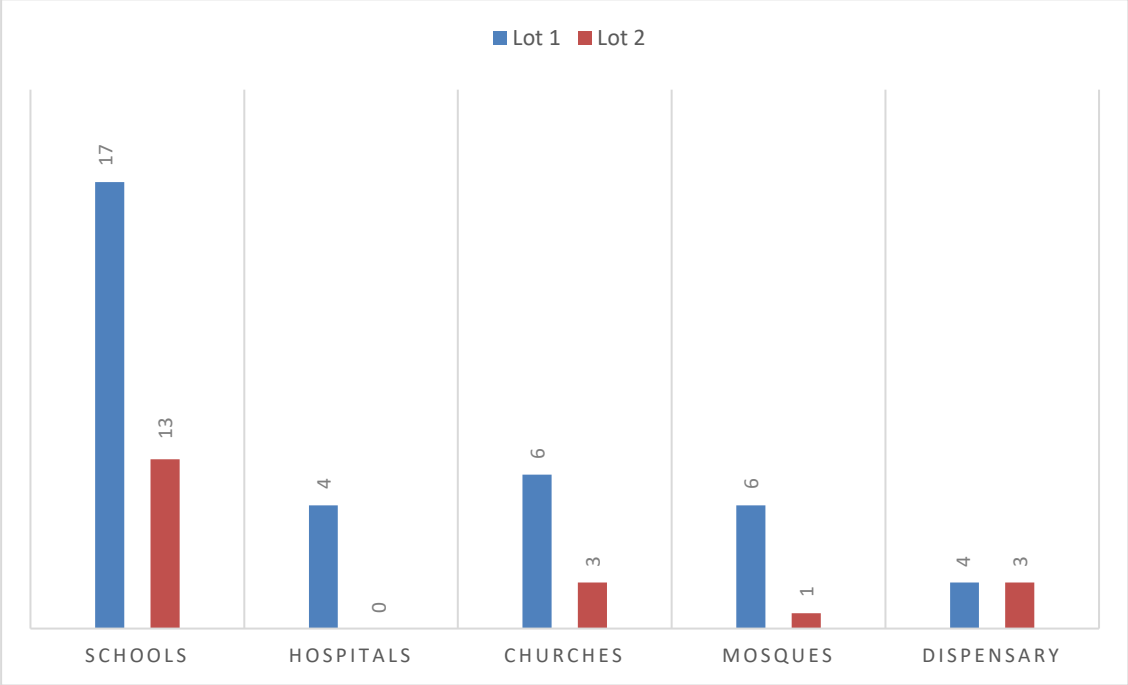


*Figure 4-15 Noise Sensitive Receptors along SGR Alignment*

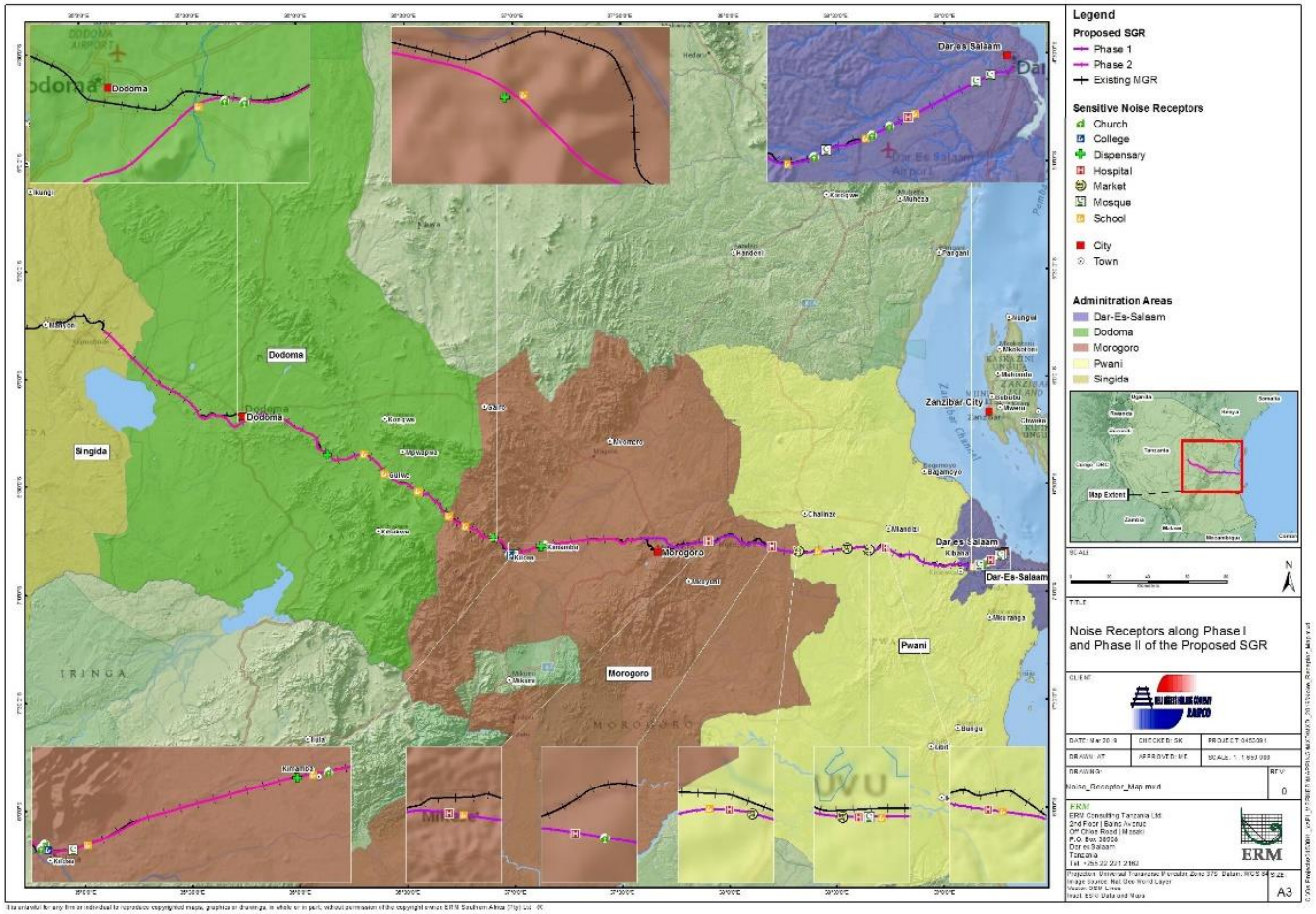


*Table 4-12 Noise Sensitive Receptors along SGR Alignment*

| ID Number | District | Village | Receptor | KM Chainage | Distance to Alignment (m) |
|---|---|---|---|---|---|
| 1 | Ilala | Shauri moyo | Al Haramain Muslim School | 001+600 | 120 |
| 2 | Ilala | Shauri moyo | Mchanganyiko Secondary School | 001+600 | 173 |
| 3 | Ilala | Shauri moyo | Songea Mosque | 001+900 | 64 |
| 4 | Ilala | Mafuriko | Masjid (Mskitini) Dodoma | 002+750 | 65 |
| 5 | Ilala | Kipawa | Kipawa Health Center | 008+500 | 130 |
| 6 | Ilala | Kipawa | Ilala Secondary School | 008+900 | 70 |
| 7 | Ilala | Kipawa | Majani ya Chaia Secondary School | 008+750 | 110 |
| 8 | Ilala | Uwanja wandege | Kipawa Lutherian Church | 009+450 | 60 |
| 9 | Ilala | Kipawa | Ugombolwa Secondary School | 009+600 | 75 |
| 10 | Ilala | Stakishari | Winners Chapel International | 011+500 | 75 |
| 11 | Ilala | Sabasaba | Kingdom Heritage Model School | 011+450 | 55 |
| 12 | Ilala | Ukonga | Cardinal Rugambwa Hospital | 013+200 | 210 |
| 13 | Ilala | Gongo la mboto | Masjid Mariam | 015+400 | 110 |
| 14 | Ilala | Gongo la mboto | Rugwa Nursery Primary School | 017+600 | 110 |
| 15 | Ilala | Guruka kwa lala | Miuma wa Moto Church | 017+900 | 510 |
| 16 | Kibaha | Kikongo | Tumaini Primary School | 067+200 | 100 |
| 17 | Kibaha | Kikongo | Kikongo Dispensary | 067+200 | 270 |
| 18 | Kibaha | Ruvu | Ruvu Secondary School | 075+400 | 160 |
| 19 | Kibaha | Ruvu | Ruvu Primary School | 076+350 | 295 |
| 20 | Kibaha | Ruvu | Ruvu Station Masjid | 075+500 | 190 |
| 21 | Kibaha | Ruvu | Ruvu Hospital | 076+100 | 100 |
| 22 | Kibaha | Kwala | Kwala Primary School | 084+700 | 70 |
| 23 | Kibaha | Msua | Msua Primary School | 100+900 | 180 |
| 24 | Kibaha | Magindu | Magindu Primary School | 113+600 | 310 |
| 25 | Chalinze | Magindu | Magindu Clinic | 113+300 | 210 |
| 26 | Chalinze | Magindu | Keketi Church | 113+500 | 225 |

| ID Number | District | Village | Receptor | KM Chainage | Distance to Alignment (m) |
|---|---|---|---|---|---|
| 27 | Chalinze | Magindu | Masjidi Nour | 113+150 | 190 |
| 28 | Morogoro vijijini | Kidugalo | Kidugalo Primary School | 127+900 | 130 |
| 29 | Morogoro vijijini | Kidugalo | Kidugalo Dispensary | 129+750 | 220 |
| 30 | Morogoro vijijini | Mikese | Church of Kidugalo | 129+700 | 190 |
| 31 | Morogoro vijijini | Kinonko | Kinonko Masjid | 149+500 | 110 |
| 32 | Morogoro vijijini | Kinonko | Kinonko Secondary School | 149+700 | 180 |
| 33 | Morogoro vijijini | Mikese | Kinonko Dispensary | 149+850 | 120 |
| 34 | Morogoro vijijini | Mikese | Mikese Primary School | 163+200 | 140 |
| 35 | Morogoro vijijini | Mikese | Mikese Dispensery | 163+250 | 140 |
| 36 | Morogoro vijijini | Mikese | Mesjidi Bayillah Mikese | 163+300 | 350 |
| 37 | Morogoro vijijini | Mikese | Mikese Church | 163+200 | 395 |
| 38 | Morogoro vijijini | Mikese | Residential Area near Rock Quarry | 205+000 | 500 |
| 39 | Kilosa | Mkata | School | 224+100 | 200 |
| 40 | Kilosa | Kimamba | Church | 252+900 | 80 |
| 41 | Kilosa | Kimamba | School | 253+000 | 80 |
| 42 | Kilosa | Kimamba | Dispensary | 254+000 | 15 |
| 43 | Kilosa | Kichangani | Residential Area near Borrow Pit | 266+000 | 500 |
| 44 | Kilosa | Kichangani | School | 269+400 | 50 |
| 45 | Kilosa | Mtendeni | Mosque | 269+650 | 15 |
| 46 | Kilosa | Kasiki | Church | 270+700 | 175 |
| 47 | Kilosa | Kasiki | College | 271+000 | 65 |
| 48 | Kilosa | Kasiki | Church | 271+000 | 65 |
| 49 | Kilosa | Munisigara | School | 284+300 | 40 |
| 50 | Kilosa | Munisigara | Dispensary | 284+500 | 85 |
| 51 | Kilosa | Kikundi | School | 301+100 | 145 |
| 52 | Kilosa | Kidete | School | 310+800 | 65 |
| 53 | Kilosa | Kidete | School | 311+150 | 60 |
| 54 | Mpwapwa | Godegode | School | 332+100 | 200 |
| 55 | Mpwapwa | Godegode | School | 332+450 | 100 |

| ID Number | District | Village | Receptor | KM Chainage | Distance to Alignment (m) |
|---|---|---|---|---|---|
| 56 | Mpwapwa | Gulwe | School | 352+800 | 185 |
| 57 | Mpwapwa | Msagali | School | 368+000 | 200 |
| 58 | Chamwino | Igandu | Dispensary | 388+000 | 150 |
| 59 | Dodoma City Council | Makulu/ Msangalale | School | 438+500 | 300 |

### *4.4.13 Baseline Noise Data of Sensitive Receptors along SGR RoW*

For most parts of the Railway, a rural background can be assumed where ambient noise level will be lower than those standards given in the Tanzanian regulations. In order to conduct a robust assessment, it has been assumed that baseline noise is low.

Baseline noise data was collected by YM in March 2019 within 1000 m RoW corridor as provided in Figure 4-16. Further measurements will be carried out at noise sensitive locations during construction works, and the need for mitigation will be implemented at those receptors where the noise levels exceed the limits as defined in Chapter 7 "Impacts to the Physical Envrionment, Section 7.3 "Impacts on Noise and Vibration".

*Table 4-13 Noise Sampling Results along the Noise Sensitive Receptors*

| ID Number | District | Village | Receptor | KM Chainage | Noise Measurements (DbA) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Min | Avg | Max |
| 1 | Ilala | Shauri moyo | Al Haramain Muslim School | 001+600 | 60 | 75 | 92 |
| 2 | Ilala | Shauri moyo | Mchanganyiko Secondary School | 001+600 | 60 | 75 | 92 |
| 5 | Ilala | Kipawa | Kipawa Health Center | 008+500 | 56 | 61 | 70 |
| 7 | Ilala | Kipawa | Majani ya Chaia Secondary School | 008+750 | 52 | 60 | 74 |
| 9 | Ilala | Kipawa | Ugombolwa Secondary School | 009+600 | 60 | 69 | 84 |
| 13 | Ilala | Gongo la mboto | Masjid Mariam | 015+400 | 60 | 75 | 92 |
| 16 | Kibaha | Kikongo | Tumaini Primary School | 067+200 | 41 | 48 | 70 |
| 18 | Kibaha | Ruvu | Ruvu Secondary School | 075+400 | 44 | 54 | 64 |
| 19 | Kibaha | Ruvu | Ruvu Primary School | 076+350 | 46 | 59 | 85 |
| 21 | Kibaha | Ruvu | Ruvu Hospital | 076+100 | 42 | 58 | 82 |
| 26 | Chalinze | Magindu | Keketi Church | 113+500 | 38 | 54 | 69 |
| 28 | Morogoro vijijini | Kidugalo | Kidugalo Primary School | 127+900 | 44 | 50 | 78 |
| 31 | Morogoro vijijini | Kinonko | Kinonko Masjid | 149+500 | 46 | 58 | 74 |
| 38 | Kilosa | Mkata | School | 224+100 | 32 | 46 | 57 |
| 39 | Kilosa | Kimamba | Church | 252+900 | 44 | 48 | 53 |
| 41 | Kilosa | Kimamba | Dispensary | 254+000 | 31 | 38 | 45 |
| 42 | Kilosa | Kichangani | School | 269+400 | 41 | 51 | 62 |
| 43 | Kilosa | Mtendeni | Mosque | 269+650 | 35 | 47 | 58 |
| 44 | Kilosa | Kasiki | Church | 270+700 | 35 | 46 | 57 |
| 45 | Kilosa | Kasiki | College | 271+000 | 30 | 43 | 57 |
| 47 | Kilosa | Munisigara | School | 284+300 | 40 | 51 | 62 |
| 48 | Kilosa | Munisigara | Dispensary | 284+500 | 42 | 54 | 66 |
| 50 | Kilosa | Kidete | School | 310+800 | 41 | 47 | 52 |
| 51 | Kilosa | Kidete | School | 311+150 | 40 | 46 | 52 |

| ID Number | District | Village | Receptor | KM Chainage | Noise Measurements (DbA) | | |
|---|---|---|---|---|---|---|---|
| 52 | Mpwapwa | Godegode | School | 332+100 | 46 | 50 | 55 |
| 53 | Mpwapwa | Godegode | School | 332+450 | 40 | 45 | 50 |
| 54 | Mpwapwa | Gulwe | School | 352+800 | 42 | 47 | 53 |
| 55 | Mpwapwa | Msagali | School | 368+000 | 32 | 41 | 50 |
| 56 | Chamwino | Igandu | Dispensary | 388+000 | 42 | 53 | 64 |
| 57 | Dodoma City Council | Makulu/ Msangalale | School | 438+500 | 41 | 48 | 54 |

### 4.4.14 *Seismic Activity*

Along the Project Area, no volcanic eruption events have been recorded before and no volcanic eruption signals were observed within Project Area of influence (ie, within 1 km). The proposed SGR alignment passes through the Rift valley between chainage (378+221) to (540+209). The Rift valley area is characterised by rise and fall (hills and valleys) in which considerable cuts will be required during construction.

The Project Area is also vulnerable to seismic events particularly Dodoma and Dar es Salaam regions. The most recent seismic events in Dodoma in 2016 and in the Coast region in 2014 had magnitudes of 5.1 and 4.2 respectively (USGS Page). The biggest seismic events recorded in the regions where the project passes was in 2002 in Dodoma Region, and had a magnitude of 5.5. (USGS Page).

## 4.5 *ENVIRONMENTAL BASELINE - BIOLOGICAL ENVIRONMENT*

### 4.5.1 *Protected Areas*

*Gazetted Protected Areas*

The current railway and the proposed SGR route passes along a few forest reserves and in the close proximity of several forest reserves. There are a number of larger protected areas in the greater vicinity, which influence the biodiversity affected by the route. *Table 4-14* presents an overview of the various protected areas, with many of these illustrated in *Figure 4-16.*

***Table 4-14 Overview of Protected Areas associated with the Proposed SGR Route***

| Protected Area Name | IUCN Management Category | Comment |
|---|---|---|
| **Dar es Salaam to Morogoro** | | |
| Pugu Hills Forest Reserve | ( IV ) | Imagery reveals healthy forest cover suggesting it is well protected, although there are signs of settlement and encroachment.<br>Is included within the Kisarawe District Coastal Forest (KDCF) IBA.<br>Baseline studies have been conducted to support the analysis of critical habitat presence. |

| Protected Area Name | IUCN Management Category | Comment |
|---|---|---|
| Ruvu South Forest Reserve | ( IV ) | Imagery reveals natural vegetation although baseline studies have revealed extensive charcoal production. Is included within the Kisarawe District Coastal Forest (KDCF) IBA. |
| Pangwe West and East Forest Reserves | ( IV ) | Located on two hills, but both include considerable disturbance. |
| Kitulanghalo Forest Reserve | IV | Elongated hill with extensive forest cover suggesting it is well protected. |
| Dindili Forest Reserve | IV | Small hill with good forest cover suggesting it is well protected. |
| Uluguru Nature Reserve | ( IV ) | Mountainous with healthy forest cover, suggesting good protection.<br>Corresponds to the Uluguru Mountains IBA and AZE. |
| **Morogoro to Dodoma** | | |
| Wami Mbiki Wildlife Management Area | ( IV ) | Community-managed area with absence of cultivation, suggesting good protection. |
| Mikumi National Park | **II** | This national park is well protected and is continuous with the vast ecosystem associated with the Selous Game Reserve. |
| Morogoro Fuel Forest Reserve | ( IV ) | Imagery shows extensive cultivation within this reserve, suggesting no protection. |
| Nguru ya Ndege Forest Reserve | ( IV ) | Located on a hill, includes some cultivation and extensive footpaths, suggesting little effective protection. |
| Nyandira Forest Reserve | ( IV ) | Imagery reveals transformed habitat |
| Mindu Forest Reserve | ( IV ) | Located on a hill, includes considerable cultivation suggesting little effective protection. |
| Kihiliri Forest Reserve | ( IV ) | Mountainous habitat with no cultivation visible. |
| Dodoma Reservoir Forest Reserve | ( IV ) | Extensive cultivation is visible within the illustrated boundaries, suggesting little effective protection |
| **Dodoma to Makutopora** | | |
| Kigongkwe Forest Reserve | ( IV ) | Appears to be heavily cultivated |
| Muhesi Game Reserve | IV | Game reserve appears to be considerably smaller than indicated by online boundaries, but this reserve is continuous with a vast protected area network from Kizigo GR to Ruaha national Park. |

Source: Global Biodiversity Information Forum (GBIF), 2018.

*Key Biodiversity Areas*

The IFC Performance Standard 6 (PS6) requires consideration of internationally protected areas in addition to gazetted protected areas.

The IUCN has compiled a global map of Key Biodiversity Areas (KBA), which include Important Bird and Biodiversity Areas (IBAs) and Alliance for Zero Extinction (AZE) Sites [1] . The PS6 additionally recognises Ramsar Sites as components of KBAs.

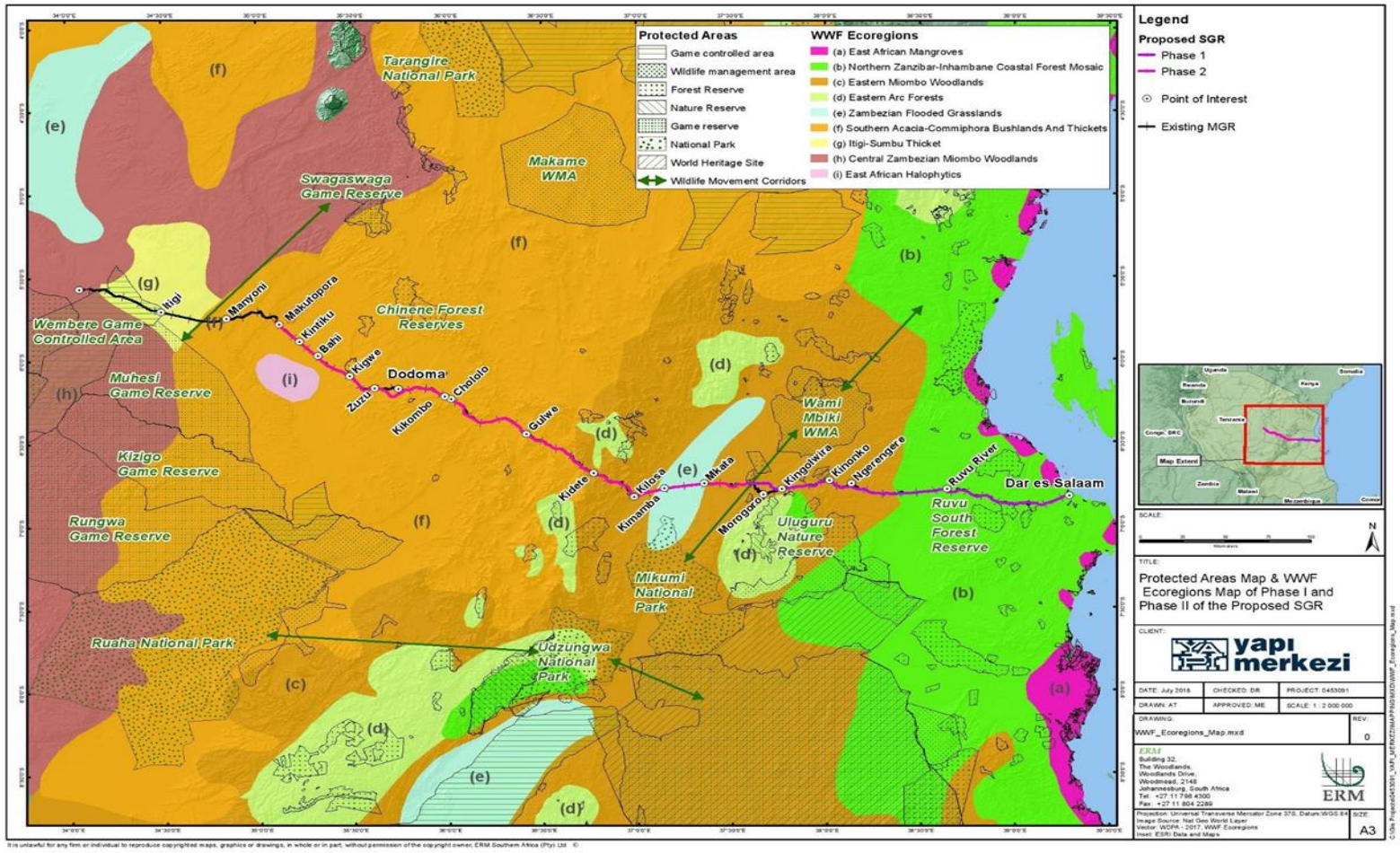
An analysis of the Project Area reveals that all IBAs and AZE sites in the proximity of the Project correspond to various gazetted protected areas, and mostly overlap with one another. The following AZE sites are recognised:

- Uluguru Mountains - This AZE site overlaps the Uluguru Nature Reserve, Mkungwe and Ruvu Forest Reserves close to Morogoro, and shares the same boundaries as the Uluguru Mountains IBA.
- Ukaguru Mountains - This AZE site overlaps the North Mamiwa Kisara Forest Reserve and shares the same boundaries as the Ukaguru Mountains IBA.
- The Pugu Hills and the Ruvu South Forest Reserves collectively share the same boundaries as the Kisarawe District Coastal Forest IBA.

Each of the above AZE and IBA sites are recognised as key biodiversity areas by the IUCN.
The only protected areas directly affected by the SGR are the Pugu Hills and Ruvu South Forest Reserves. Areas indirectly affected include the Wami Mbiki and Selous/Mikumi ecosystem due to wildlife movements across the SGR.

(1) The Alliance for Zero Extinction (AZE) is an organisation that works to identify and safeguard the most important sites for preventing global extinctions, those that have threatened species restricted to just a single site in the world. The AZE maintain a website of their recognised sites. AZE sites present a very high level of biodiversity risk.

*Figure 4-16 Layout of Protected Areas and Ecoregions along the SGR Alignment*



### *4.5.2 Habitats*

The SGR route passes through five ecoregions defined by WWF (*Figure 4-16*). Starting from the east, these are:

- Northern Zanzibar-Inhambane Coastal Forest Mosaic;
- Eastern Miombo Woodlands;
- Zambezian Flooded Grasslands; and
- Southern Acacia-Commiphora Bushlands and Thicket.

The ecoregion classification is included here as it provides an important background understanding to the expected ecological state of habitats affected by the SGR Project. This data provides a baseline for classification of areas into Modified and Natural Habitat classes, and is used as a basis to identify key issues for classification as Critical Habitat.

*Northern Zanzibar-Inhambane Coastal Forest Mosaic*

The Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion, together with the Eastern Arc montane forests, harbours densities of plant species that rank amongst the highest in the world. The ecoregion falls entirely within the Swahilian regional centre of endemism. The forest habitat in this ecoregion is highly fragmented, and becoming increasingly fragmented as agriculture and other human activities spread. In Tanzania, forested areas are not larger than 40 km², and typically are much smaller. Most of the larger forest patches remaining in this ecoregion are found within government controlled forest reserves, which were originally established for controlled resource exploitation.

There are over 4,500 plant species that occur in this mosaic, of which 3,000 species are confined to forest habitats. The drier forest types within this ecoregion are the most distinctive, with monospecific genera and numerous endemic species, especially within the plants. A feature of the endemism is the high degree of local turnover in the species between adjacent forest fragments within the landscape mosaic, and the high incidence of rare species exhibiting disjunct distributional patterns. All these features indicate an ancient history of the forests within this ecoregion, and also indicate that the species may naturally be declining in an area that has been slowly drying for millions of years.

The human population of the area is relatively high, with around 100 persons per km² in rural areas, and their impact is considerable on the surrounding

areas. It is believed that over thousands of years the forests in this ecoregion have been reduced dramatically, possibly caused by fires set by early humans. This loss has intensified recently because of farming, cutting trees for firewood, and building materials and other developments.

A review of Google Earth imagery for the SGR route through this ecoregion reveals large urbanised habitat associated with Dar es Salaam and broad wetlands associated with the Ruvu River. Forest patches are associated with the Pugu Hills Forest Reserve, and east of Ngerengere. The extent of natural habitat is estimated at approximately 20 percent.

***Figure 4-17 Example of the Northern Zanzibar-Inhambane Coastal Forest Mosaic near Kisarawe***

Source: Ardhi ESIA, 2017.

*Eastern Miombo Woodlands*

The Eastern Miombo Woodlands form a part of the belt of miombo woodland that crosses Africa south of the Congo rain forests and the savannas of East Africa. The predominant tree is miombo (*Brachystegia* sp.), along with *Baikiaea* woodland, and is a species rich ecosystem on nutrient-poor soils. This miombo vegetation is rich in birdlife, supports several miombo specialist endemic bird and lizard species, as well as big herds of large mammals, as occur in the Selous Game Reserve.

The ecoregion is thinly populated by humans, but is important to the livelihoods of the rural people, who depend on the resources available from the woodland. The wide variety of species provides non-timber products such as fruits, honey, fodder for livestock and fuelwood. A large area of this ecoregion

is protected within the Selous Game Reserve, but even outside protected areas, the woodlands have remained comparatively intact. However the woodlands are being slowly cleared for farmland and pasture throughout. Many areas of miombo woodland are managed as slash and burn farming systems.

A review of Google Earth imagery for the SGR route through this ecoregion reveals a largely natural area close to Ngerengere and Kinonko, in the vicinity of Kilosa and extensive urban habitat associated with Morogoro. Cultivation was extensive, and the extent of largely natural habitat is estimated at approximately 30 percent.

***Figure 4-18 Example of the Eastern Miombo Woodlands at Kidugalo***

Source: Ardhi ESIA, 2017.

*Zambezian Flooded Grasslands*

The Zambezian flooded grasslands is an ecoregion with a rich in wildlife potential. This ecoregion occurs on seasonally or permanently flooded lowlands in the basin of the Zambezi and neighbouring river basins within the dry and infertile miombo and mopane savannas and woodlands. Large enclaves of flooded grassland in the greater proximity of the project include the Kilombero Valley in southern Tanzania, with a smaller area associated with the Ruvu River intersected by the Project.

These floodplains have long been home to rural communities, but are mostly unspoilt and large areas are protected. However, the growing demand for water and farmland places the floodplains under constant threat.

A review Google Earth imagery for the short stretch of the SGR route through this ecoregion reveals some urban area, but much of the route passes through natural wetland habitat, estimated at approximately 60 percent.

***Figure 4-19 Example of a Wetland Habitat near Kwala***

Source: Ardhi ESIA, 2017.

*Southern Acacia-Commiphora Bushlands and Thicket*

The ecoregion is located in northern and central Tanzania, and closely resembles the Somali-Masai Acacia-Commiphora deciduous bushland and thicket of White (1983). The predominant plants include species of Acacia, Commiphora and Crotalaria. Rainfall is variable such that the short rains may fail in a given year or rain may occur between the two rainy seasons, thereby joining the two. During the long dry season (August to October), the grasslands can become extremely parched, and many of the trees and bushes lose their leaves. Fires occur naturally in the ecosystem. The human population of the ecoregion is moderate, typically between 10 and 50 persons per km$^2$. Large and small commercial farms have transformed the wetter areas, and small-holder farming is increasing in all suitable areas. Grazing by domestic livestock occurs in the dry areas unsuitable for cultivation.

Areas of largely intact habitat exist throughout the ecoregion. Protected areas cover approximately 20 percent of the ecoregion, and include some of the best-managed protected areas in Africa. There is also a sizeable portion of land protected as a multiple-use area in which both hunting and livestock grazing are permitted. Outside of protected and multiple-use areas, almost all the land suitable for large-scale agriculture has already been converted. This has reduced the number and variety of corridors available for wildlife to move. The

most damaged habitats in the ecoregion are located close to the mountains that rise from the plains. These areas provide a reliable source of rainfall and water for irrigation and are important for both large-scale commercial and subsistence agriculture.

A review Google Earth imagery for the SGR route through this ecoregion reveals that most of the area close to the railway line is cultivated, with a large urban area associated with Dodoma. The remaining natural habitat was estimated at approximately 10 percent.

***Figure 4-20 Southern Acacia-Commiphora Bushlands and Thicket near Kigwe***

Source: Ardhi ESIA, 2017.

### *4.5.3 Faunal Communities*

The species diversity for the greater area along the SGR route has been sourced from the GBIF online database, and compared against the IUCN Red List for Threatened Species. *Table 4-15* presents an overview of the diversity of vertebrate species, and the breakdown of threatened species per taxonomic group.

*Table 4-15 Overview of numbers of vertebrate fauna listed with a threatened status in the project area*

| Taxonomic Group | IUCN Red List Threatened Status | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | CR | EN | VU | NT | LC | DD | |
| Mammals | 2 | 3 | 9 | 11 | 175 | 6 | 206 |
| Birds | 4 | 11 | 7 | 13 | 618 | | 653 |
| Reptiles | 1 | 3 | 3 | 2 | 28 | 1 | 38 |
| Amphibians | 2 | 10 | 4 | 2 | 75 | 1 | 94 |
| Fishes | | 1 | 10 | 1 | 66 | 9 | 87 |
| Total | 9 | 28 | 33 | 29 | 962 | 17 | 1 078 |

Where:
CR – Critically Endangered, EN – Endangered, VU – Vulnerable, NT – Near threatened, LC – Least Concern, and DD – Data Deficient.

Source: IUCN, 2018.

The Pugu Hills Forest Reserve protects one of the most important remnants of Coastal Dry Forest, with very high diversity of species. This forest is an important 'stepping stone' for forest-dependent migratory birds such as the Spotted Ground-thrush and the Sokoke Pipit. The Rondo Dwarf Galago is a critically endangered primate that has its largest population here. This little primate has been recorded in tiny isolated populations north of Dar es Salaam and in the vicinity of Lindi, and qualifies as a near-AZE species. The Ruvu Spiny Reedfrog is an AZE trigger species that occurs in the Ruvu South Forest Reserve. Both of these reserves have been depleted of larger wildlife, with the possible exception of leopard that are considered to be present occasionally. This was confirmed through engagements local forestry officers and discussions with local communities.

*Terrestrial Fauna Observations from the Previous ESIA report*

The Pugu Hills Forest supports two endemic mammal species, and one endemic bird. The previous ESIA report states that wildlife remaining there includes elephant, hippopotamus, giraffe, impala, common warthogs, leopard, cheetah, spotted hyena, side-striped and black-backed-jackals, pangolins, elephant shrew, mongoose, civets, baboons, galagos, colobus monkeys, as well as over 80 species of birds. The protected area is small and surrounded on a few sides by communities, yet the KDCF IBA description confirms there is a population of elephants that may well move between this site and the northern approaches of the Selous Game Reserve. No wildlife was seen there during the field survey. An abandoned kaolin mine is known to be colonized by a large population of bats.

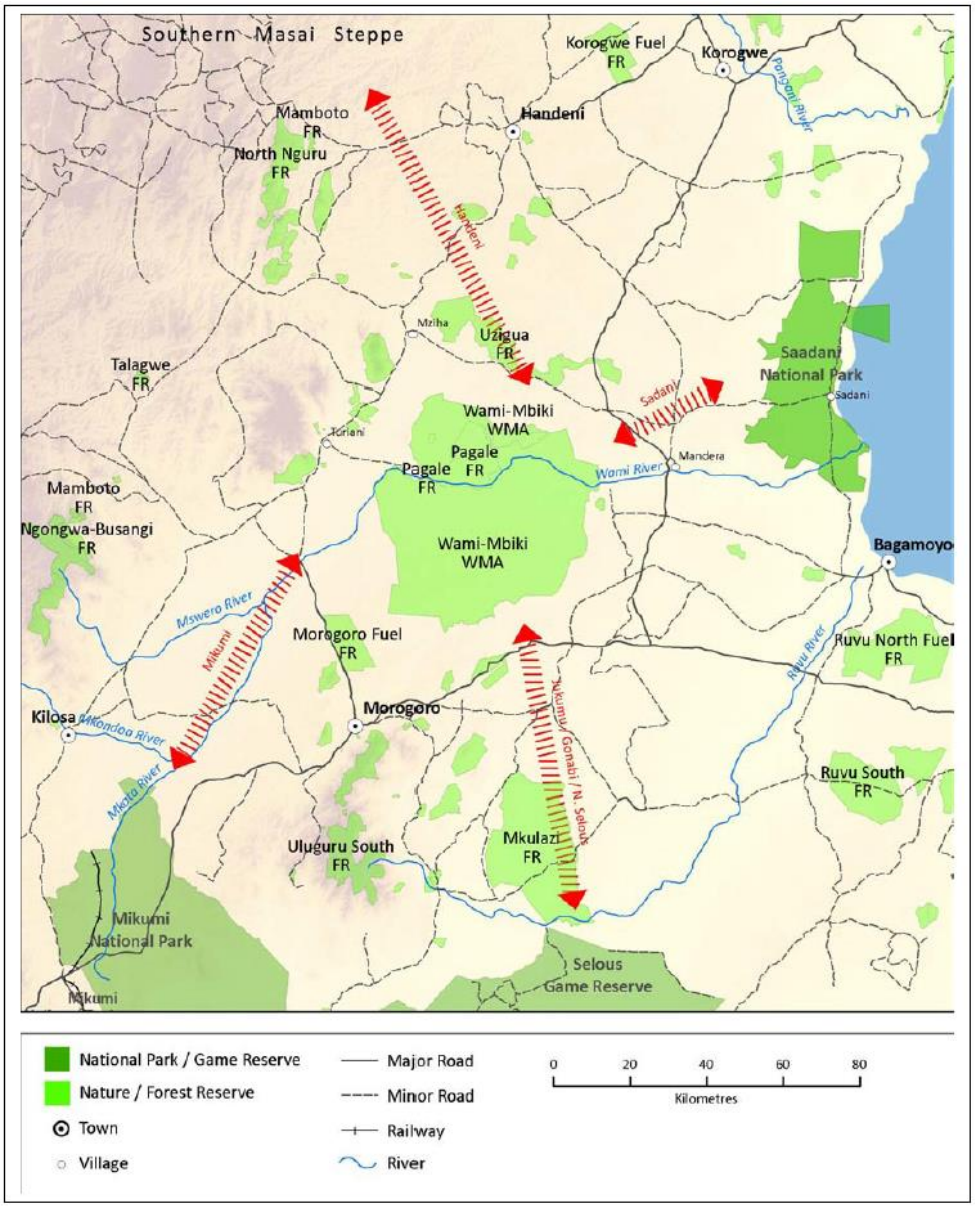
The Southern Acacia-Commiphora Bushland and Thicket habitat was surveyed between Kilosa and Gulwe. Five mammal species were observed including vervet monkey *Cerecopithecus pygerythrus*, Yellow Baboon *Papio cynocephalus*, Slender Mongoose *Herpestes sanguinea*, Four-toed Elephant Shrew *Petrodromus tetradactylus* and Mutabe Sun Squirrel *Heliosciurus mutabilis*. A rich diversity of birds (126 species) were recorded, all were non-threatened except Fisher's Lovebird *Agapornis fischeri* (NT). Twenty three species of reptiles (mostly lizards) were observed in the section, which included the Rainbow Skink *Trachylepis margaritifer* and Blue-headed Tree Agama *Acanthocercus atricollis.* A total of 11 species of amphibians were recorded, but none are threatened species.

### *4.5.4 Wildlife Corridors*

A TAWIRI report (2009) describes 31 wildlife corridors within Tanzania, of which two corridors are intersected by the SGR, namely between the Mikumi National Park and the Wami Mbiki Wildlife Management Area (WMA) and between the Selous Game Reserve and the Wami Mbiki WMA (Figure 4-21). Jones *et al.* (2012) illustrate only a single wildlife corridor between Mikumi National Park and the Wami Mbiki WMA (Figure 4-22), which is also illustrated by Riggio & Caro (2017).

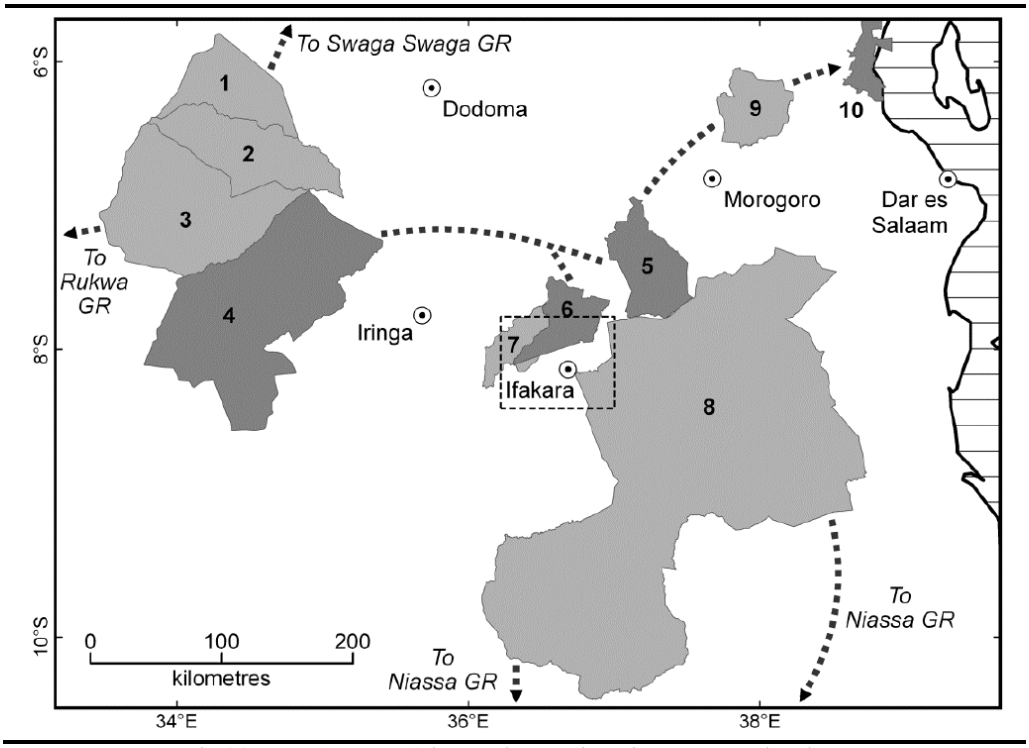
A field survey was conducted to confirm the existence of these wildlife corridors, determine the likely wildlife species involved, and investigate the possible seasonality of movement patterns. The study also investigated the permeability of the SGR to develop an opinion on the severity of wildlife fragmentation impacts.

*Figure 4-21 Map provided by TAWIRI (2009) showing Wildlife Corridors radiating outwards from the Wami Mbiki Wildlife Management Area. The two southern corridors are intersected by the SGR.*




*The SGR passes along the northern boundary of the Ruvu South Forest Reserve and through Morogoro and Kilosa towns.*

*Figure 4-22 Map provided by Jones et al. (2012) showing Wildlife Corridors emanating from the Mikumi National Park.*




*The SGR starts in Dar es Salaam and passes through Morogoro and Dodoma*

*Wildlife Presence in the Study Area*

*Table 4-16* presents the list of species, mentioned by communities, with their species names and threatened status. Results from community interviews reflected varying patterns of wildlife presence in different areas, showing that wildlife species present in one area may be different to another area. African elephants had the highest rank followed by spotted hyaena, impala and yellow baboons.

*Table 4-16 Wildlife Species reported by Communities with their Classification and Threatened Status*

| English Common Name | FAMILY and Species Name | IUCN Threatened Status |
|---|---|---|
| Impala | BOVIDAE *Aepyceros melampus* | Least Concern |
| African Buffalo | BOVIDAE *Syncerus caffer* | Near Threatened |
| Duiker sp. | BOVIDAE *[Sylvicapra grimmia]* * | Least Concern |
| Yellow Baboon | CERCOPITHECIDAE *Papio cynocephalus* | Least Concern |
| Jackal sp. | CANIDAE *Canis mesomelas / Canis adustus* | Least Concern |
| African Wild Dog | CANIDAE *Lycaon pictus* | Endangered |
| African Elephant | ELEPHANTIDAE *Loxodonta africana* | Vulnerable |

| English Common Name | FAMILY and Species Name | IUCN Threatened Status |
|---|---|---|
| African Lion | FELIDAE *Panthera leo* | Vulnerable |
| Spotted Hyaena | HYAENIDAE *Crocuta crocuta* | Least Concern |
| Rabbit sp. (or Hare) | LEPORIDAE Uncertain identity | n.a. |
| Bushpig | SUIDAE *Potamochoerus larvatus* | Least Concern |

** Presents the most likely species but identification was not confirmed*
*Taxonomy and names follow nomenclature used by the IUCN Red List of Threatened Species*

African elephants were reported as being the species with the highest community awareness in both Ngerengere and Mkata. This is not surprising as elephants have a big impact on their environment, and are wide-ranging animals due to their substantial requirements of food resources, water and sexual behaviour with their home ranges varying from 10 $km^2$ to 5000 $km^2$ (Poole, 1996). All communities engaged in Mkata were familiar with elephant movements across the SGR route. Communities were less aware of the elephant presence in Ngerengere. Ngerengere is bordered by large tracts of military land at Sangasanga, which is a no go area for communities, and serves as a refuge area for elephants and other wildlife. Little is known about the population size or seasonal presence of elephants there.

*Figure 4-23 Map showing Ngerengere Circle with Sampling Points assessed during this Survey*

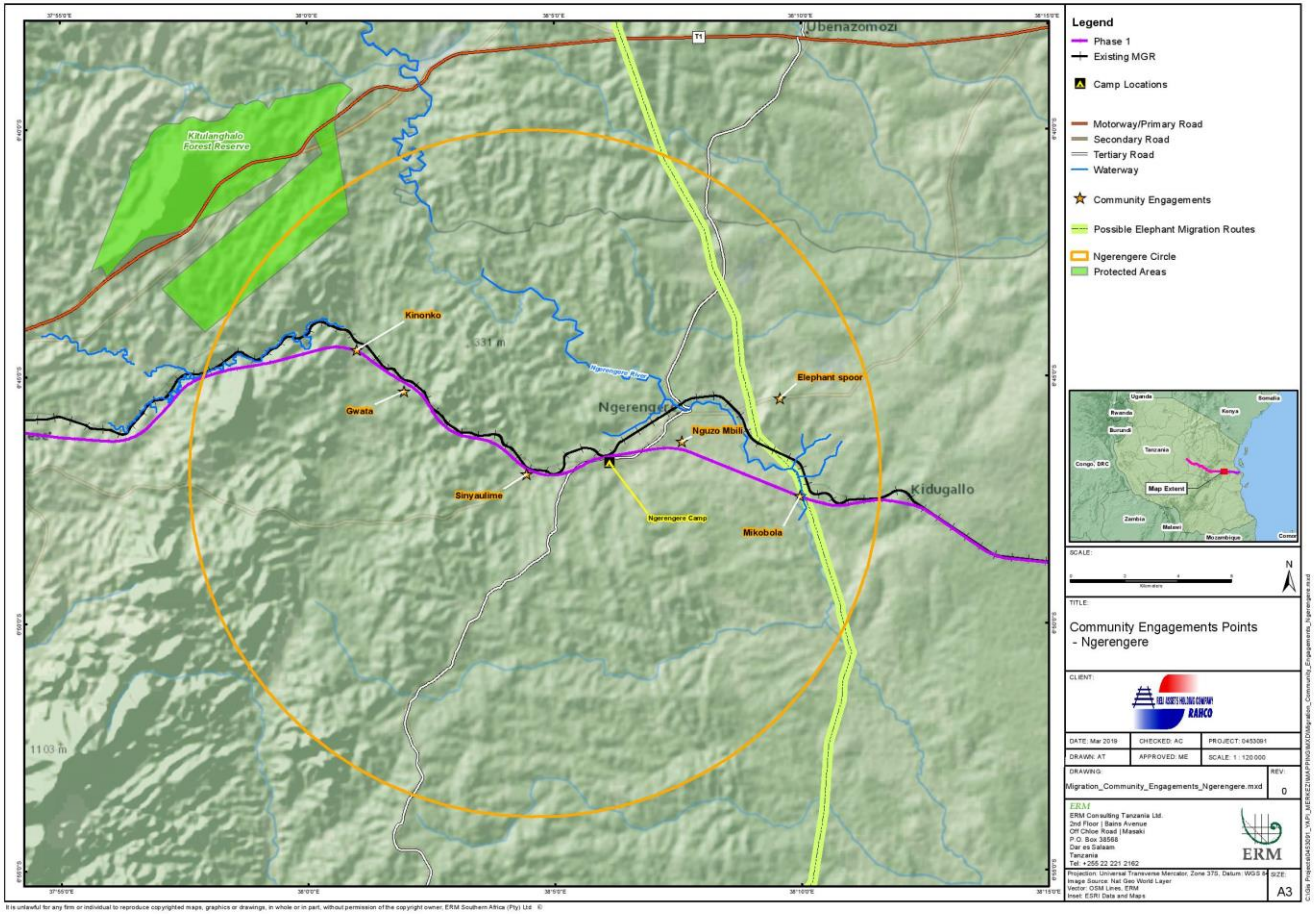
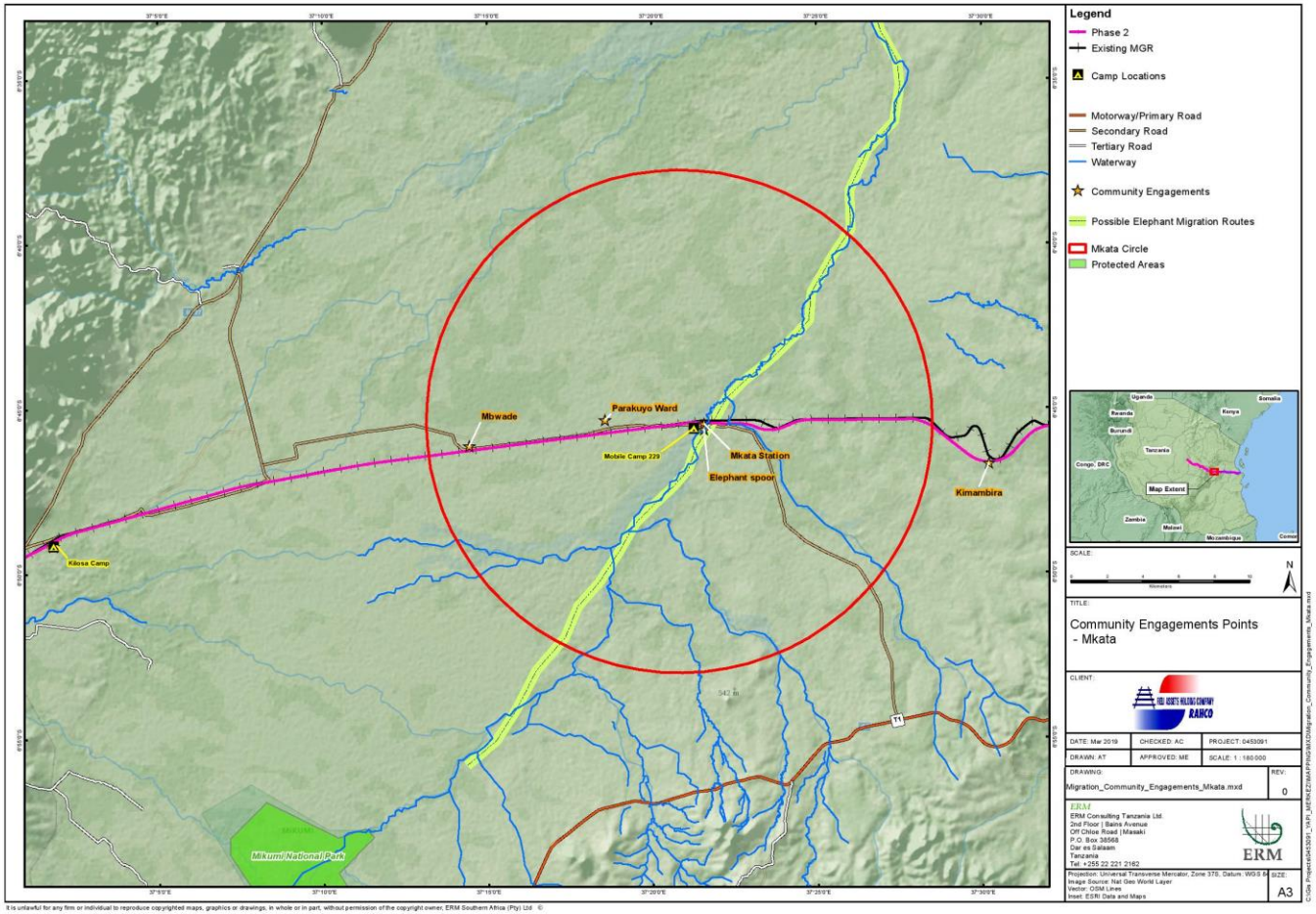


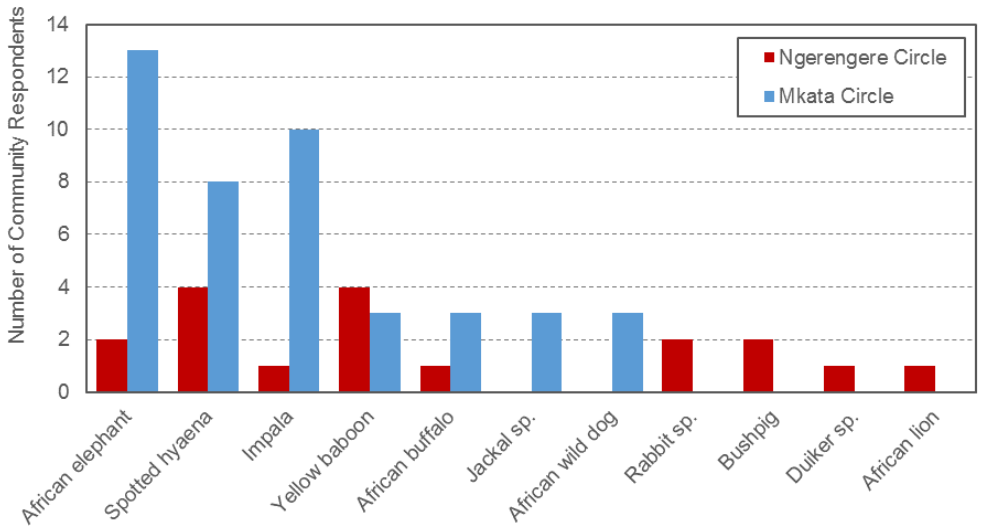
*Figure 4-24 Map showing Mkata Circle with Sampling Points assessed during this Survey*



*Wildlife Species Abundance and Diversity*

Results from this study suggest there are larger wildlife populations present in Mkata than Ngerengere (*Figure 4-25*), although the latter area may support a higher diversity of species.

***Figure 4-25 Proportional Reporting of Wildlife Species in the Areas of Investigation***




Four predator species were reported, and sufficient prey populations must therefore be present to support these predators.

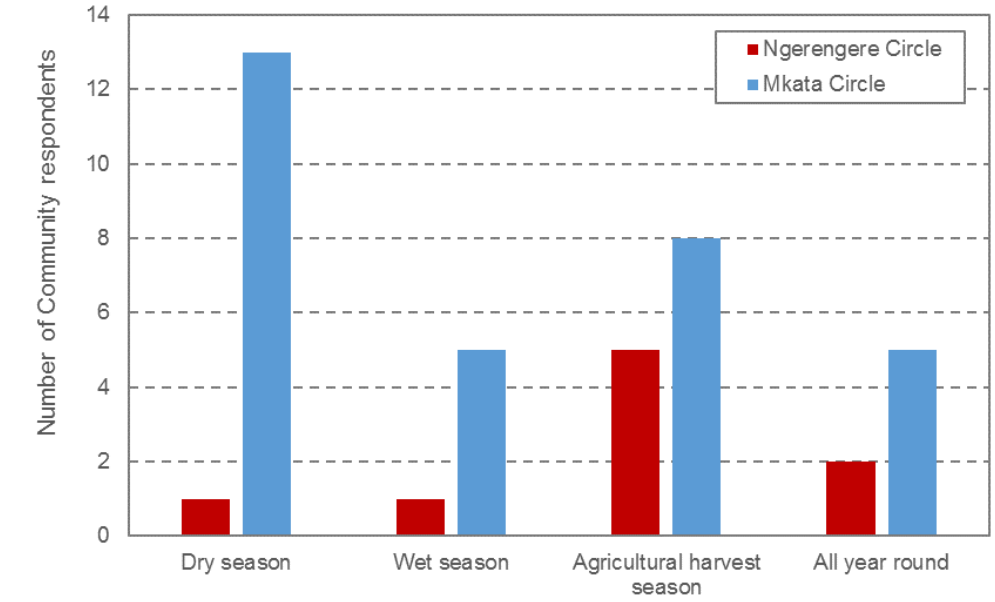
African wild dogs can be easily confused with jackals or feral dogs, and communities reporting the presence of African wild dogs were therefore specifically asked to describe their appearance and behaviour. Their descriptions were sufficiently good for the survey team to accept their identification. African wild dogs are listed by the IUCN as an Endangered species, and this data is therefore of particular interest to biodiversity studies for the SGR.

One respondent from Kinonko Village reported hearing lion roaring on the western side of the Ngerengere Circle. Cattle keepers are generally aware of the presence of lion due to the risk of predation on their livestock. Masaai cattle herders were specifically asked if lion were present but responded negatively. This one record may therefore represent a nomadic individual lion or pride and the species is not thought to be resident or frequent migrant in either circle.

*Seasonal Wildlife Movements*

Results from community engagement reveal there are some seasonal patterns to wildlife presence. Results reveal that elephant numbers increase during the dry season suggesting migratory behaviour, while impala, spotted hyaena, yellow baboons and duiker are present throughout the year and are to be considered resident populations. Community responses suggest a greater awareness of wildlife presence during the agricultural harvest season, which may reflect an influx of wildlife or awareness of the increased crop-raiding risk. Results reveal that wildlife numbers are lowest during the wet season in both the Ngerengere and Mkata Circles (*Figure 4-26*).

***Figure 4-26 Proportion of Periods/Seasons of the Year for Wildlife Abundance in the Areas of Investigation***




*Observed Evidence of Wildlife Movement - Ngerengere Elephant Crossings*

Tracks of a small elephant breeding group moving southwards were observed outside of the Sangasanga military base close to the Ngeregere River (*Figure 4-27*). These tracks were considered to be less than a month old. A local fisherman at the Ngerengere River (aquatic site B / SGR location 131+272) stated that he had seen elephants that same day, but not able to go to the site to show any evidence.

Local people consulted by Dr Nahonyo revealed that elephants make regular movements each night in search of favourite forage such as sisal, *Sclerocarya*

(Marula) fruits, maize and other crops grown in the villages of Visaraka, Migela and Kidugalo. In most of these movements, the elephants leave the Sangasanga Military forest, cross the MGR to the nearby villages beyond Hatina to feed during the night and return to the Military forest before dawn. The elephant movements are very frequent, and during the aquatic field survey, elephants made this crossing on the nights of 21 and 22nd March 2019. Reports indicate that elephant groups making these movements are breeding herds of 6 to 12 individuals comprising adult females and their young. This corresponds with the tracks observed by the other team, and illustrated in *Figure 4-27*.

These elephant movements can be summarized with the following sequence of movements:

Military forest ↔ Shegila area ↔ MGR / SGR line ↔ Fatemi Sisal Estate ↔ Visaraka ↔ Magela

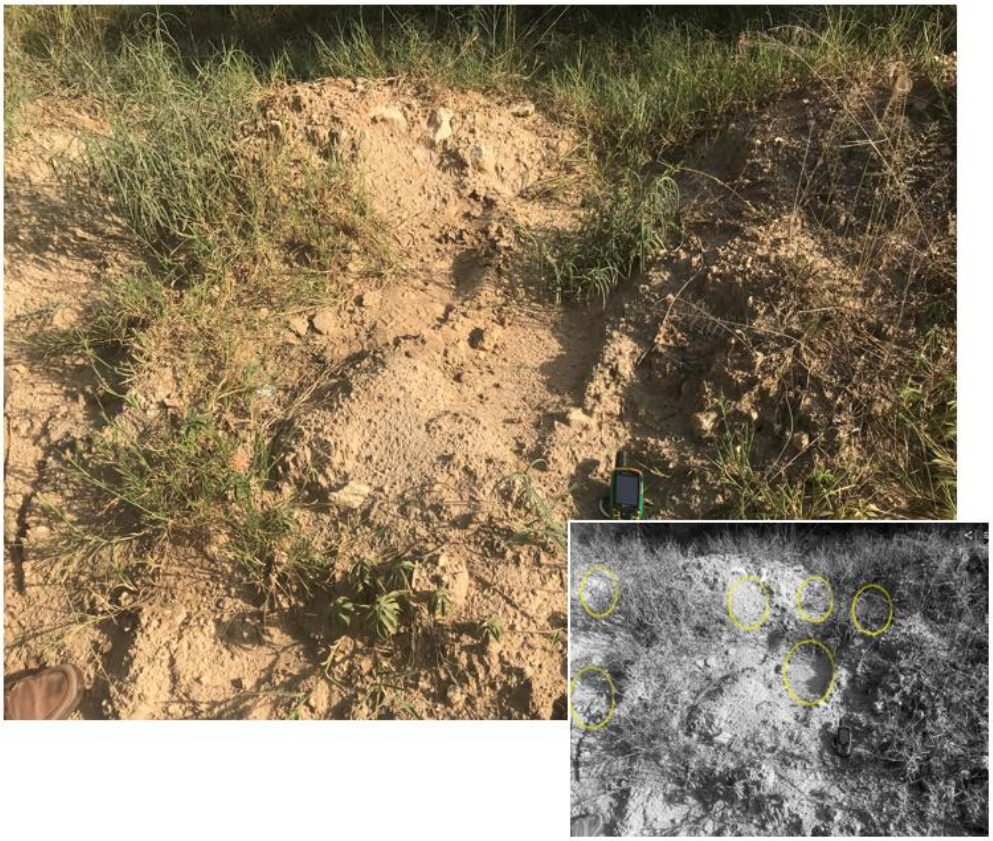
However, the frequency of reaching Magela village has declined in recent years due to elephant poaching in the village, elephant often end their nightly foraging at Visaraka village.

Reports suggest the following three crossing points in the Ngerengere area which comprise a corridor of approximately five kilometres in width:

- One crossing is where bridge BR_131-2 is being constructed across Ngerengere River (37 M 0408099, UTM 9249253; SGR location 131+272),
- A second crossing is at Fatemi Sisal Estate (Kaburi la Mzungu) (37 M 0408530, UTM 9249088; SGR location 130+750)
- A third crossing point is through the sisal estate close to the sisal processing factory (37 M 0409741, UTM 9249167; SGR location 129+500).

Elephants are able to cross the corridor because the landscape is relatively flat and the central MGR embankment is low (less than 3 meters). In places where the railway embankment is high the MGR bridges are constructed and elephants are able to pass below the bridge, such as the Fatemi Sisal Estate where elephants pass beneath a bridge (4 meters high) on the old MGR.

*Figure 4-27 Elephant Footprints near the Ngerengere Military Base (yellow highlights in the Black-&-White Inset show Various Footprint Outlines)*



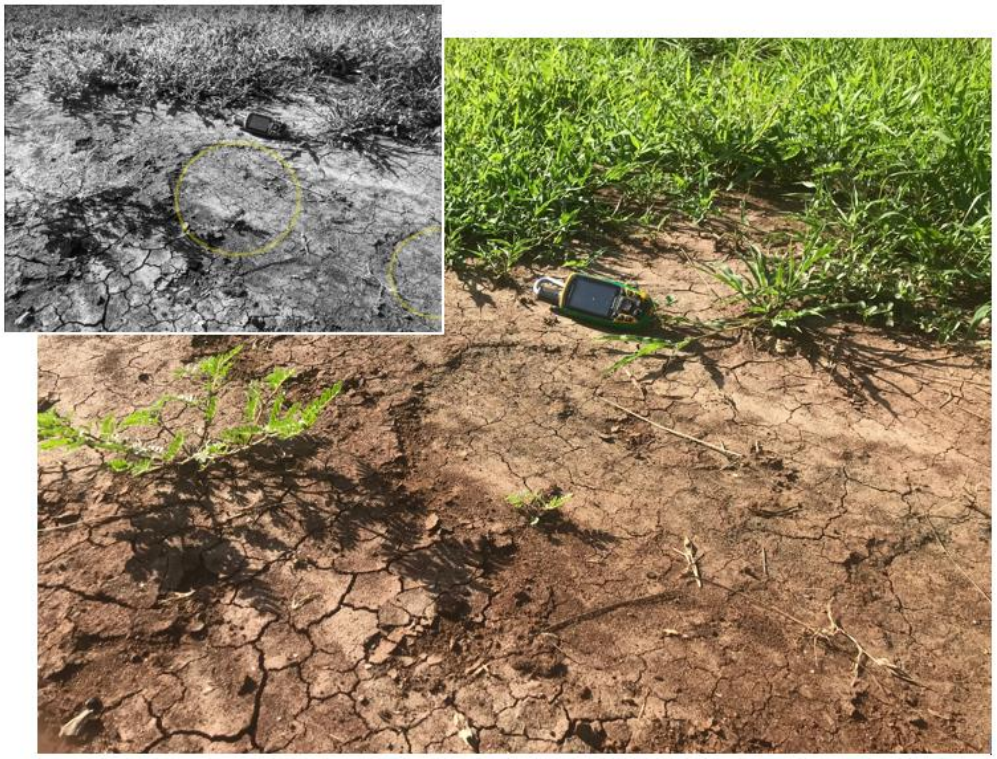
*Observed Evidence of Wildlife Movement - Mkata Elephant Crossings*

Local communities indicated the presence of large elephant tracks moving northwards along the Mkata River (SGR location 227+915) and Kononge River (SGR location 226+762). These tracks were considered to be one to two months old (*Figure 4-28*). Communities mentioned that the Mkata River is used by elephants throughout the year, although there is an increase in activity during the dry season.

Accounts provided to Dr Nahonyo by local people and MGR railway workers who have worked at Mkata Station village for over ten years indicate that this corridor is actively used by elephant. The last corridor crossing by elephants was in January 2019, which corresponds to the tracks photographed in *Figure 4-28*. The corridor according to the railway workers is found along Gang 38 and Gang 39 of the MGR, each with a length of 6 km resulting in a 12 km wide corridor inclusive of Mkata and Kitanange Rivers. Elephant crossings usually happen in the dry season and elephants are suspected to move from Mikumi

National Park, cross Mkata village to Twatwatwa forest where there is abundant forage, cover and water.

*Figure 4-28 Elephant Footprints close to the Mkata River (yellow highlights in the Black-&-White Inset show Approximate Footprint Outlines)*



### *4.5.5 Aquatic Ecology*

The railway line and proposed SGR crosses a number of permanent and seasonal rivers between Dar es Salaam and Makutupora. Twelve aquatic systems were assessed, with assessments including classification of the habitat according to the PS6, riparian vegetation, status of macro-invertebrate populations, fish populations and water quality. Results are presented in the following tables, although more detailed results are available in the reports compiled by the University of Dar es Salaam.

*Table 4-17 Ecological Status of the Aquatic Ecology and Surrounding Habitats for 12 sites along the SGR Alignment*

| Site | Location | Aquatic Ecological State | Habitat Status |
|---|---|---|---|
| **Coastal Forest Mosaic Ecoregion** | | | |
| A | Ruvu River | D - Largely modified | Natural habitat |
| **Eastern Miombo Woodland Ecoregion** | | | |
| B | Hatina village | D - Largely modified | Modified habitat |
| C | Mgololo River (Morogoro) | No flow (E- Critically modified) | Modified habitat |
| D | Mfaranyaki Stream (Morogoro) | E- Critically modified | Modified habitat |
| E | Seasonal river | No flow for assessment | Natural habitat |
| F1 | Kinonge River | No flow for assessment | Natural habitat |
| F2 | Mkata River | B - Largely Natural | Natural habitat |
| G | Mkondoa River | B - Largely Natural | Natural habitat |
| **Southern Acacia-Commiphora Bushlands And Thickets Ecoregion** | | | |
| H | Lumuma River | No flow for assessment | Modified habitat |
| I | Midegedege River | D - Largely Modified | Modified habitat |
| J | Igandu village | No flow for assessment | Modified habitat |
| K | Bubu River floodplain | D - Largely Modified | Modified habitat |
| L | Mpande River (seasonal) | E - Critically Modified | Natural habitat |

*Table 4-18 Occurrence of Fish Species recorded along the SGR Alignment*

| Fish Species | A | B | C | D | E | F1 | F2 | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Clarias gariepinus* | x | x | x | | | x | x | x | x | x | x | x | x |
| *Labeo sp.* | | x | x | | | | x | x | x | x | x | x | |
| *Oreochromis niloticus* | x | x | x | | | | x | x | x | | | | |
| *Bagrus orientalis* | x | x | | | | | x | | | | | | |
| *Oreochromis sp.* | | | | | | | | | | | x | x | x |
| *Citharinus latus* | x | | | | | | x | | | | | | |
| *Schilbe moebiusii* | x | | | | | | | | | | | | |
| *Synodontis punctulatus* | x | | | | | | | | | | | | |
| No fish present | | | | x | x | | | | | | | | |

Identification of sites:
A - Ruvu River; B - Ngerengere River; C - Mgolole River; D - Ngerengere River, Morogoro; E - Seasonal River; F1 - Kitanange River; F2 - Mkata River; G - Mkondoa River; H - Lumuma River; I - Seasonal River; J - Seasonal River; K - Bubu River; L - Mponde River

*Table 4-19 Water Quality Data collected where Surface Water was available to Sample*

| Site | UTM (Zone 37M) | | pH | DO (% saturation) | DO (ppm) | EC (µS/cm) | TDS (ppm) | Temp. (°C) | Salinity (Psu) |
|---|---|---|---|---|---|---|---|---|---|
| | North | East | | | | | | | |
| A1 | 459264 | 9248157 | 8.1 | 80.6 | 5.89 | 146 | 73 | 31.89 | 0.07 |
| A2 | 459264 | 9248157 | 8.09 | 81.5 | 5.55 | 166 | 83 | 36.3 | 0.08 |
| B | 407812 | 9249285 | 8.16 | 77 | 5.6 | 1111 | 555 | 33.58 | 0.54 |
| C | 360009 | 9248945 | 6.67 | 5.2 | 0.4 | 599 | 299 | 25.82 | 0.29 |
| D | 356657 | 9252291 | 9.27 | 21 | 1.7 | 2734 | 1366 | 27.34 | 1.41 |
| F1 | 320046 | 9252682 | 8.29 | 63 | 5.1 | 613 | 307 | 27.35 | 0.3 |
| F2 | 318897 | 9252698 | 8.14 | 67 | 4.93 | 447 | 223 | 28.78 | 0.21 |
| G | 271856 | 9251736 | 8.34 | 65.4 | 5.13 | 376 | 188 | 24.28 | 0.18 |
| H | 246112 | 9264364 | 7.04 | 39.4 | 2.89 | 1249 | 624 | 27.29 | 0.62 |
| I | 199006 | 9296127 | 7.92 | 60 | 4.38 | 402 | 201 | 28.89 | 0.19 |
| K1 | 754950 | 9339795 | 7.9 | 54.3 | 3.5 | 306 | 154 | 33.95 | 0.14 |
| K2 | 754950 | 9339795 | 8.35 | 82.3 | 5.22 | 948 | 474 | 34.67 | 0.46 |
| L | 738155 | 9355843 | 8.1 | 77.7 | 5.42 | 1683 | 840 | 28.98 | 0.85 |

Key: DO - Dissolved oxygen, EC - Electrical Conductivity; TDS - Total Dissolved Solids; Temp - Temperature

Sites C and D were located within the urban edge associated with Morogoro City, and expected to yield a poor ecological state. Sites within the Coastal Forest Mosaic and Miombo Woodland Ecoregions (apart from Morogoro City) have generally maintained a better ecological state than sites further along the SGR within the Acacia-Commiphora Bushlands Ecoregion. This latter area is widely settled and a large proportion of the route is cultivated. Sites E, F1 and F2 are located in the vicinity of Mkata where wildlife populations persists and the habitat largely in a natural state.

A limited diversity of fish species was recorded, and did not include any threatened fish species. Hippo and crocodiles were recorded at the Ruvu River, Mkata River and Mkondoa River.

Drivers of altered river ecology include primarily the following:

- Construction activities and water abstraction for railway development leading to primarily obstruction of river flows, and sedimentation.
- Invasive plants along the river banks and riparian zone indicating a high level of disturbance.

- Livestock grazing and watering at the site, leading to the destruction of the riparian zone, increased erosion of the river bank, and contributions to nutrient loading.
- Both small and larger scale agriculture, including intensive cultivation of banana plantations, maize, millet, mangoes, rice, teak and vegetable cultivation, as well as rice and sisal plantations. Agriculture on steep slopes, planting within the riparian zone, and abstraction of large amounts of water (more applicable to commercial agriculture) alters river ecology and overall river health.
- Industrial discharge, particularly at Ngerengere River at Tungi /Mfaranyaki, Morogoro, where the river is impacted by a textile factory, which discharges its effluent into the river resulting in poor water quality (black water, higher salinities, pH, dissolved salts and low oxygen levels).
- Urban settlements in the areas in close proximity to the site which drives the increase of river dependent activities such as clearing of the wetland for settlement and agriculture.

Of interest to note is the current construction activities of the SGR, and the observed impacts to river courses at:

- Ruvu River at the main bridge along SGR line located at Ruvu;
- Ruvu River at MGR line located at Ruvu;
- Site B: Ngerengere River along the SGR line located at Ngerengere;
- Drainage system on the SGR line in the vicinity of Mkata;
- Kitanange River at SGR proposed line located at Mkata;
- Mkata River at SGR proposed line located at Mkata;
- Lumuma River at MGR Bridge located at Kidete, Kilosa; and
- Bubu River at MGR Bridge 1 located at Bahi, Singida.

At these sites, it was observed that construction activities, construction of access points for water abstraction, river channelization, and activities within wetlands and the riparian zones of rivers, results in altered river flows, and increased sedimentation and turbidity, and has resulted in the alteration of the river ecology at these points.

## 4.6 *SENSITIVITY OF THE ECOLOGICAL ENVIRONMENT AND ASSESSMENT OF CRITICAL HABITAT*

The IFC PS6 analyses sensitivity based on three habitat classifications, namely modified, natural and critical habitat.

The IFC PS6 defines modified habitats as "areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands."

The IFC PS6 defines Natural habitats as "areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition."

The extent of natural habitat that is impacted by the Project is assessed in the Impact assessment.

The IFC PS6 defines critical habitats to represent the highest levels of biodiversity sensitivity. Critical habitats are a subset of either modified or natural habitats, and five specific criteria are specified for their recognition. The higher level of protected areas, based on the IUCN Management Categories, can also define critical habitat.

Guidance notes to the PS6 require critical habitats to be assessed over an ecologically appropriate area of analysis for the SGR Project. There is strong evidence for critical habitats to occur in the Coastal Forest Mosaic Ecoregion, and specifically within the Pugu Hills and Ruvu South Forest Reserves, where habitats have been protected. Baseline studies have been conducted specifically to support this critical habitat assessment, with detailed data presented in in the Enviro-Insight report (April 2019). Due to time constraints, this ESIA only presents a brief summary of key findings.

### 4.6.1 *Protected Area Critical Habitat Triggers*

The IFC PS6 recognises critical habitats based on certain types of protected areas. Gazetted protected areas that are classified by the IUCN as Management Category I and II, and areas recognised by the IUCN as Key Biodiversity Areas (KBAs) qualify as critical habitat. Various protected areas and KBAs are described in *Section 4.5.1*.

Based on the above criteria, the Pugu Hills Forest Reserve and Ruvu South Forest Reserve, which together form the Kisarawe District Coastal Forest IBA are a KBA that is impacted by the project and qualifies as a critical habitat feature.

### 4.6.2 *Analysis of Critical Habitat Criteria*

*Criteria for Recognition of Critical Habitat*

The PS6 (paragraph 16) defines the following criteria for recognition of critical habitat:

- *(i) Habitat of significant importance to Critically Endangered and/or Endangered species;*
- *(ii) Habitat of significant importance to endemic and/or restricted-range species;*
- *(iii) Habitat supporting globally significant concentrations of migratory species and/or congregatory species;*
- *(iv) Highly threatened and/or unique ecosystems; and/or*
- *(v) Areas associated with key evolutionary processes.*

*Analysis of Criterion (i) - Occurrence of Endangered and Critically Endangered species*

A total of 38 Endangered and Critically Endangered vertebrate fauna species and six invertebrates (insects) that have been identified from the IBAT database as potentially occurring along the proposed SGR alignment (

*Table* 4-20). Baseline studies have been conducted to assess the presence or likely presence of these species to the SGR Project.

*Table 4-20 Potential Critically Endangered and Endangered Species occurring along the SGR Route, showing Habitat Requirements or Distribution Relative to the Alignment*

| Species | Common Name | IUCN Threat. Status | Expected Occurrence along SGR Alignment | | | | | | | | | | Habitat / Distribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| **Mammals** | | | | | | | | | | | | | |
| *Diceros bicornis* | Black Rhinoceros | CR | x | x | x | x | x | x | x | x | x | x | Not present |
| ***Galagoides rondoensis*** | **Rondo Dwarf Galago** | **CR** | | | | | | | | | | **x** | **Confirmed Present** |
| ***Kerivoula africana*** | **Tanzanian Woolly Bat** | **EN** | | | | | | | **x** | **x** | **x** | **x** | **Not confirmed but likely based on habitat** |
| ***Lycaon pictus*** | **African Wild Dog** | **EN** | | | | | | **x** | | | | | **Reliably reported present in the Mkata area** |
| *Myosorex geata* | Geata Mouse Shrew | EN | | | | | | | x | | | | AZE trigger, restricted to Uluguru Mtns, not impacted by the SGR Project |
| **Birds** | | | | | | | | | | | | | |
| ***Acrocephalus griseldis*** | **Basra Reed-warbler** | **EN** | | | | | | **x** | **x** | **x** | **x** | **x** | **Not confirmed but likely based on habitat** |
| ***Anthus sokokensis*** | **Sokoke Pipit** | **EN** | | | | | | | | | **x** | **x** | **Not confirmed but possible based on habitat** |
| ***Ardeola idea*** | **Madagascar Pond-heron** | **EN** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **Not confirmed but likely based on habitat** |
| ***Geokichla guttata*** | **Spotted ground-Thrush** | **EN** | | | | | | | | | **x** | **x** | **Not confirmed but likely based on habitat** |
| *Balearica regulorum* | Grey Crowned Crane | EN | x | x | x | x | x | x | x | | | | Inland from the Coastal Plain |
| *Cinnyris loveridgei* | Loveridge's Sunbird | EN | | | | | | | x | | | | |
| *Malaconotus alius* | Uluguru Bush-shrike | EN | | | | | | | x | | | | Restricted to mountain habitats, these |
| *Ploceus nicolli* | Usambara Weaver | EN | | | | | | | x | | | | species are not impacted by the SGR Project |
| *Sheppardia aurantiithorax* | Rubeho Akalat | EN | | | | x | x | | | | | | |
| *Aquila nipalensis* | Steppe Eagle | EN | x | x | x | x | x | x | x | x | x | | Wide-ranging species, possible presence |
| *Gyps africanus* | White-backed Vulture | CR | x | x | x | x | x | x | x | x | x | x | Wide-ranging species, possible presence |
| *Gyps rueppelli* | Rüppell's Vulture | CR | x | | | x | x | x | x | x | x | x | Wide-ranging species, confirmed present |
| *Necrosyrtes monachus* | Hooded Vulture | CR | x | x | x | x | x | x | x | x | x | x | Wide-ranging species, possible presence |
| *Neophron percnopterus* | Egyptian Vulture | EN | x | | | | | | | | | | Wide-ranging species, possible presence |
| *Torgos tracheliotos* | Lappet-faced Vulture | EN | x | x | x | x | x | x | x | x | x | | Wide-ranging species, possible presence |
| *Trigonoceps occipitalis* | White-headed Vulture | CR | x | x | x | x | x | x | x | x | x | x | Wide-ranging species, possible presence |

| Species | Common Name | IUCN Threat. Status | Expected Occurrence along SGR Alignment | | | | | | | | | | Habitat / Distribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| **Reptiles** | | | | | | | | | | | | | |
| *Cycloderma frenatum* | Zam. Flapshell Turtle | EN | | | | | | | | | x | | Project is outside of known range |
| *Elapsoidea nigra* | Usambara Garter Snake | EN | | | | | | | x | | | | Restricted to mountain habitats, not impacted by the SGR |
| *Melanoseps emmrichi* | Uluguru Limbless Skink | EN | | | | | | | x | | | | |
| *Prosymna ornatissima* | Ornate Shovel-snout | CR | | | | | | | x | | | | |
| **Amphibians** | | | | | | | | | | | | | |
| *Arthroleptis nikeae* | Nike's Squeaker | CR | | | | | x | | | | | | Project is outside of known range |
| *Arthroleptides yakusini* | - | EN | | | | | | | x | | | | Restricted to mountain habitats, not impacted by the SGR |
| *Hoplophryne uluguruensis* | Uluguru Blue-belly Frog | EN | | | | | | | x | | | | |
| ***Hyperolius ruvuensis*** | **Ruvu Spiny Reedfrog** | **CR** | | | | | | | | | **x** | | **AZE trigger, not confirmed but likely based on habitat** |
| *Hyperolius ukwiva* | - | EN | | | | | x | | | | | | Project is outside of known range |
| *Leptopelis parkeri* | - | EN | | | | | | | x | x | | | Restricted to mountain habitats |
| *Nectophrynoides cryptus* | - | EN | | | | | | | x | | | | AZE triggers, restricted to the Uluguru Mountains that are not impacted by the SGR |
| *Nectophrynoides minutus* | Minute Tree Toad | EN | | | | | | | x | | | | |
| *Probreviceps durirostris* | - | EN | | | | | x | | | | | | Restricted to mountain habitats |
| *Probreviceps loveridgei* | - | EN | | | | | x | | | | | | AZE triggers, restricted to the Uluguru Mountains that are not impacted by the SGR |
| *Probreviceps uluguruensis* | - | EN | | | | | | | x | | | | |
| *Scolecomorphus uluguruensis* | Nyingwa Caecilian | EN | | | | | | | x | | | | |
| **Fish** | | | | | | | | | | | | | |
| *Oreochromis amphimelas* | | EN | x | | x | | x | | | | | | Dodoma to Itigi |
| **Invertebrates** | | | | | | | | | | | | | |
| ***Aerotegmina megaloptera*** | **Coastal balloon bush-cricket *** | **CR** | | | | | | | | | **x** | **x** | |
| ***Euschmidtia viridifasciata*** | **Dar es Salaam Monkey Grasshopper** | **CR** | | | | | | | | | **x** | **x** | Crickets and grasshoppers recorded from forest and/or grassland habitats in the Pugu Hills Forest Reserve |
| *Acteana alazonica* | Tz Coast Grasshopper | EN | | | | | | | | | x | x | |
| ***Parepistaurus pugui*** | **Pugu wigwag grasshopper *** | **EN** | | | | | | | | | **x** | **x** | |
| ***Parodontomelus verticulus*** | **Pugu Forest Grasshopper *** | **EN** | | | | | | | | | **x** | **x** | |

| Species | Common Name | IUCN Threat. Status | Expected Occurrence along SGR Alignment | | | | | | | | | | Habitat / Distribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| *Rhainopomma wapugu* | **Pugu Striped Grasshopper** * | **EN** | | | | | | | | | **x** | **x** | |

**Species indicated in Bold are confirmed or potential critical habitat features.**

**Key to areas (from west to east):** 10 - Makutopora; 9 - Kigwe; 8 - Dodoma; 7 - Gulwe; 6 - Kidete; 5 - Kilosa; 4 - Morogoro; 3 - Ngerengere; 2 - Ruvu; and 1 - Dar es Salaam.

**Key to IUCN Threatened Status:** CR – Critically endangered; EN – Endangered.

Results of baseline surveys have allowed the list of potential species to be trimmed substantially, and *Table 4-21* presents a reduced list of confirmed and likely critical habitat features for the SGR Project.

***Table 4-21 Shortlist of Critically Endangered and Endangered Species Confirmed Present or Likely To Occur along the SGR Alignment***

| Species | Common Name | IUCN Status | Likelihood of Presence |
|---|---|---|---|
| **Mammals** | | | |
| *Galagoides rondoensis* # | Rondo Dwarf Galago | CR | Confirmed Present |
| *Kerivoula africana* * | Tanzanian Woolly Bat | EN | Not confirmed but likely presence based on habitat |
| *Lycaon pictus* # | African Wild Dog | EN | Reliably reported present |
| **Birds** | | | |
| *Acrocephalus griseldis* * | Basra Reed-warbler | EN | Not confirmed but likely presence based on habitat |
| *Ardeola idea* * | Madagascar Pond-heron | EN | Not confirmed but likely presence based on habitat |
| *Geokichla guttata* * | Spotted ground-Thrush | EN | Not confirmed but may be present based on habitat |
| *Anthus sokokensis* | Sokoke Pipit | EN | Not confirmed but may be present based on habitat |
| **Amphibians** | | | |
| *Hyperolius ruvuensis* # | Ruvu Spiny Reedfrog | CR | AZE trigger, Not confirmed but likely presence based on habitat availability |
| **Invertebrates** | | | |
| *Aerotegmina megalopteran* | Coastal balloon bush-cricket | CR | Crickets and grasshoppers recorded from forest and/or grassland habitats in the Pugu Hills Forest Reserve |
| *Euschmidtia viridifasciata* # | Dar es Salaam Monkey Grasshopper | CR | |
| *Acteana alazonica* | Tz Coast Grasshopper | EN | |
| *Parepistaurus pugui* | Pugu Wigwag grasshopper | EN | |
| *Parodontomelus verticulus* # | Pugu Forest Grasshopper | EN | |
| *Rhainopomma wapugu* # | Pugu Striped Grasshopper | EN | |

Key: # - Species considered to be triggers for Criterion i, and qualify as Critical Habitat features for the SGR Project

* - Species considered to be likely triggers for Criterion i, but provisionally not qualifying as Critical Habitat features for the SGR Project

The Rondo Dwarf Galago is dependent on forest habitat and has been confirmed present in the close vicinity of the SGR construction activities within the Pugu Hills Forest Reserve. This little primate is highly threatened and highly range restricted, to the extent that is qualifies as a near AZE species. The little Rondo Dwarf Galago therefore needs to be recognised as the highest priority species for this biodiversity assessment.

The Tanzanian Woolly Bat is a forest-dependent species. Field surveys were not able to confirm its presence in the Pugu Hills Forest Reserve, however sufficient suitable habitat exists, and this species is therefore likely to be present. This bat roosts in trees and is not a component of the large bat populations occupying kaolin mine shafts in the same forest reserve.

Community engagements for wildlife corridors and for natural habitat assessments revealed the presence of African Wild Dog in the Mkata area. Communities were able to describe these dogs sufficiently well during different engagements for their accounts to be considered reliable records of presence. African wild dogs are wide-ranging and nomadic except when breeding. Their presence in any one area is unpredictable and, although they qualify as a CH feature, they are therefore not suitable species for demonstrating net gains.

Basra Reed-warbler and Madagascar Pond-heron were not recorded present as field surveys were conducted ahead of the migratory season due to time constraints. However the Ruvu Forest Reserve is known as a hotspot for these species and suitable wetland habitat was observed there. These birds are therefore considered to be seasonally present. These two birds are migratory and are not dependent on specific sites. Their presence can be unpredictable and they are therefore not suitable species for demonstrating net gains, and are not included as CH features.

The Spotted Ground-thrush and Sokoke Pipit are forest dependent migratory birds, which 'hop' from one forest patch to another on their annual migration. Small forest patches are therefore essential to sustain their migratory behaviour and is vital to the survival of these birds. Field surveys were not able to confirm the presence of these birds as surveys were conducted ahead of the migration season. The Spotted Ground-thrush is however considered to be present based on past records and availability of suitable habitat. Presence of the Sokoke Pipit is less likely due to past records.

Field surveys were not able to confirm the presence of the Ruvu Spiny Reedfrog, as the weather was hot and dry, however this species is considered very likely to occur within the Ruvu South Forest Reserve where suitable pans and other wetlands occur.

Field assessments of invertebrates were conducted, and a large number of species were collected. Time constraints have limited the capacity to confirm identifications, however the Pugu Striped and Pugu Forest Grasshoppers are distinctive species and there is a high level of confidence on the occurrence of

these two species based on visible characteristics of sampled specimens. The habitat is suitable and other endangered grasshoppers are considered likely to be present. These insects are listed as EN or CR on the IUCN Red List of Threatened Species, however there is a possibility that some of these insects have not been sufficiently studied and are likely to be more widespread than currently indicated, in which case their threatened status may decline in future. they are however, included as CH features for the SGR Project, although the BAP explains reasons for not demonstrating net gains.

*Table 4-20* includes seven bird species that are considered to wide-ranging foragers. White-backed Vultures were confirmed present, but all other birds in this list are considered highly likely to occur within the Project Area, particularly considering the wildlife populations present along the SGR. The PS6 does however state the following requirements for critical habitat for species that exhibit wide-ranging behaviour:

*"Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species."*

The approach adopted by IFC through various projects that ERM has been involved, has required this clause to be applied for vultures. No vulture nesting behaviour has been observed and impacts from the SGR are not expected to jeopardise the long-term survivability of vulture populations. This group are therefore not recognised as triggers of critical habitat for this Project.

*Analysis of Criteria (ii) – Habitat of Significant Importance to Endemic Restricted-range Species*

The Rondo Dwarf Galago and Ruvu Spiny Reedfrog would trigger this criterion, but are listed above under Criterion i above. A diversity of highly range-restricted species, as highlighted by the occurrence of two AZE sites, occur in the greater vicinity of the SGR alignment. These species are described in Table 4-20. Three additional species that are not Critically Endangered or Endangered, but show evidence of being highly range restricted are:

- Reptile - *Kinyongia uluguruensis* Uluguru Two-horned Chameleon (LC)
- Amphibian - *Arthroleptis lonnbergi* (DD)
- Fish - *Nothobranchius steinforti* (VU)

These species are restricted to the Uluguru Nature Reserve, which is not expected to be impacted by the Project, and no critical habitat is therefore considered for Criterion (ii).

*Analysis of Criterion (iii) – Habitat Supporting Significant Concentrations of Migratory and/or Congregatory Species*

Baseline surveys have revealed that large numbers of bats (estimated up to 10,000 bats) roost in two old Kaolin Mine shafts within the Pugu Hills Forest Reserve and adjacent to the SGR, including mostly *Triaenops afer* (Trident bat), *Mops* (free-tailed bats) and *Rhinolophus* (Horseshoe bats) species. Details are provided in the Enviro-Insight report. An old railway tunnel no longer used for the MGR line also supported a large population of bats, but construction activities for the SGR have displaced them. Bat population sizes in Tanzania are not known and it is therefore not possible to argue whether the bat congregations trigger KBA thresholds, but the very large numbers of bats are considered a CH feature as a precautionary measure.

*Analysis of Criterion (iv) – Highly Threatened and/or Unique Ecosystems*

The two AZE sites associated with the Eastern Arc Mountain Chain likely qualify as unique habitats, but these sites are not impacted by construction of the SGR, and no critical habitat is therefore considered for Criterion (iv).

*Analysis of Criterion (v) – Areas associated with key Evolutionary Processes*

No parts of the alignment of the proposed SGR alignment are known to support key evolutionary processes that could trigger this criterion.

### *4.6.3 Summary and Implications of the Critical Habitat Assessment*

The following critical habitat features (CH features) are recognised for the SGR Project as a result of this critical habitat assessment:

- The Pugu Hills and Ruvu South Forest Reserves qualify due to their recognised KBA status.
- Rondo Dwarf Galago, African Wild Dog, Ruvu Spiny Reedfrog, Pugu Striped and Pugu Forest Grasshoppers qualify under Criterion i.
- The large bat congregations associated with two Kaolin Mine shafts and with an old tunnel prior to SGR construction activities qualify under Criterion iii.

Where CH features are impacted, the PS6 requires that net gains are demonstrated through the development of mitigation. Impacts to these features are assessed in Chapter 8 of this ESIA.

The objective of the BAP is to conserve biodiversity in a manner that aligns with the PS6. The BAP therefore set targets to achieve no net loss of biodiversity to be applied where natural habitats are impacted, and sets the target to achieve net gain to be applied where CH features are impacted by the SGR Project. These aspects are detailed in the BAP.

## 4.7 SOCIOECONOMIC BASELINE

### 4.7.1 Introduction

The Standard Gauge Railway (SGR) Project crosses five regions in Tanzania, 13 districts within these regions, 56 wards and 110 villages.

This *Section* describes the current socioeconomic baseline conditions in the Study Area at the ward and village level (defined in *Section 4.10* below) along with more general information at the national level and district level for the districts located along the railway route to provide for additional context. Where possible and based on the information available, the socioeconomic conditions of the communities that will be affected by the proposed Standard Gauge Railway (SGR) Project are described , in order to determine the impacts and associated mitigation measures required to minimise negative impacts and enhance positive impacts.

The updated baseline information was determined through the review of existing secondary information, such as the original Draft ESIA by Ardhi (ESIA, 2017), the Resettlement Action Plans (RAP) for Lots 1 and 2, along with the primary data collected for the ESIA and RAPs. The baseline also relies on secondary information from publicly available online sources and studies.

This socioeconomic baseline section is further organised into the following subsections:

- **Summary of the National Context**: provides a detailed overview of the socioeconomic environment in Tanzania.
- **District Level Context:** provides an overview of relevant socioeconomic conditions in the districts through which the SGR passes.
- **Key Elements of the Social Area of Influence:** describes the key socioeconomic baseline elements in the Social Area of Influence that will inform the assessment of impacts and provide a starting point for future implementation of monitoring plans.

### 4.7.2 Methodology

Secondary data sources rely on government census data and online sources including a number of available studies on livelihoods in Tanzania. As mentioned above, the primary data used was gathered in the context of the ESIA and RAPs preparation for the Project. The ESIA primary data was gathered from a sample of communities in the social area of influence or Study Area, and complemented with more specific information collected as part of the

household census surveys conducted as part of the RAPs. The following approaches were used:

- **ESIA Socioeconomic Survey:**
  - **Key informant interviews (KIIs):** KIIs were undertaken to gather information from those that are likely to have an influence on the project and / or that are experts in a specific topic area. These included meetings with Regional Commissioners (RC), Regional Administrative Secretaries (RAS), Regional Secretariat experts, District Commissioners (DC), District Administrative secretaries (DAS), Chief Executive Officers (CEOs) of City/District/Municipal Councils, utilities agencies, wards and village leaders.
  - **Focus Group Discussions (FGDs):** Focus groups were undertaken to gather information on various topic areas and to gather Project perceptions from specific groups. FGDs include women, ward leaders, economic venture groups, influential elders, self-help groups, sports team leaders, teachers, income generating groups, livestock keepers, farmers, disabled, businessmen etc.
  - **Household Questionnaires:** A sample of surveys were undertaken on 15 households in 10 villages within the Study Area to gather quantitative data.

- **RAP (Lots 1 and 2/Phase I and Phase II) Survey:**
  - **Household Census:** Household census was used to collect demographics and socio-economic characteristics of Project Affected People (PAPs) through a structured questionnaire administered to different groups of PAPs. The household survey also involved an asset inventory and collecting information on income generating activities, and household economic stability of PAPs.
  - **Focus Groups Discussions (FGDs):** FGDs conducted in affected communities to collect and triangulate additional socioeconomic baseline information on various socio-economic dimensions in the communities (community structure, ethnic groups, social networks, religion, gender dynamics, livelihoods, access to markets, etc.)

Additional data collection was also conducted in March 2019 to complement some of the RAP information as well as general socioeconomic information on specific aspects such as the use of natural resources and ecosystem services in pre-identified areas.

### *4.7.3 Area of Influence*

The socioeconomic Area of Influence (AoI) includes all the settlements totally or partially within a 500 m corridor (250 m either side of the centreline).
These communities will be directly (e.g. through land acquisition, resettlement and loss of livelihoods, community health and safety, noise and other related impacts) and indirectly (e.g., through in-migration or indirect economic impacts) impacted.

This corridor includes the main centres and towns that are situated within the affected districts that may experience impacts to the economy through procurement and sale of goods and services during construction and to passengers at a later stage, including the capital city Dar es Salaam and the district capital of Dodoma. It is expected that most indirect and induced impacts, in particular those related to employment creation and procurement of goods and services will be experienced in these locations.

Additionally the Project will require temporary acquisition of land outside the RoW for the establishment of borrow pits, dumping sites, quarry sites, construction of marshalling yards, stations and campsites.

As detailed in *Chapter 2*, according to the *Railways Act No. 4 of 2002*, the Project will require within this 500 m corridor the establishment of a cleared RoW of no less than 15 metres from the centre line of the railway on both sides (left and right) in towns and cities while in other areas outside the towns the RoW is 30m. Within this RoW, no structures or buildings can be established. This will result in significant physical and economic displacement in line with the following requirements:

- Sections of the proposed SGR alignment that are within the existing MGR RoW (except for bypasses around Morogoro Town and Dodoma Town), where a small area of land no more than 15 m will be permanently taken on one side (only) to compensate the used portion of the RoW.
- Sections of the alignment where the SGR passes completely out of the existing MGR RoW (ie, the bypasses at Morogoro and Dodoma) where a 60 m RoW will be required (ie, – 30 m on either side of the centre line). Any structures, trees, crops within the required sections shall be permanently removed within this area.

The communities in the Area of Influence are listed in *Table 4-22*.

*Table 4-22 Communities in the Area of Influence*

| *REGION* | *DISTRICT* | *WARD* | *VILLAGE* |
|---|---|---|---|
| | | ***PHASE I*** | |
| Dar es Salaam | Temeke | Kurasini | - |
| | | Keko | - |
| | | Chang'ombe | - |
| | | Temeke | - |
| | | Sandali | - |
| | Ilala | Kiwalani | - |
| | | Kipawa | - |
| | | Ukonga | Sabasaba |
| | | | Mwembe Madafu |
| | | | Guluka kwalala |
| | | Pugu | Pugu (Station) |
| | | | Pugu (Bombani) |
| Pwani | Kisarawe | Kisarawe | Pugu (Forest) |
| | | Kiluvya | Kisopwa |
| | | Kisarawe | Visegese |
| | Kibaha | Soga | Mpiji |
| | | | Mnemela Kibaoni |
| | | | Soga |
| | | Ruvu | Ngeta/Maktopola |
| | | | Kikongo |
| | | | Kikongo (Re-alignment) |
| | | | Mkino-Kikongo |
| | | | Minazi-Mikinda |
| | | Kwala | Kwala |
| | | | Mperamumbi-Msua |
| | | Magindu | Magindu |
| | | | Miziguni |
| Morogoro | Morogoro Rural | Kidugalo | Kidugalo |
| | | | Kidugalo (Re-alignment) |
| | | Ngerengere | Mgude (Re-alignment) |
| | | | Ngerengere |
| | | Mikese | Sinyaulime |
| | | | Kinonko |
| | | | Muhunga Mkola |
| | | | Mikese |
| | | | Mtego wa Simba |
| | | Mkambalani | Mkambarani |
| | | | Pangawe |
| | Morogoro Urban | Kingolwira | Tanki la Maji |
| | | | Seminari |

| *REGION* | *DISTRICT* | *WARD* | *VILLAGE* |
|---|---|---|---|
| | | | Tungi |
| | | Bigwa | - |
| | | Kihonda | Yespa |
| | | | Kilimanjaro |
| | | | Magereza |
| | | | Kihonda Kaskazini |
| | | | Azimio |
| | | | Msimamo |
| | | | Tushikamane |
| | | | Kambi Tano |
| | | | Kambi Tano Grave Yard vol. 1 |
| | | | Kambi Tano Grave Yard (Addendum) |
| | | | Lukobe juu |
| | | | Kimambila |
| | | ***PHASE II*** | |
| Morogoro | Mvomero | Mzumbe | Mayanga |
| | | | Kimambila |
| | | Melela | Mkata |
| | Kilosa | Chanzuru | - |
| | | Kimamba 'A' | Kimamba 'A' |
| | | Mabwerebwere | Chanzuru |
| | | | Chekereni |
| | | Mkwatani | - |
| | | Mbumi | Mkwatani |
| | | Kasiki | Kasiki |
| | | | Mtendeni Str |
| | | Magomeni | Mlimani Boma Str |
| | | | Mkadage |
| | | Masanze | Munisagara |
| | | Kidete | Mzaganza |
| | | | Magulu |
| | | | Kikundi |
| | | | Mwasa |
| | | | Kidete |
| Dodoma | Mpwapwa | Gode Gode | Kisisi |
| | | | Godegode |
| | | Kimagai | Kimagai |
| | | Mazae | Gulwe |
| | | Chunyu | Msagali |
| | Chamwino | Gandu | Igandu |
| | | | Chimwaga |

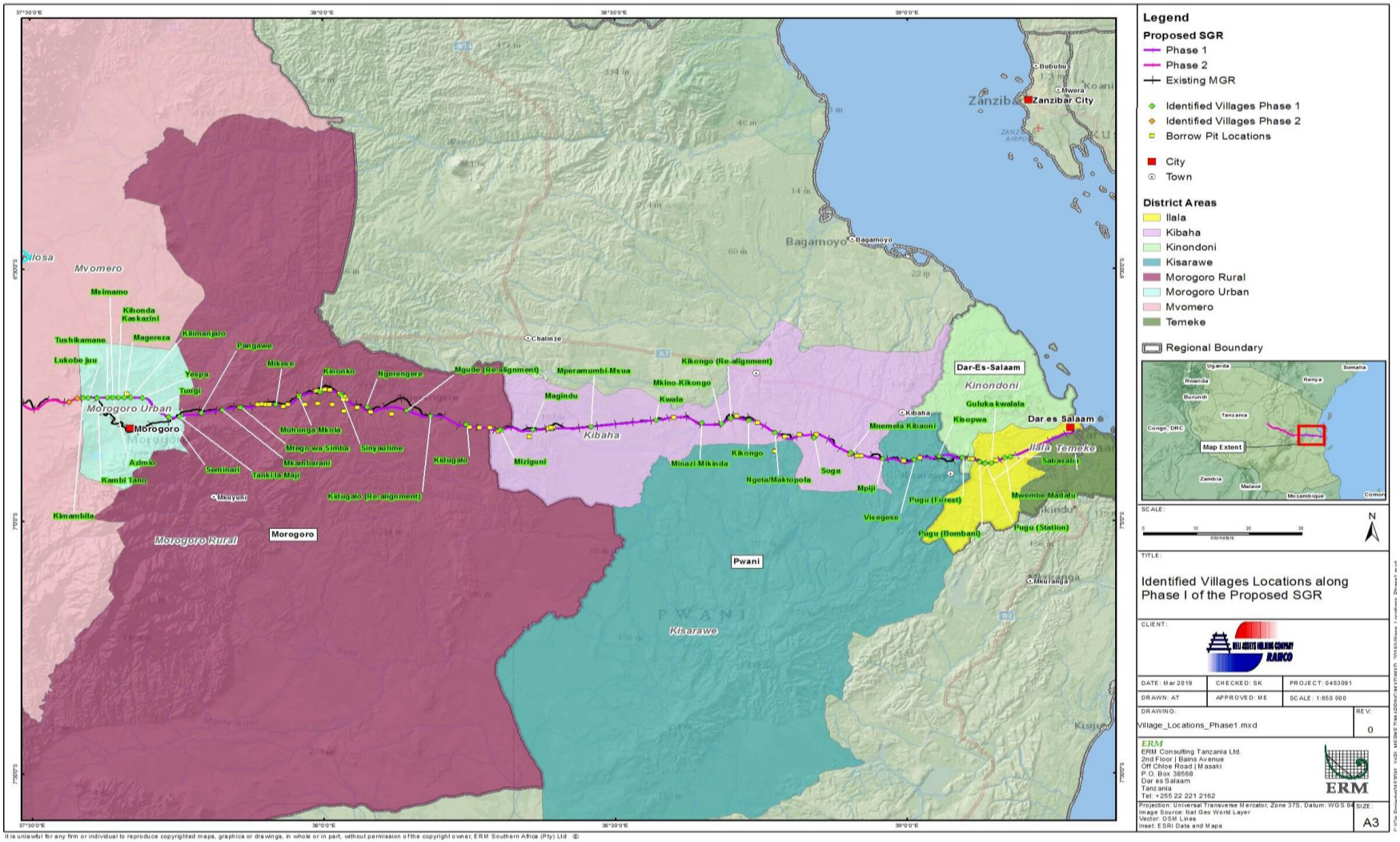
| *REGION* | *DISTRICT* | *WARD* | *VILLAGE* |
|---|---|---|---|
| | Dodoma Urban | Handali | - |
| | | Msamalo | Msalamo |
| | | | Mnase |
| | | Kikombo | Chololo |
| | | | Kikombo |
| | | Mtumba | Ihumwa |
| | | | Chilwanwa Str |
| | | | Iyumbu Str |
| | | | Nyerere Str |
| | | Dodoma Makulu | Msangalale Mashariki (Njedengwa) |
| | | | Msangalale Mashariki |
| | | | Msangalale Magharibi (Mapinduzi) |
| | | | Msangalale Magharibi |
| | | Tambukareli | Salimini Str |
| | | | Image Block D |
| | | Kilimani | Chinyoyo |
| | | | Image Str |
| | | | Image (Kilimani) |
| | | | Image (K/kusini) |
| | | Kikuyu South | - |
| | | Mkonze | Mkalama "A" |
| | | | Chidachi |
| | | | Michese Str |
| | | | Chidachi Str |
| | | | Miganga |
| | | | Bwawani |
| | | | Muungano "B" |
| | | | Mazengo |
| | | Zuzu | Pinda |
| | | | Soweto |
| | | | Mzogoni |
| | Bahi | Kigwe | Mpinga |
| | | | Kigwe |
| | | | Mzogole |
| | | | Mapinduzi |
| | | Chikola | - |
| | | Mpamantwa | Bahi Makulu |
| | | Bahi | Ng'ambo |
| | | | Bahi Sokoni |
| | | | Bahi Nagulo |
| | | | Naguro Bahi |

| *REGION* | *DISTRICT* | *WARD* | *VILLAGE* |
|---|---|---|---|
| Singida | Manyoni | Kintinku | Lusilile |
| | | Maweni | - |
| | | Chikuyu | Makutupora |

Source: Thurlow Mapping, GISc, 2019.

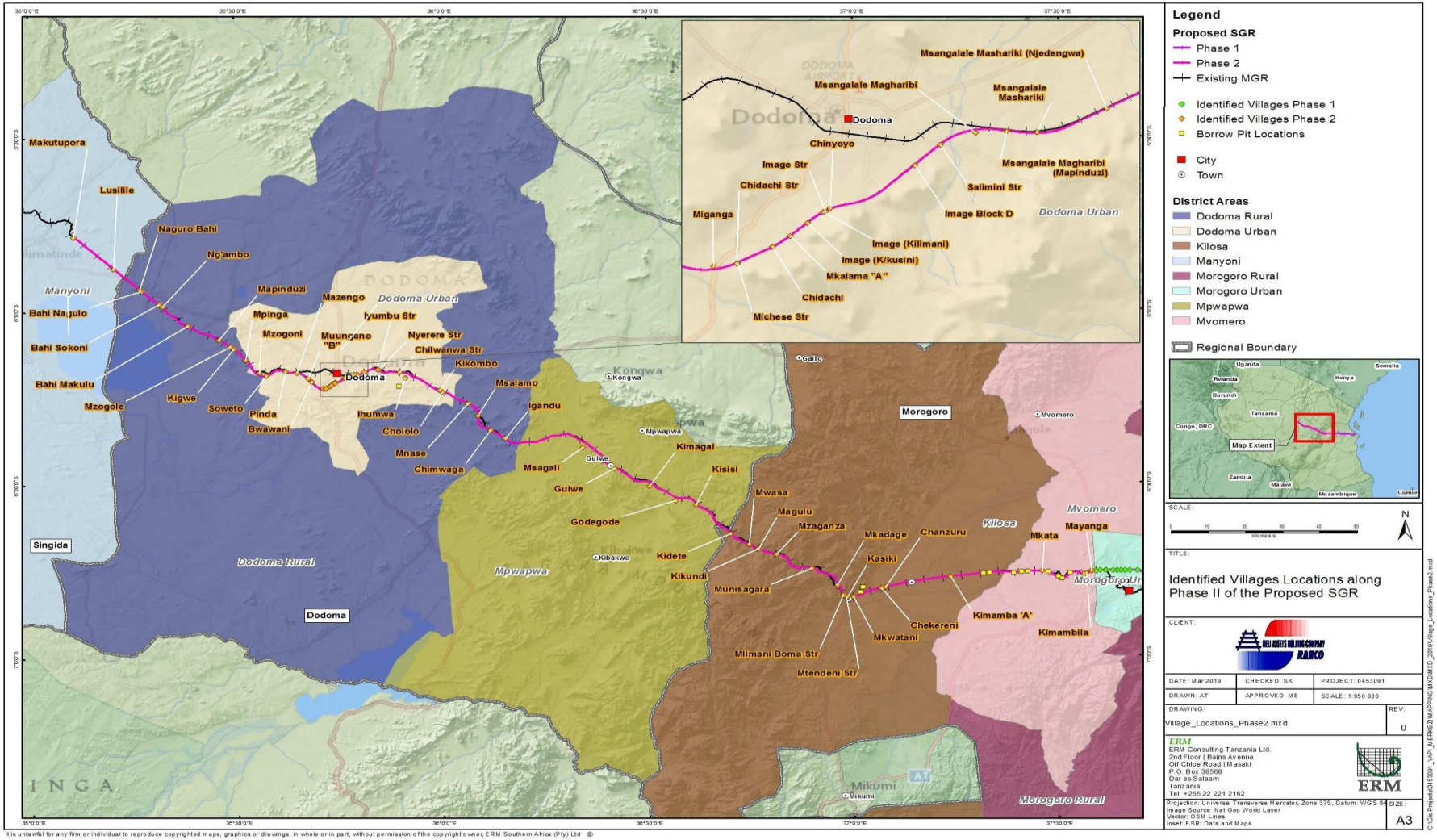
Maps showing the areas crossed by Phase I and Phase II of the railway are provided in Figure 4-15 and Table 4-12.

*Figure 4-29 Social Area of Influence – Phase I*




Source: ERM 2019.

*Figure 4-30 Social Area of Influence - Phase II*






Source: Thurlow Mapping, GISc, 2019.

## 4.8 SUMMARY OF THE NATIONAL CONTEXT

This section of the baseline provides an overview of the national context in order to compare the socio-economic situation at the national level against that at the district and village level.

### 4.8.1 Geography and Administrative Structure

Tanzania is situated on the coast of East Africa and is bordered by Kenya to the North, Rwanda and Burundi to the North-West, the Democratic Republic of the Congo (DRC), Zambia to the South-West and Malawi and Mozambique to the South. The proposed Project crosses five regions in Tanzania, respectively, Dar es Salaam, Coast, Morogoro, Dodoma and Singida.

Administrative regions are divided into districts, which are subdivided into wards, and these are further divided into villages. Local communities are represented by ward councils and village leaders.

### 4.8.2 Population and Demographics

According to the World Bank, the population of Tanzania in 2017 was approximately 57 million people (1), which is a 14.5 percent increase on the 2012 national population census figure of 49.8 million. (2) There has been a natural increase in the population arising from an increase in life expectancy. Tanzania has a very low median age with more than 44.8 percent of the population under the age of 15, 52 percent between the ages of 15 and 64 and just 3.2 percent over the age of 64 (3).

*Migration*

In 2017, estimated net migration rate for United Republic of Tanzania was -0.5[4] migrants per thousand population. Though United Republic of Tanzania net migration rate fluctuated substantially in recent years, it tended to decrease through 1970 - 2017 period ending at -0.5 migrants per thousand population in 2017 (CIA, 2018).

(1) https://data.worldbank.org/country/tanzania

[2] Basic Demographic and Socio-Economic Data, 2012 National Census Report (2014): http://nbs.go.tz/nbs/takwimu/census2012/Basic_Demographic_and_Socio-Economic_Profile_PopularVersion-KeyFindings_2012_PHC_EnglishVersion.pdf

[3] Basic Demographic and Socio-Economic Data, 2012 National Census Report (2014): http://nbs.go.tz/nbs/takwimu/census2012/Basic_Demographic_and_Socio-Economic_Profile_PopularVersion-KeyFindings_2012_PHC_EnglishVersion.pdf

[4] Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/tz.html. Accessed July 2018.

*Religion, Ethnicity and Language*

The country is ethnically diverse with approximately 120 different ethnic groups. According to the Index Mundi Tanzania Demographics Profile[1] (2018), practiced religions in the country include Christianism (61.4 percent), Islamism (35.2 percent), traditional religions (1.8 percent), other religions (0.2 percent) and unaffiliated (1.4 percent).

Languages spoken in the country include the national language, Swahili, which is spoke and understood by very nearly the entire population, English which is the international language used in higher education, and other African languages which are spoken by the minority of the population. The precise number of other languages spoken in Tanzania is not clear. Most recent surveys (developed by the "Languages of Tanzania Project" 2009) states the existence of 164 other local languages (PETZELL, 2012).

### *4.8.3 Indigenous Peoples*[2]

In Tanzania, some groups of pastoralists and hunter-gatherers self-identify as indigenous peoples, in line with contemporary norms of international law as conceptualized and contextualized by the African Commission on Human and Peoples rights (the African Commission). Specifically, there are five groups of Indigenous Peoples (IPs) that are recognised in Tanzania either by the International Work Group of Indigenous Affairs or the Coalition of Indigenous Pastoralist and Hunter Gatherer Organizations (Tanzania). These include the:

- Maasai;
- Barbaig;
- Akie;
- Taturu; and
- Hadzabe.

The Barbaig, the Taturu, and the Maasai practice pastoralism whereas the Akie and the Hadzabe are hunter-gatherers, meaning traditional communities that

[1] Available at: https://www.indexmundi.com/tanzania/demographics_profile.html. Accessed July 2018.

[2] This Section has been developed using the IFAD Report (2012): "*Country Technical Notes on Indigenous Peoples' Issues",* and a Desktop-based Study on Indigenous Peoples by a Local Specialist

make a living predominantly through collecting wild fruits and hunting wild animals.

The Akie, Taturu and Hadzabe, who are traditionally forest dwelling hunter gatherers, were not recorded as being present in the Districts traversed by the Project in the social baseline. The Hadzabe and Taturu traditionally live in Northern Tanzania, while the Akie are found close to Arusha in Western Tanzania.

The Maasai and Barabaig (a Datoga sub-tribe) who are pastoralists are present in the Districts traversed by the Project. In particular, in Chamwino District (Dodoma Region, in the middle of Phase II area) and Kilosa District (Morogoro Region, in the west part of Phase I area). The baseline also identifies the presence of the Sandawe in Chamwino District (mid-west part of Phase II area), which may also meet the criteria of IPs as they reportedly practice pastoralism and have a distinct way of life. The following general information is known about these two groups:

- Maasai: There are an estimated 430,000 Maasai in Tanzania, mainly in the North of the Country. The Masaai are traditionally semi-nomadic pastoralists (cattle, goats and sheep), practicing transhumance as well as some agriculture wherever conditions allow it. They are distributed into territorial sections within which all members have access to grazing resources. Although most live in Arusha, Manyara and Tanga regions, some are also dispersed over several regions further to the South, including Morogoro region, where they are still considered as migrants. Increasingly the Maasai in Tanzania are becoming more urbanised and are moving away from their traditional lifestyles([1]).
- Barabaig: The Barabaig numbered an estimated 30,000 in the mid-1990s and have occupied the plains around Mount Hanang in north-central Tanzania for the last 150 years ([2]). The Barabaig are traditionally semi-nomadic and herd cattle, sheep and goats. Today, many have become agro-pastoralists and farm maize, beans and millet.

Both groups keep animals; notably goats, sheep, donkeys and chickens, but cattle are by far the most important domestic animal. The meat, fat, blood, milk, hide, horns, tendons and cow dung of every animal have either practical or ritual purposes. Both the Maasai and the Barabaig have, to a large extent, kept their traditional features and customs, including their traditional way of

([1]) http://minorityrights.org/minorities/maasai/
([2]) http://minorityrights.org/minorities/barabaig/

dressing and their own languages—the Maasai speak Maa and several dialects (Kisongo and Parakuyo), the Barabaig speak a Datoga dialect.

Most members of these communities are nomadic, and still practice communal/traditional livelihoods systems that often do not align with the government's main development priorities. Top government priorities include industrialization, commercial agriculture, nature conservation and trophy hunting and resource extraction. These groups' collective and nomadic livelihood options thus heighten their susceptibility to human rights violations, notably displacement or forceful evictions in order to pave the way for other development priorities. Since independence of Tanzania in 1961, pastoralists have been the object of government policies trying to sedentarise them through the establishment of ranching associations, and subsequently through the villagization program[1].

Pastoralists have also been evicted from their traditional lands or denied access to their rangelands in order to give space to protected areas, hunting concessions, wildlife corridors, livestock ranches and commercial crop production. These changes in land use have been accompanied by a change in tenure rights from communal to private, thus intervening in and reducing transhumance mobility for pastoralists[2].

A further threat to rangelands security is land grabbing; a multi-faceted phenomenon led by influent groups (i.e politicians, private companies) and even individual migrating farmers[3]. The latter may be poor people looking for access to land for bare survival or more wealthy farmers looking for land for large-scale farming and land speculation. Both Maasai and Barabaig groups have also reportedly been subject to land grabbing; for example in Morogoro Region in Kilosa District (east part of Phase II area) where despite courts finding in favour or the Maasai over their right to ancestral land, the Maasai leaders of the village council were arrested for failing to vacate land to make way for large scale agriculture. Similarly, in Kambala village in Mvomero District in Morogoro Region (east part of Phase II area), there has been significant conflict between pastoralists and farmers who want to use the traditional ancestral lands for cultivation.

[1] "*The Villagization or Ujamaa program (1973-1976) regrouped rural communities into larger nucleated villages to be provided with services by the state. More than 8,000 villages were created by the mid-1970s, and 9 million people forcibly resettled, but traditional resistance and a difficult economic environment led to the breakdown of this idealistic social program.*", IFAD Report (2012).

[2] IFAD Report (2012): "Country Technical Notes on Indigenous Peoples' Issues", and a Desktop-based Study on Indigenous Peoples by a Local Specialist

[3] IFAD Report (2012): "Country Technical Notes on Indigenous Peoples' Issues",

It should also be noted that since 2006, evictions of agro-pastoralists from Ihefu and conflict between Maasai and crop farmers in Kilosa, the number of pastoralist and agro-pastoralist groups such as the Maasai, Barabaig migrating has increased including in Mpwapwa District (middle of Phase II area). The pastoralists have moved in search of grazing land due to pressures on grazing elsewhere. Some of the pastoralists now practice transhumance, in which they keep their animals in the area only in the dry season, whilst agro-pastoralists remain all year round and have farms. The relationship between pastoralists and settled villages is often reported to be poor, due to complaints that their cattle cause damage to crops and conflict over land availability and encroachment.

Tanzania's government is planning to open up special grazing areas for nomadic herders to give them better access to water and pastures, as part of a policy to prevent recurring conflicts between farmers and pastoralists[1]. Reportedly, none of these designated lands for pastoralists are located in the Social Area of Influence of the Project.

Presence and status of indigenous peoples in the Study Area are discussed in more detail in Section 4.10.3.

### *4.8.4 Gender Context*

*Gender Roles*

Girls and women are generally responsible for housekeeping and cooking activities, childcare, farming, gathering and pounding maize, etc., placing less value on their educational and economic attainment. Men engage primarily with the income generating activities (Jones, 2014).

*Access and Control of Resources / Gender Equality*

According to the UNDP[2] Tanzania, the country has achieved progress towards gender equality under the Millennium Development Goals (MDGs) however, women and girls continue to suffer violence and discrimination in access to employment, health services, education and decision-making processes.

[1] Makoye (2014): "*Tanzania opens up more grazing land to drought-hit herders*". Thomson Routers Foundation.

[2] http://www.tz.undp.org/content/tanzania/en/home/ourwork/genderequality/overview.html

Tanzania Gender Inequality Index, ranked 129 out of 188 countries in 2015[1] with a rating of 0.544. Root causes for gender inequalities include historical and structural power imbalances between women and men and pervasive gender stereotypes.

Under the law, women of Tanzania have equitable access to land, livestock and productive assets but in practice such access, is more often through males. In Tanzania, men mostly inherit land. Generally, in the mode of agricultural production, women suffer exploitation under patriarchal relations of production perpetuating the control of land and women's labour time by men. Even when married women have access to land through husbands, this is an interest of relatively limited scope for they (women) have no power to sell the land (Ishengoma, 2005).

*Challenges faced by Men and Women*

According to the United Nations in Tanzania[2], although the country is signatory to all major international and regional instruments that promote gender equality; implementation has been constrained by the delays in incorporating these rights into national laws along with structural weaknesses in the justice system and inadequate attention to public education, resulting in women's limited access to their rights.

Women still confront manifold violations of their human rights — when they cannot participate in the decisions that affect their lives or claim fair representation, when they face discrimination in employment, when they are denied entitlement to land and property, or when they suffer violence within their own home or face sexual harassment or extortion (sextortion) in accessing essential public services.

Other obstacles to rights arise when women and girls are prevented from going to school or attaining health care, or are subject to harmful traditional practices.

Discrimination and violence against women and girls are widely prevalent and widespread in Tanzania and are fuelled by patriarchal norms and traditions.

[1] Available at : http://hdr.undp.org/en/composite/GII. Accessed July 2018.

[2] Available at: http://tz.one.un.org/who-we-are/7-un-programmes/87-gender?showall=&start=2. Accessed July 2018.

### *4.8.5 Vulnerability*

Vulnerability is dependent on the level of resilience of individuals to cope with socio-economic or biophysical change, or shocks. Resilience is based on having access to the necessary resources (for example, financial credits, assets such as crops, shelter, etc.) and physical/mental capacity (for example, strength to relocate, skills to rebuild a business, etc.) to cope and adapt to change in the community. Vulnerable groups are consequently more susceptible to negative projects impacts and are more likely to have a limited ability to take advantage of positive impacts.

***Box 4.1 Vulnerable Groups***

Women and girls: Issues regarding gender discrimination, child marriage and teenage pregnancy, as well as reduced access to land and other assets creates high levels of vulnerability.

Female headed households: Higher levels of poverty than men due to more pressure balancing domestic and livelihood activities.

Unemployed male youth/adult men: Due to financial pressure as their role as the 'bread winner', they are vulnerable to alcoholism and depression.

Subsistence households: High levels of poverty and food insecurity creating significant household pressures and health issues.

People over the age of 60: More limited in terms of their physical ability to engage in livelihood and income generating activities. They also endure high levels of poverty due to low levels on income. Additionally, some may require additional care and support.

People with disabilities: Experience low levels of income and rely on others for support due to their physical limitations. They may also experience discrimination in relation to work and marginalisation in the community because of their disability

Orphans or Orphan headed households: Rely on carers to take responsibility for their economic situation and general wellbeing. Due to high levels of poverty in the project villages, orphans are more vulnerable to change.

According to a country participatory assessment (PPA) developed by URT in 2001, as part of the implementation of the Poverty Monitoring Master Plan, extremely vulnerable groups in Tanzania, are likely to be members from the following social groups: children, people with disabilities, individuals carrying out high-risk jobs, elderly people, youths and women. These groups are most vulnerable to impoverishing forces, such as economic, environmental, social, cultural, health, life cycle, and governance (such as restrictive policies and regulations, poor governance and limited access to productive assets such as fertile land, or business space, etc.).

### *4.8.6 Governance, Security and Human Rights*

*Governance and Security*

According to the USAID[1] (2018) although Tanzania is one of the most politically stable countries in Africa, institutionalized democracy and good governance are challenged by corruption and poor delivery of government services. While Tanzania has a number of government accountability structures, their use by citizens to ensure greater transparency and accountability has been limited. Public oversight of Government of Tanzania resources by citizens at both national and local levels remains a gap in the fight to end corruption and improve service delivery.

According to the OSAC Tanzania 2017 Crime & Safety Report[2], most incidents are non-violent property crime and non-violent street crime. Street crime is rampant in urban areas. Most incidents are crimes of opportunity, targeting people carrying bags, backpacks, computer cases, cameras, or pocketbooks. Most of these snatch-and-grab crimes are committed by unarmed assailants. Assailants tend to operate in small groups where only one person may overtly take part in a mugging.

Residential burglaries are common for dwellings. Inadequate perimeter walls, minimal lighting, non-existent/weak grilles, and poorly paid/trained guards contribute to security challenges. The overwhelming majority of victims are Tanzanians. However, rape/murder of expatriates has occurred, including during home invasions.

*Human Rights*

According to Human Rights Watch, there are a number of human rights issues that are prevalent in Tanzania [(3)]. These are detailed in *Box 4.2* below.

[1] Available at: https://www.usaid.gov/tanzania/democracy-human-rights-and-governance. Accessed July 2018.

[2] Available at: https://www.osac.gov/pages/ContentReportDetails.aspx?cid=21762. Accessed July 2018.

(3) Human Rights Watch, Report 2018. Available at https://www.hrw.org/world-report/2018/country-chapters/tanzania-and-zanzibar

### *Box 4.2 Human Rights Issues in Tanzania*

Freedom of expression: Human rights activities, political opposition parties and those from other groups have arbitrarily been arrested, threatened or harassed for expressing their views about the government and issues relating to corruption.

Freedom of media: Radio stations and newspapers have been shut down for debates regarding political activities.

Womens' and girls rights: Exploitation of girls and child marriage is common in Tanzania. Girls also face discrimination in schooling. For example, school officials can automatically expel pregnant girls and married girls from school. Additionally, Tanzanian women working as domestic workers in the Middle East face labour rights violations and other abuses. Tanzania has no law to protect migrant workers overseas, and weak safeguards facilitate abuse of workers.

Sexual Orientation and Gender Identity: Discrimination due to sexual orientation and sexuality in Tanzania is common and groups have been targeted and threatened by police due to these factors.

Asylum Seekers and Refugees: In 2017, Tanzania hosted over 240,000 refugees who entered the country from Burundi since April 2015, following the political unrest. Recently the registration and naturalization of thousands of Burundian refugees has been suspended and they have been urged to return to Burundi.

In relation to labour and working conditions, Tanzania has ratified all eight of the fundamental International Labour Organisation Conventions, listed in *Table 4-23* below (1).

### *Table 4-23 ILO Conventions Ratified*

| Convention | Date Ratified |
|---|---|
| C029 - Forced Labour Convention, 1930 (No. 29) | 30 Jan 1962 |
| C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87) | 18 Apr 2000 |
| C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98) | 30 Jan 1962 |
| C100 - Equal Remuneration Convention, 1951 (No. 100) | 26 Feb 2002 |
| C105 - Abolition of Forced Labour Convention, 1957 (No. 105) | 30 Jan 1962 |
| C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111) | 26 Feb 2002 |
| C138 - Minimum Age Convention, 1973 (No. 138)Minimum age specified: 14 years | 16 Dec 1998 |
| C182 - Worst Forms of Child Labour Convention, 1999 (No. 182) | 12 Sep 2001 |

(1) ILO, Ratifications for Tanzania. Available at https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11200:0::NO::P11200_COUNTRY_ID:103476

Regardless of the conventions ratified, Tanzania published a National Child Labour Survey in 2014, noting that 94.1 percent of working children are engaged in agriculture. *Table 4-24* Children's Work and Education provides key indicators on children's work and education in Mainland Tanzania (1).

***Table 4-24 Children's Work and Education***

| Children | Age | Percent |
|---|---|---|
| Working (% and population) | 5 to 14 | 29.3 (3,573,467) |
| Working children by sector | | |
| Agriculture | | 94.1 |
| Industry | | 1.0 |
| Services | | 4.9 |
| Attending School (%) | 5 to 14 | 74.3 |
| Combining Work and School (%) | 7 to 14 | 24.6 |
| Primary Completion Rate (%) | | 73.7 |

Source: Data from 2014, published by UNESCO Institute for Statistics, 2016 and Tanzania Mainland National Child Labour Survey Cited in Bureau of International Labor Affairs.

The Project will be require to ensure that risks relating to human rights and child labour and managed effectively.

### *4.8.7 Economy*

Tanzania is ranked relatively low at 151 out of 188 countries in the Human Development Index (HDI), which measures components of health, knowledge and a standard of living (2) . The main aspects that affect the ranking are low levels of education in combination with high levels of poverty across the country.

According to the World Bank[3] Tanzania's real gross domestic product, (GDP) growth rate slowed in 2017. According to government data, growth for the first three quarters of 2017 stood at 6.8 percent, down from 7.3 percent during the same period in 2016. The decline is mainly due slower growth of services from the supply side and slower expansion of consumption and investment from

(1) Cited in Bureau Of International Labor Affairs. Child Labor and Forced Labor Reports, Tanzania. Available at https://www.dol.gov/agencies/ilab/resources/reports/child-labor/tanzania

(2) http://hdr.undp.org/en/composite/HDI

[3] Available at: http://www.worldbank.org/en/country/tanzania/overview. Accessed at July 2018.

demand side. Although Tanzania's real GDP growth rate is estimated to have slowed, it was the highest in the East African Community (EAC) for 2017.
The economy depends on agriculture, which accounts for slightly less than one-quarter of GDP and employs about 65 percent of the work force, although gold production in recent years has increased to about 35 percent of exports. All land in Tanzania is owned by the government, which can lease land for up to 99 years. Proposed reforms to allow for land ownership, particularly foreign land ownership, remain unpopular (CIA, 2018).

### *4.8.8 Education and Literacy*

*Education system*

The education system in Tanzania is organized around two years of pre-primary education, seven years of primary education, four years of secondary ordinary level education, two years of secondary advanced level of education and three or more years of university education.

Although the government has made noticeable progress in terms of access and equity in primary education, many challenges persist related to retention, completion, and the transition of girls to secondary education, as well as in the quality of education.

*Literacy*

The literacy rate in Tanzania in 2015, adult literacy rate for United Republic of Tanzania was 80.4[1] percent (Knoema, 2018). Though United Republic of Tanzania adult literacy rate fluctuated substantially in recent years, it tended to increase through 1988 - 2015 period ending at 80.4 percent in 2015.

### *4.8.9 Land Ownership and Tenure System*

Land laws of Tanzania are embedded in the '*Land Act No. 4 of 1999*' and the '*Village Land Act No. 5 of (1999)*'. These laws declare all land in Tanzania as "Public land" to be held by the state for public purposes. The Acts enable the President of the United Republic of Tanzania, to revoke the "Right of Occupancy" of any landholder for the "public/national interest" should the need arise. In short, the President holds *land in trust* for all citizens and can acquire land for public use, including resettling people.

[1] Available at:
https://webcache.googleusercontent.com/search?q=cache:17aaDTccWG0J:https://knoema.com/atlas/United-Republic-of-Tanzania/topics/Education/Literacy/Adult-literacy-rate+&cd=1&hl=pt-PT&ct=clnk&gl=mz. Accessed July 2018.

As such, all land in Tanzania is vested in the President as a trustee for and on the behalf of all the citizens. This means that people can only obtain rights to use land and not own land, although such rights can be inherited and bought and sold. In Tanzania there are three types of land defined by law namely, general land, village land and reserved land. These are summarized in *Box 4.3* below.

***Box 4.3 Land Categories in Tanzania***

Under the Land Acts, there are three categories of land in Tanzania:

- **General Land**. All urban land (including land within a municipality) falls under this category, except land, which is covered by laws governing Reserved Land.
- **Village Land** is land that falls under the jurisdiction and management of a registered village. Due to the rural nature of much of Tanzania, most land in the country is Village Land. Each village is required to define three land-use categories within its own borders: Communal Village Land; Individual and Family Land; and Vacant Land (for future village expansion).
- **Reserved Land** is land set aside and governed by nine specific laws, including protected areas such as national parks, forest reserves, wildlife reserves and marine parks as well as areas intended and set aside by spatial planning for (future) infrastructure and other development.

Source: Land Act and Village Land Act 1999

It is understood that most/majority of the land along the planned alignment is within the right of way of the existing MGR and belongs to the railway authority. The remaining land that will be impacted is privately owned or owned by other institutions and customary in some cases. However, this will need to be confirmed in the RAPs for Phase I and II.

To date, through RAP activities that have taken place to date, approximately xxx households (xx for Lot 1 and xx for Lot 2) will be affected by the project through physical and economic displacement. Additionally, xx public infrastructure (e.g. schools, dispensaries etc.) shall be affected (xx in Lot 1 and xx in Lot 2). Additional information on resettlement will be available on completion on the RAP Phase I and Phase II documents.

### *4.8.10 Agricultural Livelihoods*

According to Tanzania Invest (2018), agriculture contributes the most to the economy. In 2014, the agriculture sector contributed USD 13.9 billion to Gross

Domestic Product (GDP) (nearly 30 percent) and 67 percent to total employment during 2014 (1).

The report also states that in 2013 396,500 sq.km (45 percent of total land area) was used for agriculture, compared to 369,744sq.km in 2008, representing an increase of seven percent over the five–year period (2). At the same time, Tanzania's crop production increased by 44 percent during 2008–2013, compared to the Sub-Saharan Africa average crop production growth rate of 18 percent during the same period, according to the World Bank's (WB) crop production index (3).

Tanzania's main exported cash crops are tobacco, cashew nuts, coffee, tea, cloves, cotton, and sisal.

*Livestock*

Tanzania's livestock production rose by 33 percent during 2008–2013(4), exceeding the Sub-Saharan Africa average livestock production growth rate of 11 percent during the same period, as per the WB's livestock production index. During the same period, meat production increased by 33 percent; from 422,230 tons to 563,086 tons.

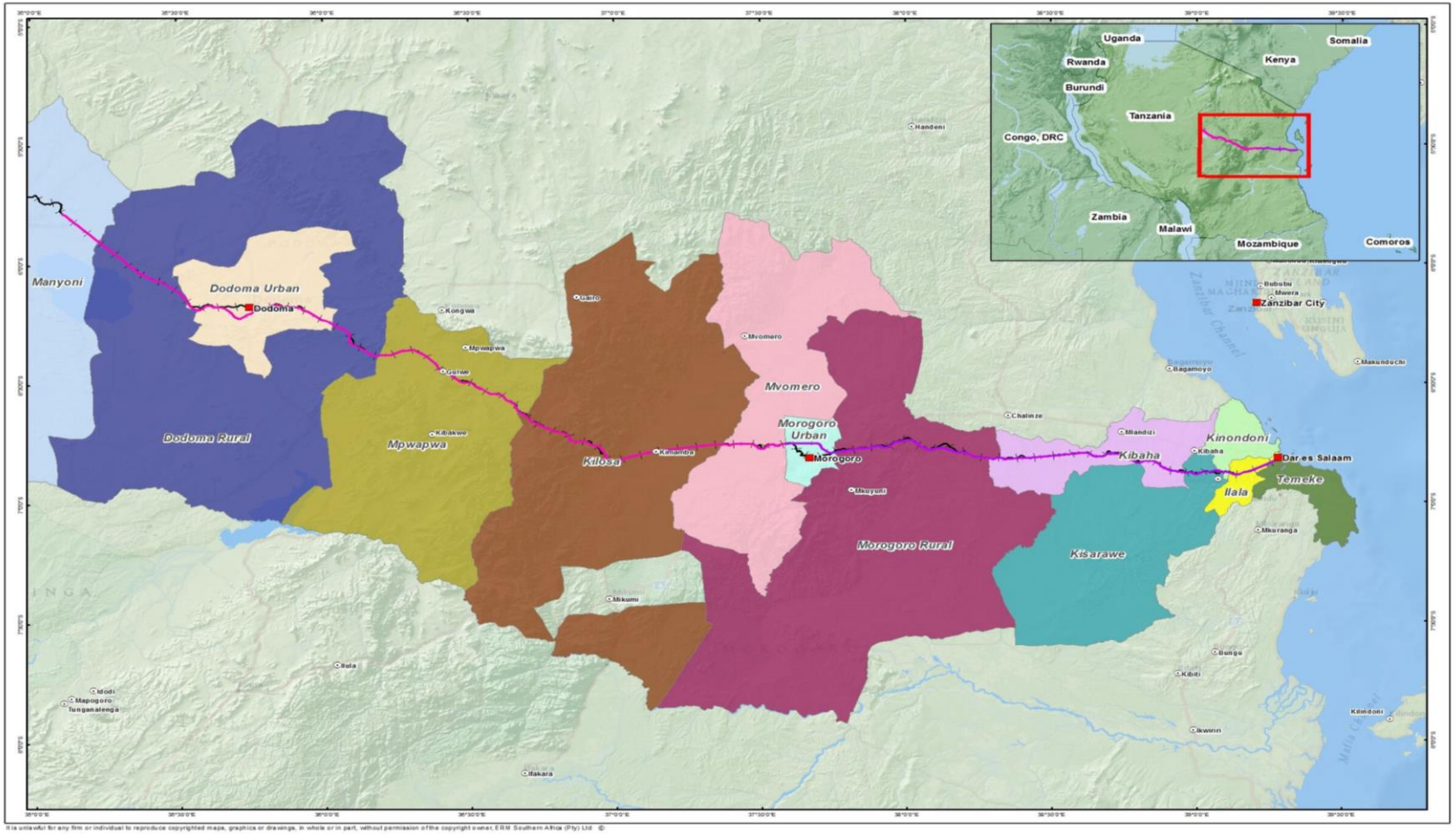
Out of the total meat production, 55 percent comes from cattle, 21 percent from sheep and goats, 14 percent from pigs, and only 10 percent from chicken (5).

## 4.9 *DISTRICT LEVEL CONTEXT*

This section describes the socioeconomic context at the district level. As previously stated in Section 4.2, the information is presented in relation to eight of the 13 districts crossed by the rail line. However, the information provided for the eight districts is considered representative of the characteristics of the districs that are not described.

(1) Tanzania Invest (2018) Tanzania Agriculture Available at: https://www.tanzaniainvest.com/agriculture/page/3. (accessed July 2018)
(2) Tanzania Invest (2018) Tanzania Agriculture Available at: https://www.tanzaniainvest.com/agriculture/page/3. (accessed July 2018)
(3) Cited in Tanzania Invest (2018) Tanzania Agriculture Available at: https://www.tanzaniainvest.com/agriculture/page/3. (accessed July 2018)
(4) Tanzania Invest (2018) Tanzania Agriculture Available at: https://www.tanzaniainvest.com/agriculture/page/3. (accessed July 2018)
(5) Tanzania Invest (2018) Tanzania Agriculture Available at: https://www.tanzaniainvest.com/agriculture/page/3. (accessed July 2018)

*Figure 4-31 Districts Crossed by the Project*




Source: Thurlow Mapping, GISc, 2019.

### 4.9.1 *Ilala District, Dar es Salaam Region*

*Administrative Structure*

Administratively the Municipality of Ilala is the regional headquarters for Dar es Salaam Region (east part of Phase I area), made up of three Divisions, which are subdivided into 26 administrative wards, and these are further subdivided into 101 "*Mitaa*". The Ilala Municipal Council has three constituencies respectively, Ilala, Segerea and Ukonga.

*Demographics*

**Population**

In 2002, the Municipality had a population of 634,924 habitants with an average growth rate of 4.6 percent. According to the 2012 National Household Census[1], Ilala Municipality had a total population of 1,220,611[2] habitants (624,683 females and 595,928 males), which shows an increase of more than 1, 000,000 habitants between 2002 and 2012. *Table 4-25* shows the population in affected communities in Ilala.

***Table 4-25 Ilala – Population and Households in Wards***

| District | Ward | Number of Households | Population size | | |
|---|---|---|---|---|---|
| | | | Males | Females | Total |
| Ilala | Pugu | 9,821 | 10,367 | 18,223 | **28,590** |
| | Ukonga | 16,202 | 34,490 | 33,726 | **68,216** |
| | Kiawah | 14,827 | 29,872 | 31,419 | **61,291** |
| | Gerezani | 920 | 2,709 | 2,962 | **5,671** |
| | Kivukoni | 700 | 1,774 | 1,937 | **3,711** |
| | Kiwalani | 15,993 | 31,928 | 30,555 | **62,483** |
| | Mchafukoge | 4,633 | 9,180 | 9,093 | **18,273** |
| | Vingunguti | 22,773 | 40,755 | 42,494 | **83,249** |

Source: 2012 Population and Housing Census

According to households surveys undertaken, approximately 31 percent of households are female headed and 59 percent are headed by males.

[1] Available at: http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf. Accessed July 2018.

[2] Available at: http://www.citypopulation.de/php/tanzania-admin.php?adm2id=0702. Accessed at 07 July 2018.

**Migration**

The rapid economic growth of the city has attracted an influx of people from inside and outside the country. Ilala is experiencing a population change whereby the majority Dar es Salaam citizens spend their daytime at Ilala Municipality and sleep at other Municipalities. As such, this is adding pressure onto social facilities, such as water and infrastructures, as well is contributing to an increase in pollution in the city.

**Ethnicity, Religion and Language**

The main native ethnic groups in Ilala Municipality are Zaramo and Ndengereko but due to urbanization, many people of different ethnicities have immigrated to Ilala, contributing to a heterogonous tribal composition whereby no single ethnic group accounts for more than 25 percent of the total population. Ilala is the most affected area in the City due to its status of being hub for social-economic activities and other interactions.

Specific religious and language data regarding Ilala Municipality was not available at the time of report compilation.

*Education and Literacy*

**Education System**

The Education Department of the Municipality provides its services within urban and peri urban areas. It has been engaged in constructing and rehabilitating classrooms, teacher's houses, staff rooms and head teacher's offices. It is also active in soliciting donors to assist primary schools in projects such as constructing school fences; providing teaching and learning materials equipment and sports gear to improve the teaching and learning environment.

**Access to Education**

Ilala Municipal Council for the year 2012 had managed to establish 76 pre-primary centres out of 105 public primary schools. While for private sectors, there are 52 registered pre-primary centres. In total, there were 3656 children (1,780 boys and 1,876 girls) in public schools and 4,636 children (2,464 boys and 2,172 girls) in non-Government pre-schools. The Municipal Council had 105 public primary schools and 53 non-government schools. Expected enrolment in public schools for 2012/2013 was 20,279 pupils (9,999 boys and 10,680 girls). The actual enrolment is 10,032 boys and 10,531 girls, which totals to 20,563. The enrolment shows access of 101.4 percent. This indicates the success of community awareness on education.

There are 2633 permanent classrooms, 151 teachers' houses and 2,380 pit-latrines in the public primary schools in the council. The Primary Education

department constitutes the total number of 3476 of which females are 2,964 and males 512.

Secondary School Education refers to post-primary school education offered to successful students who score the required grades for admission. There are 95 secondary schools of which 49 are for government and 46 are owned privately. The total students for secondary schools are 44,543 among of them 20,852 are girls and boys are 23,791.

**Literacy Levels**

According to the Dar es Salaam region Basic Demographic and Socio-economic Profile (2016)[1] the literacy rate for the population aged five years and above was 94 percent. Literacy rate was higher among those aged between 10 and 69 years. Adult literacy rate (ie, literacy rate for population aged 15 years and above) was 97 percent and was significantly higher (98 percent) for males than females (96 percent). No specific data on Ilala Municipality literacy levels was available at the time of report compilation.

*Land Use*

**Land Use**

Major land use categories in Ilala Municipality include residential, commercial, agricultural, industrial and recreational uses (Ilala Municipal Council, 2007). In central business area there is mixed land use, with high concentration of institutional, commercial premises, light industries and few residential buildings. Institutional areas are predominant in the municipality and account for one third of the Central Business District in Ilala.

**Agriculture**

Agriculture and livestock sector in the Municipality employ around 13 percent of the total population and is used as a source of income. Major food crops are cassava, sweet potatoes, paddy and maize; cash crops includes cashew nuts, coconuts and citrus fruits. About 15,000 ha are potential arable land for agricultural production, however only 5,370 ha are used for food crop production and 2,086 ha for cash crops.

Horticulture activities are carried out in the urban areas in open spaces and in backyard gardens. The main cash crop in Ilala Municipal Council includes a variety of vegetables such as amaranthus, chinese cabbage, eggplant, okra, kale,

[1] Available at: Dar es Salaam region Basic Demographic and Socio-economic Profile (2016). Accessed July 2018.

leek (*matembele*) and nightshade (*Mnavu*), fruits like citrus, passion, pawpaw, pineapples, mangoes and cashew. Cassava composes the main food crops in the rural areas where a variety being cooked while fresh or dried for making flour.

Other food crops include sweet potatoes and paddy grown during the long rain season especially in waterlogged areas.

Two types of farming systems are being practiced ie, rain dependent agriculture and irrigation agriculture. The total area suitable for irrigation farming is 4,000ha. Irrigation farming is highly encouraged in the Municipality; about 66 hectares are being irrigated using seasonal and permanent streams, dip and shallow wells. Most of the farmers depend on rain fed agriculture and irrigation on small scale. Two small irrigation schemes have been established at Kidole and Zingiziwa at Msongola and Chanika wards respectively.

**Utilisation of Natural Resources / Forest Products**

Forestry and beekeeping activities are also carried in the Municipal Council of Ilala. A total of 18 hectares were allocated to forest plantations in year 2006. Efforts are employed in planting new tree seedlings. During the period 2001 to 2006, a total of 751,333 new tree seedlings were planted in the Municipality .

Beekeeping is also a source of revenue in the municipal. During the period from 2001-2006, the number of beehives has been on the increase.

**Livestock**

Livestock keeping is mostly done in remote areas (*Table 4-26*). Major types of animals kept are dairy cattle, poultry, sheep, goats and pigs. Zero grazing is mainly done in urban areas, and semi intensive to extensive methods in peri-urban areas. Ukonga, Segerea, Kitunda & Kipawa wards are leading livestock keeping.

***Table 4-26 Livestock Population of Ilala Municipality in 2012/2013***

| Type of Animal | Total Number |
|---|---|
| Cattle | 10,100 |
| Sheep | 218 |
| Goats | 3,832 |
| Pigs | 12,318 |
| Chicken | **1,435,070** |

Source: Ilala Municipal annual report, 2013.

*Health*

**Access to Healthcare**

Ilala Municipal Council health delivery system follows the national pyramid system. The municipal has only two levels of health care service delivery: First level and Second level.

The first level are Health Centres and Dispensaries and affiliated clinics delivering first line primitive, preventive, and curative health services including Reproductive and Child Health (RCH), outpatient, public/community, environmental, school health and investigation services.

The second level are the Municipal Hospital (Amana) delivering preventive and curative second line services including RCH paediatrics and obstetric services. Outpatient, inpatient, investigation services and health promotion are integrated in a routine activity through outpatient services. The numbers of health facilities in Ilala District are summarized in *Table 4-27* and the top ten diseases are shown in *Table 4-28*.

***Table 4-27 Health Facilities in Ilala District***

| Health Type | Ownership | | Total |
|---|---|---|---|
| | Public | Private/ Public Institution | |
| National Referral | 1 | 0 | 2 |
| Referral | 1 | 0 | 1 |
| Hospitals | 1 | 8 | 9 |
| Health centres | 2 | 20 | 22 |
| Dispensaries | 20 | 148 | 168 |
| Public Inst. (Military | 9 | 0 | 9 |
| Special clinics | 1 | 14 | 15 |
| Total | 34 | 190 | 224 |

Source: Ilala Municipal annual report, 2013.

***Table 4-28 Top Ten Diseases Appearing Mostly on Admission and Causing Death to Admitted Patient in Ilala Municipal Council***

| Diagnosis | 5 - Years | Diagnosis | 5+ Years |
|---|---|---|---|
| Pneumonia | 1799 | HIV/AIDS | 1351 |
| Gastroenteritis | 1321 | Malaria | 1096 |
| Neonatal Septicaemia | 940 | abortion | 993 |
| Malaria | 667 | Hypertension | 671 |
| Birth Asphyxia | 492 | Anaemia | 537 |

| Diagnosis | 5 - Years | Diagnosis | 5+ Years |
|---|---|---|---|
| Anaemia | 364 | tuberculosis | 371 |
| Septicaemia | 207 | gastroenteritis | 328 |
| HIV/AIDS | 172 | Diabetes | 259 |
| UTI | 160 | pneumonia | 259 |
| Malnutrition | 84 | Hernia | 250 |
| **TOTAL** | **6206** | **TOTAL** | **6115** |

Source: Ilala Municipal annual report, 2013.

Over 70 percent of the population in Ilala Municipality utilizes health services in public facilities due to their affordability, accessibility as well as quality. The bed occupancy rate at Amana is currently ranging between 250-300 percent with a doctor patient ratio of 1:1000.

**Health Prevalence Rates**

Despite the efforts to control the transmission of Human Immunodeficiency Virus at different levels in the Municipality, HIV/AIDS still features among the top ten diseases. Moreover, reports from the Municipal Hospital shows that 50-60 percent of the patients admitted in the medical wards are on account of AIDS related complications.

So far, data shows that 6,425 HIV/AIDS cases have been reported since 1988. Out of these, 54 percent are female and the rest are male. A total of 1,842 HIV/AIDS deaths have been reported so far.

Efforts done by the Municipality to control AIDS transmission include:

- Provide HIV/AIDS Health education to the community by using IEC strategy;
- Offering counselling services and VCT through the Municipal Hospital social support unit;
- Collaborate with public, private, community based and Non-Governmental Organizations in implementing HIV/AIDS activities;
- Promotion and distribution of condoms;
- Has established two functional youth club (IDC and Vingunguti) where the youth meet and share knowledge, experience and socialize about HIV;
- All 18 health facilities have been equipped with STD drugs which are free of charge when available for HIV detection; and
- Implements HIV/AIDS education to youth in and out schools.

Of the notifiable communication diseases, Cholera is a main source of health hazards. About 70 percent of city population resides in unplanned settlement where there is a high rate of communicable diseases spread due to lack of public services, water supply, health facilities, road accessibility, poor sewerage system and waste disposal site.

*Public Infrastructure and Services*

**Water Services**

Ilala Municipality has 304 wells as amongst the sources of water for human consumption. There are 170 deep wells of which 146 are in operation and the remaining 158 have stopped functioning due to technical problems. The wells, which are in operation, have the capacity of generating 1,231,439 litres that could have served 490,434 people by at least three buckets a day.

Availability of water supply in Ilala Municipality is not sustaining the needs. Out of 76 percent of Ilala population depends on deep/shallow wells, which supplied about 2,058 liters per day, which total 43 percent of the actual needs (4,770 liters) of water supply in the Municipal.

Nevertheless, the total population of 190,623 of Ilala population (24 percent) depends on tap water from Lower and Upper Ruvu River source.

**Energy Sources**

Different sources of energy are used for different activities especially cooking, lightning, ironing and running electrical equipment. The costs for each source vary and therefore household opted type of sources is based on affordability, accessibility and reliability.

Available sources include electricity, charcoal, gas, solar power, kerosene, candles, batteries etc., and in a reduced scale firewood.

**Traffic and Transportation**

Ilala Municipality has access to good infrastructures and services. It can be easily accessed from all parts of the country by a well-maintained tarmac roads, railway lines, and air or by sea. Ilala Municipal Council has the services of Mwalimu Nyerere International Airport, which is the main entrance of incoming and outgoing passengers through air.

It has also TAZARA railways and TRC railways services. The Tanzania Railways Corporation starts at Ilala- Dar es Salaam to Tabora- Kigoma having another line, which is Tabora-Mwanza (which is now providing out mainly cargo services as compared to passengers services).

The Dar es Salaam port which is under Tanzania Port Authority is at Ilala Municipal Council and hence majority of passenger using ships and speedboats have to pass through Ilala Municipal Council. The port is the main gateway through to Zanzibar Islands and serving many of land locked countries such as Uganda and others.

The road network has 804.77 kilometres in Ilala Municipality, that fall under the following categories:

- Tarmac road of 79.65 km;
- Gravel 78.87 km; and
- Earth roads 646.25.

These roads facilitate movements of different traffics within and outside of the Municipality.

### *4.9.2 Kisarawe District, Coast Region*

*Geography and Administrative Structure*

Kisarawe District (mid-east part of Phase I area) is one of the six districts of the Pwani Region of Tanzania. It is bordered to the North by the Kibaha District, to the East by the Mkuranga District, to the South by the Rufiji District and to the West by the Morogoro Region. The Kisarawe District is administratively divided into 15 wards, namely Cholesamvula, Kibuta, Kiluvya, Kisarawe, Kuruhi, Mafinzi, Maneromango, Boga, Marui, Marumbo, Masaki, Msanga, Msimbu, Mzenga, Vihingo, and Vikumbulu .

*Demographics*

**Population**

Kisarawe has a total population of 101,598 (2012 National Census[1]) where 50,631 are female and 50,967 are men. The population annual growth rate is estimated 0.6 percent and the average household is 3.9 persons per household.

According to the 2012 National census, about 53.9 percent of the population of the district was the working age group (15 – 64 years), which were about 54,786.

[1] Available at: http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf. Accessed July 2018.

The dependants were 46,812, which essentially include children and elderly people.

**Migration**

Detailed information on migration characteristics and patterns along Kisarawe District were not available at the time of report compilation.

**Ethnicity, Religion and Language**

The population mainly comprise of Zaramo who are the major ethnic group accounting for 85 percent of the population followed by Makonde, Ndengereko, Gogo, Nyamwezi and the other minor groups .

Specific religious and language data regarding Kisarawe District was not available at the time of report compilation.

*Education and Literacy*

**Education System**

The Education Department of the Kisarawe District provides its services within urban and peri urban areas. It has been engaged in constructing and rehabilitating classrooms, teacher's houses, staff rooms and head teacher's offices. It is also active in soliciting donors to assist primary schools in projects such as constructing school fences; providing teaching and learning materials equipment and sports gear to improve the teaching and learning environment.

**Access to Education**

Kisarawe District had in 2013, 79 primary schools with 636 teachers and 23464 pupils of which 12082 were boys and 11382 were girls. Apart from primary school, the district had 18 secondary schools (MNEMELE, 2013).

**Literacy Levels**

The literacy rate in Tanzania in 2015, adult literacy rate for United Republic of Tanzania was 80.4[1] percent. Though United Republic of Tanzania adult literacy rate fluctuated substantially in recent years, it tended to increase through 1988 - 2015 period ending at 80.4 percent in 2015.

No specific data on Kisarawe District literacy levels was available at the time of report compilation.

[1] Available at: https://webcache.googleusercontent.com/search?q=cache:17aaDTccWG0J:https://knoema.com/atlas/United-Republic-of-Tanzania/topics/Education/Literacy/Adult-literacy-rate+&cd=1&hl=pt-PT&ct=clnk&gl=mz. Accessed July 2018.

*Economy and Livelihoods*

**Economic Context**

According to the World Bank[1] Tanzania's real gross domestic product (GDP) growth rate slowed in 2017. According to government data, growth for the first three quarters of 2017 stood at 6.8 percent, down from 7.3 percent during the same period in 2016. The decline is mainly due slower growth of services from the supply side and slower expansion of consumption and investment from demand side. Although Tanzania's real GDP growth rate is estimated to have slowed, it was the highest in the East African Community (EAC) for 2017.

The economy depends on agriculture, which accounts for slightly less than one-quarter of GDP and employs about 65 percent of the work force, although gold production in recent years has increased to about 35 percent of exports. All land in Tanzania is owned by the government, which can lease land for up to 99 years. Proposed reforms to allow for land ownership, particularly foreign land ownership, remain unpopular (CIA, 2018).

Detailed information on Kisarawe District economic context was not available at the time of report compilation.

**Livelihoods Activities and Household Income**

Kisarawe district council was the leading district with 51 percent in Coast region in regards to the people who live below poverty line. The rate of poverty gap of Kisarawe district council was also high with 16 percent. Ginny Coefficient Rated 30 percent .

*Land Use*

**Land Use**

The land use pattern in the district is as follows: 69.2 percent is used for farming, 13.8 percent for grazing, 11.2 percent for game reserve and the rest are for settlement, water and forest .

**Agriculture**

The People of Kisarawe practice agriculture for their daily living. *Table 4-29* shows the output of most cultivated crops. The main food crops are cassava, maize, paddy, sorghum, and leguminous crops like beans. The cash crops includes cashewnuts, oranges, mangoes, etc.

[1] Available at: http://www.worldbank.org/en/country/tanzania/overview. Accessed at July 2018.

*Table 4-29 Estimated Production (Tonnes) of Major Food Crops, Kisarawe District Council, 2008/09 to 2011/12*

| Crop | 2008/09 | 2009/10 | 2010/11 | 2011/12 | Total | Average per year | Percentage of the total |
|---|---|---|---|---|---|---|---|
| Cassava | 32,254 | 34,796 | 36,538 | 38,364 | 141,952 | 35,488 | 81 |
| Maize | 5,100 | 6,640 | 5,035 | 4,565 | 21,340 | 5,335 | 12 |
| Paddy | 496 | 682 | 716 | 500 | 2,394 | 599 | 1 |
| Sorghum | 1,264 | 1,959 | 1429 | 1,064 | 5,716 | 1,429 | 3 |
| Leguminous | 1,186 | 1,185 | 1,245 | 1,186 | 4,802 | 1,201 | 3 |
| Total | **948** | **1828** | **2391** | **752** | **176,204** | **44,051** | **100** |

Source: District Executive Director's Office (Agriculture Department), Kisarawe District Council, 2013

*Table 4-30 Estimated production (Tonnes) under Major Cash Crops, Kisarawe District Council; 2007/08-2011/12*

| Crop | 2007/08 | 2008/09 | 2009/10 | 2010/11 | 2011/2012 | Total | Yearly Average | Percent of Total |
|---|---|---|---|---|---|---|---|---|
| Cashewnuts | 9,200,000 | 9,888,000 | 2,330,000 | 2,226,000 | 3,227,000 | 1896 | 5,374,200 | 98.95 |
| Oranges | 12,600 | 13,230 | 13,987 | 15,545 | 13,545 | 2973 | 13,781 | 0.25 |
| Mangoes | 42,210 | 42,630 | 44,805 | 39,984 | 40,684 | 3520 | 42,063 | 0.77 |
| Passion | 290 | 305 | 394 | 300 | 200 | 1489 | 298 | 0.01 |
| Coconuts | 819 | 834 | 780 | 870 | 810 | 4113 | 823 | 0.02 |
| Total | **1109** | **1139** | **1174** | **1170** | **1010** | **13991** | **5,431,164** | **100.00** |

Source: District Executive Director's Office (Agriculture Department), Kisarawe District Council, 2013

*Health*

**Access to Healthcare**

The district health delivery system follows the national pyramid system having only two levels of health care service delivery: First level and Second level.

The first level are Health Centres and Dispensaries and affiliated clinics delivering first line primitive, preventive, and curative health services including Reproductive and Child Health (RCH), outpatient, public/community, environmental, school health and investigation services.

Kisarawe District had in 2011[1] over 24 health facilities, including one district hospital, three health centres and 20 dispensaries. Out of these, 19 facilities were

[1] Available at: http://kisesamimi.blogspot.com/p/a.html. Accessed July 2018.

providing family planning services while five were not due to the lack of infrastructure and trained medical personnel.

*Public Infrastructure and Services*

**Water Services**

Part of the water services in the district are provided by Kisarawe Water Supply and Sanitation Authority, which started its operations in 2007. According EWURA (2015), it had in 2015, in its area of responsibility has a total population of 12,087 out of whom 3,564 has direct access to water services provided by the utility. The total water demand for the town is estimated at 1,209 $m^3$/day while water produced is estimated at 287.7$m^3$/day. The Authority depends on two water sources ie Kimani borehole and Minaki dam. The water supply main network is 6.64km long with five storage tanks of total capacity 966.5 $m^3$. The source installed production capacity is 495$m^3$/day and 135 $m^3$/year for Kimani borehole and Minaki dam respectively. The present production capacity is not sufficient to meet the estimated water demand. The utility has mini water treatment plant for water from Minaki dam with capacity of 10$m^3$/day purposely for drinking. Water is supplied for at an average of 4 hours per day.

According to the EWURA (2015), the district had in 2014/2015 around 445 total connections to the water supply system.

**Energy Sources**

Energy is a prerequisite for proper functioning of nearly all sectors in the economy. The main sources of energy in Kisarawe District Council are electricity, solar, firewood and charcoal. Electricity is commonly used in urban or semi urban areas .

**Traffic and Transportation**

In Kisarawe District Council, road transportation is the major type of transportation for people and goods within and outside the council. Trunk, regional, district and feeder roads serve the council. The length of the road network was 720 kilometres in 2012. The roads that are maintained by the central government are classified as trunk or regional roads, while those that are maintained by the district council are called district or feeder roads. The rest of the roads are called peripheral roads and are mostly maintained by Village/Mitaa communities .

Kisarawe district council has neither an airport no an airstrip, however, it is located near Julius Nyerere International airport about 20 km from Kisarawe town.

### *4.9.3 Kibaha Town Council, Coast Region*

*Geography and Administrative Structure*

Kibaha Town Council (located in the middle of Phase I area) is one among the seven Councils of Coast Region; it also headquarters of the Region. The council is 40 km away from Dar es Salaam City. The district is bordered to the north by the Bagamoyo District, to the east by Dar-es-Salaam, to the south by the Kisarawe District and to the west by the Morogoro Region .

Administratively, the Council has 11 Wards, which are Tumbi, Mailimoja, Kibaha, Visiga, Mkuza, Kongowe, Misugusugu, Picha ya Ndege, Msangani, Mbwawa and Pangani and 53 Mitaa (streets).

*Demographics*

**Population**

Kibaha Town as per 2012, census has an estimated population of 128,488[1] of which 65,835 were females and 62,653 males, with 17,788 households and average size of 4 people per household.

**Migration**

In 2017, estimated net migration rate for United Republic of Tanzania was -0.5 migrants per thousand population. Though United Republic of Tanzania net migration rate fluctuated substantially in recent years, it tended to decrease through 1970 - 2017 period ending at -0.5 migrants per thousand population in 2017 (CIA, 2018).

Detailed information on migration characteristics and patterns along Kibaha town were not available at the time of report compilation.

*Education and Literacy*

**Access to Education**

Kibaha District has 47 primary schools in the council of which 39 are public schools and eight are private schools. No further information on access to education along the district was available at the time of report compilation.

[1] Available at: http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf. Accessed July 2018.

**Literacy Levels**

No specific data on Kibaha District literacy levels was available at the time of report compilation.

*Land Use*

**Land Use**

Land use categories in the district include residential, commercial, agricultural, industrial and recreational uses . No further information on land use along the district was available at the time of report compilation.

**Agriculture**

In brief, the main economic activity in Kibaha Town Council is agriculture, which employs 70 percent of the total labour force. Crops cultivated include both cash and food crops such as cash nuts, oranges, mangoes and vegetables for cash and maize, cassava, etc., for food crops. The main constraints to agricultural production include insufficient agricultural extension officers, pests and insects (mainly aphids, stalk borers, cassava mill bugs) and low purchasing power of farmers. Unreliable rainfall does affect production from time to time. According to Agriculture Department (2013), the total estimated production of major cash crops (cashew nuts, coconuts, orange and mango) at Kibaha Town Council include 4,502.5 tones (2007/08), 4,348 tones (2008/09), 4,193.5 tones (2009/10), 7,906 tones (2010/11) and 7,709 tones (2011/12) .

**Livestock**

Livestock keeping is another economic activity, which include livestock keeping such as cattle, goats, sheep, donkeys, pigs and chicken, both indigenous and broilers and layers. Up to the season of 2011/12, the council had a total population of 440,456 livestock .

*Health*

**Access to Healthcare**

There are 23 health facilities (one hospital, five health centres and 17 dispensaries) in Kibaha Town Council of which nine of them are under non-government organization and 14 belongs to government. According to Health Department (2013), the major top diseases (in chronological order) comprise of malaria, pneumonia, diarrhoea, oral conditions, ARI, skin infections, cardiovascular diseases, intestinal worms, eye conditions, HIV/AIDS and anaemia .

**Health Prevalence Rates**

Currently, Kibaha Town Council has a total number of 537 people living with HIV infections. Of the total infected people, there are more male than female, which is 312 male and 225 female .

*Public Infrastructure and Services*

**Water Services**

The main sources of water for domestic use are shallow wells, rainwater harvest tanks, boreholes and river water, piped scheme and dam. Percentage of Kibaha Town Council served with clean and safe water is 50.2 percent (64,500 people) out of total council population of 128,488.

**Energy Sources**

The main source of energy is firewood and charcoal obtained from wood forests. Electricity is also available in Kibaha, Kongowe, Mailimoja, Mkuza, Misugusugu, Tumbi, Visiga, Mbwawa, Picha ya Ndege and Msangani areas; also generators do produce energy to various capable persons as well as solar powers .

**Traffic and Transportation**

Kibaha Town Council is accessible by a tarmac road from Dar es Salaam about 40 kilometres away. The length of road network in Kibaha Town Council is 335.95 Km, whereby 199.76 are passable throughout the year, 115.92 passable a greater part of the year and 20.27 not passable most of the year. Tumbi ward has a total road network of 91.79 Km of which, 30 Km are passable throughout a year and has 3.79 Km not passable most of the year. As indicated in *Table* 4-31, Tumbi has the longest road network among all 11 wards in Kibaha Town Council. Visiga, which is also under upgrading project has 25.7 Km all of which are passable throughout a year and it has part of the road included under 11Km to be upgraded to bitumen standard .

***Table 4-31 Pass-Ability of Road Network by Ward, Kibaha Town Council, 2012***

| Ward | Condition of Network Throughout the Year in Km | | | | Percentage Passable |
|---|---|---|---|---|---|
| | Passable throughout the year | Passable Greater Part of the Year | Not Passable Most of the Year | Total Road Network | |
| Tumbi | 30 | 58 | 3.79 | 91.79 | 62.12 |
| Kibaha | 17 | 20 | 8.3 | 45.3 | 38.32 |
| Mkuza | 3.2 | 1.15 | 2.0 | 6.35 | 32.6 |
| Msangani | 12 | 7.02 | 1.43 | 20.45 | 14.01 |
| Pangani | 20.1 | 15.3 | 4.75 | 40.15 | 27.13 |

| Ward | Condition of Network Throughout the Year in Km | | | | Percentage Passable |
|---|---|---|---|---|---|
| | Passable throughout the year | Passable Greater Part of the Year | Not Passable Most of the Year | Total Road Network | |
| Mailimoja | 17.1 | 3.2 | 0 | 20.3 | 15.76 |
| Picha ya Ndege | 30 | 11.25 | 0 | 41.25 | 27.27 |
| Mbwawa | 9.2 | 0 | 0 | 9.2 | 100 |
| Kongowe | 9.1 | 0 | 0 | 49.1 | 100 |
| Misugusugu | 19.36 | 0 | 0 | 16.36 | 100 |
| Visiga | 25.7 | 0 | 0 | 25.7 | 100 |
| Total | 199.76 | 115.92 | 20.27 | 335.95 | 94 |

Source: Kibaha Council, 2012.

### *4.9.4 Morogoro Rural, Morogoro Region*

*Geography and Administrative Structure*

Morogoro District (west part of Phase I area) is one among the five districts in Morogoro Region. The District is located at North East of Morogoro Region between 6$^{o}$ and 8$^{o}$ Latitudes South of Equator also between Longitudes 36$^{o}$ and 38$^{o}$ East of Greenwich. It is bordered by Bagamoyo and Kisarawe districts (Coast region) to the east, Kilombero District to the south and Mvomero District to the North and West .

The district has a total land area of 11,731 km$^2$, which is 16.06 percent of the land area of the entire Morogoro Region (73,039 km$^2$). Administratively, the district is divided into 6 divisions (Bwakira, Mvuha, Mikese, Mkuyuni, Matombo, Ngerengere), 29 Wards and 146 Villages.

*Demographics*

**Population**

As from the National level, at the District level the four Censuses have shown definite trends in the various characteristics of the Morogoro Rural. In 1967 population of 291,373, 1978 population of 344,083, in 1988 population of 430,237. The 2002 Population and Housing Census Morogoro District Population is 263,920 (Males 129,285, Females 134,635).

According to the latest 2012 Population and Housing Census[1] Morogoro District population is 286,248 where male is 140,824 and female 145,424. In Morogoro District, sex ratio is 97 male for 100 females with the household size of 4.2 persons. Generally, the population of females continues to be bigger than the males. The dependency ratio has been decreasing reaching to 88. The average household in Morogoro Rural is 4.2 person per Household.

**Migration**

In Morogoro District, most immigrate includes Wachaga, Wamasai, Wasukuma, Wapare, who are not the indigenous. Likewise there are those who immigrate within the District like the Maasai immigrates from one village to another in search of pure pastures for their cattle's. Also the District indigenous themselves are migrating within the District depending on different reasons – good soil, climate (CIA, 2018).

**Ethnicity, Religion, and Language**

The ethnic composition includes Waluguru, Wakaguru, Wapogoro,Wakutu, Wazigua, Wakwere, most of the Waluguru, Wakaguru and the Wapogoro tend to concentrate in the mountainous area .

*Education and Literacy*

**Access to Education**

Morogoro district has a total of 147 primary schools with the sum of 63,072 pupils of which 30,626 are boys and 32,446 are girls. This translates to 48.6 percent boys and girls are 51.4 percent girls. There are 24 secondary schools in Morogoro District of which only one is privately owned .

**Literacy Levels**

Morogoro region percentage of literate men was 85.1[2] percentage in 2010 while percentage of literate women was 73.3[3] percentage in the same year. No recent data on literacy rates for Morogoro region and Morogoro District were available at the time of report compilation.

[1] Available at: http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf. Accessed July 2018.

[2] Available at: https://knoema.com/atlas/United-Republic-of-Tanzania/Morogoro-Region/Percentage-of-Literate-Men. Accessed July 2018.

[3] Available: https://knoema.com/atlas/United-Republic-of-Tanzania/Morogoro-Region/Percentage-of-Literate-Women. Accessed July 2018.

**Land Use**

Land use categories in Morogoro district include residential, commercial, agricultural, industrial and recreational uses . No further information on land use along the district was available at the time of report compilation.

**Agriculture**

Morogoro District's Economy depends on Agriculture, mainly from Crop production . Major food crops are Maize, Paddy, Cassava and Sorghum. Main cash crops produced are Cotton and Sisal. 82 percent of the adult population in Morogoro Rural earn their livelihood from Agriculture though mainly at subsistence level, 6 percent in Business Operation, 6 percent in Elementary Occupations, 4 percent in Office Work and 1.3 percent in Livestock Keeping (Census 2002). Morogoro is endowed with natural resources hence apart from agriculture; people also take part in forestry, fisheries, beekeeping, wildlife and tourism activities to earn income.

Geographically, Morogoro District is divided into 3 agro-ecological zones, as follows:

- Mountainous zone: Morogoro region is dominated by the Uluguru Mountains. The mountain topography ensure the area received sufficient rains and is suitable for growing crops like beans, spices, coffee, tea, vegetables and fruits. Because of the topography, the area faces a number of challenges including soil erosion; deforestation caused by residents during land clearance for farming and limited transport and communication.
- Low Mountainous zone: This zone makes up 20 percent of the whole area of Morogoro region. Average total annual rainfall in is between 1000 – 2000mm and has sandy soil which is suitable for growing maize, cassava, and finger millet. The area is also good for livestock keeping (specifically .
- Savannah zone: This area takes 55 percent of the whole area of the Morogoro District. This zone received annual rainfall between 900 – 1200 mm and comprised of rivers namely; Mgeta, Kafa, Ruvu, Wami, Msongozi, Mbulumi, and Ngerengere. The type of soil in this zone is good for cultivation of maize and rice. Fishing in the rivers is also a common activity in this zone.

**Utilisation of Natural Resources / Forest Products**

Morogoro District has 7.14 millions of hectares of forests which is equivalent to 60 percent of the district land area (11,925,000 ha). Out of 7.14 million hectares, 7,096,582 hectares are of natural forests and 43,418 hectares are of planted

forests. There are two types of natural forests normally managed and owned by Central government, Local government and Village/Community namely protected and production forests. Protected forests cover an area of about 117,100 ha, while production forests cover 3, 163.7 ha. Ugulo (3.5 hectares) is the only community forest reserve present in the District and used as traditional sacred forest. The remaining area of the forestland is covered by general land forests potential for production of wood and non-wood forest products. These products are used for timber, fuel wood and charcoal production, construction materials (poles and posts), burning bricks and livestock keeping .

These are also important for safeguarding the natural vegetation; regeneration capacity and productivity; harbouring endemic species of animal and plants; provision of animal habitats and conservation; and management of water sources. They also form wonderful landscapes.

These forests in Morogoro rural district are classified into protected, productive and community forests.

Community forests are mostly owned and managed by villages and Non – Government Organization (NGOs) or sometimes managed by Joint Forest Management. These types of forests in Morogoro District includes forest areas which are managed by communities for different purposes such as worshiping, ritual sites, fuel wood collection, charcoal making, livestock keeping, timber harvesting, local medicine and beekeeping activities. Ugulo (3.5 hectares) is the only community forest reserve, which is present in the District and used as traditional sacred forest .

**Livestock**

Livestock keeping is another important source of employment of the people of Morogoro District. The tribes like Masai, Wasukuma, Wapare and Wamang'ati, practice traditional livestock keeping system. The divisions in the District, which practice livestock keeping on a large scale, are Bwakira, Mvuha, Ngerengere and Mikese. In Matombo division and Mkuyuni division livestock keeping practice in small scale .

*Health*

**Access to Healthcare**

In Morogoro District, there are eight Rural Health Centres of which seven are owned by the Government and one owned by Roman Catholic Church (RC). The district also have 43 dispensaries (owned by Government), 4 dispensaries (owned by Tanzania People's Defence Force, TPDF), 3 (owned by Prisons), 1 (owned by Parastatal Organization), 10 (owned by various Religion

Institutions) and 3 (privately owned by individuals). This makes a total of 62 functioning Health facilities in the District .

The top ten disease shown in *Table 4-32*, of which malaria leads the list. Important health indicators for the district are shown in *Table 4-33*.

***Table 4-32 Top Ten Diseases in Morogoro District Council (above 5 years)***

| Diseases | Occurrences Number | Percentage (%) | Ranking |
|---|---|---|---|
| Malaria | 124,180 | 42 | 1 |
| Acute Respiratory Infection | 41,496 | 16 | 2 |
| Pneumonia | 22,944 | 9 | 3 |
| Intestinal Worms | 15,716 | 8 | 4 |
| Diarrhoea | 17,716 | 7 | 5 |
| Minor Surgical | 5,204 | 4 | 6 |
| Eye Infections | 5,878 | 4 | 7 |
| Anaemia | 2,816 | 4 | 8 |
| UTI | 14,000 | 3 | 9 |
| Skin Infectious | 2,876 | 3 | 10 |
| Total | 252,826 | 100 | |

Source: Department of Health, Morogoro District, 2012.

***Table 4-33 Important Health Indicators for Morogoro District***

| Indicator | |
|---|---|
| MMR | Death 13 (738/100,000 live births) |
| IMR | 51/1000 live birth |
| Under five Mortality Rate | 81/1000 children |
| Life Expectancy at Birth | Females 51, Males 49 |
| Crude Birth Rate | 39/1000 population |
| Total fertility Rate | 6.1 children/woman |

Source: Department of Health, Morogoro District, 2012.

*Public Infrastructure and Services*

**Water Services**

There is a low coverage of water services on the district and therefore more people travel various distance from their homes in search of water. 62 percent of the population in the district sources clean water from a distance of than 400meters from their homes .

**Sanitation**

Around ten percent of the household in Morogoro district has acceptable latrines and the remaining majority do not have acceptable latrines. This potentially exposes people to a risk of faecal oral transmitted and water related diseases. .

**Energy Sources**

There are different forms of energy used by people in Morogoro District. These include electricity, fuel wood (90 percent), kerosene (60 percent), solar and biogas .

**Traffic and Transportation**

Morogoro District has a road network with a total of 920.5 km of which 36.4 km (3.93 percent) are trunk roads; 406.8 km (43.86 percent) are regional roads and 484.2 km (52.21 percent) are feeder or rural roads.

Two railways passes through and have a station in Morogoro District. These are Tanzania Railways Corporation (TRC) and TAZARA (Tanzania and Zambia Railway Authority). The Central Railway in the district passes in the wards of Kidugalo and Ngerengere from Dar es Salaam to Dodoma or Dodoma to Dar es Salaam. TAZARA Railway passes Kisaki ward from Dar es Salaam to Mbeya. There is an Airstrip at Ngerengere Division in Ngerengere Ward. This belongs to and used only for activities of "Tanzania Peoples Defence Forces – T.P.D.F.".

### *4.9.5 Kilosa District, Morogoro Region*

*Geography and Administrative Structure*

Kilosa District Council (east part of Phase II area) forms one of the seven Councils in Morogoro Region. The district is located in the East Central Tanzania at an average distance of 300km west of Dar es Salaam and it is bounded by latitude 5'55" and 7'53" south and Longitude 36'30" and 37'30" East. Kilosa district is bordered with Gairo district on the Northern side, Mvomero district to the East, Kilombero and Kilolo (in Iringa region) districts to the South, Mpwapwa district (in Dodoma Region) to the West and Kongwa district (in Dodoma region) to the South West .

Kilosa District is divided into 40 wards and 139 registered villages with 835 hamlets. The District has two parliamentary constituencies namely Kilosa and Mikumi. Kilosa has two township authorities, which are Kilosa and Mikumi Township. The District have land area of 12,394 square kilometres.

*Demographics*

**Population**

According to the 2012 National Population Census[1], the district has 438,178 people of which 218,378 are male and 219,797 are female and the average household size is 4.2 persons per household. Morogoro regions population statistics indicate that Kilosa District accounts for 19.8 percent of total population of Morogoro region.. The growth rate is 2.6 percent which makes 2015 Population Projection of 474,088 people (236,276 males and 237,812. females).

**Migration**

In 2017, estimated net migration rate for United Republic of Tanzania was -0.5 migrants per thousand population. Though United Republic of Tanzania net migration rate fluctuated substantially in recent years, it tended to decrease through 1970 - 2017 period ending at -0.5 migrants per thousand population in 2017.

*Education and Literacy*

**Access to Education**

The district has 155 pre-primary schools classrooms, of which 150 are government and five are private schools. The district has a total 162 primary schools, of which one was a special school for blind pupils, five were private schools and the rest (157) were public schools. Data further indicate that in the same year there were a total of 73,907 pupils in public primary schools of which 36,302 were boys and 37,605 were girls. In 2010, the district had 256 dropouts while in 2015 it had 259 dropouts. Main reason for drop out for both boys and girls was truancy accounting for more than two-thirds of total dropouts. Drop out due to pregnancies accounted for around 10 percent of total drop out for girls in the year 2010 and 2015 .

The number of secondary schools in the district were 43 by 2016, of which 39 belong to Government (where 38 are day schools and four are boarding), and four secondary are run by private providers.

[1] Available at: http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf. Accessed July 2018.

**Literacy Levels**

Morogoro region percentage of literate men was 85.1[1] percentage in 2010 while percentage of literate women was 73.3[2] percentage in the same year. No recent data on literacy rates for Morogoro region and Kilosa District were available at the time of report compilation.

*Land Use*

**Land Use**

Land use categories in the district include residential, commercial, agricultural, industrial and recreational uses . No further information on land use along the district was available at the time of report compilation.

**Agriculture**

District has a total of 536,590 ha of arable land out of which only 97 percent was utilized for both cash and food crop production. The District produces both subsistence and cash crops while 7 percent is used for cash crop production. However, crops like rice, maize and beans can fall into both categories .

The food crops grown in Kilosa District include maize, paddy, sweet potatoes, cassava, beans, and bananas. Maize is the main food crop in the district. However, most farmers own small farms with an average of two acres. Crop yields in these farms are generally low due to poor farming methods employed by famers. Most of farmers produce at subsistence level and depends on rain-fed agriculture. Irrigation is practiced in few areas such as Lumuma with irrigated crops being mainly horticultural crops such as Onion.

Furthermore, Kilosa District has about 32,295 ha are potential area for irrigation, out of which 10,708 (33 percent) ha are surveyed and designed. Also 5592 ha are using improved irrigation system while 5,116 ha use traditional irrigation system. There are 39 traditional smallholder schemes, out of which only nine schemes have been improved.

**Utilisation of Natural Resources / Forest Products**

The district is also endowed with extensive forests. The district is estimated to have 869,263 ha of natural forests. These forests are source of various products such as timber, bee wax, honey, charcoal, and fuel wood. A number of people in the district depend on trading forest products as one of their important

[1] Available at: https://knoema.com/atlas/United-Republic-of-Tanzania/Morogoro-Region/Percentage-of-Literate-Men. Accessed July 2018.

[2] Available: https://knoema.com/atlas/United-Republic-of-Tanzania/Morogoro-Region/Percentage-of-Literate-Women. Accessed July 2018.

livelihood strategies. Natural forest reserve area occupies nearly half of total forest area .

**Livestock**

The livestock population is steadily rising, with adverse environmental consequences due to overgrazing. The concept of zero grazing has been introduced particularly to those areas, includes keeping cattle, goats, sheep, pig, poultry and diary. This activity is mostly performed by Masai, Mang'ati and Sukuma tribes who in migrate from other Regions. Where dairy cattle is practiced especially to the villages where HPT – Tanzania have introduced the project (kopa Ngo'mbe lipa Ng'ombe). Such villages are Kilosa, Kimamba, Msimba, Rudewa, Myombo, Nyaranda, Ibuti, Magole, Kiegea, Mambegawa and Dumila. In other villages, goats are kept at Vidunda and Msimba (Mikumi)

Data available also indicate that while highest population of cattle, goat, sheep and chicken were found in Rudewa ward, highest population of pig were found in Uling'ombe and Zombo wards. The area suitable for grazing is 483,390 ha, out of which 93,792 ha have been affected by tsetse flies as a result no pastoralist grazing at this area. The carrying capacity of the suitable area is 192,956 ha livestock, estimated carrying capacity is 2.5 ha per one cattle .

*Health*

**Access to Healthcare**

The district has three hospitals, eight health centres, 57 and 90 village health posts. While hospitals are located in some specific areas, dispensaries and village health posts are distributed evenly throughout the district. The most causes of morbidity for outpatients are presented in *Table 4-34. M*alaria was the leading cause of morbidity in the district followed by ARI and Pneumonia .

***Table 4-34 Ten Most Commonly Reported Causes of Morbidity for Out-patients in 2013/2014***

| UNDER FIVE (5) YEARS | | | | ABOVE 5 YEARS | | | |
|---|---|---|---|---|---|---|---|
| No. | Disease | No | Death | No | Disease | No | Death |
| 1 | Malaria | 4,101 | 86 | 1 | Malaria | 6,850 | 131 |
| 2 | Pneumonia | 1,960 | 53 | 2 | HIV/AIDS | 365 | 85 |
| 3 | Anaemia | 346 | 18 | 3 | Anaemia | 713 | 33 |
| 4 | Diarrhoea Diseases | 531 | 15 | 4 | Hypertension | 329 | 27 |
| 5 | Acute Respiratory Diseases | 126 | 1 | 5 | Cardiac Failure | 139 | 26 |
| 6 | Perinatal condition | 98 | 9 | 6 | Pneumonia | 972 | 26 |
| 7 | Burns | 88 | 1 | 7 | Tuberculosis | 273 | 19 |

| UNDER FIVE (5) YEARS | | | | ABOVE 5 YEARS | | | |
|---|---|---|---|---|---|---|---|
| 8 | Poisoning | 44 | 1 | 8 | Diabetes Mellitus | 77 | 13 |
| 9 | Severe energy malnutrition | 36 | 4 | 9 | Sickle Disease | 30 | 10 |
| 10 | HIV/AIDS | 14 | 5 | 10 | Diarrhoeal Diseases | 475 | 8 |

**Health Prevalence Rates**

HIV/AIDS was reported to be among the top causes of mortality for in-patients in the district by the year 1988. This trend was growing on a yearly basis; Kilosa District undertook efforts to curb the situation but despite the interventions, the trend is still growing. Reported most affected areas include Mikumi, Magomeni, Ruaha, Mkwatani, Kasiki, Rudewa, Dumila and Mbumi .

In an effort to control the prevalence rates, the district in collaboration with NGOs, CBOs and FBOs has improved access to HIV and Aids to all people. These services include counselling and testing of pregnant women. Some of NGOs, FBOs and CBOs dealing with these services include Family Health International (FHI) in collaboration with TUNAJALI, peer groups like, Kimamba Youth Organization (KYO), Kilawila Group (MAGUBIKE), Huwaya (KIDODI) and Faraja Group (KISANGA). By 2015, the district had 54 Care and Treatment Centre and 36 VCT centres . Number of people voluntarily screened for HIV status between 2012 and 2015 in the district is indicated in *Table 4-35*.

***Table 4-35 HIV/AIDS Testing in Kilosa District (2016)***

| Year | Screened | | | HIV+ | | |
|---|---|---|---|---|---|---|
| | Men | Women | Total | Men | Women | Total |
| 2012/2013 | 5,428 | 12,099 | 17,527 | 122 | 363 | 485 |
| 2013/2014 | 13555 | 15,388 | 28,943 | 763 | 1084 | 1847 |
| 2014/2015 | 20,014 | 29,341 | 49,355 | 894 | 1338 | 2232 |
| Total | **38,997** | **56,828** | **95,825** | **1,779** | **2,785** | **4,564** |

Source: DMO Kilosa, 2016

*Public Infrastructure and Services*

**Energy Sources**

In Kilosa district, several sources of energy used include electricity, firewood, charcoal, and fuel, in which most respondents use charcoal and firewood. The electric power supply is carried out by the Tanzania National Electric Supply Company (TANESCO) whereby several settlements are covered including Kilosa town, Ruaha, Kidodi Mikumi, Kimamba, Mvumi, Msowero, Chanzuru,

Ilonga, Magole, Parakuyo Rudewa, Msowero Berega, Kilangali, Parakuyo, Madoto and Dumila .

**Traffic and Transportation**

The District has road network with a total of 1426 km, out of which 499 km are regional roads and 927 kms are district roads. Most feeder roads are in bad condition. The District emphasizes on improving feeder and community roads to focus meet the needs of the poor marginalized population.

The Tanzania Railways Corporation runs the Central railway line 234 km crossing the District. There are six stations in the district namely Mkata, Kimamba, Kilosa Town, Munisagara, Mwasa and Kidete. The central line is linked by railway line connection in Kilosa station to Kilombero sugar factories in the South. The link is now fainting due lack of maintenance on the railway and bridges .

### *4.9.6 Mpwapwa District—Dodoma Region*

*Geography and Administrative Structure*

Mpwapwa (located in the middle of Phase II area) is one of the seven districts of Dodoma region. It is located at the Southwest end of Dodoma region, about 120 km from the regional headquarters. It is bordered to the North by Kongwa, to the East by Morogoro Region, to the South by Iringa Region, and to the West by Chamwino District.

Mpwapwa District was administratively divided into 30 wards, namely, Berege, Chipogoro, Chitemo, Chunyu, Galigali, Godegode, Gulwe, Ipera, Iwondo, Kibakwe, Kimagai, Kingiti, Lufu, Luhundwa, Lumuma, Lupeta Malolo, Massa, Matomondo, Mazae, Mbuga, Mima, Mlunduzi, Mpwapwa, Mtera, Nghambi, Pwaga, Rudi, Vingh'awe and Wotta.

*Demographics*

**Population**

In 2012, the District had a total population of 305,056 (of which 147,306 male & 157,750 female) and 66,316 households according to National Population Census[1] in conducted on August 2012 (NBS, 2012). The district has an annual district growth rate of 2.1 percent and an average household size of 4.6 persons

[1] http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf

**Migration**

In 2017, estimated net migration rate for United Republic of Tanzania was -0.5 migrants per thousand population. Though United Republic of Tanzania net migration rate fluctuated substantially in recent years, it tended to decrease through 1970 - 2017 period ending at -0.5 migrants per thousand population in 2017 (CIA, 2018).

Detailed information on migration characteristics and patterns along Mpwapwa District were not available at the time of report compilation.

**Ethnicity, Religion, and Language**

There are a number of tribes in Mpwapwa District,. The most dominant tribes are the Gogo, Kaguru and Hehe. The Gogo is the most dominant accounting for 39.8 percent of all the tribes, followed by Kaguru 16.2 percent, Hehe 10.9 percent and others 33.1 percent. There are few pastoral ethnic groups like Mang'ati and Masai who are migrating into the District especially in the southern plains around Mtera Dam and Ruaha Rivers .

*Education and Literacy*

**Literacy Levels**

In Dodoma region, the percentage of literate men was 72.8[1] percent in 2010 while percentage of literate women was 62[2] percent. No recent data on literacy rates were available for the Chamwino District and Dodoma region at the time of report compilation.

*Economy*

**Economic Context**

About 90 percent of the population are employed in Agriculture and livestock activities; 7 percent in small and medium scale businesses; 1 percent in small-scale industries and 2 percent in office works .

*Land Use*

**Land Use**

Land use categories in the district include residential, commercial, agricultural, industrial and recreational uses. No further information on land use along the district was available at the time of report compilation.

[1] https://knoema.com/atlas/United-Republic-of-Tanzania/Dodoma-Region/Percentage-of-Literate-Men

[2] Available at: https://knoema.com/atlas/United-Republic-of-Tanzania/Dodoma-Region/Percentage-of-Literate-Women. Accessed July 2018.

**Agriculture**

Agricultural activities are conducted in all 33 Wards of the Council. Major food crops are maize, millet, beans, paddy and sweet potatoes etc.; major cash crops are groundnuts, onions, Sesame and sunflower etc. However, in most parts of the Council, agriculture is characterized by low productivity due to unfavourable climatic conditions. The district council encourages farmers to cultivate drought resistant crops especially millet, sorghum and cassava. The arable land available for agricultural production is 228,991 hectares, equivalent to 31.0 percent of total area of the district, while 262,000 hectares is suitable for grazing. Rudi Game controlled area covers an area of 136,450 hectares, while other conservation areas and community forest cover an area of 9,151 and 6,380 hectares respectively. Water bodies cover a total area of 64,000hectares and the remaining 30,928 hectares is used for other activities and settlements .

**Utilisation of Natural Resources / Forest Products**

The forests plays an important role in the maintenance of climate stability, conservation of water sources, soil fertility, controlling land erosion, and providing source of wood fuel, industrial materials and non-wood products such as honey and bee-wax. Mpwapwa District Council in collaboration with stakeholders is making efforts to maintain forest resources to ensure sustainable livelihood of the people .

**Livestock**

Livestock keeping is another important sector in which people depend on for their livelihood such as cows, goats, sheep and chicken. Available data show that cows and chicken contribute a large percentage in the earnings of livestock keepers.

*Health*

**Access to Healthcare**

Within the district, there is 1 hospital, 4 health centres and 52 dispensaries (48 are public owned, four owned by parastatals and one is private). 46 out of 113 villages have health facilities equivalent to 51 percent of the total villages. Only 25.5 percent of the total population live within five kilometres from health facilities. The health sector has 308 out of 604 required qualified staff .

**Health Prevalence Rates**

The HIV Infection and AIDS in Mpwapwa District has been alarming, the prevalence rate dropped from 3.9 percent in 2010 to 1.2 percent in 2015 .

*Public Infrastructure and Services*

**Water Services**

Water supply coverage is only 32 percent in rural areas and about 70 percent in Mpwapwa Town. The district has 113 villages. The district has 43 functioning Deepwater wells, 144 functioning shallow water wells and 28 working natural spring make a total of 215 water sources. The operation of these water schemes is managed by the communities through contributions. 32 percent of the people in the rural areas have access to clean and safe water while in 70 percent have access to clean and safe water .

**Traffic and Transportation**

The council has a total road network of 659 km, of which 60 km are paved, 202 km are gravel roads and remaining are earth roads. .

The district and feeder roads connect all the villages and are drivable with difficulties especially during rainy season.

### *4.9.7 Chamwino District—Dodoma region*

*Geography and Administrative Structure*

Chamwino District (west part of Phase II area) is one of the seven districts of Dodoma region. It lies on the central plateau of Tanzania in the western bearing along Dar es Salaam road. The district lies between latitudes 40° S and 80° S and between longitudes 35° E and 37° E of Greenwich meridians. The district has a total area of 8,056 $km^2$ .

The district borders Dodoma Municipal on the Western front; Chemba and Kondoa Districts on the North; Kongwa and Kiteto Districts on the East; Mpwapwa District and Iringa rural on the Southwest and Bahi District on Southeast front.

Administratively, the district council is divided into 5 divisions, 36 wards, 107 villages and 814 hamlets. The district has two parliamentary electoral constituencies namely: Chilonwa and Mtera.

*Demographics*

**Population**

In 2016, the population in the district was estimated at 368,886 people, of which 195,510 are female and 173,376 are male . The population growth rate is 2.9 and the average number of people per household is 4.5.

The Population density is 46 people per $km^2$. The average household size at the national level is estimated at 5.2 while the average household size (persons per household) in the district is 4.15 (resulting from 79,019 household).

**Migration**

Detailed information on migration characteristics and patterns along Chamwino District was not available at the time of report compilation.

**Ethnicity, Religion, and Language**

Chamwino district is dominated mainly by Gogo tribe. Other tribes existing in the district include Nguu, Rangi, and Mbuwi. The main economic activity is subsistence farming (Agropastoralist) while Maasai, Barbaigs and Sandawe are pastoralist (hunting and livestock keeping) .

Specific religious and language data regarding Chamwino District was not available at the time of report compilation.

*Education and Literacy*

**Access to Education**

The district has 120 primary schools including one special school for handicapped disables blind at Buigiri Mission. Only 01 school out the 120 primary schools is private and the rest are owned by the Government. There are 1,143 primary school teachers of which grade IIIA are 1,084; grade IIIB/C are 37; diploma holders are 12; degree holders are 8 and master's degree holders are 2. Based on available information, there is shortage of 263 teachers in the district.

In 2016, the district had 28 secondary schools, of which 27 are owned by government and 01 is private. The number of students in government secondary schools by the year 2016 was 6,39, of which male students were 3,137 and female students were 3,257. The only private secondary school in Chamwino had 604 students .

**Literacy Levels**

In Dodoma region, percentage of literate men was 72.8[1] percent in 2010 while percentage of literatewomen was 62[2] percent. No recent data on literacy rates were available for the Chamwino District and Dodoma region at the time of report compilation.

*Economy*

**Economic Context**

Generally, people in Chamwino District are engaged in farming and business activities like small shops, selling of crops, selling of livestock, masonry, handcraft and security guards. Few people are also employed in government institutions such as teachers, health officers, police officers, extension officers, village executive officers and ward executive officers .

*Land Use*

**Land Use**

Land use categories in the district include residential, commercial, agricultural, industrial and recreational uses . No further information on land use along the district was available at the time of report compilation.

**Agriculture**

About 80 percent of Chamwino district economy comes from farming . The main actors in this sector are the smallholder farmers most of which do not use improved farming practices. Most of these smallholder farmers do rely on rain fed farming. As a result, yield practice is relatively low.

Agriculture sector constitutes the mainstay of the economy of Chamwino district and its population as it provides income, employment and adequate food supplies. A small segment of the population is engaged in commercial and industrial sectors. The latter sector is limited to small scale enterprises that include maize mills, carpentry, and tailoring. These are mainly found at Chamwino, Mvumi Mission and trading centers of Haneti, Chalinze, Izava Mpwayungu and Mlowa Barabarani.

Chamwino district produces food crops such as sorghum, maize and cassava. Other crops grown this district include grapes, sunflower, simsim, groundnuts, bulrush millet, finger millet and paddy.

[1] https://knoema.com/atlas/United-Republic-of-Tanzania/Dodoma-Region/Percentage-of-Literate-Men

[2] Available at: https://knoema.com/atlas/United-Republic-of-Tanzania/Dodoma-Region/Percentage-of-Literate-Women. Accessed July 2018.

**Utilisation of Natural Resources / Forest Products**

The district has six forest reserves covering an area of 107,720 ha. These include the East and West Chenene 29,839 ha; Chinyami 43,330 ha, Goima 6,959 ha; Sasajila 1,145 ha and Chamhene 3,785 ha. The forest and woodland areas in the district have been greatly dilapidated due to deforestation as a result of shifting cultivation, uncontrolled bush fires, overgrazing and the catering for energy use .

**Livestock**

Livestock keeping is ranked second as a vital economic activity in the district, though its actual contribution to the district economy in terms of provisions of income, employment and contribution to GDP and Per Capita income is yet to be accurately assessed. The common livestock are traditional cattle breed, sheep and goats. However, improved dairy cattle also form a source of income, especially in ward with urban features. Besides livestock, forestry products are also prominent sources of the district economy. The forest products include timber, honey and wax, charcoal and fuel wood from Chenene forest. Livestock keeping is done traditionally and mostly involve indigenous cattle (322,167) goats (55,662), sheep (56,343), donkeys (3262), chicken (351,097) and pigs (3,642).

*Health*

**Access to Healthcare**

The district has 65 working health facilities, 1 hospital, 5 rural health centre and 59 dispensaries. By 2016, the district had 420 staff out of the required 1,250. Malaria, ARI, diarrhoeal diseases, eye diseases, and pneumonia are leading causes of morbidity. Infections/communicable diseases are the main causes of morbidity in the district .

**Health Prevalence Rates**

The district HIV/AIDS data show that the rate of infection dropped from 3.0 percent in 2007 to 2.9 percent in 2010 . The council continues with sensitization strategies to reduce further spread of HIV/AIDS and at the same time providing good care to the present HIV victims.

*Public Infrastructure and Services*

**Water Services**

The district has 201 water supply schemes. These schemes, if operational, are capable of providing clean and safe water to 72 percent of the district population. However, only 144 schemes were operational (in 2016) and was able to serve 61 percent of the population .

**Sanitation**

By 2015, 55 percent of the households in Chamwino had acceptable sanitary (toilets) facilities. The remaining 45 percent of the households did not have toilet facilities (ACU, 2015).

**Energy Sources**

In Chamwino district, several sources of energy used include electricity, firewood, charcoal, and fuel, in which most respondents use charcoal and firewood.

**Traffic and Transportation**

The district has a total of 873.1 km of road network. The district is well serviced by inter-regional transport links with the Central Railways line passing through two villages in the district. These villages are Igandu and Mnase and there is one sub-railway station at Igandu. Railway line infrastructures available in the district are approximately 15.6 km .

There are two airstrips located at Mvumi and Izava villages. These are mostly used by flying doctors to Mvumi Hospital. There is no reliable data records in terms of services provided and this is attributed by not having scheduled flights since the operation is performed occasionally by individuals .

### *4.9.8 Dodoma Municipal—Dodoma Region*

*Geography and Administrative Structure*

Dodoma Municipal (west part of Phase II area) is one of the seven districts of the Dodoma Region of Tanzania. It is bordered to the West by Bahi District and to the East by Chamwino District. It is the smallest district in Dodoma region representing 6.3 percent of the total area. Dodoma Municipality is administratively divided into 1 parliamentary constituency, 4 divisions, 41 wards, 18 villages, 170 *Mitaa* and 89 hamlets .

*Demographics*

**Population**

According to the 2012 National Housing and Population Census[1], the population of Dodoma Municipal Council was 410,956 of which 199,487 are males and 211,469 are females. Basing on the annual growth rate of 2.4 percent of 2012, the population of Dodoma Municipality is exponentially projected at

[1] Available at: http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf. Accessed July 2018.

463,353 in 2017 (five years since 2012 census) and 522,428 in 2022 (ten years after the 2012 census). The average household size is 4.4 person per household.

The population density for the Municipality was 116.6 persons per sq. km in 2002, 148.4 persons per sq.km in 2012 and in 2013 is 151.7 persons per sq.km as obtained from the projected population. In 2022, the population density is projected to be 202.3 persons per sq.km.

**Migration**

Detailed information on migration characteristics and patterns along Dodoma Municipal Council was not available at the time of report compilation.

**Ethnicity, Religion, and Language**

Dodoma Municipality is one of the districts in Tanzania that is endowed with cultural practices. The major tribes in the Municipality include Gogo, Rangi, Sandawe, and few other tribes (Warangi, Wasandawi). The polygamist, extended families and male dominating decision-making are among of the key cultural beliefs of the area.

The most common languages spoken in the municipal include Kiswahili, Kigogo, Kisandawe, Kirangi and other languages of smaller tribes. .

No specific data on religious groups in Dodoma Municipal Council were available at time of report compilation.

*Education and Literacy*

**Access to Education**

For the year 2013, the number of primary schools in Dodoma Municipal Council was 111 whereby, the largest share was dominated by public schools in terms of distribution and quantities. In all 37 wards of the Municipal there was at least one public primary school in each ward, while private primary schools are found in only twelve wards. These schools attracted a total of 74,529 pupils in 2013, made up of 67,836 pupils from public schools and 6,693 from private schools .

The number of secondary schools in Dodoma Municipal Council are 36 and 15 secondary schools for public and private respectively. Most of these secondary schools are found in Chamwino and Kizota wards (both have 12 secondary schools), followed by Kiwanja cha ndege ward (9 schools), Mtumba (9 schools), Mbabala (9 schools) and others. Almost 8 percent of these secondary schools are boarding schools and the rest are day schools. Considerable physical facilities

shortages such as furniture (chairs, tables, desks etc.) and other facilities such as dormitories, teacher's houses and offices, libraries, beds etc., have been reported and observed in most secondary schools especially public ones .

Eight institutions offering tertiary education (institutes and universities) are available in the Municipality.

**Literacy Levels**

In Dodoma region, the percentage of literate men was 72.8[1] percent in 2010 while percentage of literate women was 62[2] percent. No recent data on literacy rates were available for the Dodoma Municipal Council and Dodoma region at the time of report compilation.

*Land Use*

**Land Use**

The land in the Municipal is used for subsistence agriculture, grazing and forest reserve. The Municipal has few roads which are accessible in all year round especially in urban. However, in some areas especially in rural accessibility is difficult during rainy season. About 71 percent (196,000 hectares) of the total area (276,900 hectares) is suitable for agricultural production. The estimated area for food crop production is 107,249 hectares and about 49,304 hectares are for cash crops production. The rest of the land is subdivided into grazing land (39,447 hectares), forest reserves (30,046 hectares), open land (11,362 hectares) and urban area covers 39,492 Hectares, .

*Health*

**Access to Healthcare**

In Dodoma Municipal Council, there are 70 health-offering points, of which 49 are owned by government while the remaining 21 are owned by private entities including religious institutions and individual health specialists .

*Public Infrastructure and Services*

DUWASA is a fully autonomous public utility responsible for the overall operation and management of water supply services in the Dodoma Municipality (EWURA, 2015).

[1] https://knoema.com/atlas/United-Republic-of-Tanzania/Dodoma-Region/Percentage-of-Literate-Men

[2] Available at: https://knoema.com/atlas/United-Republic-of-Tanzania/Dodoma-Region/Percentage-of-Literate-Women. Accessed July 2018.

The Utility has a sewerage system with sewer line length of 78 km, and sewage treatment is by use wastewater stabilization ponds. The average daily flow into ponds is 4,690 $m^3$/day (1,711,850 $m^3$/year).

**Traffic and Transportation**

There is one operating airport in the municipal that is located in Kiwanja cha ndege ward. The air services are mostly provided by a Mission Aviation Fellowship Company (MAF) and other undetermined air service providers. The air services are not currently used commercially since the business has not taken the market. However, in most cases the airport serves Government officials when they visit the capital of Dodoma. Due to its location and taking cognancies of the capital city the Tanzania Government started venture of designing and construction of Dodoma International Airport which is to be located at Msalato in Miyuji ward. Compensation has been affected and designs are in progress. There is an airstrip at Hombolo which is privately used by the Catholic Missionaries.

Dodoma Municipal Council is well connected with most areas through the central railway line which is a major railway line in Tanzania. It runs west from Dar es Salaam to Mwanza and Kigoma. In the Municipality, there are three railway stations at Zuzu, Kikombo and Dodoma town (Tambukareli). However, operational services provided by the Railway Corporation have not been impressive due to factors including old facilities, old infrastructure and management challenges .

## *4.10 KEY ELEMENTS OF THE SOCIAL AREA OF INFLUENCE*

This section describes the key socioeconomic baseline elements at the local level in the Social Area of Influence.

As previously stated, information presented is based on data collected through the initial ESIA field survey as well as information presented in the draft RAPs for Phase I (RAP Lot I) and Phase II (Rap Lot 2).

### *4.10.1 Population and Demographics*

The railway route runs primarily through rural areas with some sections covering urban areas in the Region of Dar es Salam (Phase I) and Morogoro (Phase II). Along Phase I of the SGR line, Ilala and Morogoro Municipal District Councils are characterized by urban features (i.e. densely built up and with higher migration), whereas Kibaha and Morogoro Rural District Councils are more rural with some larger towns such as Kwala, Magindu, Ngerengere

and Mikese. Along Phase II, the majority of the route is rural with Morogoro Rural Council, Mvomero, Mpwapwa, and Dodoma Rural presenting mostly rural features.

Among the 13 districts crossed by the railway route, eight are described in detail in the above *Section 4.9*; namely Ilala District, Kisarawe District, Kibaha Town Council, Morogoro Rural, Kilosa District, Mpwapwa District, Chamwino District and Dodoma Municipal (See *Figure 4-31*). The population in these eight districts represents around 5,7 % of the country's population.[1] Considering the relative homogeneity of socioeconomic features along the railway route, the information provided for the eight districts is considered representative to the entire length of the route.

The total population in the 8 districts is about 3.26 million, of which 50% are females and 49 % are males. Ilala District (east part of Phase I area) has the largest population (37.4%), followed by the Kilosa District in the east part of Phase II area (13.4%), while Kisarawe district (mid-east part of Phase I area) is the least populated (3.1%). The population data displays a 0.9 population increase between 2002 and 2012 in Ilala District. In the other districts, the population growth rate range from 0.6 (Kisarawe District) to 4.6 (Ilala District). The average household size at the national level is estimated at 4.8 while the average household size (persons per household) in the districts that are crossed by the railway line range from 3.9 (Kisarawe District) to 4.5 (Mpwapwa District, in the middle of Phase II area).

At the Area of Influence level, based on the socio-economic assessment survey conducted as part of the RAP Lot 2 for Phase II, gender and age distribution and household size follows the regional patterns found at the district level (see Section 4.9). Specifically, along Phase II, the majority of the population is male with a mean age of 45. The dominant age group is 29 to 48 (representing almost half of the population).

In terms of household size, most surveyed households as part of the RAP Lot 1 household interview survey for Phase I have a household size of 3 to 5 (primarily in Ilala and Kihaba Districts). Data indicates that larger household sizes found in the west part of Phase I area, in particular Morogoro Rural District Concil (3 to 7) and Morogoro Municipal Council (3 to 6). In Phase II, the reported average household size was around 4 with the highest household size in the east part of Phase II, in Mvomero District .

[1] Tanzania Population and Housing Census (2012). http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf

### *4.10.2 Ethnicity and Religion*

The main ethnic groups in the districts crossed by the railway line are, amongst others, Zaramo, Ndengereko and Gogo. The Morogoro District (west part of Phase I) has other ethnic groups, such as the Walaguru, Wakaguru, Wapogoro, Wakutu, Wazigua and Wakwere. In terms of languages, apart from Swahili, local languages exist at a district/local level.

Along Phase I of the line, Zaramo is one of the major ethnic groups in Ilala District (east part of Phase I) and especially in the Kisarawe District, mid-east of Phase I (85%), followed by Ndengereko. Note that due to urbanization, many people from different ethnicities have migrated to Ilala District (Dar es Salaam Region), contributing to create a heterogeneous tribal composition whereby no single ethnic group has more than 25% of the total population. Other minor ethnic groups present are Makonde, Nyamwezi and Gogo (see Section *4.9*).

Along Phase II, Gogo is a major group in the Districts of Mpwapwa, Chamwino and Dodoma Municipal (mid and west part of Phase II)[1]. Other dominant ethnic groups present are Luguru and Pogoro; Kaguru and Hehe (mostly for Mpwapwa District) Nguu, Rangi and Mbuwi (Chamwino District) and Rangi, Sandawe, Warangi and Wasandawi (Dodoma Municipal). The Morogoro Rural District has other ethnic groups, such as the Walaguru, Wakaguru, Wapogoro, Wakutu, Wazigua and Wakwere.

### *4.10.3 Indigenous Populations*

As mentioned in *Section 4.8.3*, The Maasai and Barabaig are pastoralist groups present in the Districts traversed by the Project. In particular, in Magindu and Miziguni villages (Kibaha District, mid part of Phase I), Parakuyo and Mbwade villages (Kilosa District, mid-east part of Phase I) and Kinonko and Kidugalo villages (Morogoro Rural District, west part of Phase I)[2]. There are also pastoralists groups along Kisarawe District.

Indigenous communities use land for which they have customary rights of occupation. Some of them, for example in the Mikese village, occupy land that they bought from mainstream communities. Most of the pastoralists groups belong to the Maasai, while the Barbaig are mostly present in Kwasa and Soga

[1] According to RAP Lot 2 survey findings, the biggest ethnic group for Phase II is Gogo (56.5%).

[2] This information was provided by an Indigenous People's specialist Report and it is based on site visit findings combined with desktop information.

villages (Kibaha District). Parakiyo and Mbwade (Kilosa District) are the only villages inhabited uniquely by indigenous communities. However, findings from the Indigenous Peoples study[1] state that these groups were found to be much assimilated into the broader community and while they continued to undertake traditional pastoralist activities, their lifestyles were sedentarized.

Table 4.36 summarizes the above information.

[1] Consultations with indigenous peoples within the Project area were conducted in March – April 2019 and detailed in an assessment commissioned by ERM. At the writing of this document, the report is still in the process of finalization however provides some insight into indigenous peoples with regards to the Project.

*Table 4.36 Indigenous Peoples along the Area of Influence*

| Community reference number | IP* Group (Maasai/Barbaig) | Region | District | Village | Sub-village | Is the IP* group the sole group of the village? | Number of people (IPs in settlement) | Male/Female |
|---|---|---|---|---|---|---|---|---|
| 1 | Maasai | Morogoro | Kilosa | Parakiyo | N/A | Yes | | |
| 2 | Maasai | Morogoro | Kilosa | Mbwade | N/A | Yes | | |
| 3 | Maasai | Morogoro | Morogoro Rural | Mikese Mjini | Mikese | No | | |
| 4 | Maasai | Morogoro | Morogoro Rural | Kinoko | Kinoko | No | | |
| 5 | Maasai | Morogoro | Morogoro Rural | Kidugalo | Ekenywa | No | 648 | 240/408 |
| 6 | N/A | Pwani | Kibaha | Magindu | Masaki | No | 326 | 152/174 |
| 7 | Maasai | Pwani | Kibaha | Magindu | Mizicuni B | No | 815 | 303/512 |
| 8 | Barbaig | Pwani | Kibaha | Kwasa | Waya | No | 412 | 176/236 |
| 9 | Barbaig | Pwani | Kibaha | Soga | Kibonde | No | 268 | 121/147 |

* *Note: IP = Indigenous Peoples*

Source: Indigenous Peoples Field Study by a Local specialist, 2019

According to the indigenous people's field study by a local specialist, pastoralist's settlements are part of greater rangelands and livestock graze in the whole land. The distance covered depends on the availability of natural resources (pastures, water and salt) from their settlements. In general terms the main livelihood for all indigenous people's groups identified along the SGR line is pastoralism or traditional livestock keeping, and the second livelihood is crop growing or agriculture (practiced very occasionally).

According to field surveys, the main risks identified for these communities are the accessibility to social services and water sources for livestock. However, as long as access is guaranteed through adequate crossings, they will not lose access to their grazing lands. The potential for land fragmentation can be reversed through appropriate crossings. This is furtherly developed in the Social Impacts Section.

### *4.10.4 Gender Dynamics*

As introduced briefly in Section 4.8.4, although the Tanzanian Constitution, the Land Act and Village Act of 1999, give women and men equal right in terms of access to and owning properties and land, customary practices supress these rights for women in terms of property ownership. This has been observed during the draft RAP Phase I survey, showing that there are few women owning land because very few women in the affected communities can raise funds to acquire land. In such instance, women can only inherit property from their husbands and not from their parents.

Although men usually decide how agricultural land will be used or cultivated, agriculture is a shared activity between men and women in the household. However, where the men engage in other income generating activities, the majority of the farm work falls upon the women. According to the draft RAP Phase II findings, maize and vegetables are sold by both formal and informal stalls throughout the Project footprint, largely by women. Women were observed to be responsible for agricultural livelihood activities in villages, while men were seen doing other forms of work, such as motorbike taxis, welding, woodwork, construction and mechanics (See Section 4.10.8).

### *4.10.5 Community Support Systems*

In a few cases, household interview surveys conducted as part of the draft RAP Lot 1 reported dependency ties between people from old age and people living in the neighbourhoods, as they assist and support their living in many ways. This was observed during the RAP Phase I field survey for an old couple with

no children living in Kinonko Village (Morogoro Rural District, west part of Phase I), who gets assistance on food, farming, water collection and medical care from the people in the village. Thus, access to basic goods and services for elderly sometimes depend on their neighbourhoods support network.

Social cohesion has significant importance on people who spent all their life or more than 10 years in one area. According to the RAP Lot 2 for Phase II, more than half of the project affected households have lived for more than 10 years in the affected areas.

### *4.10.6 Vulnerable Groups*

Vulnerability is related to the ability of individuals and groups to adapt to socio-economic or bio-physical change. Vulnerable individuals and groups are therefore more susceptible to negative impacts and/or have a limited ability to take advantage of positive impacts. Vulnerability is a pre-existing status that is independent of the project and may be reflected by the existing low level of access to key socio-economic or environmental resources or a lack of access to information and decision making.

In the Study Area, vulnerability has been identified and linked to the following factors:

- *Households with particularly low incomes and high land dependency for subsistence and income generation.* Low income households have fewer resources on which to rely and are less likely to have savings and / or access to alternative sources of income. Low income households can be found throughout the Study Area, and are prevalent in the rural settlements where agriculture is the primary livelihood activity and most of the produce is used for subsistence. In these cases, restricted access to the land used for income generation and food production could also impact household income and food security levels of these households.
- *Households with disabled household members.* Those who lack physical mobility or who have mental health issues may be vulnerable to changes and have more difficulties adapting to new contexts. With relation to the railway, displacement impacts related to restriction on land access or need to replace housing could be particularly challenging.
- *Elderly.* The elderly have specific vulnerabilities relating to income levels and limited ability to change or increase access to additional income sources. They usually live on minimal income and are more likely to have

less physical and mental capacity to cope with changes to their environment.

- *Female and / or child headed households*. These households are likely to have fewer resources on which to rely and are less likely to have savings and / or access to alternative sources of income. The main causes of vulnerability for female-headed households lie on gender stereotypes related to the role of women in the households and their access to land and other resources, while child headed households suffer from the inability to take care of themselves and their siblings.
- *Pastoralists groups (including indigenous)*: The vulnerability of these groups lies primarily in their access to land and other resources for grazing and farming, in particular surface water resources. As discussed in Section 4.8.3, pastoralists are exposed to land grabs and evictions, often supported by government policies. Their culture and way of life differ considerably from the national trends and are under risk.

### *4.10.7 Land Ownership and Land Use*

*Land Tenure*

As stated in Section 4.8.9, the state is the custodian of the land and the land is therefore owned by the State, whereas citizens have a usage right (inherited or purchased) which allows them to use the land and reside on it.

The majority of the land along the SGR is within the existing Right of Way of the existing MGR and belongs to the railway authority. The remainder is primarily customary land or "village land" (land under the jurisdiction of management of villages – in rural areas), mostly along Phase II, and to a lesser extent, general land (urban land including land within a municipality or small town as well as privately owned land). Urban land is mostly found around Dar es Salam and large settlements or main cities in Morogoro (west part of Phase I) and Dodoma (west part of Phase II) districts.

In rural areas where the land is considered primarily village land, the majority of the land affected households in Phase II reportedly "owns" and "co-owns" the land under customary tenure. This corresponds to formal customary usage rights, where most of these rights are inherited from generation to generation. Customary leaseholds represent a very small proportion of land tenure in the area, whereas a slightly higher percentage of population do not have any formal usage rights (informal settlers, caretakers, etc.).

*Land Use*

The existing land uses along the SGR line are primarily agricultural, along with some shrub and forested areas.

Within the 500 m corridor specifically, 34% of the land cover is indicated by GIS analysis to be cropland, 28% shrub land, 24% grassland, 10% trees cover areas and only 4% built up areas.The Table 4.36 below shows the area and percentage of land within the 500m corridor by land cover type.

***Table 4-37 Land cover/land use in the 500 m corridor***

| *Land Cover/Land Use in the Project area* | *Hectares (Ha)* | *Percentage of Total Area (%)* |
|---|---|---|
| Bare land | 29 | 0.10 |
| Built up areas | 1,055 | 3.94 |
| Cropland | 9,115 | 34.09 |
| Grassland | 64,04 | 23.95 |
| Lichen Mosses / Sparse vegetation | 5 | 0.01 |
| Open water | 1 | 0.002 |
| Shrubs cover areas | 7,406 | 27.70 |
| Trees cover areas | 2,689 | 10.05 |
| Vegetation aquatic or regularly flooded | 30 | 0.11 |
| **Total** | 2,6735 | 100 |

Source: ERM, 2019 using Google Earth satellite imagery

As previously detailed in Section 4.7.3, the Project will require within this 500m corridor the establishment of a cleared RoW. According to GIS analysis, Lot 1 RoW covers 1,500 hectares, from which 41% are grasslands, 29% croplands and 17% trees cover areas. For Lot 2, RoW occupies 2,191 hectares from which 40% are shrub lands, 39% croplands and 12% lichen mosses /sparse vegetation. *Table 4-38* and *Table 4-39* show the area and percentage of land within the RoW by land cover type for Lot 1 and Lot 2.

***Table 4-38 Land cover use in the RoW for Lot 1***

| **Land Cover in the Project area** | **Hectares (Ha)** | **Percentage of Total Area (%)** |
|---|---|---|
| Bare land | 0 | 0.003 |
| Built up areas | 61 | 4.07 |
| Cropland | 435 | 29.02 |
| Grassland | 626 | 41.78 |
| Lichen Mosses / Sparse vegetation | 0 | 0.01 |

| Land Cover in the Project area | Hectares (Ha) | Percentage of Total Area (%) |
|---|---|---|
| Open water | 0 | 0 |
| Shrubs cover areas | 116 | 7.73 |
| Trees cover areas | 258 | 17.23 |
| Vegetation aquatic or regularly flooded | 2 | 0.12 |
| **Total** | 1,500 | 100 |

Source: ERM, 2019 using Google Earth satellite imagery

### *Table 4-39 Land cover in the RoW for Lot 2*

| Land Cover in the Project area | Hectares (Ha) | Percentage of Total Area (%) |
|---|---|---|
| Bare land | 2 | 0.10 |
| Built up areas | 20 | 0.91 |
| Cropland | 857 | 39.14 |
| Grassland | 258 | 11.80 |
| Lichen Mosses / Sparse vegetation | 0.08 | 0.003 |
| Open water | 0 | 0 |
| Shrubs cover areas | 896 | 40.88 |
| Trees cover areas | 156 | 7.12 |
| Vegetation aquatic or regularly flooded | 0.39 | 0.01 |
| **Total** | 2,191 | 100 |

Source: ERM, 2019 using Google Earth satellite imagery

As stated in Section 4.7.3, the Project will also require additional temporary acquisition of land outside the RoW for the establishment of borrow pits, dumping sites, quarry sites, construction of marshalling yards, stations and campsites. *Table 4-40* and *Table 4-41* show the area and percentage of additional land acquisition by land cover type for Lot 1 and Lot 2.

### *Table 4-40 Land cover area for Lot 1 facilities*

| Land Cover in the Project area | Hectares (Ha) | Percentage of Total Area (%) |
|---|---|---|
| Bare land | 0.12 | 0.01 |
| Built up areas | 0 | 0 |
| Cropland | 126 | 16.06 |
| Grassland | 362 | 46.17 |
| Lichen Mosses / Sparse vegetation | 0 | 0 |
| Open water | 0 | 0 |

| Land Cover in the Project area | Hectares (Ha) | Percentage of Total Area (%) |
|---|---|---|
| Shrubs cover areas | 49 | 6.28 |
| Trees cover areas | 246 | 31.46 |
| Vegetation aquatic or regularly flooded | 0 | 0 |
| **Total** | 784 | 100 |

*Table 4-41 Land cover area for Lot 2 facilities*

| Land Cover in the Project area | Hectares (Ha) | Percentage of Total Area (%) |
|---|---|---|
| Bare land | 0 | 0 |
| Built up areas | 0.01 | 0.005 |
| Cropland | 138 | 37.16 |
| Grassland | 58 | 15.56 |
| Lichen Mosses / Sparse vegetation | 0.09 | 0.02 |
| Open water | 0 | 0 |
| Shrubs cover areas | 122 | 32.76 |
| Trees cover areas | 53 | 14.42 |
| Vegetation aquatic or regularly flooded | 0.20 | 0.05 |
| **Total** | 372 | 100 |

### *4.10.8 Employment and Livelihoods*

*Overview*

Population size differs, but main livelihoods are quite homogeneous, with the predominance of agriculture and livestock breading in rural areas primarily, as well as casual farm labour. Complementary sources of income also include fishing in some areas, and collection and sale of forest products such as timber, charcoal, and honey. In urban areas or closer to urban centres, economic activities are more diverse, ranging from temporary jobs, formal employment, trading, farming and livestock keeping.

Agriculture and livestock rearing is one of the primary income generating activities along the SGR line, especially in rural areas where it is the main livelihood activity. Poorer households also tend to work as casual labour and farm labour for better-off households. Complementary sources of income also

include fishing in some areas, and collection and sale of forest products such as timber, charcoal, and honey.

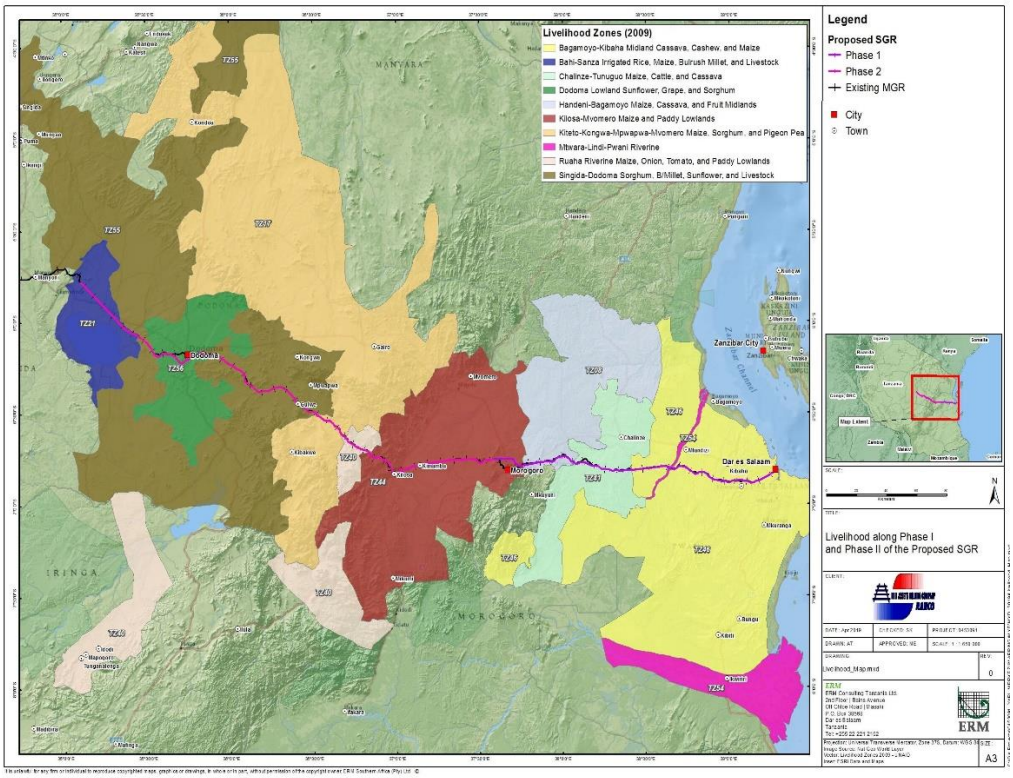
Typically, households will tend to rely on agricultural production as their main source of food and income. Poorer households supplement their crop incomes by working on better-off household's farms. A minority of the poor travel to local towns for work. Better-off households earn additional cash by selling livestock, especially cattle, while poorer households can only afford to sell a few animals and often according to immediate need.
In urban areas or closer to urban centres, economic activities are more diverse, ranging from temporary jobs, formal employment, trading, farming and livestock keeping. Trading, temporary jobs, and formal employment tend to be the main livelihood activities in urban areas.

To provide a better geographical understanding of livelihoods in the Study Area, the area was divided according to 10 livelihood zones based on a USAID study on livelihoods in Tanzania[1].. This study organizes the territory into 78 livelihood zones along with an associated livelihood profile for each, grouping together people who share similar livelihood patterns. The SGR line crosses 10 of these zones.

A summary of the main livelihood activities in each of the applicable zones is presented in *Table 4-42*. Figure 4-32 illustrates the livelihoods along the SGR route. The different types of livelihood activities are described in more detail in the following sub sections.

[1] USAID Preliminary Rural Livelihood Zoning: Tanzania (2008). The report was furtherly updated for two Zones (44 in 2014 and 55 in 2015). We decided to keep the 2008 version for consistency, as it covers all the areas crossed by the railway line and it is representative for the current situation. However, the updated reports for Zone 44 and 55 are used to provide more detail for this two areas.

*Figure 4-32 Livelihoods areas along the SGR Route*




Source: USAID Preliminary Rural Livelihood Zoning: Tanzania (2008), modified by ERM, 2019.

*Table 4-42 Summary of Livelihood Areas along the SGR Line*

| SGR Phase | Districts in AoI | Location (chainage points) | Main Livelihood | Secondary Livelihoods |
|---|---|---|---|---|
| **Zone 8: Handeni-Bagamoyo Maize, Cassava, and Fruit Midlands** | | | | |
| Phase I | Morogoro | 144+300 – 178+900 | • Agriculture and crop sales<br>• Labor | • Sisal labor (Mikese ward)<br>• Livestock sales |
| **Zone 17: Kiteto-Kongwa-Mpwapwa-Mvomero Maize, Sorghum, and Pigeon Pea** | | | | |
| Phase II | Mpwapwa | 315+500 – 338+000 | • Agriculture and crop sales<br>• Labor | • Livestock sales |
| **Zone 21: Bahi-Sanza Irrigated Rice, Maize, Bulrush Millet, and Livestock** | | | | |
| Phase II | Bahi<br>Manyoni | 484+000<br>534+980 | • Agriculture and crop sales | • Labor<br>• Livestock sale<br>• Fishing |
| **Zone 40: Ruaha Riverine- Maize, Onion, Tomato, and Paddy Lowlands** | | | | |
| Phase II | Kilosa | 294+000<br>312+000 | • Agriculture and crop sales (onions and tomatoes) | • Labor<br>• Informal markets |

| SGR Phase | Districts in AoI | Location (chainage points) | Main Livelihood | Secondary Livelihoods |
|---|---|---|---|---|
| **Zone 41: Chalinze-Tunuguo- Maize, Cattle, and Cassava** | | | | |
| Phase I | Kibaha-Morogoro | 103+100<br>144+300 | • Agriculture | • Labor<br>• Livestock sale<br>• Petty trade |
| **Zone 44: Kilosa-Mvomero- Maize and Paddy Lowlands** | | | | |
| Phase I/II | Morogoro Rural; Morogoro Urban; Mvomero; Kilosa | 178+900<br>293+000 | • Agriculture and crop sales | • Livestock sale<br>• Labor<br>• Timber sales (minority) |
| **Zone 46: Bagamoyo-Kibaha Midland- Cassava, Cashew, and Maize** | | | | |
| Phase I | Ilala; Temeke; Kisarawe; Kibaha | 0+000<br>76+300;<br>78+000<br>103+00 | • Agriculture and crops sale | • Labor<br>• Timber sale |
| **Zone 54: Mtwara-Lindi-Pwani Riverine** | | | | |
| Phase I | Kibaha | 76+400<br>77+900 | • Agriculture and crop sales | • Labor<br>• Fish sale<br>• Charcoal sale<br>• Wild honey sale |
| **Zone 55: Singida-Dodoma - Sorghum, B/Millet, Sunflower, and Livestock** | | | | |
| Phase II | Mpwapwa; Chamwino; Dodoma; Urban; Bahi | 338+000<br>431+000;<br>466+000<br>483+000 | • Agriculture and crop sale<br>• Livestock sales | • Labor<br>• Charcoal sale<br>• Wild honey sale |
| **Zone 56: Dodoma - Lowland Sunflower, Grape, and Sorghum** | | | | |
| Phase II | Dodoma; Urban; | 429+000<br>465+000 | • Agriculture and crop sales (grapes)<br>• Livestock sales | • Labor |

Source: ERM 2019, based on USAID Preliminary Rural Livelihood Zoning Tanzania (2008)

*Agriculture*

As stated above, agriculture is the main livelihood activity in the Study Area, especially in rural areas, which constitute the majority of the line route, such as Kibaha and Morogoro Rural District councils (mid and west part of Phase I) and Dodoma Rural District and Mpwapwa District (mid and west part of Phase II). Whereas, in urban areas such as Ilala and Morogoro Municipal Councils (mid and east part of Phase I) and Dodoma Municipal District Council (west part of Phase II), the population has a more diversify income base although agriculture remains an important source of income.

Most of the population in communities living adjacent to the railway line engage in farming for both subsistence and income generation. Food crops for subsistence include paddy, maize, beans, cassava, sweet potatoes, vegetables,

fruit trees and bananas, whereas crops primarily used for income generation are sisal, sugar cane, rice, maize, sesame, sunflower, cashew nuts and coconuts; although some may fall into both categories, such as rice, maize and beans.

Sesame is dominant in the Morogoro Wards, while Sisal plantations cover most of Mikese ward (Morogoro Rural District) in Zone 08 (see *Table 4-42*). Orange, mangoes and jackfruit trees are mainly present in Zone 08 (Morogoro district), and onion and tomato sales are common in the Dodoma District (Zone 40).

In the Ruvu ward in Kibaha District Council, (in the middle of Phase I Zone 54), favourable conditions including arable land in the Ruvu river floodplain, and suitable climate support agricultural activity year round with different kind of crops including seasonal and perennial crops such as mango, cashew and coconut trees as well as horticultural crops such as sweet pepper, eggplants and paddy. According to the USAID study, better-off households earn significant income from selling rice, sweet potatoes, and other vegetables, while the poorer households rely mostly on rural paid work. Those that have access to irrigated plots plant vegetables and rice.

***Figure 4-33 Agricultural Activities in Morgoro Rural District and Kimbaha District Council***

Source: RAP Lot 1

Processing food crops is limited in the Area of Influence, and communities tend to only process the quantity they consume. The rest of their produce is sold as raw produce either to intermediaries to sell in urban centres or directly by the household in the village itself or in nearby markets. For example, in Zone 08 (North East of Morogoro Town) oranges, mangoes, jackfruit are grown and

consumed or sold locally by households, and also sold by traders in Dar es Salam (see *Commerce and Trade* Section below).

Mechanised farming was not observed during the field surveys, however there is a high use of hired labour, particularly for better-off households with larger plots of lands (see section on *Other Livelihood Activities* below).

*Animal Farming and Livestock Rearing*

Livestock keeping is another prominent economic activity across the railway line, contributing to both household consumption and household income through sales. It includes keeping cattle, goats, sheep, pigs and poultry. While it is not considered a primary livelihood activity (see *Table 4-42*), it constitutes a secondary activity supplementing farming. Cattle in particular are strictly kept for market purposes, while other livestock such as sheep, goats, chicken and ducks can be used for household consumption as well as for sale. In Zone 17 (Mpwapwa District, located in the middle of Phase II) , livestock sales provide a significant secondary income for the wealthier; animals are sold locally then exported to other areas within and outside Tanzania.

Dodoma and Singida (Zone 55) are intermediary markets connecting villages to terminal markets, such as Dar es Salaam. In Zone 55, although livestock are sold throughout the year, there are two peak periods: one from May to July, when livestock are in the best condition and prices are highest; the second is in January and February, when poorer households need to buy food. At this point, households sell one or two animals at a time at markets (for cattle and goats) often near dry season grazing areas; traders collect and transport livestock to Dar es Salaam by truck (USAID Report)[1].

Livestock are allowed to roam freely within the villages and cattle graze on village or general land. Villagers in Kibaha District Council around the Ruvu South Forest (located in the middle of Phase I) use the forested areas for grazing as well as collection of firewood (see below).

Poultry farming was also observed in the villages of Ruvu and Gwata in Kibaha District Council (Zones 46 and 54). These activities are carried at different scales within the same village. Small scale poultry farming is usually carried out by family members in a facility tied to the main house and primarily for

[1] USAID Report (2015): Singida-Dodoma Bulrush Millet, Sorghum, Sunflower & Livestock Livelihood Zone Profile December 2015.

subsistence purposes. In Zone 46 (Kibaha District), all households sell indigenous poultry. Large scale poultry farms are also found in the settlements in the Area of Influence and represent a source of income for the owner and the employees, and is carried out in a designated structure with supporting infrastructure.

***Figure 4-34 Small and Large Scale Poultry Farming in Kibaha District Council***

Source: RAP Lot 1

*Pastoralism*

Pastoralism is a livelihood practice involving indigenous livestock grazing by making use of sparsely distributed resources such as pastures, salt licks and water sources.[1] Pastoralism is commonly practiced in arid and semi-arid environments where resources (water and pasture) are variable in time and space. Local knowledge of rainfall patterns, pasture quality and availability, and pasture management are based on mobility, long-term social networks, and flexible management regimes. Mobility is central to this system to both access resources across variable environments, and also allow for different pastures to rest at different times of the year.[2] Among Tanzania's large number of pastoralists and agro-pastoralists, two groups—the

[1] In Tanzania, the livestock sub-sector which is highly characterized by indigenous livestock breeds or pastoralism. This livelihood system contributes about 30% of the entire gross value output of agriculture.

[2] For a comprehensive analysis of pastoralism and land use, see Oba, G., & Kaitira, L. M. (2006). Herder knowledge of landscape assessments in arid rangelands in northern Tanzania. *Journal of Arid Environments*, *66*(1), 168; Scoones, I. (Ed.). (1995). *Living with Uncertainty*. London: Intermediate Technology Publications; Niamir, M. (1990). *Herders' decision-making in natural resources management in arid and semi-arid Africa* (No. 4). Rome: FAO.

Maasai and the Barabaig—identify as indigenous according to IFAD Report and IFAD and a Desktop-based Study on Indigenous Peoples by a Local Specialist (see Sections 4.8.3 and4.10.3 above).

The USAID study indicates that Zone 41 (Kibaha and Mrogoro districts, mid-west part of Phase I) is a mixed livelihood zone where a number of farmers and pastoralitst compete for the same resources, leading to conflict over resources (migration routes and water). Such conflicts are also common in Zone 44. Based on RAP Lot 2 findings, the District Land Officer in Kilosa indicated that while these disputes were previously numerous, the Tanzanian government's efforts to quell these tensions has been effective. The implementation of the Livestock Act of 2010 has subsequently provided guidance on the movement of livestock and regulates pastoralists and farmers alike. Pastoralists are assigned dedicated land for their livestock within each District. Pastoralists are required to first obtain permission from the Chairman or leadership of the village and to confirm that land will be set aside for them to move to. If pastoralists access land without following this process, they are made to leave.

Pastoralists rarely have enough herds to live by milk and meat alone, and therefore, their economy is based on the trade of livestock or livestock products in the markets in exchange for grains and other necessities. They also tend to engage in some food cultivation when possible (i.e. in areas where the rainfall is suitable and sufficient and if labour beyond the demands of animal husbandry is available). This being said, as described in the *Animal Farming and Livestock Rearing* Section above, livestock trade is not exclusive to pastoralists. Farmers also attempt to maintain some livestock even if only a goat or some poultry. According to the USAID study, farmers usually see the main value of the livestock in market terms, whether the sale of a few animals is an annual part of the household income or one fallback resource when times are particularly hard. In contrast, livestock rearing and sale is the main livelihood for pastoralists.

*Figure 4-35 FGD with Masai Pastoralist communities*

Source: RAP Socioeconomic Survey, April 2019

*Forest Resources*

Collection of forest products such as firewood for cooking and energy generation is common in rural areas in villages located close to forests. Along Phase I, villages around Pugu Forest Reserve in Zone 46 (Kisarawe District Council and Ilala District, east part of Phase I) collect firewood from the forest. Firewood collection near forested areas is also common, specifically in villages around the Ruvu South Forest in Zone 54 (Kibaha District Council, middle part of Phase I), and in Morogoro Rural District (Zone 46, west part of Phase I).

Forest related activities include timbering, the collection of firewood, the production and sale of charcoal, fishing, and wild honey production. In the field survey for RAP Lot 2 it was observed that reeds and other fibrous plants are also being harvested for use in thatching, weaving and other important livelihood activities.

Fishing is conducted mainly in Zone 21 in the Bahi swamps and in the Sulunga River (Singida district, west part of Phase II) and in Zone 54 (Kibaha District) in villages close to the Ruvu River. Fishing represents an alternative income-

generating activity for those who can afford the necessary inputs (nets, boats etc.). However, while occurring on a small subsistence scale in isolated parts of the social area of influence, it is not noted to be an important livelihood activity.

Some households close to the Lake Sulunga in Singida district (Zone 21, Bahi and Manyoni Districts in the west part of Phase II) also perform mining activities, but to a limited extent.

Charcoal production is widespread along the SGR route. Charcoal and wild honey sales supplement population's income in Morogoro and Kilosa Districts (Zone 46, mid-east part of Phase I), and meagrely in Mpwapwa, Chamwino and Dodoma Districts (Zone 55, mid-west of Phase II). Charcoal has been consumed in and around the YM construction camps. The consumption is likely to have resulted in an increased production of charcoal in surrounding areas. Tree resources are being depleted, and almost all charcoal is produced either illegally in reserves or from forests/woodland on village land in an unsustainable manner. During field surveys for RAP Lot 2 along the SGR route, extensive illegal charcoal production was observed within the Ruvu South Forest Reserve and to a lesser extent in the Pugu Hills Forest Reserve.

Due to the dependence of poor communities on natural resources both for income generation and for household consumption, there is a growing understanding of the important role forest and woodland resources play in supporting livelihoods, providing income for the rural poor and in sustaining important ecological services. Participatory Forest Management (PFM) has therefore been adopted as an official strategy in Tanzania to achieve sustainable forest management by encouraging the management or co-management of forest and woodland resources by the communities living closest to the resources themselves. PFM can contribute to improving rural livelihoods whilst protecting the environment and promoting gender-equality. A well managed catchment forest would also benefit a wide range of other stakeholders located far away from forests in the form of water for domestic use, hydroelectricity, tourism and carbon sequestration among others[1].

Timber production and sale is also present within the area, especially in Kisarawe District, north Kibaha (mid-east part of Phase I) and, to a lesser extent Kilosa District (Zones 44 and 46, east part of Phase II).

According to field survey for RAP Lot 2, the collection of medicinal plants, was said to be done by less than a third of communities and was more prevalent in

[1] Impacts to Ecosystem services, ERM 2019.

the most rural villages and hamlets in the Project footprint. Some plants mentioned in the FGD's that were used for medicinal purposes included Baobabs.

There is no hunting in the area. Hunting is mostly conducted by the Hadzabe hunter-gatherers living in lowland forest around Lake Eyasi, outside the Study Area.

*Commerce and Trade*

Commercial activities are usually carried out in residential areas or in designated areas within the villages and towns such as the village centre, neighbourhood centre and community centre. Enterprises are either run from the home, a small fixed location or from a mobile location usually within the village, or a nearby town. Commercial activities include retail shops selling goods/commodities, street or market vending, market traders, etc.

As for agriculture, crop sale is an important source of income for the population in the Study Area. Households grow fruits and crops and sell them to traders at local markets, who in turn take them to larger markets, such as Dar es Salaam or Dodoma. In the large markets, some of the products are exported to Kenya and Uganda. When located in a vicinity of an urban centre, producers can directly access large markets. People living next to the A7 highway in Zone 40 (Kilosa District, east part of Phase II) can trade with consumers and traders transiting the area.
As discussed previously, livestock trading constitutes a secondary income-generating activity especially for the wealthier households. Cattle and indigenous poultry are sold in many municipalities such as Kibaha or Morogoro (mid-east part of Phase I). The quantity of indigenous poultry sold a year depends on the wealth of the family. Poorer households may also be involved in livestock sales, but mostly chickens and goats.

*Other Livelihood Activities*

As a common livelihood pattern, most of the poorer households rely on agricultural production and paid work to meet most of their income needs. In order to supplement their crop incomes, some sell their labour to better-off household farms while others find seasonal work in urban centres, such as Dar es Salaam or Dodoma.

For example, in Zones 17 and 21 (west part of the Social Area of Influence), for many of the zone's poor, the harvest may last only a few months. As a result, they must sell their labor to be able purchase the necessary food and other

essentials. Most of the labor is performed in the zone with a minority of the laborers traveling to larger settlements or urban centres nearby such as Dodoma and Dar es Salaam for a few months in search of work.

Other sources of income may include formal employment such as teaching or government jobs, artisanal activities such as handcrafts and masonry, as well as small temporary jobs such as drivers, etc. Based on RAP Lot 2 findings for Phase II, around 6% of the population along Phase II of the line are government employees (teachers, police officers, ward executive officers, etc.), and another 6% are formal employees in the private sector. Other types of economic activities include self-employment in the informal sector such as transportation i.e. motorcycle (known as "bodaboda" in Swahili), small food vendors ("mama ntilie") and other entrepreneurship activities

### *4.10.9 Infrastructure and Services*

*Overview*

Access to basic infrastructure is limited, especially in rural areas. The main sources of water for domestic use are shallow wells, rainwater harvest tanks, boreholes and river water, piped scheme and dam. In some Districts, such as Ilala or Morogoro Rural District (mid-east part of the Phase I), availability of water supply is not sufficient to address the needs of the population.

*Housing Characteristics*

The pictures below show the different types of houses having different structures and construction materials. Earth mud or animal dung is the most common type of walling materials, followed by vibrated blocks, burnt blocks and other type of walling materials. Most houses have iron sheet roofing. In some Districts such as Zone 44 most households own bicycles and mobile phones. Better off households and some middle class households own motorcycles (some of which are used as motorcycle taxis or boda boda) or power tillers, which they use for their own harvesting and to rent out to others (USAID Report)[1]

[1] USAID Report (2014), Kilosa-Mvomero Maize &Paddy Lowlands Livelihood Zone Profile. September 2014

*Figure 4-36 Different types of houses with different structure and construction materials*


House in Chilwana street, Dodoma

House in Mkwatani street, Kilosa

House in Godegode village, Mpwapwa

House in Igandu village, Chamwino

Source: RAP Lot 2. SGR lot 2 socio-economic survey data, (2018-2019)

*Access to Water and Sanitation*

Along Phase I, the predominalt water sources include: (1) water sources that serve the community in their respective area; and (2) water sources found at plot levels. The project is likely to affect water sources present in Ilala and Morogoro Districts. In Ilala and Morogoro Rural District, access to water is currently not sustaining the needs of the population, especially in rural areas.

Along Phase II, the most common sources of water for domestic and farm / livelihood usage include unprotected wells, water piped into yard, running surface water, protected sources and surface water. Only a small percentage of the population have, water piped into dwelling.

*Figure 4-37 Water Sources*

Pipe water into yard in Kasiki street, Kilosa DC

Protected well in Mkwatani, Kilosa DC

Rain harvesting system in Muungano "B" street, DCC

Unprotected well in Chololo village, Chamwino DC

Source: RAP Lot 2. SGR lot 2 socio-economic survey data, (2018-2019)

Only a small percentage of households use an improved toilet facility, defined as any toilet facility using a flush system (inside and outside of the main building) to a piped sewer systems or septic tanks. The large majority of households use unimproved sanitation facilities, such as pit latrines, ventilated improved pit (VIP) latrines, pit latrines with/without slabs, composting toilets and unventilated pit latrines.

Unimproved toilet facilities (mainly unventilated pit latrines) are more likely to be found in rural areas, whereas most of improved toilet facilities (like flushed toilet outside the house) are found in urban areas. See *Figure 4-38* for examples of different types of sanitation facilities used per affected household.

*Figure 4-38 Different types of sanitation facilities used per affected household*

Flushed toilet inside house in Msangalale Mashariki, (Dodoma City Council)

Unventilated pit latrine in Igandu village, (Chamwino)

Source: RAP Lot 2. SGR lot 2 socio-economic survey data, (2018-2019)

*Energy Sources*

The localities of Phase I (RAP Lot 1) use a variety of available energy sources ranging from electricity, charcoal, gas, solar power, kerosene, candles, batteries, and firewood, depending greatly on the District. The costs for each source vary and therefore the chosen type of energy source is based on affordability, accessibility and reliability.

For Phase II, the use of solar power for lighting is widspread. Firewood is the main source of fuel for cooking followed by charcoal. Based on observations made during field visits, electricity is not available to large extent. For instance, in Dodoma City Council most of the houses are found in areas like Chidachi, Miganga, Bwawani, Muungano and Zuzu were electric power grids are yet to be connected to households. In Kilosa, the majority of households are found in rural areas like Mwasa, Mzanganza, Magulu and Munisagari where there is no electricity network at all. *Figure 4-39* below show solar panels on some houses in the project affected area.

*Figure 4-39 Modern house and house with solar power in Dodoma City Council*


Source: RAP Lot 2. SGR lot 2 socio-economic survey data, (2018-2019)

In this context, the economic status of Project affected households plays a significant role in selection of cooking energy that is affordable for the household. Observations on source of cooking energy were made during field visit. The below *Figure 4-40* show different types of cooking energy used by Project affected households.

*Figure 4-40 Different types of cooking energy used per affected household*

*Cooking gas from high income Project affected household in Msangalale Mashariki street, Dodoma City Council*

*Women from low income Project Affected Household with bundle of firewood collected in Gulwe village, Mpwapwa District*

Source: RAP Lot 2. SGR lot 2 socio-economic survey data, (2018-2019)

*Access to Healthcare*

The district health delivery system follows the national pyramid system having only two levels of health care service delivery: First level (Health Centres and Dispensaries) and Second level (Municipal hospitals). In general, there are poor health services and sanitation. Along Phase II specifically, facilities are very far from most households.

*Access to Education*

Along Phase I, three types of education facilities were identified during the RAP Lot 1 survey: (1) pre-primary schools (Ilala District), (2) primary schools; and (3) secondary schools. As for Phase II, more than half of the land-affected households reported having access to primary education, and to a lesser extent to secondary education. RAP Lot 2 socio-economic and census surveys indicated that primary schools were located nearby households. However, a wide majority of the respondents reported that secondary schools were very far from their households.

## 4.11 CULTURAL HERITAGE RESOURCES

### 4.11.1 Introduction

The cultural heritage resources of Tanzania represent a record of human activity that stretches back over 4 million years. The paleontological, archaeological, and ethnographic record in Tanzania contains valuable historical and cultural information on human development and activity from the Pliocene Epoch beginning in the Early Stone Age through the Middle and Late Stone ages; the Iron Age Bantu expansion; the growth and fluorescence of Swahili international trading centers on the coast during the 11$^{th}$-19$^{th}$ centuries; the late 19$^{th}$ –early 20$^{th}$ century European colonial period; and the modern period of the 20$^{th}$ and 21$^{st}$ centuries.

The Antiquities Division (AD) of the Tanzanian Ministry of Natural Resources and Tourism has created seven categories for the types of cultural heritage resources found in Tanzania and defined in the Antiquities Act (1964 and 1979):

- Archaeological or paleontological sites such as Olduvai Gorge, Laetoli Footprint, Isimila Stone Age site, and Engaruka Ruins;
- Historical sites such as Kaole Ruins, Kunduchi Ruins, Kilwa Kisiwani Ruins, and Songo Mnara Ruins;

- Historical towns such as Bagamoyo, Kilwa Kivinje, and Mikindani;
- Traditional settlements such as Kalenga in Iringa and Bweranyange in Kagera;
- Historic buildings like Colonial Administrative Buildings in many Districts in Tanzania;
- Sites with special memories like Colonialists Cemetery, Cemeteries of World War I and II, and Defensive Walls; and
- Natural features and structures such as Mbozi Meteorite, Amboni Caves, and Kondoa Rock Art Shelters (AD 2018).

The AD manages or controls 19 cultural heritage resources located across the country (*Table 4-43*). Three of those resources, Olduvai Gorge, Kilwa Kisiwani and Songo Mnara, and the Kondoa Rock Art sites are listed on the UNESCO World Heritage list. AD research indicates that as many as 128 cultural heritage resources are listed as protected resources in the National Gazette under the provisions of the Antiquities Act and that there are more than 500 additional significant cultural heritage resources known across the country (MNRT 2018).

***Table 4-43 Ministry of Natural Resources and Tourism, Antiquities Division Antiquities Sites (AD 2018)***

| Site Name | Region | District | Type of Heritage | Date/Period |
|---|---|---|---|---|
| Olduvia Gorge | Arusha | Ngorongoro | Stone Age Site/Paleontological Site | 1.75 million years ago. |
| Laetoli Footprint | Arusha | Ngorongoro | Footprints Site | 3.0-3.6 million years ago |
| Ambon Caves | Tanga | Tanga Urban | Geological Site | Not known |
| Tongoni Ruins | Tanga | Tanga Urban | Swahili Cultural Site | 14th century AD |
| Bagamoyo Historic Town | Coastal | Bagamoyo | Historic Town | 19th century AD |
| Kaole Ruins | Coastal | Bagamoyo | Swahili Cultural Site | 13th century AD |
| Kondoa Irangi Rock Art | Dodoma | Kondoa | Rock Art/Paintings | 5,000 years ago |
| Kwihara Livingstone Memorial Museum | Tabora | Tabora Urban | Historic Site | 19th century AD |
| Ujiji Livingstone Memorial Museum | Kigoma | Kigoma Urban | Historic Site | 19th century AD |

| Site Name | Region | District | Type of Heritage | Date/Period |
|---|---|---|---|---|
| Mbozi Meteorite | Mbeya | Mbozi | Geological Site | Not known |
| Isimila Site | Iringa | Iringa rural | Stone Age Site (Acheulian) | 100,00-40,000 years ago |
| Kalenga Museum | Iringa | Iringa Urban | National Monument | 19th century AD |
| Kilwa Kisiwani Ruins | Lindi | Kilwa | Early Coastal Settlement (late Iron Age) | 9th century AD |
| Songo Mnara Ruins | Lindi | Kilwa | Swahili Cultural Site | 14th century AD |
| Mikindani Historic Town | Mtwara | Mtwara Urban | Historic town | 19th century AD |
| Bweranyange Museum | Kagera | Karagwe | Iron Age Site | 13th century AD |
| Kunduchi Ruins | Dar es Salaam | Kinondoni | Swahili Cultural Site | 20th century AD |
| Magomeni Museum | Dar es Salaam | Kinondoni | Museum | 13th century AD |
| Engaruka Irrigation Furrows | Arusha | Monduli | Historic Irrigation System | 15th century AD |

Source: AD, 2018.

None of the above-listed sites is within the Project Area.

The seven categories established by the AD are aligned with the IFC PS 8 definition of tangible cultural heritage. In addition to these seven categories, the IFC PS 8 definition of cultural heritage includes what are typically described as "living heritage" sites/resources. These resources include the physical places, natural features, and associated objects that embody cultural values or are the locations where cultural traditions and practices take place. Examples of living heritage resources include religious structures (churches, mosques, shrines), sacred/ritual landscape features (groves, rocks, lakes, waterfalls, etc.), and modern memorial sites (graves and cemeteries).

The cultural heritage resource categories established by the AD and IFC PS 8 provide a framework for identifying the types of known cultural heritage resources and undiscovered/undocumented resources that could be present within the proposed Project Area.

### *4.11.2 Known and Potential Tangible and Intangible Cultural Heritage in Project Area*

Tangible cultural heritage resources have been identified across Tanzania *(Figure 4-41*). Examples of the types of resources within each of the seven DA categories are shown in *Figure 4-42* through *Figure 4-48*.

None of the example sites shown in the above figures is located within the proposed Project Area, and there are overall no known tangible and intangible cultural heritage sites within the Project Area.

*Figure 4-41 Map of Tanzania Showing Areas with Natural and Cultural Heritage (Mabulla and Bower 2010)*

*Figure 4-42 Olduvai Gorge archaeological and paleontological site (left) and an example of a typical Achulean chipped stone hand axe found at the site (right)*

Source: TTB 2018a and Alvarez, 2018.

*Figure 4-43 Isimila Stone Age (100,000-40,000 years before present [B.P.]) archaeological site (left) and examples of stone artefacts recovered from the site (right)*

Source: TE, 2018.

*Figure 4-44 Examples of the rock art found at the 5,000 year old, UNESCO World Heritage Kondoa Irangi Rock Art site*

Source: UNESCO, 2018.

*Figure 4-45 Ruins at the Late Iron Age/Early Coastal Settlement Kilwa Kisiwani site dated to the 9th century A.D*

Source: TTB, 2018.

*Figure 4-46 Ruins at the Swahili Cultural Site of Tongoni dated to the 14th century A.D. site*

Source: Kelly, 2018.

*Figure 4-47 Settlement and Irrigation System Ruins at the 15th century A.D. site of Engaruka*

Source: AO, 2018.

*Figure 4-48 Examples of 19th century buildings in the Mikindani Historic Town resource: Boma Hotel (left) and the Mikandani Church (right)*

Source: EAR 2018; van Zeijst, 2018.

Archaeological resources typically consist of discrete concentrations of artefacts (potsherds, chipped and ground stone tools, metal tools and/or weapons, iron slag, etc.), features (postmolds, floors, iron smelting remains, stone foundations, fire or storage pits, etc.), archaeological deposits (trash or midden deposits, occupation layers, etc.), and human burials. The depth at which archaeological sites are found depends on the local environment. In areas with little to no soil deposition (uplands such as hilltops and flat, open plains) sites can be found at or just below the ground surface. In areas of high soil deposition, such as the floodplains of rivers, sites could be deeply buried below meters of soil. Undiscovered archaeological sites dating from the Stone Age through Colonial Periods and similar to the Isimila, Kondoa Irangi, and Engaruka sites *could potentially be found* along the entire proposed Project Area: in rural settings, within towns and villages, and within larger urban centers.

Historic and/or traditional built heritage resources (buildings, structures, infrastructure, etc.) such as the buildings found in Mikindani are most likely to be found where sections of the Project right-of-way pass through or near existing towns and settlements.

### *4.11.3 Living Heritage in Project Area*

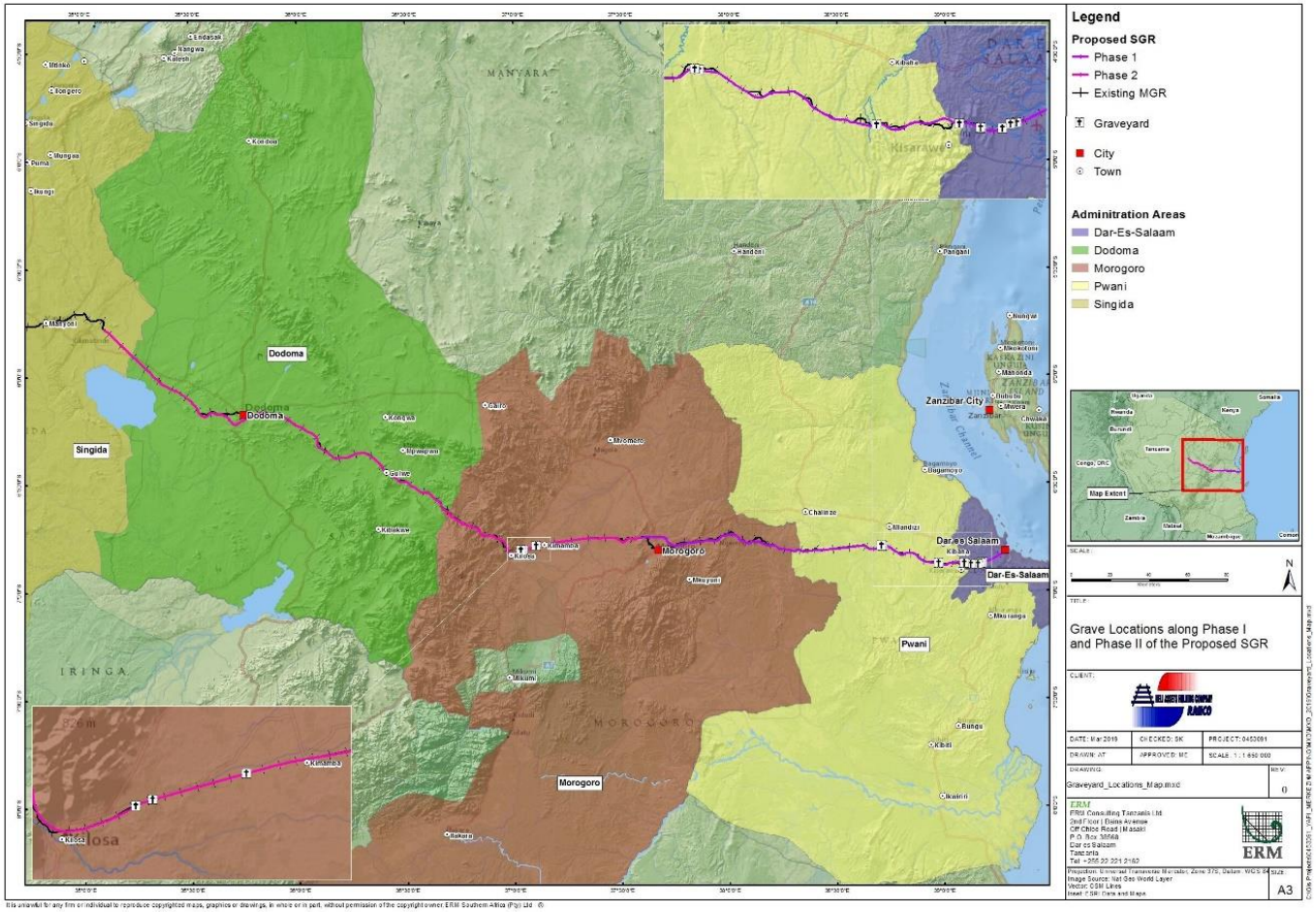
Living heritage resources such as religious structures, sacred landscape features, traditional folk/ritual sites, and memorial sites are likely to be found within and around settlements of all sizes. Natural landscape features and traditional folk/ritual sites may be found between settlement sites.

The cultural heritage baseline study team for this Project identified some the cemetery areas near or within the Project area of influence. Graves were one of the cultural sites observed to be near or within the RoW to be affected in the Project Area as listed in Table 4.43 and shown in Figure 4.49.

***Table 4-44 Locations of the graveyards along SGR alignment***

| Lot 1 (Km) | Lot 2 (Km) |
|---|---|
| 013+500 - 013+600 | 256+913 – 256+950 |
| 014+380 - 014+660 | 263+650 – 263+690 |
| 016+000 - 016+100 | 264+883 – 264+950 |
| 019+500-019+700 | |
| 019+700 - 019+800 | |
| 023+000 - 023+500 | |
| 023+400-023+450 | |
| 037+320-037+380 | |
| 068+900-069+000 | |
| 069+600-069+700 | |
| Number of graves to be displaced | |
| 1893 | 325 |

*Figure 4-49 Graveyards along SGR Alignment*



In addition, living cultural heritage that will be affected by the SGR Project are certain Baobab trees. Baobab is considered as cultural heritage to people living in Dodoma region; apart from the tress providing fruits and shades, they are also used for spiritual and healing rituals. Several Baobab trees will need to be cut down during construction of the railway.The villages which will mainly be affected are Chololo, Mnase, Msamalo, and Chimwaga villages. Figure 4.29 below shows Baobab trees which will be cut down in Msamalo village.

***Figure 4-50 Baobab trees found in Msamalo village (Lot 2)***

# 5 STAKEHOLDER CONSULTATION AND PARTICIPATION

## 5.1 OVERVIEW

Stakeholders include individuals, groups, organizations and institutions that may, in one way or another, either affect or be affected by (positively or negatively) the Project. The principal entities identified for this EIA Study included government ministries, departments or agencies at national, district and local levels, private companies, NGOs, community- based organizations, user groups and people directly affected by the project, such as goods and services providers.

This *Chapter* describes the approach used to identify and engage the identified stakeholders, and presents feedback regarding the potential impacts of the Project that were identified by stakeholders.

## 5.2 PUBLIC PARTICIPATION OBJECTIVES

Public consultation is an inclusive and culturally appropriate process which involves sharing information and knowledge, seeking to understand the concerns of others and building relationships based on collaboration. It allows stakeholders to understand the risks, impacts and opportunities of the Project in order to achieve positive outcomes.

The public participation process is designed to provide information to and receive feedback from stakeholders for use throughout the EIA process, thus providing them with an opportunity to raise concerns and make comments and suggestions regarding the Project.

The main aim of the consultation process as elaborated in an introductory part was to inform people about the proposed Project and incorporate the views of stakeholders in the design of the mitigation measures, Environmental and Social Management Plan (ESMP) and Resettlement Action Plan (RAP). The specific aims of the consultation process were to:

- Increase long term Project sustainability and ownership;
- Reduce problems of institutional coordination;
- Provide precise information about the Project to the communities along the proposed SGR;

- Obtain the main concerns and perceptions of the population and their representatives regarding the Project;
- Obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures; and
- Identified local leaders with whom further dialogue can be continued in subsequent stages of the Project.

## *5.3 LEGISLATIVE CONTEXT*

In Tanzania, the Environmental Impact Assessment and Audit Regulations (2005) regulate public participation (ie stakeholder engagement). Stakeholder engagement for the Project will follow all required steps of the GoT Regulations, ensuring that the ESIA for the Project includes adequate public participation (stakeholder engagement activities) and feedback for the EIA.

## *5.4 THE CONSULTATION PROCESS*

Identification of the relevant stakeholders as well as involving them in the entire ESIA study was guided by the Stakeholder Engagement Plan (SEP) developed for the Project, as introduced in *Chapter 1*, and provided separately.

The SEP has been prepared for the purpose of ensuring that a consistent, comprehensive, coordinated and culturally appropriate approach is taken to stakeholder engagement and Project disclosure throughout the ESIA. The SEP was also used as a tool to enable TRC to align with international best practice approaches for engaging stakeholders. Moreover, TRC is committed to full compliance with all Tanzanian EIA Regulations, as well as aligning to the international standards namely the IFC Performance Standards and any other directly relevant policies of the IFC and World Bank. To achieve this goal, a well-planned procedure for stakeholder consultation for the ESIA study was thus an imperative.

In line with current international best practice, the SEP aims to ensure engagement that is free of manipulation, interference, coercion and intimidation. It also aims to ensure that stakeholder engagement is conducted on the basis of timely, relevant, understandable and accessible information, in a culturally appropriate format. In this way, the SEP seeks to ensure that stakeholder groups are given sufficient opportunity to voice their opinions and concerns, and that these concerns influence Project decisions.

The SEP therefore:

- Outlines the approach to be adopted to engagement, showing how this will be integrated into the rest of the ESIA process;
- Identifies stakeholders and mechanisms through which they will be included in the ESIA process; and
- Serves as a way to document engagement undertaken throughout the ESIA.

Fundamentally, these consultations intended to disseminate project information and to collect feedback regarding the Project. Also they intended to collect information regarding sources of livelihood, living standards, and views and perceptions of stakeholders regarding the Project.

Characteristically, the agenda for these consultations included:

- Presenting the Project;
- Presenting the proposed routing of the railway (using maps);
- Defining the Regional/District institutional framework;
- Discussing the previous experience along the railway corridor with respect to compensation eligibility criteria and entitlement packages;
- Obtaining from the authorities their socio-economic concerns and perceptions regarding the proposed railway ; and
- Discussing the role of the authorities in public information dissemination, monitoring and in the implementation of the management plan.

## *5.5 CONSULTATION WITH TRL, REGIONAL, AND DISTRICT ADMINISTRATION*

Consultative meetings were held in all five regions traversed by the SGR, which includes Dar es Salaam, Coast, Morogoro, Dodoma and Singida. At regional and district levels, the consultations involved discussions with regional and district officers, specialists and other knowledgeable people. Specific consultations were undertaken with Regional Commissioners (RC), Regional Administrative Secretaries (RAS), Regional Secretariat experts, District Commissioners (DC), District Administrative secretaries (DAS), Chief Executive Officers (CEOs) of City/District/Municipal Councils, and Utilities agencies.

Such consultations had as their objective:

- To provide a briefing on the SGR Project;
- To define the Regional/District institutional framework;
- Discuss local experiences in the Region/District with respect to compensation eligibility criteria and entitlement packages; and
- Identify environmental and socio economic concerns and perceptions regarding the proposed Right of Way (ROW) of the SGR Project and discussion on the role of the authorities in public information dissemination, monitoring and management plan.

The EIA team also consulted Tanzania Railways Limited (Head Quarters) and major stations at Morogoro, Dodoma, Kilosa, Munisagara, Nzaganza, Kidete, Godegode, Gulwe, Kikombo, Ihumwa, Zuzu, Bahi, Kitinku and Makutupora.

Stakeholders consulted in each region are listed in *Table 5-1*.

***Table 5-1 Stakeholders Consulted in Each Region***

| Region | Institutions Consulted |
|---|---|
| Dar es Salaam | • Regional Commissioner Office<br>• Ilala District Council<br>• TRL (HQ) |
| Coast | • Regional Commissioner<br>• Kisarawe and Kibaha District Commissioners<br>• Kisarawe and Kibaha District Councils |
| Morogoro | • Regional Commissioner Office<br>• Morogoro Rural, Morogoro (Municipality), Kilosa, Mvomero and Gairo District Commissioners<br>• Morogoro Rural, Morogoro (Municipality), Kilosa, Mvomero and Gairo District Councils<br>• TRL Morogoro, Kilosa, Munisagala, Nzaganza, Kidete, Godegode, Gulwe, Kikombo |
| Dodoma | • Regional Commissioner Office<br>• Mpwapwa, Chamwino, Dodoma (Municipality), Bahi, District Commissioners<br>• Mpwapwa, Chamwino, Dodoma (Municipality), Bahi, District Councils<br>• TRL Dodoma, Ihumwa, Zuzu, Bahi, Kitinku and Makutupora Stations |
| Singida | • Regional Commissioner Office<br>• Manyoni District Commissioner<br>• Manyoni District Council<br>• TRL Kitinku and Makutupora Stations |

## 5.6 COMMUNITY CONSULTATION

*Meetings with Communities – Village and Ward Leadership*

Meetings were held with local leaders including ward and village officials for the wards/villages traversed by the railway. Meetings were held at ten settlements and were selected based on the following criteria: geographical setting, political setting, land use characteristics (urban/rural), locational aspects, and importance of the railway operation. These settlements included Pugu, Soga, Ngerengere, Mkata, Gulwe, Bahi, Kintiku, Zuzu and Makutopora.

Meetings with ward/village leaders focused on the existing socio-economic situation in the area and the need to identify clusters of people likely to be adversely affected by the Project. The discussions provided an opportunity to introduce the Project to the leaders and identify key informers. The meetings were also intended to encourage a community consultative approach, thus fostering a community participatory approach right from the initial stages of the proposed Project. Prior to holding meetings, notification by letter or mobile phone contact was made with the village/ward office to seek appointments.

A checklist was used to obtain relevant secondary data from the villages. The data collected were analysed manually by the ESIA team. The same data was then compared with that obtained from district profiles, and was used in the description of the baseline.

*Public Consultation with Villagers*

***Sample Villages***

Public meetings were conducted in all the sampled ten settlements. The following wards and/or villages were consulted by the study team during public consultation: Makutupora Station, Kinkintu, Bahi, Zuzu, Ihumwa, Mkata, Msamvu, Ngerengere, Soga and Pugu Station. Various aspects were used in selecting the villages including geographical location (villages were selected to cover the entire Project stretch), population size and land use (both rural and urban setting), ecological and cultural considerations.

***Project Information Disclosure***

In order to achieve an in-depth exchange of views and information an Informed Consultation and Participation (ICP) was anticipated through disclosure of information including providing information on:

- The purpose, nature, and scale of the Project;

- The duration of proposed Project activities;
- Any risks to and potential impacts on such communities and relevant mitigation measures;
- The envisaged stakeholder engagement process; and
- The grievance mechanism.

As such, the Agenda for the Community consultative meetings included:

- Presenting the SGR Project – verbal explanation (in Kiswahili) and also using maps;
- Presenting the proposed Row;
- Presenting way leave management features;
- Defining the local institutional framework and stakeholders;
- Obtaining from the local population their socio-economic concerns and perceptions regarding the proposed Row; and
- Facilitating identification by the communities of the main land uses and land tenure issues along the Row.

*Focus Group Discussions*

Focus group discussions were conducted. These focus groups comprised of women, ward leaders, economic venture groups, influential elders, self-help groups, sports team leaders, teachers, income-generating groups, livestock keepers, farmers, women, disabled, businessmen and women etc. It is assumed that population is stratified on basis of incomes ie low, middle and high incomes. The income levels determine affordability of basic needs and social services and other goods. The study ensured that all income levels were fairly represented and issues related to gender diversity were addressed.

*Household Questionnaires*

15 questionnaires were conducted in the 10 villages mentioned above. From the household questionnaires, quantitative information was obtained, while other sources gave qualitative information. Fifteen households per village were interviewed with emphasis on gender balance.

Individual household information plus the conclusions from focus group discussions contributed towards the baseline description.

*Figure 5-1 Meeting with Community of Mkata (L) and Ngerengere (R) village*

Source: ARU ESIA, 2018.

*Figure 5-2 Meeting with Community of Zuzu Village*

Source: ARU ESIA, 2018.

## 5.7 ISSUES RAISED BY STAKEHOLDERS

The following is the summary of major issues that were raised by stakeholders during stakeholder's consultation process.

In general, people consulted were eager to hear that a new rail system was being established. They acknowledged that the Standard Gauge railway line would promote agro-economic transportation of cash and food crops such as maize, beans, rice as well as other business and tourism activities. They believe that the Standard Gauge rail system upgrading will provide employment opportunities, greatly enhance social and economic interaction speed up travel by train.

## *5.8 ADDITIONAL STAKEHOLDER CONSULTATION ACTIVITIES*

The above text describes primarily the stakeholder consultation undertaken by Ardhi as part of the preparation of the Draft ESIAs in May/November 2018. During the finalisation of the ESIA in February and March 2019, additional interactions with stakeholders were undertaken by Ardhi and ERM. These included Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) at a number of villages to obtain further information on the baseline socio-economic conditions, including specific focus on pastoralists and ethnic minorities. The purpose of the consultations was also to inform the Resettlement Action Plans (RAPs) and livelihood restoration planning for both Lots 1 and 2.

The specific descriptions of these 2019 stakeholder surveys are provided in the RAP documents, as well as summarised in the social baseline section of Chapter 4 of this ESIA Report.

*Table 5-2 Summary of Issues Raised by Stakeholders and where the Issue Have been Addressed in the ESIA*

| Issues Raised by Stakeholders | Where the Issues Have been Addressed in the Report |
|---|---|
| **Land take and Compensation:** This issue was raised by almost all stakeholders consulted. Stakeholders think this is the main issue for this Project as it touches directly the lives of the people living near the proposed SGR. Stakeholders in Dar es Salaam and Mwanza are complaining that their houses have been demolished without compensation while they were outside of the railway reserve of 7.5m from the centerline while TRC used the RoW of 15m from the centerline. Stakeholders of Kisarawe, Kibaha also complained about the access road constructed by the contractor while neither valuation nor compensation have been done. Stakeholders advised that, for smooth implementation of the Project, valuation of properties must be conducted, and fair compensation paid before taking the land for the Project. | Section 2.5.2<br>Section 4.7.9<br>Section 9.1.1 |
| **Public Safety**: Stakeholders are afraid that the Project may increase accidents which might result in injuries and loss of lives. This is because, the Project will pass through human settlements and it crosses some existing roads. The safety concern raised from the fact that the train speed will be approx. 160 km/h in places, many people have never experienced this before. They advised that the rail line must be fenced and where the SGR cross the main roads, over passes should be provided rather than level crossings. | Section 2.5.2<br>Section 9.1.6 |
| **Employment:** The issue of employment during construction phase was raised by almost all stakeholders, the issue can be divided into four groups;<br>a. All unskilled labor must be sourced from the villages along the Project Area<br>b. All labor laws must be followed especially the provision of the minimum wage and registration to the pension funds<br>c. Recruitment process should be open and transparent, preferably local leaders should be involved directly. | Section 9.1.8<br>Section 9.1.9 |
| **HIV AIDS and other STDs:** This is a strong issue to address in the Project Area. Along the Project Area, there are several areas mostly hit by the pandemic disease. Stakeholders are worried that the project will lead to HIV and STDs transmission within camps and neighboring community due to influx of people working in the project area and job seekers. The data collected from Community development officer in every district along the Railway shows that the prevalence rate is 2 (at Mpwapwa). HIV AIDS sensitization program must be prepared and implemented during construction phase all along the Project Area. | Section 9.1.4<br>Section 9.1.7 |

| Issues Raised by Stakeholders | Where the Issues Have been Addressed in the Report |
|---|---|
| **Solid Waste Management during Construction**: Proper solid waste management during construction and operation phase was emphasized by stakeholders. During the construction phase there shall be a lot of vegetation from site clearing, packaging materials, debris etc. The contractor must have a good waste management plan to ensure that wastes are collected and disposed in a manner that it does not pollute the environment. All proposed temporary dumping area must be well investigated and approved by respective District/ Municipal Council before dumping start otherwise all waste for disposal must be disposed of at authorized dumpsites. | Section 2.5.2<br>Table 2.15 |
| **Liquid Waste Management during Construction Phase**: Sewage and Oils are the mail liquid wastes during construction phase. Stakeholders with experience from past liner projects raised this issue as they expect that workers when working far from the camp shall help themselves haphazardly on the environment since the toilets are provided only at the camp. Used oils at the camps and is also a big issue since it is categorized as Hazardous waste. Stakeholders had the opinion that if possible contractor should have mobile toilets which can be moved from one area to another then desludging should be done at the camp. Also the contractor must have adequate facilities to handle used oils at site before they are collected by authorized waste collector (by NEMC). | Section 2.5.2<br>Table 2.15<br>Section 9.1.5 |
| **Liquid Waste Management during Operation Phase**: Stakeholders (Especially) TRL expect that the sanitation system within the SGR shall be different from the one in the MTR. The trains must have enough capacity to hold wastewater for the whole period of the journey so that emptying should be done at the end stations. At the stations, there must be special conduits that can be attached to the train to drain the wastewater from the train to the designated area. | Section 2.5.3 |
| **Drainage, flooding and Sedimentation issues**: It was emphasized during consultations that the drainage channels should not be directed to the farms or settlement rather it should be directed to proper existing natural drainage channels. In addition, some parts of the project area either receives high rainfalls or located in flood prone areas. In these sections, flooding and huge sedimentation is usual during rain period. As such, there are many culverts and bridges, many of them may need improvement. Stakeholders in Kilosa and Mpwapwa have Identified Gulwe area to be a flood prone area and therefore needs special attention of the designer. The existing drainage system and detention dams have been highly affected by sedimentation. Stakeholders advise that detailed hydrological studies should be conducted to have a design that can accommodate the flows during rainy season. | Section 2.5.1<br>Section 2.5.2<br>Section 4.4.9<br>Section 4.4.10 |
| **Increased Traffic:** The SGR is expected to pass through district and regional towns as it traverses from Dar es Salaam to Mwanza. Stakeholders consulted are worried that if level crossings shall be provided where the railway crosses the road then the traffic congestion shall dramatically increase. The towns in subject are Dar es Salaam, Morogoro Town and Dodoma Town. They suggest that if possible, the SGR should divert these towns (Except for Dar es Salaam and Mwanza) or Overpass must be providing in all junctions that the railway cross the road. | Section 2.5.1 |

| Issues Raised by Stakeholders | Where the Issues Have been Addressed in the Report |
|---|---|
| **Provision of Service Ducts:** The new design of the railway line has to provide the service ducts/pipes for water and other services to accommodate the towns expansion with requisite service provisions. It was propose that the service ducts has to be provided at the interval of every 500m to 1000m or any depending on the technical aspects. | Section 2.5.1 |

# 6 IMPACT ASSESSMENT AND MITIGATION METHODOLOGY

## 6.1 INTRODUCTION

The impact assessment stage comprises a number of steps that collectively assess the manner in which the SGR Project will interact with elements of the physical, biological, cultural or human environment to produce impacts to resources/receptors. The steps involved in the impact assessment stage are described in greater detail below.

## 6.2 IMPACT ASSESSMENT

### 6.2.1 Impact Prediction

*Introduction*

The impact assessment process predicts and describes impacts that are expected to occur for different phases of the SGR Project. Where possible, impacts are quantified to the extent practicable, which may include hectares of land affected; increase in noise or air pollution levels above acceptable standards; volume of waste or water discharged, number of graves affected, etc.

For each impact, its significance is evaluated by defining and evaluating two key aspects:

- The ***magnitude*** of the impact; and
- The ***sensitivity*** of the feature or receptor that will be impacted.

*Impact Magnitude*

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. A magnitude rating tends to reflect a combination of the size of an area that may be affected, the duration over which the aspect may be altered, and the size, degree or scale of that change. In essence, magnitude is a descriptor for the degree of change that is predicted to occur in the resource or receptor.

For positive impacts (which are mostly socio-economic impacts) magnitude is generally categorised as 'Positive' unless sufficient information is available to support a more robust characterisation and to assign the degree of magnitude as Small, Medium or Large. For instance, if the number of jobs to be assigned to

local community members is confirmed or if the size or value of the contribution to the national, regional or district economy is known then a magnitude rating can be assigned. If not, then the significance rating is assigned based on the sensitivity of the feature impacted by a specific activity or change.
The term '***magnitude***' therefore encompasses all the characteristics of the predicted impact including:

- Extent;
- Duration;
- Scale;
- Frequency; and
- Likelihood (only used for unplanned events).

The definitions for characteristics of magnitude used during the impact assessment are summarised in *Table 6-1*.

***Table 6-1 Impact Characteristic Terminology***

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

The evaluation of pre-mitigation impact significance takes into account control measures that are already part of, or embedded within, the Project design. This avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls that are defined as part of the Project description. Examples of embedded controls could include acoustic reduction measures around noisy

equipment or servitude and buffer requirements the development is obliged to implement and is part of the layout. Additional mitigation measures aimed at further reducing the significance of impacts are proposed where necessary or appropriate and are assessed as part of the 'residual' impact significance rating.

In the case of ***type***, the designations are defined universally (i.e., the same definitions apply to all resources/receptors and associated impacts). For these universally defined designations, the definitions are provided in *Table 6-2*.

***Table 6-2 Designation Definitions***

| **Designation** | Definition |
|---|---|
| Type | |
| Direct | 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 | 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 | 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). |
| **Extent** | |
| Local | Impacts that affect an area in proximity to the development area within an area defined on a resource/receptor-specific basis. |
| Regional | Impacts occurring at a regional scale as determined by administrative boundaries or which affect regionally important resources or ecosystems. |
| International | Impacts that extend across international boundaries or affect resources such as features, resources or areas protected by international conventions. |
| **Duration** | |
| Temporary | Impacts are predicted to be of short duration (in the order of days) and/or intermittent/occasional. |
| Short-term | Impacts that are predicted to last only for the duration of the construction period (i.e. – 8 years). |
| Medium-term | Impacts that will continue for a period of 5 to 10 years following the completion of the construction phase e.g., where the impact may reverse or affected resources or receptors recover within this period of time. |
| Long-term | Impacts that will continue for the life of the Project, but will either cease when the Project stops operating or is decommissioned, or where the impact may reverse or the affected resource / receptor recovers or reverts to a near-natural state after 10 or within 20 years following the completion of the construction phase. |
| Permanent | Impacts that cause a permanent change in the affected receptor or resource (e.g., removal or destruction of ecological habitat) that endures substantially beyond 20 years following the completion of the construction phase. |

In the case of ***scale*** and ***frequency***, these characteristics are not assigned fixed designations, as they are typically numerical measurements (e.g., number of acres affected, number of times per day, etc.).

The terminology and designations are provided to ensure consistency when these characteristics are described in an impact assessment deliverable. However, it is not a requirement that each of these characteristics be discussed for every impact identified.

For unplanned events (e.g., accidental release of hazardous materials) the ***likelihood*** of the impact occurring is taken into consideration in deriving the magnitude rating. The likelihood of an impact occurring as a result of an unplanned event is expressed as a probability and is designated using a qualitative scale (or semi-quantitative, where appropriate data are available), according to the attributes described in *Table 6-3*.

***Table 6-3 Definitions for Likelihood Designations (only used for unplanned events)***

| Likelihood | Definition |
|---|---|
| Unlikely | The event is unlikely but may occur at some time during normal operating conditions. |
| Possible | The event is likely to occur at some time during normal operating conditions. |
| Likely | The event will occur during normal operating conditions (i.e., it is essentially inevitable). |

Likelihood is estimated on the basis of experience and/or evidence that such an outcome has previously occurred.

It is important to note that likelihood is a measure of the degree to which the unplanned event is expected to occur, *not* the degree to which an impact or effect is expected to occur as a result of the unplanned event. The latter concept is referred to as *uncertainty*, and this is typically dealt with in a contextual discussion in the impact assessment deliverable, rather than in the impact significance assignment process.

In the case of impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is utilised, but the 'likelihood' factor is considered, together with the other impact characteristics, when assigning a magnitude designation. There is an inherent challenge in discussing impacts resulting from (planned) Project activities and those resulting from unplanned events. To avoid the need to fully elaborate on an impact resulting from an unplanned event prior to discussing what could be a very low likelihood of occurrence for the unplanned event, this methodology

incorporates likelihood into the magnitude designation (i.e., in parallel with consideration of the other impact characteristics), so that the "likelihood-factored" magnitude can then be considered with the resource/receptor sensitivity/vulnerability/importance in order to assign impact significance. Rather than taking a prescriptive (e.g., matrix) approach to factoring likelihood into the magnitude designation process, it is recommended that this be done based on professional judgment, and assisted by quantitative data (e.g., modelling, frequency charts) where available.

Once the impact characteristics are understood, these characteristics are used (in a manner specific to the resource/receptor in question) to assign each impact a *magnitude*. In summary, magnitude is a function of the following impact characteristics:

- Extent;
- Duration;
- Scale;
- Frequency; and
- Likelihood.

Magnitude essentially describes the degree of change that the impact is likely to impart upon the resource/receptor. As in the case of extent and duration, the magnitude designations themselves (i.e., negligible, small, medium, large) are universally used and across resources/receptors, but the definitions for these designations will vary on a resource/receptor basis, as is discussed further below. The universal magnitude designations are:

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

The magnitude of impacts takes into account all the various dimensions of a particular impact in order to make a determination as to where the impact falls on the spectrum (in the case of adverse impacts) from negligible to large. Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes can

be regarded as essentially having no impact, and should be characterised as having a *negligible* magnitude.

*Sensitivity*

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity/vulnerability/importance of the impacted resource/receptor to the type of activity proposed (e.g., habitat clearance, topsoil removal, etc.) or the consequences of a Project activity (e.g., dust, noise, water pollution, or induced population influx). This requires a range of physical, biological, cultural or human factors to be taken into account and may also need to include other factors such as legal protection, government policy, stakeholder views and economic value.

Characterisation of sensitivity for a physical or biological resource or receptor (e.g., a water feature or parameter, cliff, vegetation type) will take into account its conservation status and importance (on a local, national and international scale), its vulnerability to disturbance, and its resilience to recover or withstand a specific impact or type of impact. Where the receptor is human or cultural, the value of that social and cultural heritage receptor/s and its vulnerability to the impact is considered, taking into account the receptor's resilience, including ability to adapt to change or use alternatives where available.

As in the case of magnitude, the sensitivity/vulnerability/importance designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis. The universal sensitivity/vulnerability/importance designations are:

- Low;
- Medium; and
- High.

*Evaluating Significance*

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterised, the significance of the impact is assigned using the impact significance matrix shown in *Table 6-4*.

For impacts resulting from unplanned events (typically accidents, such as a major oil spill or other event that cannot be reasonably foreseen), the above methodology is applied but likelihood is also considered when assigning the magnitude designation, as classified in *Table 6-2*.

*Table 6-4 Impact Significances*

| Evaluation of Significance | | Sensitivity/Vulnerability/Importance of Resource/Receptor | | |
|---|---|---|---|---|
| | | **Low** | **Medium** | **High** |
| **Magnitude of Impact** | **Negative Impacts** | | | |
| | **Negligible** | Negligible | Negligible | Minor |
| | **Small** | Negligible | Minor | Moderate |
| | **Medium** | Minor | Moderate | Major |
| | **Large** | Moderate | Major | Critical |
| | **Positive Impacts** | | | |
| | **Positive** | Minor | Moderate | High |

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

*Box 6.1* provides a context for what the various impact significance ratings signify.

***Box 6.1 Context of Impact Significances***

An impact of ***Negligible*** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of ***Minor*** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of ***Moderate*** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of ***Major*** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

An impact of ***Critical*** significance after all feasible mitigation measures have been identified and assessed warrants the highest level of attention and concern. As with residual impacts of major significance, the regulators and stakeholders will need to closely evaluate whether the positive impacts of the project outweigh residual negative impacts of critical significance. In many cases residual critical impacts can be considered as a potential fatal flaw of the project.

*Mitigation of Impacts*

Once the significance of a given impact has been characterised using the above mentioned methodologies, the next step is to evaluate what mitigation measures are warranted. In keeping with the Mitigation Hierarchy, the priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

It is important to have a solid basis for recommending mitigation measures. The role of any given ESIA is to help develop a consentable project, and to help clients meet their business objectives in a responsible manner. Impact

assessment is about identifying the aspects of a project that need to be managed, and demonstrating how these should be appropriately dealt with through implementation of the project Environmental and Social Management and Monitoring Plan (ESMMP). As key influencers in the decision making process, the role of the impact assessment is not to stop development or propose every possible mitigation or compensatory measure imaginable, but rather to make balanced judgements as to what is warranted, informed by a high quality evidence base.

Additional mitigation measures should not be declared for impacts rated as not significant, unless the associated activity is related to conformance with an applicable requirement. Further, it is important to note that it is not an absolute necessity that all impacts be mitigated to a not significant level; rather the objective is to mitigate impacts to an as low as reasonably practicable (ALARP) level.

As previously mentioned, embedded controls (i.e., physical or procedural controls that are planned as part of the project design and are not added in response to an impact significance assignment), are considered as part of the project (prior to entering the impact assessment stage of the impact assessment process).

*Residual Impact Assessment*

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

*Cumulative Impacts/Effects*

Cumulative impacts and effects are those that arise as a result of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. These are termed cumulative impacts and effects.

The impact assessment process will predict cumulative impacts/effects to which the Project may contribute. The approach for assessing cumulative impacts and effects resulting from the Project and another activity affecting the same resource/receptor is based on a consideration of the approval/existence status of the 'other' activity and the nature of information available to aid in predicting the magnitude of impact from the other activity.

A cumulative impact assessment for the Project is detailed in *Chapter 10* of this ESIA report.

# 7 IMPACTS TO THE PHYSICAL ENVIRONMENT

## 7.1 HYDROLOGY, WATER, AND FLOOD IMPACT ASSESSMENT

The predicted impacts of the proposed project to the hydrological environment are described in this *Section*. The impacts on the hydrological environment are based on the due diligence review of the Hydrology and Flood Risk reports for the Dar es Salaam to Morogoro Standard Gauge Railway Line Project.

### 7.1.1 Impacts on the Ruvu Floodplain (Operational)

*Description of the Baseline Environment*

The Ruvu River floodplain is an important part of the river system; it provides flood storage during periods of high flows and acts as a deposition zone for sediment and nutrients.

*Proposed Project Activities and Potential Impacts*

As an elevated transport link, the rail alignment potentially interferes with the natural drainage function of the floodplain. Rail embankments and hydraulic structures may encroach on the floodplain, restrict flow and affect the hydromorphology of the river. Under- designed structures can increase flood levels upstream due to a lack of hydraulic capacity of the structure. Crossings can constrict flood flows, forcing flood flows through a relatively narrow opening at a crossing point. This can increase bed and bank erosion, and alter sediment deposition damaging river habitats and crossing structures.

*Sensitive Resource / Receptors*

The Ruvu River is an important water source for Dar es Saalem and experiences high turbidity levels (FAO, 2009). The Ruvu floodplain provides important ecosystem goods and services. Higher upstream flood levels could affect agricultural land and nearby communities. The rail embankment may affect the hydromorphology of the river and impact on the natural migration of the main channel within the floodplain.

*Significance of Impact (Pre-Mitigation)*

The existing MGR alignment experiences regular issues with flooding. A due diligence review on the flood hydrology and hydraulic assessment for the proposed Dar es Salaam to Morogoro SRG line concluded that *the flood*

*estimation procedure was not in line with best practice, resulting in an underestimate of flood peaks and under designed hydraulic structures.*

Based on the conclusion of the due diligence report, the impact will be a "**major negative impact**" on flood risk and sediment dynamics pre-mitigation (refer to Table 7-1).

Pre-mitigation is based on the assumption that rail embankments will cross the floodplain as with the existing rail link.

*Mitigation Measures Proposed for the Ruvu Floodplain Crossing and Other Watercourse Crossings (Operational)*

ERM referred to the following commonly used technical standards and design guidelines, with specific reference to design flood estimation in ungauged catchments:

- Ministry of Works, Transport and Communication (MOWTC) Tanzania, Tanzania Low Volume Roads Manual 2016: Part D Design – Chapter 11 Hydrology and Design Structures;
- U.S Department of Transportation, Federal Highways Administration (FHWA) Hydraulic Design Series No.2 (HDS 2) – Highway Hydrology;
- South African National Roads Agency (SANRAL) - Drainage Design Manual, 6th Edition;
- Ethiopian Roads Authority (ERA) – Drainage Design Manual;
- Republic of Malawi Ministry of Transport and Public Works - Design Manual for Low Volume Sealed Roads using the DCP Design Method.
- Görgens, A.H.M. (2007) Joint Peak-Volume (JPV) Design Flood Hydrographs for South Africa. WRC Report No. 1420/3/07. Water Research Commission, Pretoria, South Africa.

The due diligence review of the Hydrology Report and Flood Risk Report for the proposed Dar es Salaam to Morogoro SRG line concluded that the imbedded project mitigation (i.e. hydraulic structures at watercourse crossings) *is inadequate due to an underestimation of the flood pea*ks.
A summary of the major limitations of the hydrology and flood risk reports:

1. The reports contain no description of rainfall data and flow data quality checks, the assumption is that no data quality checks were utilised. An illustration of this is with flow gauge 1HB2 where on several occasions the

annual maximum daily discharge is the same, to two decimal points, in consecutive years.

2. Only one method to estimate the flood peak used in each catchment size category.
3. The approach to the regional flood frequency analysis is a single site frequency analysis at each of the gauges. Application of an average of the individual growth factors for each gauge to the ungauged catchments. This approach does not address the limitations of having short observed records.
4. An application of one factor (1.15) to all gauges regardless of catchment size to convert daily flows to instantaneous values, which is required for flood frequency analysis. However, the difference between daily and instantaneous is greater for catchments 100 $km^2$ than it is for larger catchments of over 10 000 $km^2$ (Fill and Steiner, 2003; SWECO, 2004; Chen et. al., 2017).
5. Taking an average of the growth factors from all the single site frequency analysis. The average growth factor applied to all catchments ranging from 200 $km^2$ to >14000 $km^2$. However, the hydrological characteristics and dominant hydrological processes of a catchment with an area 200 $km^2$ are quite different to that of a catchment of over 10 000$km^2$. A different approach to the frequency analysis is required to account for this.
6. A brief description of potential climate change impacts on flows is given but the report does not state if there was an adjustment to the design flows to account for this.
7. Use of non-standard units such as l/s for flood peaks. Should use cubic metres per second ($m^3s^{-1}$).

Data checks of rainfall and flow recorded are of primary importance for flood studies in data sparse areas. When flood records of sufficient length (>20 years or so) exist for a regional pooled frequency analysis, possible future flood peaks of high recurrence interval design can be determined by modelling past floods with an extreme value distribution. Even in this beneficial position, it is best practice to crosscheck the frequency estimates with deterministic and empirical estimates. When applying a regional flood index method it is crucial to group catchments that are hydrologically similar and of similar catchment size. A clear and scientifically defendable approach to account for climate change impacts on extreme floods is required.

The mitigation to prevent an increase in upstream flood levels is to recalculate the flood peaks to allow for sufficient capacity in the hydraulic strictures. A

brief description of a best practice approach to flood peak estimation in data sparse areas is outlined below.

It is best practice to use more than one method in flood peak estimation (Pegram and Parak, 2004) which is likely to be a combination of empirical, deterministic and flood frequency methods. Some of recommended methods for flood peak estimation for use in the Tanzania context are:

- < 1 km2 Rational Method – it is appropriate to use one method for minor catchments;
- > 1-30 km2 Rational Method and SCS-SA;
- 30-200 km2 TRRL East Africa Flood Model, Regional Pooled Flood Frequency Analysis and Rational Method;
- >200-10000 km2 Regional Pooled Flood Frequency Analysis and the Channel Geometry Method (Wharton and Tomlinson, 1999) as a check.

*Data Quality Checks*

Single mass plots and double mass plots are a quick to way to check the data quality of both rainfall and flow data. The Mann-Whitney test can be applied to check for any statistically significant trends in the data. If the information is available, it useful to check for the correct application of the rating curve at each flow gauge.

*Design Rainfall*

Given the short data sets used to produce, the design rainfall in the TRRL storm rainfall study (Fiddes, 1974) additional design rainfall determination is required using longer datasets, ideally Probabilistic Rainfall Analysis (PRA) on the daily rainfall records at available stations. If the rainfall records are short, then a regionally pooled approach is recommended which, involves the standardisation of each of the annual maximum rainfall records by dividing each value by the mean of all the values in that record for area with similar rainfall. The resulting dimensionless values are "pooled" to form a large sample of dimensionless annual maximum flood peaks. For the determination of the design rainfall at given recurrence intervals, the Log-Pearson Type III (LPIII) and the General Extreme Value (method of moments) (GEVmm) annual exceedance probability distributions are the preferred distributions. The resulting dimensionless design rainfall is dimensionalised by multiplying the dimensionless recurrence interval values by the representative mean annual maximum rainfall value of the homogenous rainfall zone.

*Areal reduction factor*

The use of the TRRL areal reduction factor is appropriate (Fiddes, 1974).

*Daily Average and Instantaneous Flows*

Instantaneous flows are required in flood frequency analysis. Often due to manual flow gauges readings only daily average flows are available. A number of studies have presented methods to estimate instantaneous daily flows from mean daily flows (Fill and Steiner, 2003; SWECO, 2004; Chen et. al., 2017). The size and topography of the catchment influences the difference between the instantaneous and mean daily flow values. For example, an analysis of the flow gauges on Pugwe River in Mozambique found that to convert daily average flows to instantaneous values required an application of a factor 1.5 to a catchment of 700 $km^2$ and a factor of 1.2 to a catchment 8000 $km^2$ (SWECO, 2004).

*Empirical Methods*

The TRRL East Africa Flood Model (Fiddes, 1976) and Channel Geometry Method (Wharton and Tomlinson, 1999) are empirical flood estimation methods, and have application limitations, but provide a useful check when used in combination with other methods.

*Deterministic Methods*

The Rational Method and SCS-SA methodologies are deterministic approaches, which require design rainfall data as input to yield design flood peaks/hydrographs. The use of the SCS-SA method is normally limited to smaller catchments under 30 $km^2$. The Rational Method is more robust and has been applied successfully to larger catchments (SANRAL, 2013).

The SCS approach yields a full design flood hydrograph. The representation of the flood response of the catchment is by two quasi-physical parameters: Curve Number (CN) - a function of soil group, land-use, vegetation cover and antecedent soil moisture conditions; and Lag Time - a function of average catchment slope and length of the longest watercourse and CN.

The Rational Method yields a design flood peak only (i.e. no hydrograph). The flood response of the catchment expressed by two quasi-physical parameters: Runoff Coefficient, which is a function of average catchment slope, permeability, land-use, Mean Annual Precipitation, recurrence interval and Time of Concentration.

The derivation of the runoff coefficient used in the Rational Method and the curve number in the SCS-SA method is from published standards/ guidelines and the method used clearly documented. The SCS-SA method incorporates adaptations for southern Africa.

*Pooled Regional Flood Frequency Analysis*

An established international practice for ungauged sites is the execution of a Regionally Pooled (multi-catchment) probabilistic flood peak analysis (Görgens, 2007). The regional analysis approach is founded on the concept that reliable estimates of high recurrence interval design flood peaks might be attained by pooling annual flood maxima from a number of stations in a "region" with relatively homogeneous hydrological response characteristics. This method addresses the problem of short observed flow records. The Regional Pooled Flood Frequency Analysis methodology requires observed instantaneous annual maximum discharge records.

The pooling of stations is for hydrologically similar catchments and the pooling criteria guidelines are:

- similar relief and land-cover;
- catchment area of the same spatial scale as the study site;
- no large dams immediately upstream of the selected gauge;
- at least 20 years of reliable data (for a reliable estimate of the mean).

The index flood based regionally-pooled approach involves the standardisation of the annual maximum flood peak record at the streamflow gauging stations by dividing each value by the mean of all the values in that record. The resulting dimensionless values are "pooled" to form a large sample of dimensionless annual maximum flood peaks. For the determination of the design flood peaks, the Log-Pearson Type III (LPIII) and the General Extreme Value (method of moments) (GEVmm) annual exceedence probability distributions are the preferred distributions.

The resulting dimensionless design flood peak for any specific recurrence interval is dimensionalised by multiplying the dimensionless recurrence interval values by the representative mean annual maximum flood peak at the study site. The mean annual flood peak at each crossing is estimated from the relationship between catchment size and mean annual flood peak at the gauges used in the study.

*Climate Change*

A pragmatic and scientifically defendable approach to account for climate change impacts on floods is required. Climate change is further discussed in this *Chapter*.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact to Ruvu River floodplain will be a "**moderate negative impact"** post mitigation (refer to *Table 7-1*).

*Table 7-1 Rating of Impacts Related to increased upstream flooding on the Ruvu River floodplain (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Regional | Regionally important water resource. | Regional | Regionally important water resource. |
| **Duration** | Long-term | Flooding will occur every time there is a high flow that exceeds the hydraulic capacity of the drainage structures. | Long-term | Flooding will occur every time there is a high flow that exceeds the hydraulic capacity of the drainage structures. |
| **Scale** | High | The rail embankment will affect high flows and sediment dynamics. | Low | High flows can pass under the viaduct. |
| **Frequency** | Rare | Based on the modelling report made available upstream flooding is likely to occur several times during the life span of the infrastructure (as it does presently for the MGR). The sediment and nutrients affected annually during the high flows. | Once-off | High flows can pass under the viaduct if adequately designed for the 1:100 year flood. |
| **Likelihood** | Likely | The rail embankments blocks the floodplain so upstream flooding is likely. | Unlikely | Extreme flows can pass under the viaduct so upstream flooding is unlikely. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Large Magnitude** | | | **Medium Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Medium Sensitivity | | | | |
| The Ruvu River is a regional water resource, and the floodplain is an important part of the river system in terms of high flows, sediment and nutrients. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Major Impact | | | **Moderate Impact** | |

### *7.1.2 Alteration of Flow Regime (Operational)*

*Description of the Baseline Environment*

The proposed rail alignment crosses both perennial and seasonal watercourses as well as different rainfall regimes. To demonstrate this, the mean annual precipitation along the rail alignment ranges from 600mm at Dodma through to 1,150mm for Dar es Salaam at the coast. Towards the coast, the higher rainfall months are October to December and March to May, and at higher altitude towards Dodoma, the rainy season is from December to May.

*Proposed Project Activities*

The rain alignment crosses many watercourses (there are a total of 104 major catchments along the proposed SGR alignment) and if the hydraulic structures have insufficient capacity then the flow regime of the watercourse is affected and localised erosion is likely, which will increase river turbidity. Undersized hydraulic structures will restrict high flows and badly constructed culverts impede low flows.

*Sensitive Resource / Receptors*

Hydraulic structures with insufficient capacity would reduce upstream velocity in the river leading to increased sediment deposition and increase velocity downstream of the structure potentially increasing erosion rates and adding to the turbidity of the river.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact from the rail embankment and bridge/culvert on the flow regime will be a "**moderate negative impact**" pre-mitigation (refer to Table 7-2).

*Mitigation measures Proposed for Altered Flow Regime, Bank Erosion and Sediment Mobilisation at Water Crossings (Operational)*

Best practice in bridge and culvert design prevents and limits erosion and sediment mobilisation and limits alteration to the flow regime in the operational phase, these measures for bridges include:

- The bridge designed and constructed to accommodate all flow conditions;

- The bridge aligned perpendicular to the watercourse;
- The watercourse's natural hydraulic regime preserved as much as possible;
- The piers and footings placed beyond the channel and above the high water mark to avoid constricting the channel and reducing the flow area;
- Any piers and footings placed in the channel should be parallel to the flow to avoid directing flow onto the banks;
- The minimum number of optimally shaped piers used to minimise eddying and scouring of the watercourse;
- Erosion protection should be included if scouring is likely to occur.

Best practice culvert design practices provide good drainage, prevent erosion, and include the following:

- Water velocities in the culvert should be similar to those at the site before the culvert was constructed;
- There should also be no differences in the flow rates upstream, in and downstream of the culvert;
- The culvert should not reduce the cross-sectional area of the channel and infilling of the channel should be avoided;
- The culvert designed so that its hydraulics is similar to that of the watercourse, with culverts with a natural bed preferred.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact to the flow regime of the watercourse will be a "**minor direct impact**" post mitigation (refer to *Table 7-2*).

*Table 7-2 Rating of Impacts Related to water course crossings (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local/Regional | The extent of the impact depends on the size of the watercourse and its regional importance. | Local/Regional | The extent of the impact depends on the size of the watercourse and its regional importance. |
| **Duration** | Long-term | Impact will exist until the removal of embankment and structure. | Short-term | Flow potentially impeded only during construction. |
| **Scale** | Medium | Restricts high flows and impedes low flows. | Low | High flows and low flows can pass through the structure unimpeded. |
| **Frequency** | Often | Potentially affects both high and flow flows. | Once-off | High flows and low flows can pass through the structure unimpeded. |
| **Likelihood** | Likely | Structure and embankment potentially restricts high flows and impedes low flows | Unlikely | High flows and low flows can pass through the structure unimpeded. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Small Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Medium Sensitivity | | | | |
| Can constrict high flows and impede flow flows. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Moderate Impact | | | **Minor Impact** | |

### *7.1.3 Sediment Mobilisation and Hydrocarbon Spills at Water Crossings (Construction)*

*Description of the Baseline Environment*

The rail alignment crosses both perennial and seasonal watercourses and spans regions with differing rainy seasons and mean annual precipitation.

*Proposed Project Activities*

The rail alignment crosses many watercourses. During construction on embankments and hydraulic structures, there is a potential for sediment mobilisation and hydrocarbon spills.

*Sensitive Resource / Receptors*

Mobilised sediment would increase river turbidity locally and there is potential for a hydrocarbon spill to travel further downstream.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact from the rail embankment and bridge/culvert on the flow regime will be a "**minor negative impact**" pre-mitigation (refer to *Table 7-3)*.

*Mitigation Measures proposed for Sediment Mobilisation and Hydrocarbon Spills at Water Crossings (Construction)*

Prevention of sediment mobilisation in the construction phase by the use of silt traps and limiting work in the channel and not leaving bare soil exposed during the west season. These silt traps would need to be cleaned regularly. Mitigation measures include:

- Minimisation of in-stream works and timing of such works to avoid high flows:
- Interception, channelling and/or discharge of surface water from sumps, excavations and exposed soil surfaces to silt traps or settlement lagoons;
- Construction of silt traps, settlement ponds or hydrocarbon interceptors (either temporary or permanent) at sensitive outfalls at an early stage in the construction programme;

- Construction of cut-off ditches to prevent surface water run-off from entering excavations;
- Storage of fuel, oils and chemicals on an impermeable base, away from drains and watercourses
- Refuelling of plant and vehicles on impermeable surfaces, away from drains and watercourses; and
- Provision of spill kits at high risk and/or sensitive sites.

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures (refer to *Section 6.1.4*), the significance of the impact to the flow regime of the watercourse will be a "**negligible impact**" post mitigation (refer to *Table 7-3).*

*Table 7-3 Rating of Impacts Related to sediment mobilisation and hydrocarbon spill (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local/Regional | The extent of the impact depends on the size of the watercourse and time of year the water pollution occurs. | Local | High flows and low flows can pass through the structure unimpeded. |
| **Duration** | Short-term | Duration of the construction period. | Short-term | Duration of the construction period. |
| **Scale** | Medium | Impact would result in notable pollution but can be resolved over time. | Low | The impact would be of restricted nature. |
| **Frequency** | Occasional | Potentially affects both high and flow flows. | Once-off | High flows and low flows can pass through the structure unimpeded. |
| **Likelihood** | Likely | Potential for erosion at the water crossings. | Unlikely | Procedures in place to reduce the likelihood of water pollution. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Small Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Medium Sensitivity | | | | |
| Can constrict high flows and impede flow flows. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Minor Impact | | | **Negligible Impact** | |

### *7.1.4 Impact on Surface Water Quality*

*Description of the Baseline Environment*

The rail alignment crosses both perennial and seasonal watercourses (refer *to Table 7-4*) and spans regions with differing rainy seasons and mean annual precipitation. Baseline water quality shows that most water courses have high levels of turbidity and carry high sediment loads, which are exacerbated in the rainy season, and are primarily as a result of land clearance and deforestation, and poor farming practices in the affected river catchments. The other primary water quality parameter of concern in surface water is high faecal loads (reflected in high levels of *E. Coli*), due mainly to inadequate sewage infrastructure and treatment. No river crossings showed any traces of oil and grease contamination in surface waters.

***Table 7-4 Rivers Crossing the Railway and Other***

| S/N | Name of the River/reservoir/lake | Location (Region) | Chainage | Remarks |
|---|---|---|---|---|
| 1 | **Mpiji river** | **Coastal** | **38+500** | **Seasonal** |
| 2 | **Ruvu river** | **Coastal** | **76+750** | **Perennial** |
| 3 | **Ngerengere A river** | **Morogoro** | **131+320** | **Seasonal** |
| 4 | **Ngerengere B river** | **Morogoro** | **197+000** | **Seasonal** |
| 4 | **Mkata river** | **Morogoro** | **227+915** | **Perennial** |
| 5 | **Mkondoa river** | **Morogoro** | **280+150** | **Perennial** |
| 6 | **Kidete river** | **Morogoro** | **310 +388** | **Seasonal** |
| 7 | **Kidimo river** | **Dodoma** | **342+434** | **Seasonal** |
| 8 | **Msaze river** | **Dodoma** | **352+000** | **Seasonal** |

*Proposed Project Activities*

The proposed SGR will involve construction activities near or inside these watercourses. The project also require the storage, handling and use of dangerous or hazardous materials during the construction phase. Dangerous and hazardous materials include:

- Hydrocarbons (including diesel, greases, oils and other lubricants);
- Hazardous chemicals (viz. paints, etc.);
- Wastewater, including sewage; and
- Concrete batch plant and concrete washout.

The presence and use of such dangerous and hazardous chemicals increases the probability of accidental spills or releases of minor quantities of these materials into the receiving hydrological environments. In addition, the washing of equipment and vehicles, as well as dirty water run-off from different Project components has the potential to contaminate surface- and groundwater resources if not managed appropriately. Further, site preparation activities and associated construction of infrastructure can result in increased sediment loads in receiving watercourses.

*Sensitive Resource / Receptors*

The likelihood of sediment mobilisation and a hydrocarbon spill travelling to the watercourses is higher during the wet season. The surrounding communities depend of these water sources for domestic, livestock and agricultural use as do the downstream ecosystems.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the potential for pollution of these rivers/water bodies from the release of hazardous substances such as fuel, and through siltation of rivers resulting from construction in watercourses render the unmitigated impact of the SGR Project a "**moderate negative impact**" pre-mitigation (refer to *Table 7-5*).

*Mitigation Measures to Reduce Impacts on Surface Water Quality*

- The Project should consult with the Wami Ruvu Water Basin Office to confirm the need and applicability for water discharge permits/licenses necessary for the successful construction of the proposed SGR. Such discharge permits/licenses will be associated with effluent discharges (*viz.* stormwater and treated sanitary/domestic sewage). The Special Terms and Conditions associated with each Water Use Permit should be followed, and adherence to such should be monitored and confirmed through routine inspections and/or audits;
- Method Statements detailing spill emergency response and clean-up procedures for spills should be developed.
- Training regarding proper methods for transporting, transferring and handling hazardous substances that have the potential to impact surface- and groundwater resources should be undertaken.
- Areas where spillage of soil contaminants occurs should be excavated (to the depth of contamination) and suitably rehabilitated. If any other minor

spillage occurs the spillage should be cleaned immediately and the contaminated area should be rehabilitated. All contaminated material should be suitably disposed of.

- The washing of Project vehicles in any surface water bodies in and around the proposed Expressway should be prohibited. All Project vehicles should be washed at designated wash bays on site. These wash bays should include oil/grease and sediment traps for grey water.
- The *ad hoc* maintenance of vehicles in and around the area of the proposed Expressway should be prevented. All vehicles should be maintained at a designated workshop. The workshop should include containment berms and an oil/grease trap.
- All construction areas and associated facilities should be maintained in a good and tidy condition; debris and wastes should be contained in such a way that they cannot become entrained in surface run off during periods of heavy rain.
- Where practical, exposed surfaces and friable materials should be covered / sheeted.
- To the furtherest extent practicably possible, construction activities should be conducted > 60 m away from water bodies (in conformance to the requirements of the Water Resources Management Act, 2009), except where crossings are required.
- Sufficient toilets at active work areas should be provided for site staff and workers and these should be serviced regularly by a competent and suitably qualified person.
- The sewage treatment system should be managed in a manner that results in zero discharge of raw sewage to the environment, and if treated sewage is discharged into the environment then this should conform to recognised Tanzanian discharge standards prior to discharge (which will be prescribed in effluent discharge permits).
- All wastewater which may be contaminated with oily substances should be managed in accordance with an approved Waste Management Plan, and no hydrocarbon-contaminated water should be released into the environment.
- Fixed fuel storage infrastructure should be on flat, impermeable surface and surrounded by a bund with a volume of 110 percent of the volume of the storage tank(s), and fuel transfer at fixed stations should be performed on a concrete surface draining to a mechanical oil separator.
- Position Construction Camps, laydown areas and access roads as far as possible from local streams and rivers (e.g. > 60 m away from water courses

and on local high points, to minimise the risk of affecting surface water quality through the generation of silt (e.g.: by erosion) or waste (e.g.: from ablution facilities, refuelling of vehicles etc.).

- Chemicals storage and dispensing areas should be located no less than 500 m from surface water bodies, and in no instance should they be located within floodplains. Storage should be on flat, impermeable surface and surrounded by a bund or enclosed storage. To avoid siltation of rivers and other surface water bodies, soil stockpile should be located away from surface water bodies.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures the significance of the impact to the flow regime of the watercourse will be a "**minor negative impact**" post mitigation (refer to *Table 7-5*).

*Table 7-5 Rating of Impacts Related to Surface Water Quality (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local/Regional | The extent of the impact depends on the size of the watercourse and time of year the water pollution occurs. | Local | Any pollution event occurring with mitigation in place will likely be localised and clean-up procedures will ensure the extent remains site specific. |
| **Duration** | Medium-term | Duration of the construction period of 30 months. | Medium-term | Duration of the construction period of 30 months. |
| **Scale** | Medium | Impact would result in notable pollution but can be resolved over time. | Low | The impact would be of restricted nature, will remain localised and will be cleaned up as soon as possible. |
| **Frequency** | Occasional | Potential for erosion and pollution events, particularly at the water crossings | Occasional | Procedures in place to reduce the likelihood of water pollution. |
| **Likelihood** | Likely | Potential for erosion and pollution events, particularly at the water crossings. | Unlikely | Procedures in place to reduce the likelihood of water pollution. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Small Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| High Sensitivity | | | | |
| Communities and downstream users, including the ecosystem, depend on raw water for drinking and other purposes. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Moderate Impact | | | **Minor Impact** | |

### *7.1.5 Water Supply for Proposed Project Activities*

Water will be required for the following activities during construction:

- Water use by earthwork teams required for compaction;
- Water use for concrete production;
- Water use for dust suppression along service and access roads; and
- Water use in the camp sites.

Estimated water use for these activities is provided in *Table 7-6* below.

***Table 7-6 Estimates of Water Use per Activity***

| **Activity** | Required Water Use ($m^3$) |
|---|---|
| Compaction – Backfill | 160,000 |
| Compaction – Sub ballast | 40,555 |
| Concrete production | 167,000 |
| Dust suppression – Service and Access roads | 163,620 |
| Water use in camp sites<br>• Ngerengere:<br>• Soga<br>• Lugoba<br>• Marshalling Yard<br>• Ilala | 13, 335 |
| **Total** | **544,500** |

As per *Table 7-6,* the amount of surface water required for the different construction activities over the project construction period of 30 months, is estimated at 544,500 $m^3$.

The following surface water resources are planned to be used by the Project for dust control and construction purposes:

- Km 145+800 - Kinonko
- Km 148+600 - Kinonko
- Km 150+560 - Kinonko
- Km 150+600 - Kinonko

- Km 152+400 - Kinonko
- Surface water - Kibaha
- Swamp in Soga Ward
- Km 229+000 Mkata River
- Km 260+000 Chanzuru
- Km 270+000 Mkondoa

Over the operations period, water use is minimal, and will be limited primarily to domestic water use at the stations.

Estimated groundwater use per day for each camp (assumed at an average occupancy of 70% with an average water consumption per person per day of 120 litres per day), is estimated as per the figures provided in *Table 7-7* below.

***Table 7-7 Estimated Groundwater Use per camp***

| **Camp** | **Capacity** | **Daily Water use (in litres)** | Monthly Water Use (in $m^3$) |
|---|---|---|---|
| Ngerengere | 320 | 26, 880 | 806.40 |
| Soga | 760 | 63, 840 | 1,915.20 |
| Lugoba | 208 | 17,472 | 524.16 |
| Marshalling Yard | 163 | 13,692 | 410,76 |
| Ilala | 313 | 26,292 | 788.76 |

*Data courtesy of Yapi Merkezi*

Groundwater use will be regulated through the use of groundwater permits issued by the Wami Ruvu Water Basin Office.

*Impacts on the Community due to Usage of Water Resources by the Project*

The surrounding communities depend on their water sources for domestic, livestock and agricultural use, as do downstream ecosystems. Since the Project will use groundwater and surface water resources to supply water for the activities as

defined in this *Section,* the Project must ensure that those communities reliant on these water resources will not be negatively affected.

*Impacts caused by Groundwater Usage*

In order to understand the impacts of groundwater usage by the Project on the adjacent communities where boreholes will be utilised as a source of water supply, Lot 2 borehole pump test reports were evaluated; the results of which are provided in *Table 7-8*. Such data is not yet available for Lot 1, but the same evaluation must be carried out for these boreholes, and the mitigation measures committed to based on such data, must be committed to in the ESMMP.

*Table 7-8 Impact Assessment on Groundwater resources to be used by the Project:*

| Groundwater Well | Evaluation | Further Actions Required |
|---|---|---|
| KM 201 - Lukobe | Due to rapid recharge rates suggested by the recovery test, it's likely that the use of this borehole won't have an effect on the Morogoro.<br><br>Considering that the borehole's static water level is fairly shallow, agricultural crops in close proximity may be negatively affected. | EPC Contractor to verify if Morogoro town has any water supply wells in the surrounding area.<br><br>The Grievance records need to be checked to establish whether there were any grievances raised related to water supply.<br><br>Further investigations are needed to verify if agricultural crops in close proximity are affected. |
| KM 211 - Kimambila | The well is located in an apparently undeveloped area, should no groundwater wells be present here, abstraction from this well is unlikely to adversely affect communities. | EPC Contractor to verify if there are any wells near the livestock paddock and hut located 75m north of this borehole location.<br><br>The Grievance records need to be checked to establish whether there were any grievances raised related to water supply. |
| KM 215 - Kimambila | No nearby communities were identified, but a stream is located ~ 700m south from KM215, followed by agricultural areas south and southeast. It is considered unlikely that abstraction from this well will adversely affect communities. | The Grievance records need to be checked to establish whether there were any grievances raised related to water supply. |
| KM 229 (228+600 Mkata Camp) | The building located south of the road (210m northwest of the borehole) may be a school, and the potential for the presence of a borehole here should be investigated. The sandstone and limestone units are likely to be permeable and the effects of groundwater drawdown may be experienced over this distance. | EPC Contractor to verify if there are any boreholes at the addressed building (school).<br><br>The Grievance records need to be checked to establish whether there were any grievances raised related to water supply. |

| Groundwater Well | Evaluation | Further Actions Required |
|---|---|---|
| | | |
| KM 241 - Kimamba | Aerial imagery suggests that no communities or groundwater users are located nearby, therefore it is considered unlikely that abstraction from this well will adversely affect groundwater users. | The Grievance records need to be checked to establish whether there were any grievances raised related to water supply. |
| KM 249 - Kimamba | Due to rapid recharge rates suggested by the recovery test data, it is probable that the borehole usage wouldn't have an effect on the Kimamba Town, however the location of any water supply wells for Kimamba should be considered. Large cultivated areas are located west of here (based on available satellite imagery), however if these are currently present near the proposed well and make use of groundwater for irrigation, abstraction from this well may affect them. | EPC Contractor to verify if Kimamba town has any water supply wells in the surrounding area.<br><br>The Grievance records need to be checked to establish whether there were any grievances raised related to water supply.<br><br>Further investigations are needed to verify if irrigation is negatively affected by the Project water supply. |
| KM 264 – Ihumwa Camp | Due to rapid recharge rates suggested by the recovery test data, it is probable that the borehole usage could have a minimal effect on any shallow wells that may be present around nearby houses and no effect on the Kilosa town water supply. The construction of these well is not known (particularly the screened interval), and given that the groundwater is shallow (the static water level is ~3m), it is likely that any nearby wells are hand dug and shallow. If these boreholes are screened over a portion close to the surface, it is possible that they may adversely affect any private wells located nearby. | EPC Contractor to verify if there are any hand dug wells exist in the surrounding area.<br><br>The Grievance records need to be checked to establish whether there were any grievances raised related to water supply. |
| KM 424 – Kilosa Camp | Considering that the static water level in these boreholes is fairly shallow and that the area around these wells appears to be a seasonal wetland, excessive abstraction from these wells may adversely affect both local water users and ecological water users. Given the intensive agricultural activity around these boreholes, it is likely that shallow hand dug wells are | EPC Contractor to verify if there are any hand dug wells exist in the surrounding area.<br><br>The Grievance records need to be checked to establish whether there were any grievances raised related to water supply. |

| Groundwater Well | Evaluation | Further Actions Required |
|---|---|---|
| | present. The recovery of water levels in these wells was good, suggesting that if pumped at sustainable rates abstraction from these wells should not adversely affect other groundwater users. | |

*Mitigation Measures to reduce Impacts on Groundwater and Surface water resources*

The Project should develop **Surface and Groundwater Management Procedures** for both the construction and operation phases which should address the following requirements:

- Consultation with the Wami Ruvu Water Basin Office to obtain any groundwater permits/licenses required for the construction camps, in conformance to the requirements of the Water Resources Management Act of 2009. The Special Terms and Conditions associated with each Water Use Permit should be followed, and adherence to such should be monitored and confirmed through routine inspections and/or audits.
- Measures that should be applied to mitigate against the impact of surface water flow and quality resulting from the SGR include those listed for soil erosion (refer to *Section 7.1.3*).
- Assessments of the boreholes at Phase 1 water supply scheme and analysis of pump test data (if technically applicable) to avoid high abstraction rates to prevent subsequent impacts to sensitive social receptors.
- Engagement with the local community and verification of registered and unregistered wells (including hand dug wells) surrounding the water resources used by the Project to ensure that local wells and boreholes are not negatively affected.
- Provision of alternative water supplies to the local community in the case the Project affects the local sources of water supply in a negative way.
- Close monitoring of any grievances received related to community water supply.
- Implementation of a surface and groundwater quality and water use monitoring programme.
- maintenance of the following distances of waste water treatment infrastructure from boreholes and wells:
    - 50 meters from septic tanks, sewers;
    - 100 meters from pit latrines, soak-aways, trenches; and sub-surface sewage disposal fields.
    - 150 meters from cesspools, sanitary land field areas and graves.

- The following measures will be implemented in the case construction is required to take place in wetlands and inside of a watercourse:
    - Prevention of sediment mobilisation in the construction phase by the use of silt traps and limiting work in the channel and not leaving bare soil exposed during the west season. These silt traps would need to be cleaned regularly. Mitigation measures include:
        - Minimisation of in-stream works and timing of such works to avoid high flows.
        - Interception, channelling and/or discharge of surface water from sumps, excavations and exposed soil surfaces to silt traps or settlement lagoons.
        - Construction of silt traps, settlement ponds or hydrocarbon interceptors (either temporary or permanent) at sensitive outfalls at an early stage in the construction programme.
        - Construction of cut-off ditches to prevent surface water run-off from entering excavations.
        - Storage of fuel, oils and chemicals on an impermeable base, away from drains and watercourses.
        - Refuelling of plant and vehicles on impermeable surfaces, away from drains and watercourses; and
        - Provision of spill kits at high risk and/or sensitive sites.

*Mitigation Measures to reduce Impacts on Water Flow*

- Where possible, in-stream construction activities should be scheduled for during the dry season.
- Project infrastructure should be designed and located to minimise the impacts to natural water flow; see comments related to hydrology in *Section 7.1.1 and 7.1.2*
- To the furtherest extent possible, the disturbance of the natural topography and catchment characteristics should be minimised (e.g. limit large-scale earthworks, vegetation removal, soil compaction etc.), so as to not alter the natural flow characteristics of the rivers.

- Existing vehicles crossing points over rivers including bridges, fords, and causeways should be used as far as possible for temporary diversions in lieu of creating new crossings.
- Should new crossings have to be established these should be designed and constructed to international standards to minimise the risk of erosion, such as making use of gabions, fascines, concrete blocks with openings, and soil retention baskets.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures the significance of the impact to the flow regime of the watercourse will be a "**minor negative impact**" post mitigation (refer to *Table 7-9*).

*Table 7-9 Rating of Impacts Related to Surface and Groundwater Resources (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local/Regional | The extent of the impact depends on the size of the watercourse and time of year the water abstraction will occur. Groundwater abstraction likely more localised | Local | Abstraction will likely have a local impact, especially during the low flow periods. |
| **Duration** | Short-term | Duration of the construction period. | Short-term | Duration of the construction period. |
| **Scale** | Medium | Impact may affect users downstream | Low | The impact would be of restricted nature. |
| **Frequency** | Occasional | Throughout the construction period, but more frequent occurrence in the dry season | Occassional | Throughout the construction period, but more frequent occurrence in the dry season |
| **Likelihood** | Likely | Potential for impact on downstream water users in the low flow periods. | Possible | Procedures in place to reduce the likelihood of over abstraction. Permit conditions to be maintained. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Small Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| High Sensitivity | | | | |
| Downstream water users depend on surface water and shallow groundwater for sources of potable water, irrigation and livestock watering. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Moderate Impact | | | **Minor Impact** | |

## 7.2 *IMPACTS TO WETLANDS*

Apart from stream and river crossings, the SGR does also pass adjacent to and through wetlands. Specific impacts to wetlands are also discussed in the BAP (*Annex F*).

Wetlands and aquatic ecosystems are very sensitive to soil erosion and soil dumping which would result in an accumulation of sediments and high turbidity of the water. High sediment loads and increased turbidity means that light no longer penetrates the turbid water, which suppresses growth of aquatic plants, leads to die-off of fish and aquatic invertebrates, and has knock-on effects to many dependent food chains.

To avoid impacts to wetlands, the following mitigation measures apply in addition to the measures defined in BAP:

- Development within 60 meter buffers from wetlands and streams need to be avoided (in compliance to Clause 34 of the Water Management Act of 2009 and the Tanzanian Environmental Management Act of 2004), and where non-essential developments exist, these need to be removed.
- 60-meter buffers need to be delineated around all rivers, streams, water bodies and seasonal wetlands based on the high water mark during the high flow season.
- No extraction of soil, dumping of surplus soil, equipment laydown areas, development of access tracks is to be allowed within those buffer areas, within the exception of the authorized SGR route and adjacent service road.
- Stormwater management of construction sites should be planned in advance and implemented to separate clean and dirty water systems to avoid the transport of contaminants into aquatic systems.
- Potential contaminated sites, such as fuel and chemical storage areas, heavy equipment parking and maintenance stations should be tested for contamination prior to closure, and remediated in a manner that addresses all hazardous chemicals identified in the test results.
- Any contaminated sites that develop as a result of accidental spills should be remediated according to a Spill Management and Response Plan that will be

developed. Spill response kits should be available at sites where there is a high risk of contamination from fuels, oils and chemicals.

## 7.3 NOISE AND VIBRATION IMPACT ASSESSMENT

This section reports an assessment of the potential noise and vibration impacts that may arise from the construction and operation of the SGR Project. Baseline surveys have been carried out as defined in ESIA Chapter 4 "Baseline Environmental and Social Conditions"and sensitive noise receptors have been identified along SGR RoW, near quarries, borrow pits and camps to understand the potential noise impacts on these receptors and the mitigation measures to be implemented where needed.

### 7.3.1 *Baseline Conditions*

The main source of current noise pollution in the proposed SGR alignment are the locomotives currently using the existing MGR. Noise monitoring completed by TRC at Kisaki, Morogoro rural area show that the daytime noise levels ranged between 37.16 dB(A) and 67.72 dB(A) and for night-time ranged between 37.84 dB(A) and 43.44 dB(A). This is in comparison to the IFC Guidelines and National Environmental Standards Compendium General Tolerance Limits for Environmental Noise(1) of 55 dB(A) for the day and 45 dB(A) during the night, set for mixed residential landuse. Day time exceedances of the noise limits therefore do occur.

Noise monitoring completed by TRC at Kilosa station, Morogoro Region, taken on the 4th December 2015 between 13h00 to 15h00 (representing day time noise levels) and 05h00 and 06h00 (representing night time noise levels), indicated low average noise levels (40.2 to 44.2 DB(A)), with intermittent noise levels peaking at up to 66 dB(A) (train with no whistle) to 88 dB(A) (train with whistle).

Secondary data collected on vibrations indicate increased vibrations at the stations when the training is passing. The data indicates lower vibration at the railway line foundation than off-points close to the station. According to measurements done at Kilosa station in 2015 (as reported by TRC, 2016), an approaching train in the MGR recorded high vibration values of 8.3 mm/s.

(1) National Environmental Standards Compendium (Tanzania Bureau of Standards), EMDC 6 (1733) P 3: Acoustics - General Tolerance Limits for Environmental Noise

*Sensitive Receptors*

The recent field surveys by YM in March 2019 identified 59 noise sensitive receptors along the SGR alignment within 1000 m corridor including 2 residential areas close to rock quarry at KM 205+000 and borrow pit at KM 266+000 as listed in Table 7-10. The sensitive receptors have been identified by Community Liaison & Environmental team of YM by field studies; all receptor locations were visited.

*Table 7-10 Sensitive Receptors, their distances to RoW and Baseline Noise Levels*

| ID Number | District | Village | Receptor | KM Chainage | Distance to Alignment (m) |
|---|---|---|---|---|---|
| 1 | Ilala | Shauri moyo | Al Haramain Muslim School | 001+600 | 120 |
| 2 | Ilala | Shauri moyo | Mchanganyiko Secondary School | 001+600 | 173 |
| 3 | Ilala | Shauri moyo | Songea Mosque | 001+900 | 64 |
| 4 | Ilala | Mafuriko | Masjid (Mskitini) Dodoma | 002+750 | 65 |
| 5 | Ilala | Kipawa | Kipawa Health Center | 008+500 | 130 |
| 6 | Ilala | Kipawa | Ilala Secondary School | 008+900 | 70 |
| 7 | Ilala | Kipawa | Majani ya Chaia Secondary School | 008+750 | 110 |
| 8 | Ilala | Uwanja wandege | Kipawa Lutherian Church | 009+450 | 60 |
| 9 | Ilala | Kipawa | Ugombolwa Secondary School | 009+600 | 75 |
| 10 | Ilala | Stakishari | Winners Chapel International | 011+500 | 75 |
| 11 | Ilala | Sabasaba | Kingdom Heritage Model School | 011+450 | 55 |
| 12 | Ilala | Ukonga | Cardinal Rugambwa Hospital | 013+200 | 210 |
| 13 | Ilala | Gongo la mboto | Masjid Mariam | 015+400 | 110 |
| 14 | Ilala | Gongo la mboto | Rugwa Nursery Primary School | 017+600 | 110 |
| 15 | Ilala | Guruka kwa lala | Miuma wa Moto Church | 017+900 | 510 |
| 16 | Kibaha | Kikongo | Tumaini Primary School | 067+200 | 100 |
| 17 | Kibaha | Kikongo | Kikongo Dispensary | 067+200 | 270 |
| 18 | Kibaha | Ruvu | Ruvu Secondary School | 075+400 | 160 |
| 19 | Kibaha | Ruvu | Ruvu Primary School | 076+350 | 295 |
| 20 | Kibaha | Ruvu | Ruvu Station Masjid | 075+500 | 190 |
| 21 | Kibaha | Ruvu | Ruvu Hospital | 076+100 | 100 |
| 22 | Kibaha | Kwala | Kwala Primary School | 084+700 | 70 |
| 23 | Kibaha | Msua | Msua Primary School | 100+900 | 180 |
| 24 | Kibaha | Magindu | Magindu Primary School | 113+600 | 310 |
| 25 | Chalinze | Magindu | Magindu Clinic | 113+300 | 210 |
| 26 | Chalinze | Magindu | Keketi Church | 113+500 | 225 |
| 27 | Chalinze | Magindu | Masjidi Nour | 113+150 | 190 |

| ID Number | District | Village | Receptor | KM Chainage | Distance to Alignment (m) |
|---|---|---|---|---|---|
| 28 | Morogoro vijijini | Kidugalo | Kidugalo Primary School | 127+900 | 130 |
| 29 | Morogoro vijijini | Kidugalo | Kidugalo Dispensary | 129+750 | 220 |
| 30 | Morogoro vijijini | Mikese | Church of Kidugalo | 129+700 | 190 |
| 31 | Morogoro vijijini | Kinonko | Kinonko Masjid | 149+500 | 110 |
| 32 | Morogoro vijijini | Kinonko | Kinonko Secondary School | 149+700 | 180 |
| 33 | Morogoro vijijini | Mikese | Kinonko Dispensary | 149+850 | 120 |
| 34 | Morogoro vijijini | Mikese | Mikese Primary School | 163+200 | 140 |
| 35 | Morogoro vijijini | Mikese | Mikese Dispensery | 163+250 | 140 |
| 36 | Morogoro vijijini | Mikese | Mesjidi Bayillah Mikese | 163+300 | 350 |
| 37 | Morogoro vijijini | Mikese | Mikese Church | 163+200 | 395 |
| 38 | Morogoro vijijini | Mikese | Residential Area near Rock Quarry | 205+000 | 500 |
| 39 | Kilosa | Mkata | School | 224+100 | 200 |
| 40 | Kilosa | Kimamba | Church | 252+900 | 80 |
| 41 | Kilosa | Kimamba | School | 253+000 | 80 |
| 42 | Kilosa | Kichangani | Residential Area near Borrow Pit | 266+000 | 500 |
| 43 | Kilosa | Kimamba | Dispensary | 254+000 | 15 |
| 44 | Kilosa | Kichangani | School | 269+400 | 50 |
| 45 | Kilosa | Mtendeni | Mosque | 269+650 | 15 |
| 46 | Kilosa | Kasiki | Church | 270+700 | 175 |
| 47 | Kilosa | Kasiki | College | 271+000 | 65 |
| 48 | Kilosa | Kasiki | Church | 271+000 | 65 |
| 49 | Kilosa | Munisigara | School | 284+300 | 40 |
| 50 | Kilosa | Munisigara | Dispensary | 284+500 | 85 |
| 51 | Kilosa | Kikundi | School | 301+100 | 145 |
| 52 | Kilosa | Kidete | School | 310+800 | 65 |
| 53 | Kilosa | Kidete | School | 311+150 | 60 |
| 54 | Mpwapwa | Godegode | School | 332+100 | 200 |
| 55 | Mpwapwa | Godegode | School | 332+450 | 100 |
| 56 | Mpwapwa | Gulwe | School | 352+800 | 185 |

| ID Number | District | Village | Receptor | KM Chainage | Distance to Alignment (m) |
|---|---|---|---|---|---|
| 57 | Mpwapwa | Msagali | School | 368+000 | 200 |
| 58 | Chamwino | Igandu | Dispensary | 388+000 | 150 |
| 59 | Dodoma City Council | Makulu/ Msangalale | School | 438+500 | 300 |

### *7.3.2 Impacts on Noise and Vibration from Construction Activities*

Noise impact from construction activities will arise principally from the following activities:

- construction of the Railway itself;
- construction of the structures (bridges, stations, overpasses, tunnels, etc.)
- excavation and preparation of construction materials in quarries or borrow pits; and
- transportation of excavated and construction materials.

Noise impacts can be caused by noise emissions from construction equipment (earthmovers, etc.), and construction vehicles carrying materials and spoil to and from the locations where work is taking place along the Railway.

Therefore, the sources and extent of noise impacts have been included in this assessment as far as is possible given the current state of knowledge regarding the location and activities that will take place at the quarry and borrow pit sites.

Construction of the Railway will progress along the route, and will result in a noise impact on a relatively short-term basis (typically some weeks/few months) at most of the receptors as the construction approaches and moves past each settlement. However, noise impacts at quarries/ borrow puts will have long-term impacts due to aggregate supply during entire construction period.

*Methodology and Modelling Parameters*

Tanzanian Standard limits (TBS – NESC) and WHO/IFC guidelines require noise emission levels to be less than 45 dBA during the night (23h00 to 07h00) and 55 dBA during the day (07h00 to 23h00) within mixed residential areas.

The overall evaluation of *significance* of construction noise impacts is based on two aspects: (i) the impact *magnitude* and (ii) the *size/sensitivity* of the affected receptors. As shown in *Table 7-11*, the noise impact *magnitudes* in this ESIA are based on the amount by which a noise level exceeds a relevant Tanzanian regulatory/IFC noise limit. If the noise level exceeds an applicable Tanzanian regulatory/IFC noise limit by less than 10 dB (A), the magnitude of impact is classified as *medium*. An impact

that is 10 dB (A), or more, above the limit the magnitude of the impact is classed as *large*. A noise increase of 10 dB (A) is generally perceived to be twice as loud.

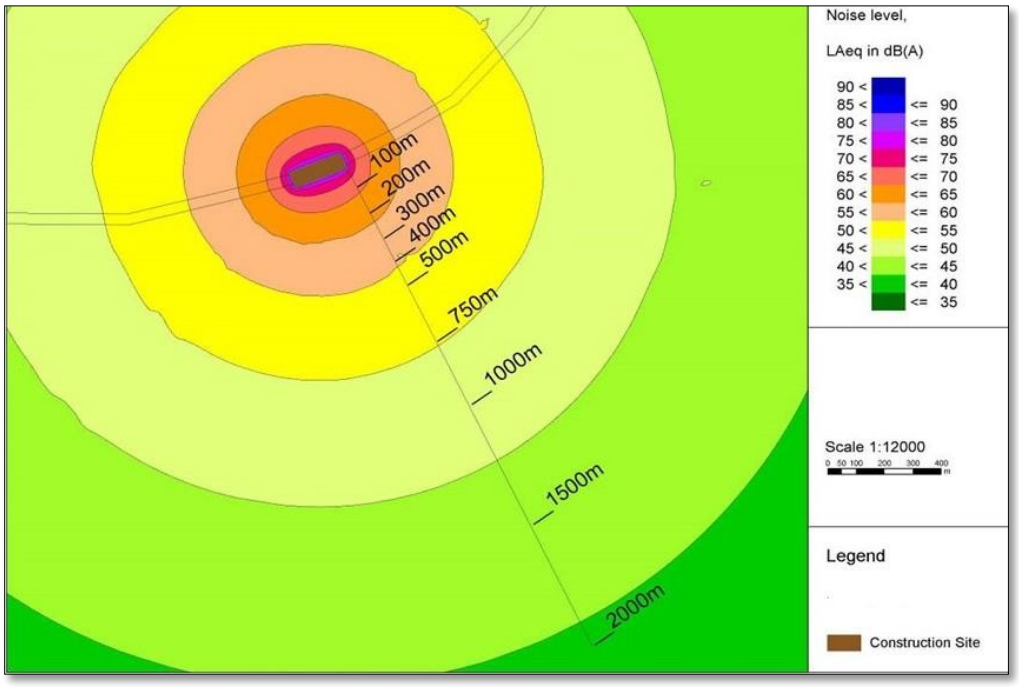
The classification of *sensitivity* depends on the range of potentially affected residential buildings or the presence of particularly sensitive use (*e.g.* school, hospital, mosques, churches, etc.). Based on present information on the settlements along the Railway route, there are 59 hospitals, schools, mosques and churches within a distance of 500 m to the alignment, and such *sensitivity* is considered as *high*.

***Table 7-11 Evaluation of Significance for Construction Noise***

| **Sensitivity/ Value of Resource/ Receptor** | **Magnitude of Impact** | | |
|---|---|---|---|
| | **Negligible/Small** (Does not Exceed Tanzanian Regulations/ IFC Noise Limits) | **Exceeds Tanzanian Regulations / IFC Noise Limits** | |
| | | **Medium** (Exceeds by 0-10 dB(A)) | **Large** (Exceeds by 10 dB(A) or more) |
| **Low - (Few residential buildings)** | **Not significant** | **Minor** | **Moderate** |
| **High – (Schools, hospitals, churches, mosques)** | **Not significant** | **Moderate** | **Major** |
| Tanzanian Standard limits (TBS – NESC) and WHO/IFC guidelines require noise emission levels to be less than 45 dBA during the night (23h00 to 07h00) and 55 dBA during the day (07h00 to 23h00) within mixed residential areas. | | | |

*Figure 7-1* shows noise contours calculated for an example railway construction site. This approach provides a conservative prediction of construction noise as it is unlikely that all equipment will operate simultaneously, and topographic structures may hinder the free propagation of noise. No specific mitigation measures beyond the use of modern and/or well-maintained equipment was included in this prediction.

*Figure 7-1 Illustrative Noise Modelling of Construction of the Railway*




Tanzanian Standard limits (TBS – NESC) and WHO/IFC guidelines require noise emission levels to be less than 45 dBA during the night (23h00 to 07h00) and less than 55 dBA during the day (07h00 to 23h00) within mixed residential areas.

Table 7.12 shows the significance of impacts during daytime and night time without any implemented mitigation measures, based on the distances of the sensitive receptors to the construction site and predicted noise levels in accordance with Figure 7.2.

Significance of impacts during night time at schools are not applicable since the schools are not open during those hours.

*Table 7-12 Significance of Impact from Railway Construction (Pre-Mitigation)*

| ID Number | District | Village | Receptor | KM Chainage | Distance to Alignment (m) | Sensitivity | Predicted Noise Level dBA (Figure 7.2) | Significance of Impact Daytime | Significance of Impact Nighttime |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Ilala | Shauri moyo | Al Haramain Muslim School | 001+600 | 120 | High | 65-70 | Moderate | NA |
| 2 | Ilala | Shauri moyo | Mchanganyiko Secondary School | 001+600 | 173 | High | 60-65 | Moderate | NA |
| 3 | Ilala | Shauri moyo | Songea Mosque | 001+900 | 64 | High | 70-75 | Major | Major |
| 4 | Ilala | Mafuriko | Masjid (Mskitini) Dodoma | 002+750 | 65 | High | 70-75 | Major | Major |
| 5 | Ilala | Kipawa | Kipawa Health Center | 008+500 | 130 | High | 65-70 | Moderate | Major |
| 6 | Ilala | Kipawa | Ilala Secondary School | 008+900 | 70 | High | 70-75 | Major | Major |
| 7 | Ilala | Kipawa | Majani ya Chaia Secondary School | 008+750 | 110 | High | 65-70 | Moderate | NA |
| 8 | Ilala | Uwanja wandege | Kipawa Lutherian Church | 009+450 | 60 | High | 70-75 | Major | Major |
| 9 | Ilala | Kipawa | Ugombolwa Secondary School | 009+600 | 75 | High | 70-75 | Major | NA |
| 10 | Ilala | Stakishari | Winners Chapel International | 011+500 | 75 | High | 70-75 | Major | Major |
| 11 | Ilala | Sabasaba | Kingdom Heritage Model School | 011+450 | 55 | High | 70-75 | Major | NA |
| 12 | Ilala | Ukonga | Cardinal Rugambwa Hospital | 013+200 | 210 | High | 55-60 | Moderate | Major |
| 13 | Ilala | Gongo la mboto | Masjid Mariam | 015+400 | 110 | High | 65-70 | Moderate | Major |
| 14 | Ilala | Gongo la mboto | Rugwa Nursery Primary School | 017+600 | 110 | High | 65-70 | Moderate | NA |
| 15 | Ilala | Guruka kwa lala | Miuma wa Moto Church | 017+900 | 510 | High | 50-55 | Minor | Moderate |
| 16 | Kibaha | Kikongo | Tumaini Primary School | 067+200 | 100 | High | 65-70 | Moderate | NA |
| 17 | Kibaha | Kikongo | Kikongo Dispensary | 067+200 | 270 | High | 55-60 | Minor | Moderate |
| 18 | Kibaha | Ruvu | Ruvu Secondary School | 075+400 | 160 | High | 60-65 | Moderate | NA |
| 19 | Kibaha | Ruvu | Ruvu Primary School | 076+350 | 295 | High | 55-60 | Minor | NA |
| 20 | Kibaha | Ruvu | Ruvu Station Masjid | 075+500 | 190 | High | 60-65 | Moderate | Major |
| 21 | Kibaha | Ruvu | Ruvu Hospital | 076+100 | 100 | High | 65-70 | Moderate | Major |
| 22 | Kibaha | Kwala | Kwala Primary School | 084+700 | 70 | High | 70-75 | Major | NA |
| 23 | Kibaha | Msua | Msua Primary School | 100+900 | 180 | High | 60-65 | Moderate | NA |
| 24 | Kibaha | Magindu | Magindu Primary School | 113+600 | 310 | High | 55-60 | Minor | NA |

| ID Number | District | Village | Receptor | KM Chainage | Distance to Alignment (m) | Sensitivity | Predicted Noise Level dBA (Figure 7.2) | Significance of Impact Daytime | Significance of Impact Nighttime |
|---|---|---|---|---|---|---|---|---|---|
| 25 | Chalinze | Magindu | Magindu Clinic | 113+300 | 210 | High | 55-60 | Minor | Moderate |
| 26 | Chalinze | Magindu | Keketi Church | 113+500 | 225 | High | 55-60 | Minor | Moderate |
| 27 | Chalinze | Magindu | Masjidi Nour | 113+150 | 190 | High | 60-65 | Moderate | Major |
| 28 | Morogoro vijijini | Kidugalo | Kidugalo Primary School | 127+900 | 130 | High | 65-70 | Moderate | NA |
| 29 | Morogoro vijijini | Kidugalo | Kidugalo Dispensary | 129+750 | 220 | High | 55-60 | Minor | Moderate |
| 30 | Morogoro vijijini | Mikese | Church of Kidugalo | 129+700 | 190 | High | 60-65 | Moderate | Major |
| 31 | Morogoro vijijini | Kinonko | Kinonko Masjid | 149+500 | 110 | High | 65-70 | Moderate | Major |
| 32 | Morogoro vijijini | Kinonko | Kinonko Secondary School | 149+700 | 180 | High | 60-65 | Moderate | NA |
| 33 | Morogoro vijijini | Mikese | Kinonko Dispensary | 149+850 | 120 | High | 65-70 | Moderate | Major |
| 34 | Morogoro vijijini | Mikese | Mikese Primary School | 163+200 | 140 | High | 65-70 | Moderate | NA |
| 35 | Morogoro vijijini | Mikese | Mikese Dispensery | 163+250 | 140 | High | 65-70 | Moderate | Major |
| 36 | Morogoro vijijini | Mikese | Mesjidi Bayillah Mikese | 163+300 | 350 | High | 55-60 | Minor | Moderate |
| 37 | Morogoro vijijini | Mikese | Mikese Church | 163+200 | 395 | High | 55-60 | Minor | Moderate |
| 38 | Morogoro vijijini | Mikese | Residential Area near Rock Quarry | 205+000 | 500 | High | 50-55 | Minor | Moderate |
| 39 | Kilosa | Mkata | School | 224+100 | 200 | High | 60-65 | Moderate | NA |
| 40 | Kilosa | Kimamba | Church | 252+900 | 80 | High | 70-75 | Major | Major |
| 41 | Kilosa | Kimamba | School | 253+000 | 80 | High | 70-75 | Major | NA |

| ID Number | District | Village | Receptor | KM Chainage | Distance to Alignment (m) | Sensitivity | Predicted Noise Level dBA (Figure 7.2) | Significance of Impact Daytime | Significance of Impact Nighttime |
|---|---|---|---|---|---|---|---|---|---|
| 42 | Kilosa | Kichangani | Residential Area near Borrow Pit | 266+000 | 500 | High | 50-55 | Minor | Moderate |
| 43 | Kilosa | Kimamba | Dispensary | 254+000 | 15 | High | 75-80 | Major | Major |
| 44 | Kilosa | Kichangani | School | 269+400 | 50 | High | 70-75 | Major | NA |
| 45 | Kilosa | Mtendeni | Mosque | 269+650 | 15 | High | 75-80 | Major | Major |
| 46 | Kilosa | Kasiki | Church | 270+700 | 175 | High | 60-65 | Moderate | Major |
| 47 | Kilosa | Kasiki | College | 271+000 | 65 | High | 70-75 | Major | Major |
| 48 | Kilosa | Kasiki | Church | 271+000 | 65 | High | 70-75 | Major | Major |
| 49 | Kilosa | Munisigara | School | 284+300 | 40 | High | 75-80 | Major | NA |
| 50 | Kilosa | Munisigara | Dispensary | 284+500 | 85 | High | 70-75 | Major | Major |
| 51 | Kilosa | Kikundi | School | 301+100 | 145 | High | 65-70 | Moderate | NA |
| 52 | Kilosa | Kidete | School | 310+800 | 65 | High | 70-75 | Major | NA |
| 53 | Kilosa | Kidete | School | 311+150 | 60 | High | 70-75 | Major | NA |
| 54 | Mpwapwa | Godegode | School | 332+100 | 200 | High | 60-65 | Moderate | NA |
| 55 | Mpwapwa | Godegode | School | 332+450 | 100 | High | 65-70 | Moderate | NA |
| 56 | Mpwapwa | Gulwe | School | 352+800 | 185 | High | 60-65 | Moderate | NA |
| 57 | Mpwapwa | Msagali | School | 368+000 | 200 | High | 60-65 | Moderate | NA |
| 58 | Chamwino | Igandu | Dispensary | 388+000 | 150 | High | 65-70 | Moderate | Major |
| 59 | Dodoma City Council | Makulu/ Msangalale | School | 438+500 | 300 | High | 55-60 | Minor | NA |

Based on the above given significance assessment, the following can be concluded (in absence of any further mitigation):

- Daytime and night time construction will cause *major* noise impacts for the sensitive receptors located within a distance of 100m to the site.
- Daytime construction will cause *moderate* noise impacts for the sensitive receptors located within a distance of 100 m - 200m to the site. However, night time construction will cause *major* noise impacts.
- Daytime construction will cause *minor* noise impacts for the sensitive receptors located within a distance of 200m - 500 m to the site. However, night time construction will cause *moderate* noise impacts.

*Mitigation/ Management Measures during Construction*

Based on the evaluation of the screening table results, the following mitigation measures will be implemented where necessary to keep the noise levels below the applicable national standards at the closest sensitive receptors to the source:

- All potentially impacted receptors will be informed of the nature of works to be carried out, the expected noise levels and duration, as well as contact details for an appropriate representative that be contacted in the event of a complaint. All complaints should be managed as part of the Projects external feedback and grievance mechanism.
- Regular noise monitoring will be done by YM as defined in ESMMP.
- Site management will periodically check the site and nearby residences (or other sensitive land uses) for noise related issues so that solutions can be efficiently and timeously applied.
- Where feasible and reasonable, mobile plant clustering near residences and other sensitive land uses will be avoided.
- Periods of respite will be provided in the case of unavoidable maximum noise level events. These respite periods will be negotiated with the relevant local stakeholders.
- Silencers or acoustic enclosures on machinery will be installed, where applicable, such as installation of suitable mufflers on engine exhausts and compressor components.

- Wherever possible, Project traffic routing through community areas should be avoided and speed limits should be implemented for all construction vehicles.
- Hours of Operation for specific equipment or operations (e.g. trucks or machines operating in or passing through community areas) should be limited.

*Mitigation of Noise at Construction Camps and Construction Plants*

In addition to the general noise mitigation measures above, the following measures will also implemented to mitigate adverse effects of noise at Construction Camps and Construction Plants:

- Construction Camps and associated plants at least 500 m from sensitive receptors (health and educational facilities, residential homesteads) where applicable.
- Working during daytime hours only at the plant if sensitive receptors are located nearby the working site.
- Storing excavated material (with cover to avoid dust erosion), or use of buildings / structures or temporary noise barriers to form a noise barrier between the Construction Camp and any noise sensitive receptors.
- Shutting down of machines in intermittent use in the intervening periods between work (or throttle them down to a minimum).
- Positioning of all ancillary plant (e.g. crushers, mixers, loaders, generators, compressors, etc.) so as to cause minimum noise disturbance.
- Providing acoustic enclosures, if necessary.

*Mitigation of Noise and Vibration at Quarries and Borrow Pits*

The following measures for quarry and borrow pit operation should be followed to mitigate adverse noise impacts:

- Consider social issues in designing the transport routes for construction vehicles carrying materials and spoil to and from quarries and borrow pits. Transport routes should (as far as possible) avoid residential areas. This not only for noise impacts, but to reduce other impacts such as dust exposure and health and safety risks associated with heavy vehicle movement.

- Method statement should be developed to manage the activities at quarries and borrow pits in accordance with ESIA requirements. These method statement should include plans to retain rock structures as noise barriers between the quarrying area and any potentially affected noise receptor.
- Night-time operation should be minimized where receptors are located close by.
- Hammers should be shielded by noise screens in order to avoid significant increase in noise impacts on communities situated in the vicinity.
- The Project should consider the use of delayed, micro-delayed, or electronic detonators to reduce individual charge mass to safe limits.

At quarry sites, and if blasting is required during earthworks, close monitoring/supervision will be undertaken to ensure that legislative requirements and blasting permit conditions are complied with; if the standards are exceeded additional measures will be investigated to reduce vibration impacts.

*Vibration Mitigation Measures at Active Work Sites along the Proposed SGR alignment*

- Identification of buildings located within 50m of significant sources of vibration ahead of construction works. Evaluation of the sensitivity of the identified buildings and building occupants to vibration impacts will be undertaken. This will include photos to show the structural conditions of the buildings and its foundation (i.e., whether buildings are prone to structural damage), type of building material, cracks in building, etc.
- Monitoring of vibration on commencement of relevant activities to ensure that the vibration levels are within recommended limits.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact from noise and vibration will be a "**Minor to Major ´Negative Impact**" pre-mitigation – depending on specific location.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact from Noise and Vibration will be a "**Minor to Moderate Negative Impact**" post mitigation – depending on specific location.

*Table 7-13 Rating of Impacts Related to Noise and Vibration from Construction (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Area potentially affected will be a maximum of approx. 300m from the railway alignment. | Local | Area potentially affected will be less than under the unmitigated scenario. |
| **Duration** | Short term | Expected to last a few weeks at each sensitive receptor except the activities at quarries. | Short term | Expected to last a few weeks at each sensitive receptor except the activities at quarries. |
| **Scale** | Local | Noise impacts will be local but will depend on many factors, such as noise baseline (current), construction activities, topography and locality of noise sensitive receptors. | Local | Area potentially affected will be less than under the unmitigated scenario. |
| **Likelihood** | Likely | Construction noise will occur from construction equipment and construction vehicles. | Likely | Construction noise will occur from construction equipment and construction vehicles. |
| **Magnitude** | | | | |
| **Pre-mitigation:** | | | **Post-mitigation (Residual)** | |
| **Large Magnitude** | | | **Small Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| High Sensitivity | | | | |
| Noise and vibration impacts are considered to have a high sensitivity to Noise sensitive receptors (residential dwellings, hospitals, clinics, schools, etc), and to nearby structures along the proposed alignment | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Minor to Major Impact | | | **Minor to Moderate Impact** | |

### *7.3.3 Impacts on Noise and Vibration during the Operational Phase*

Operation of SGR will result in generation of noise and vibration from a variety of sources. Normally, railway noise is generated by the contact between wheel and rail during normal movement and braking; aerodynamic noise generated by the train pushing air, and by the engine and cooling fans.

*Limitations and Assumptions*

As described above, a total of 59 sensitive receptors were identified near the SGR alignment. Representative baseline noise monitoring would typically be done over 48 hours duration for each receptor. There was not sufficient time available in this ESIA preparation to conduct such full site-specific baseline monitoring and corresponding noise modelling. Instead, a conservative noise model was used as an initial screening (with conservative model inputs as described below), and this will be followed by the full site-specific baseline monitoring and modelling during ESIA implementation.

Residual noise impacts have not been assumed for the current modelling because specific mitigation measures have not yet been defined and assessed for each receptor.

*Railway Noise Calculation Method*

Noise levels (in terms of the LAeq parameter) at the nearest noise sensitive receptors from the railway have been predicted according to CRN (1). The CRN is the standard UK procedure, which defines measurement and calculation methods for predicting railway noise impact, and is widely accepted internationally as a good practice for such applications.

CRN enables predictions to be carried out using the LAeq parameter. CRN provides correction factors for different types of track and track support. Experience shows that used carefully, it gives acceptable predictions, particularly for long-term averages.

(1) Calculation of Railway Noise 1995. UK

The CRN method is implemented using the latest SoundPLAN software package. SoundPLAN is specialised in acoustical modelling and simulation. The software is widely used and accepted internationally, and has been tested worldwide on actual projects to ensure that the predicted data are in agreement with measured noise levels.

*Model Inputs for Operation*

The following source information and key assumptions were used to model noise from the proposed SGR.

Topographical Data: A flat ground model was used in to the model without any buildings or other objects that could produce noise screening effects at the receptors. This is therefore a very conservative assumption for this modelling; in reality, many of the receptors will have some buildings, trees, embankments or other structures located between them and the SGR railway.

Train Movements: The model considered the following train movements defined in "Project Mainline Operation Plan"(MDM-YMI-AL-GL00X-O-OT-REP-0001-0):

- 20 freight train movements per day consisted by 2 electric locomotives and 63 freight wagons;
- 4 passengers train movements per day consisted by 4 EMU coaches.

Travelling time schedule information is not yet available, therefore it was assumed that train movements were equally distributed during the period of 24 hours. For this Project, the time periods of day and night time were defined as per Tanzanian standards (day – 06:00 to 22:00, night – 22:00 to 06:00).

*Predicted Noise Levels Based on the Models*

The following operational speed scenarios were modelled to predict the noise levels at each distance to identify the operational noise impacts of SGR on each sensitive noise receptor.

- Scenario 1: Freight trains 110 km/h – Passengers trains 160 km/h;
- Scenario 2: Freight trains 80 km/h – Passengers trains 80 km/h;
- Scenario 3: Freight trains 40 km/h – Passengers trains 40 km/h;

These scenarios are intended to reflect trains traveling at their respective full speeds (Scenario 1), moderate speeds (Scenario 2, e.g. moving through semi-urban areas) and slow speeds (Scenario 3, eg approaching/departing stations).

The figures below reflect the results of the modelling for each scenario.

*Figure 7-2 Scenario 1*

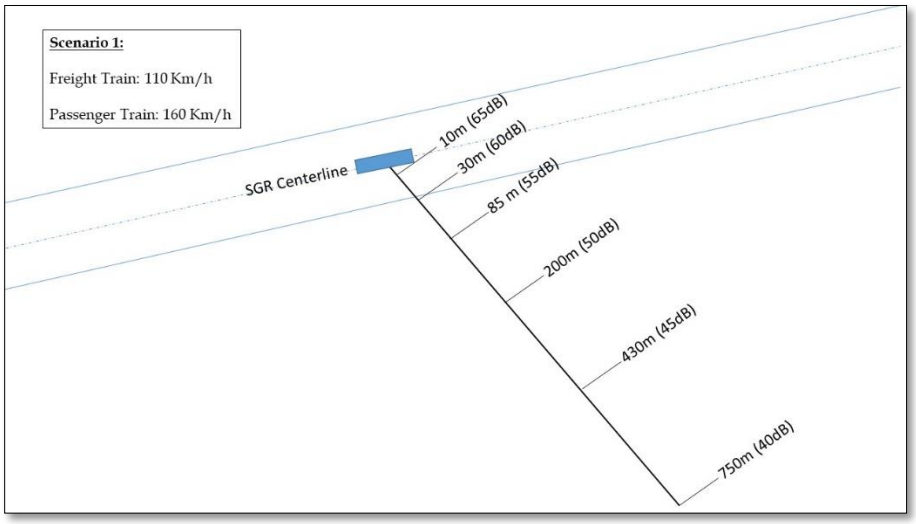



*Figure 7-3 Scenario*

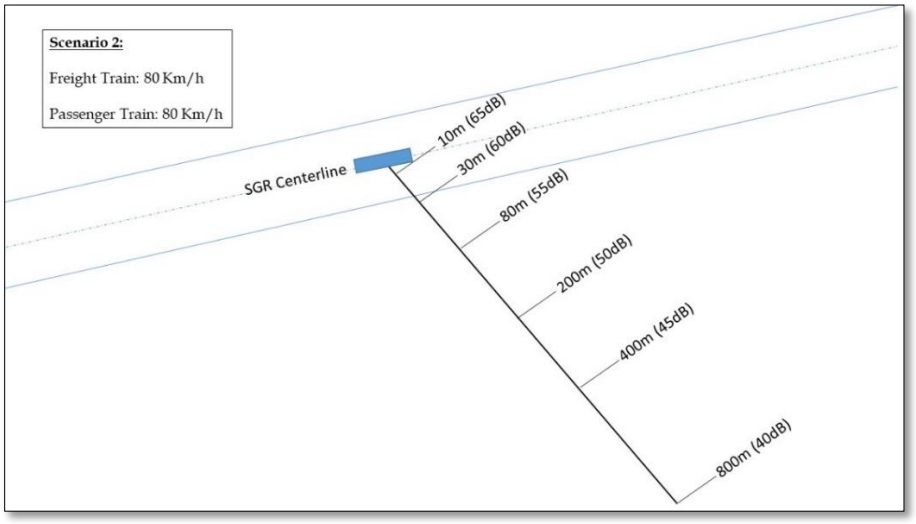
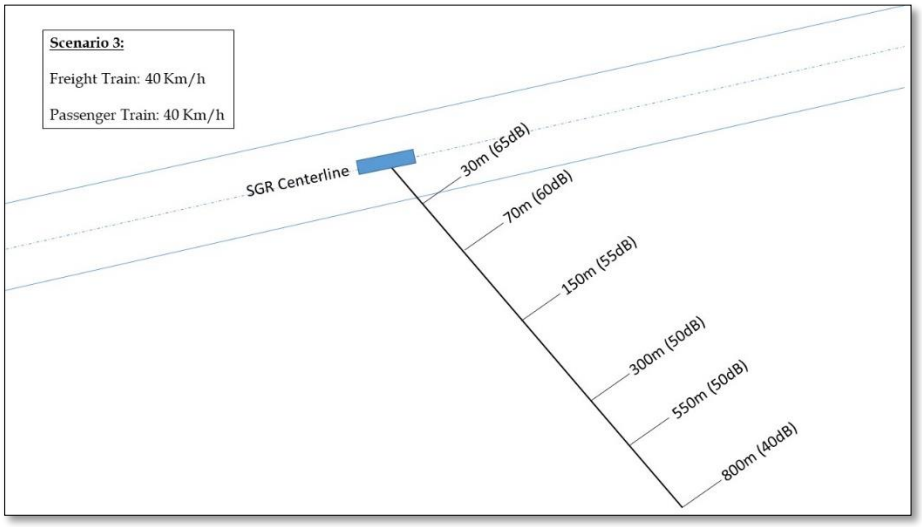


*Figure 7-4 Scenario 3*




The above models show that the daytime noise limit of 55 dBA is reached at distances of between 80m and 150m, while the night time limit of 45 dBA is reached at 400m to over 550m.

*Impact Management Strategy*

A particular set of steps will be followed (as shown in the figure below) to assess the potential impacts of the operational activities at the sensitive receptors and determine where specific mitigation measure may need to be further defined.

The site –specific modelling for each receptor will be carried out as a supplementary study as committed in ESMMP within defined timeframes. Therefore, implementation of noise mitigation measures will be possible just after the site-specific modelling and the results of the model will be incorporated in the SGR design.

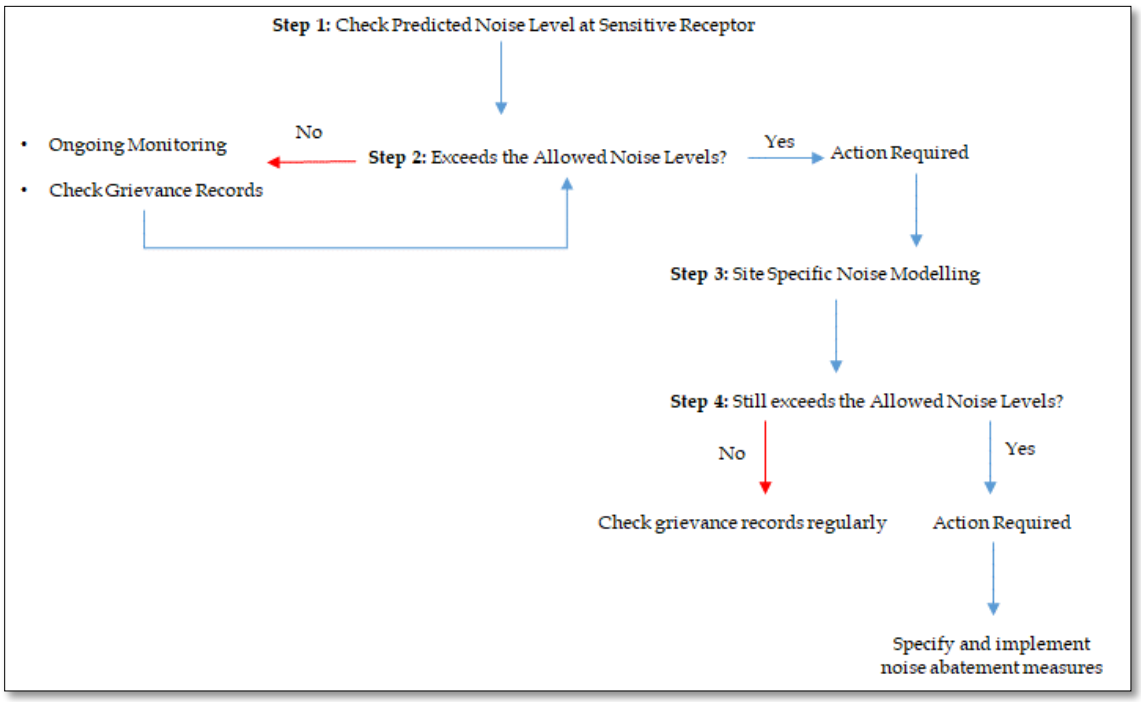
Depending on the results of the model, the following mitigation measures (or combinations thereof) will be considered as appropriate for the specific receptor:

- Landscape screening by adding landscape bunds, fences, walls, etc.

- Taking advantage of the natural topography as a noise buffer during design (if the railway is designed in cutting, noise screening will be provided by the design and topography itself),
- Installing noise barriers along the border of the RoW where passing through sensitive receptors cannot be avoided,
- Where these mitigation measures are not adequate, a voluntary scheme for noise insulation at the receptor will be considered for *major* noise impacts at the affected receptors.

***Figure 7-5 Steps to be followed to minimize the impacts caused by Operation***

Essentially, the first two "screening steps" have already been undertaken and are presented in this chapter. The conservative basic noise model is applied to all 59 sensitive locations (see table further below). For those locations resulting in a predicted exceedance of the noise limits, a further site-specific modelling will be undertaken (Step 3) taking into account the realistic local conditions of the receptor (eg perhaps surrounded by other buildings that would block railway noise) and the situation of the railway alignment (eg at grade, in a cut or on an embankment/ viaduct). If the site-specific modelling still predicts an exceedance of the limits (Step 4), then appropriate noise mitigation measures will be implemented for the location. In any case, further monitoring will be done, as well as the obligatory tracking of any grievances and followup.




The table below shows the results of the noise modelling as compared to the 59 sensitive receptor locations. Note: these are the very conservative "pre-mitigation" model results assuming that no mitigation measures have yet been applied.

The color codes given in Figure 7.18 are used to identify the sensitive receptors where further actions and mitigation measures will be required to minimize the noise impacts generated during operation.

***Figure 7-6 Screening Color Codes***

| | |
|---|---|
| *Predicted Noise Level ≥ 55Db (Day)*<br>*Predicted Noise Level ≥ 45Db (Night)* | *Exceeds noise levels* |
| *Predicted Noise Level ≤ 55Db (Day)*<br>*Predicted Noise Level ≤ 45Db (Night)* | *Does not exceed levels* |
| *Since there are no activities at school at night, the predicted levels for night is not applicable.* | *Not Applicable* |

*Table 7-14 Predicted Noise Levels at Sensitive Receptors During SGR Operations (Pre-Mitigation)*

| ID | District | Village | Receptor | KM Chainage | Distance to Alignment (m) | Predicted Noise Levels (dBA) at Scenario 1,2,3 | Allowed Noise Levels Day Less than 55 (dB) | Allowed Noise Levels Night Less than 45 (dB) |
|---|---|---|---|---|---|---|---|---|
| 1 | Ilala | Shauri moyo | Al Haramain Muslim School | 001+600 | 120 | 55 -60 | | |
| 2 | Ilala | Shauri moyo | Mchanganyiko Secondary School | 001+600 | 173 | 50 - 55 | | |
| 3 | Ilala | Shauri moyo | Songea Mosque | 001+900 | 64 | 55 - 60 | | |
| 4 | Ilala | Mafuriko | Masjid (Mskitini) Dodoma | 002+750 | 65 | 55 - 60 | | |
| 5 | Ilala | Kipawa | Kipawa Health Center | 008+500 | 130 | 50 - 55 | | |
| 6 | Ilala | Kipawa | Ilala Secondary School | 008+900 | 70 | 55 - 60 | | |
| 7 | Ilala | Kipawa | Majani ya Chaia Secondary School | 008+750 | 110 | 55 -60 | | |
| 8 | Ilala | Uwanja wandege | Kipawa Lutherian Church | 009+450 | 60 | 55 - 60 | | |
| 9 | Ilala | Kipawa | Ugombolwa Secondary School | 009+600 | 75 | 55 - 60 | | |
| 10 | Ilala | Stakishari | Winners Chapel International | 011+500 | 75 | 55 - 60 | | |
| 11 | Ilala | Sabasaba | Kingdom Heritage Model School | 011+450 | 55 | 55 - 60 | | |
| 12 | Ilala | Ukonga | Cardinal Rugambwa Hospital | 013+200 | 210 | 50-55 | | |
| 13 | Ilala | Gongo la mboto | Masjid Mariam | 015+400 | 110 | 55 -60 | | |
| 14 | Ilala | Gongo la mboto | Rugwa Nursery Primary School | 017+600 | 110 | 55 -60 | | |
| 15 | Ilala | Guruka kwa lala | Miuma wa Moto Church | 017+900 | 510 | 45-50 | | |
| 16 | Kibaha | Kikongo | Tumaini Primary School | 067+200 | 100 | 55 -60 | | |
| 17 | Kibaha | Kikongo | Kikongo Dispensary | 067+200 | 270 | 45-55 | | |
| 18 | Kibaha | Ruvu | Ruvu Secondary School | 075+400 | 160 | 50 - 55 | | |
| 19 | Kibaha | Ruvu | Ruvu Primary School | 076+350 | 295 | 45-55 | | |
| 20 | Kibaha | Ruvu | Ruvu Station Masjid | 075+500 | 190 | 50-55 | | |
| 21 | Kibaha | Ruvu | Ruvu Hospital | 076+100 | 100 | 55 -60 | | |
| 22 | Kibaha | Kwala | Kwala Primary School | 084+700 | 70 | 55 - 60 | | |
| 23 | Kibaha | Msua | Msua Primary School | 100+900 | 180 | 50-55 | | |
| 24 | Kibaha | Magindu | Magindu Primary School | 113+600 | 310 | 45-55 | | |
| 25 | Chalinze | Magindu | Magindu Clinic | 113+300 | 210 | 50-55 | | |
| 26 | Chalinze | Magindu | Keketi Church | 113+500 | 225 | 50-55 | | |

| ID | District | Village | Receptor | KM Chainage | Distance to Alignment (m) | Predicted Noise Levels (dBA) at Scenario 1,2,3 | Allowed Noise Levels Day Less than 55 (dB) | Allowed Noise Levels Night Less than 45 (dB) |
|---|---|---|---|---|---|---|---|---|
| 27 | Chalinze | Magindu | Masjidi Nour | 113+150 | 190 | 50-55 | | |
| 28 | Morogoro vijijini | Kidugalo | Kidugalo Primary School | 127+900 | 130 | 55 -60 | | |
| 29 | Morogoro vijijini | Kidugalo | Kidugalo Dispensary | 129+750 | 220 | 50-55 | | |
| 30 | Morogoro vijijini | Mikese | Church of Kidugalo | 129+700 | 190 | 50-55 | | |
| 31 | Morogoro vijijini | Kinonko | Kinonko Masjid | 149+500 | 110 | 55 -60 | | |
| 32 | Morogoro vijijini | Kinonko | Kinonko Secondary School | 149+700 | 180 | 50-55 | | |
| 33 | Morogoro vijijini | Mikese | Kinonko Dispensary | 149+850 | 120 | 55 -60 | | |
| 34 | Morogoro vijijini | Mikese | Mikese Primary School | 163+200 | 140 | 50 - 55 | | |
| 35 | Morogoro vijijini | Mikese | Mikese Dispensery | 163+250 | 140 | 50 - 55 | | |
| 36 | Morogoro vijijini | Mikese | Mesjidi Bayillah Mikese | 163+300 | 350 | 45-55 | | |
| 37 | Morogoro vijijini | Mikese | Mikese Church | 163+200 | 395 | 45-55 | | |
| 38 | Kilosa | Mkata | School | 224+100 | 200 | 50-55 | | |
| 39 | Kilosa | Kimamba | Church | 252+900 | 80 | 55 - 60 | | |
| 40 | Kilosa | Kimamba | School | 253+000 | 80 | 55 - 60 | | |
| 41 | Kilosa | Kimamba | Dispensary | 254+000 | 15 | 55 - 65 | | |
| 42 | Kilosa | Kichangani | School | 269+400 | 50 | 55 - 60 | | |
| 43 | Kilosa | Mtendeni | Mosque | 269+650 | 15 | 55 - 65 | | |
| 44 | Kilosa | Kasiki | Church | 270+700 | 175 | 50-55 | | |

| ID | District | Village | Receptor | KM Chainage | Distance to Alignment (m) | Predicted Noise Levels (dBA) at Scenario 1,2,3 | Allowed Noise Levels Day Less than 55 (dB) | Allowed Noise Levels Night Less than 45 (dB) |
|---|---|---|---|---|---|---|---|---|
| 45 | Kilosa | Kasiki | College | 271+000 | 65 | 55 - 60 | | |
| 46 | Kilosa | Kasiki | Church | 271+000 | 65 | 55 - 60 | | |
| 47 | Kilosa | Munisigara | School | 284+300 | 40 | 55 - 60 | | |
| 48 | Kilosa | Munisigara | Dispensary | 284+500 | 85 | 55 - 60 | | |
| 49 | Kilosa | Kikundi | School | 301+100 | 145 | 50 - 55 | | |
| 50 | Kilosa | Kidete | School | 310+800 | 65 | 55 - 60 | | |
| 51 | Kilosa | Kidete | School | 311+150 | 60 | 55 - 60 | | |
| 52 | Mpwapwa | Godegode | School | 332+100 | 200 | 50-55 | | |
| 53 | Mpwapwa | Godegode | School | 332+450 | 100 | 55 -60 | | |
| 54 | Mpwapwa | Gulwe | School | 352+800 | 185 | 50-55 | | |
| 55 | Mpwapwa | Msagali | School | 368+000 | 200 | 50-55 | | |
| 56 | Chamwino | Igandu | Dispensary | 388+000 | 150 | 50 - 55 | | |
| 57 | Dodoma City Council | Makulu/ Msangalale | School | 438+500 | 300 | 45-55 | | |

Based on the above given assessment, operation of SGR during daytime and night time will cause noise impacts for the sensitive receptors located within a distance of 300 m to the railway if not mitigated.

*Operational Mitigation/ Management Measures*

The following actions will be taken at sensitive locations where the predicted noise levels exceed or has potential to exceed as listed in Table 7-19. These actions will keep the noise levels below the applicable national standards at the closest sensitive receptors to the source:

- The receptors marked in red colors will be subject to site visit and monitoring of background noise and site specific noise modelling.
- In case the noise model indicates that the accepted noise levels are still higher than allowed, then noise abatement measures will be implemented (e.g. noise barriers along railways or next to receptor buildings, soundproofing, relocation of the sensitive receptor etc).
- A "Noise Mitigation Monitoring Plan" will be developed for operation phase to confirm adequacy of mitigation measures for implementation during Operation.
- Noise reduction or prevention measures will be implemented at the source (ie SGR train) including:
    - Use of modern non-metallic disc brakes, which can reduce rolling noise by 8-10 decibels (dB) (if applicable),
    - Reducing the roughness of running surfaces through regular maintenance of wheels and tracks.

## 7.4 AIR QUALITY IMPACT ASSESSMENT

The predicted impacts on air quality as a result of the proposed Project are described in this *Section*.

### 7.4.1 Impacts on Air Quality Related to Construction Dust Emissions

*Description of the Baseline Environment*

Generally, the area has relatively high levels of dust. PM10 concentrations (the respirable fraction of dust) measured at Kisaki, Morogoro rural area ranged between 6µg/m3 and 27µg/$m^3$; these values are below the General WHO/IFC guideline and Tanzania Emission Limits of 50µg/$m^3$ and 60 - 90µg/$m^3$ respectively. Construction activities as a result of the proposed project are, however expected to increase the levels of dust (and respirable dust) and related impacts in the surrounding areas.

*Proposed Project Activities*

Dust generation is mainly expected during the construction phase. Dust is expected to be generated from the following activities:

- Earth moving activities and ground preparation;
- Movement of vehicles over open ground, on unpaved roads and on the surrounding road network;
- Operation of borrow pits and quarries; and,
- On-site concrete batching, handling of friable materials and stockpiling.

Demolition of buildings located on the path of the railway route might also result in the generation of asbestos containing materials that might have been used in the past for their construction.

Significant dust generation is not expected during the operations phase of the project.

*Sensitive Resource / Receptors*

During construction, impacts from increased dust levels are expected across the axis of the railway (at a distance of ± 1km). The dispersion area of exhaust fumes

and dust will depend on the concentration of machinery and equipment at the site and the capacity of their engines.

*Mitigation Measures Required to improve Air Quality*

The control and mitigation of dust emissions is a primary consideration during the construction phase of the proposed SGR. The mitigation measures set out here aim to reduce impacts on both sensitive human receptors and vegetation.

The Project should implement the following dust mitigation / management measures:

- Unpaved roads and other dust generating areas should be controlled by water spraying under dry weather conditions.
- A grievance procedure in the event of any dust complaints being received should be developed and implemented.
- Speed limits should be set to as low as possible on unpaved roads
- Work vehicles should be kept sufficiently clean to avoid tracking dirt around and off the site.
- Work vehicles transporting friable materials should be kept adequately covered to prevent materials being spread around and off the site.
- Where feasible, surface binding agents should be used on exposed open earthworks. Upon completion of earthworks, stabilization of surfaces (i.e., establishing vegetative cover, or placing ground cover) should occur as soon as possible
- Drop heights of material should be minimised.
- Stockpile should be managed in accordance with the mitigation / management measures provided for Impacts on Soil Erosion. In addition, stockpiles should be located as far away from receptors as possible.
- Issue and ensure use of appropriate PPE such as dust masks.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact on Air Quality from Construction Dust Emissions will be a "**Moderate Negative Impact**" pre-mitigation (refer to *Table 7-15*).

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures the significance of the impact on Air Quality from Construction Dust Emissions will be a "**Minor Negative Impact**" post mitigation (refer to *Table 7-15*).

*Table 7-15 Rating of Impacts Related to Construction Dust Emissions (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Affect an area in proximity to the development area | Local | The extent of the impact will not change. |
| **Duration** | Short term | Expected to last during the construction period (30 months) | Temporary | Reduced levels and exposure |
| **Scale** | Unknown | Dispersion and coverage area is dependent on other factors such as wind speed and direction | Unknown | But mitigations will minimise exposure |
| **Likelihood** | Will occur | Construction will involve movement of earthworks and using unpaved roads | Will still occur | Reduced levels and exposure |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Minor Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Moderate Sensitivity | | | | |
| Impacts on Air Quality Related to Construction Dust Emissions is considered to have high sensitivity to health of the workers and surrounding communities | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Moderate Impact | | | **Minor Impact** | |

### *7.4.2 Impacts on Air Quality Related to Construction Equipment Emissions*

*Description of the Baseline Environment*

There are no consistent monitoring stations at respective emission sources found along the railway and nearby areas. Data collected in the wet season at Kisaki Morogoro, where the railway line passes, indicates that all the values were below their respective standards with the exception of carbon monoxide (CO). CO is a product of incomplete combustion of organic materials therefore the use of firewood and charcoal may be attributing to its presence in the communities. The proposed project may cause the increase in concentration of these gases through its fuel combustion engines for power generators or heavy equipment, during the construction phase. Construction activities are expected to contribute to the increase in the levels of these emissions.

*Proposed Project Activities*

*Construction Phase*

The proposed SGR construction will likely contribute to combustion air emissions from construction equipment. The construction camps, which will host the construction work force, may be another additional source of air emissions, both from on site generators and when workers commute to and from sites.

*Operational Phase*

The assessment of operational impacts focuses on the potential negative effects of emissions from operational trains at sensitive receptor locations surrounding the proposed alignment.

*Sensitive Resource / Receptors*

The proposed SGR alignment passes through different settings. It passes through urban areas in Dar es Salaam, Morogoro and Dodoma and through rural settings, away from major cities. Sensitive receptors include human receptors in major towns and in villages surrounding the SGR.

Other sensitive receptors include the protected areas, namely the Kisarawe District Coastal Forest IBA (comprising the Pugu Hills and Ruvu South Forest Reserves), Uluguru Nature Reserve, AZE site and IBA and the Mikumi National Park.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact on Air Quality from Construction Dust Emissions will be a "**Moderate Negative Impact**" pre-mitigation (refer to *Table 7-16*).

*Mitigation Measures Required to improve Air Quality*

The Project should implement the following emissions mitigation / management measures:

- Where feasible and reasonable, vehicles that are compliant with recent emission standards (for example, EURO Tier 3) should be used. These vehicles should be maintained in reasonable working order. When not in use, vehicles should be switched off, unless impractical for health and safety reasons (for example maintenance of air conditioning).
- Maintain and service machines and engines off-site.
- Refuel from authorised fuel stations.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures the significance of the impact on Air Quality from Construction Dust Emissions will be a "**Minor Negative Impact**" post mitigation (refer to *Table 7-16*).

*Table 7-16 Rating of Impacts Related to Construction Equipment Emissions (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Regional | Potential to affect regionally important resources or ecosystems | Regional | The extent of the impact will not change |
| **Duration** | Short term | Expected to last during the construction period (30 months) | Temporary | Reduced levels and exposure |
| **Scale** | Unknown | Dispersion and coverage area is dependent on other factors such as wind speed and direction | Unknown | Minimised exposure due to mitigations |
| **Likelihood** | Will occur | Construction will involve movement of earthworks | Will still occur | Reduced levels and exposure |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Minor Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Moderate Sensitivity | | | | |
| Construction Equipment Emissions are considered sensitive and may impact sensitive receptors (protected areas and human receptors) | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Moderate Impact | | | **Minor Impact** | |

## 7.5 IMPACT TO SOILS

The predicted impacts to soil as a result of the proposed Project are described in this Section.

### 7.5.1 Impacts on Soil erosion

*Description of the Baseline Environment*

Potential areas for soil erosion along the project area during the construction include hilly areas during levelling and/or construction of underpass roads along the SGR line connections; borrow pits and quarry sites. Other areas with high erosion potential include river banks like Mkondoa River at Kilosa and areas between Kilosa and Gulwe. Areas between Mpwapwa and Makutopora are observed to have unstable soils making them vulnerable to soil erosion.

*Proposed Project Activities*

The clearing and removal of vegetation and soil will occur as a result of the proposed SGR and associated facilities. These involve clearance of vegetation, excavation of quarries and borrow pits, establishment of Construction Camps, development of access roads, equipment laydown areas and possibly other construction activities.

The Project activities listed above may result in direct physical impacts to soil. Possible direct physical impacts include erosion and compaction as a result of activities such excavation and reinstatement.

The Project activities that may result in soil erosion are limited to the construction phase of the proposed SGR Project.

No impacts are anticipated during the operational phase of the Project; however, if impacts realised during the construction phase are not adequately managed and addressed during site rehabilitation, then they may persist into the operational phase.

*Sensitive Resource / Receptors*

Areas at risk areas where quarries and borrow pits, establishment of Construction Camps, development of access roads, equipment laydown areas, marshalling yards

and other construction sites. The locations of these structures are provide in the project description.

Soil erosion is in evidence to various degrees at some sections along the entire proposed SGR alignment. Erosion from construction sites can impact surrounding subsistence agriculture and result in increased sediment loads to surface waters, thereby affecting communities who in many cases rely on subsistence agriculture and untreated water for their livelihoods.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact soil erosion will be a "**Moderate to Major Negative Impact**" pre-mitigation (refer to *Table 7-17*).

*Mitigation/Management Measures*

The following measures are recommended to mitigate / manage soil erosion along the alignment of the proposed SGR and associated facilities:

- Progressive rehabilitation measures should be implemented, beginning during site preparation.
- Rehabilitation interventions in high priority areas (i.e. – areas where there is a low likelihood of natural revegetation or where areas are prone to erosion from surface runoff) should be prioritised.
- Following completion of construction activities for a section of the proposed SGR and associate facilities, rehabilitation and stabilisation of all areas along that section impacted on by construction should be undertaken with no significant erosion events.
- Rehabilitation effort for each section of the proposed SGR should be monitored at a frequency necessary to maximise rehabilitation success.
- A Method Statement should be compiled for quarries and borrow pits that (amongst others) includes measures –
    - Design aspects that reduces additional work / excavation required for rehabilitation of the borrow pit and quarries;
    - That ensure that the resultant shaping / forms of the benches and walls are appropriate to the surrounding natural land form;

- Where rehabilitation of quarries and borrow pits be conducted in parallel with the final extraction;
- For rehabilitation that ensures for adequate runoff / drainage, and that runoff is not concentrated where it may cause erosion or wash away of top soil.

During the construction phase, inspections will be carried out to identify areas where erosion is occurring as a result of construction activities. Such monitoring will be carried out on a daily basis during the rain seasons and on a periodically scheduled basis during the dry seasons.

- Should erosion events be identified, appropriate remedial action, including the restoration of the eroded areas, and where necessary, the relocation of the paths causing the erosion, should be undertaken.
- Additional measures will be implemented in areas identified as having a high erosion potential.
- Topsoil shall be stockpiled separate from subsoil. Stockpiles shall not exceed 2 m height, shall be located away from drainage lines, shall be protected from rain and wind erosion, and shall not be contaminated.
- Soil stockpiles should be in areas that are protected from construction activities and vehicle movement, human and livestock trampling etc.
- Soil stockpiles should be periodically dampened with dust suppressant or equivalent when necessary to avoid wind erosion.
- Soil stockpile areas should be re-vegetated as soon as possible after use.
- Surface water diversions should be installed around stockpiles so as to reduce risk of erosion during storm events.
- Berms on the downslope side of stockpiles should be created to minimize soil loss or spread.
- Minimise duration of topsoil stockpiles through implementing ongoing rehabilitation of works areas on completion of construction in each work area. Topsoil stockpiles should not be left for more than 6 months after which they will need upgrading.
- Land clearance should only be undertaken immediately prior to construction activities taking place there.

- Unnecessary land clearance should be avoided.
- Temporary access tracks should be aligned along contours to avoid cutting straight down steep slopes.
- Contour temporary access roads / laydown areas so as to minimise surface water runoff and erosion, especially on steeper slopes.
- Temporary access tracks should include sufficient culverts, especially on steeper slopes.
- Unless foreign material such as aggregate needs to be inserted, after the installation of features requiring the excavation of a deep trench (*viz.* stormwater drainage pipes, services, etc.), soil should be replaced in the trench so as to mimic the pre-construction profile, (i.e.: subsoil placed at the base of the trench and topsoil above it, and should be compacted).
- Cut and fill slopes should be shaped and trimmed to resemble natural conditions, should not be excessively steep. Moreover, where the upper slope of cut face may erode, suitable stabilisation methods should be implemented.
- Cut slopes should have priority for spread of some topsoil or loose substrate to infill rock gaps in order to facilitate more rapid recolonization by naturally occurring flora species.
- Quarries and borrow pits should be located away from river systems.
- Grievance redress mechanism for the project to be implemented and communicated to all surrounding communities, where impacts of erosion to their livelihoods (subsistence agriculture and to surface water) can be raised and addressed.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of soil erosion will be a "**Minor to Moderate Negative Impact**" post mitigation (refer to *Table 7-17*).

*Table 7-17 Rating of Impacts Related to Soil Erosion (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Regional | Risk of soils erosion will be largely restricted to the proposed SGR footprint including the road reserve, borrow pits, Construction Camps and laydown areas. | Regional | Risk of soils erosion will be restricted to the proposed SGR footprint including the road reserve, borrow pits, Construction Camps and laydown areas. |
| **Duration** | Short term | This is a **medium term** impact expected to occur during the construction phase of the Project (~6 years). | Medium term | This is a medium term impact expected to occur during the construction phase of the Project (~6 years). |
| **Scale** | Medium | Risk of soils erosion will be restricted to the proposed SGR footprint; however, it is expected to be of higher magnitude in the sections identified as being more sensitive. | Low | The scale of erosion will reduce with effective implementation of management / mitigation measures and effective rehabilitation. |
| **Frequency** | Seasonal | The impact is expected to occur on a seasonal basis, particularly during the wet season (when the potential for water-induced erosion is highest) but possibly also during the dry windy season (when the potential for wind-induced erosion is highest). The frequency should diminish during the course of the construction phase if rehabilitation is undertaken throughout construction. | Occasional | The impact is expected to occur on a seasonal basis, particularly during the wet season (when the potential for water-induced erosion is highest) but possibly also during the dry windy season (when the potential for wind-induced erosion is highest). Occasional (and sporadic) erosion may occur; however, implementation of mitigation / management measures will reduce the frequency, especially if progressive rehabilitation is implemented. |
| **Likelihood** | Likely | Construction is expected to involve movement of earthworks from borrow pit and quarries and using unpaved roads | Likely | Reduced erosion risk due to mitigation measures |

| Magnitude | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Major Magnitude** | **Minor Magnitude** |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | |
| High Sensitivity | |
| The soil in certain sections of the footprint of the proposed SGR is considered highly sensitive to erosion due to rainfall, soil type, and topographic slope. The remaining sections of the proposed SGR are considered to be of medium sensitivity. Receptors potentially affected by soil erosion are considered highly sensitive due to their reliance on subsistence agriculture and untreated water. | |
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| Moderate to Major Impact | **Minor to Moderate Impact** |

## 7.6 GREENHOUSE GAS (GHG) EMISSIONS

### 7.6.1 Introduction

*OVERVIEW*

The Greenhouse Gas (GHG) Emissions Assessment in this section estimates the GHG emissions which will arise as a result of the SGR Project during its construction and operational phases. The construction phase will result in direct GHG emissions ("Scope 1") primarily associated with (i) the combustion of fossil fuels due to the transportation of materials to site, transportation of excavated materials and the use of construction plant, as well as (ii) GHG emissions released from biogenic carbon contained within the vegetation that is cleared for the construction sites. The operational phase will result mainly in indirect GHG emissions ("Scope 2") due to the use of electricity in locomotives and other rolling-stock of the railway; emissions from occasional use of diesel fuel for shunting or other ancillary functions (Scope 1) are considered negligible compared to electricity use during operations.

*POLICY FRAMEWORK*

The Government of Tanzania recognizes the adverse impacts of natural disasters and climate change and has put in place relevant legislation to address the challenges. The key policy documents relevant to this Project assessment include:

- National Adaptation Programme of Action (NAPA 2007);
- Tanzania National Development Plan (2016/17- 2020/21);
- National Climate Change Strategy 2012; and
- Tanzania's Intended Nationally Determined Contribution (INDC), 2015.

Tanzania has not yet signed or ratified the Paris Agreement, but submitted their INDC to the UNFCCC in 2015. Under its INDC, Tanzania will reduce annual greenhouse gas emissions economy-wide between 10-20% by 2030 relative to the Business-as-Usual (BAU) scenario of 138 - 153 Million tons of carbon dioxide equivalent (MtCO2e) gross emissions, depending on the baseline efficiency improvements, consistent with its sustainable development agenda. The BAU emissions represent projected future emissions in the absence of further climate policies or other measures.
In addition, there are climate-relevant and sector-specific strategies which include:

- National Guidelines for Mainstreaming Gender into Climate Change Related Policies, Plans, Strategies;
- Tanzania Climate Change Gender Action Plan;
- Tanzania Agriculture Climate Resilience Plan, 2014–2019;
- The National Climate Change Communication Strategy;
- Guidelines for Integrating Climate Change into National Sector Policies, Plans and Guidelines, 2013; and
- The Disaster Management Act 1990.

While the policies on climate change are in place, challenges remain on commitment to implement actions with the necessary institutional coordination and inter-sectoral co-operation[1].

*IFC PERFORMANCE STANDARDS*

Regarding resource efficiency, including the use of energy and other GHG-relevant activities, the IFC's Performance Standard 3: Resource Efficiency and Pollution Prevention states the following:

> *The client will implement technically and financially feasible and cost effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs, with a focus on areas that are considered core business activities. Such measures will integrate the principles of cleaner production into product design and production processes with the objective of conserving raw materials, energy, and water. Where benchmarking data are available, the client will make a comparison to establish the relative level of efficiency.*

With specific reference to GHGs, the Standard states that:

> *The client will consider alternatives and implement technically and financially feasible and cost-effective options to reduce project-related GHG emissions during the design and operation of the project. These options may include, but are not limited to, alternative project locations, adoption of renewable or low carbon energy sources, sustainable agricultural, forestry and livestock management practices, the reduction of fugitive emissions and the reduction of gas flaring.*

Therefore, a requirement exists to undertake consideration of the emissions associated with the Project during its initial construction and later operational stages.

[1] Resilience and Economic Inclusion Team: *TANZANIA CLIMATE ACTION REPORT FOR 2016*

*ORGANISATIONAL BOUNDARIES*

The ISO 14064 standard on GHG emissions allows the setting of organisational boundaries on either the control principle or the shareholding principle. Under the control principle all emissions by entities and activities controlled by the organization must be included. Under the shareholding principle, emissions of the entities in which the organization has a share must be counted proportional to the shareholding.
The control principle was used for this study. This includes all of the construction activities and operational (transportation) activities over which SGR has direct control.

*OPERATIONAL BOUNDARIES*

The operational boundary was drawn around all SGR Project construction activities and the rail transportation of freight and passengers during the operational phase. In accordance with the ISO 14064-1 standard and the GHG protocol, direct and indirect GHG emissions are considered per the following description:

- Direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity (eg diesel combustion in construction vehicles);
- Indirect GHG emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity (eg power plants supplying the national electric power grid).

Furthermore, direct and indirect emissions are categorised into three broad scopes (see Figure 7-7 ):

- Scope 1: Direct GHG emissions;
- Scope 2: Indirect GHG emissions from the use of purchased electricity, heat or steam; and
- Scope3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities not covered in Scope 2, outsourced activities, waste disposal, etc.

In line with IFC requirements, the focus of this study will be on the **Scope 1 and 2 emissions**.

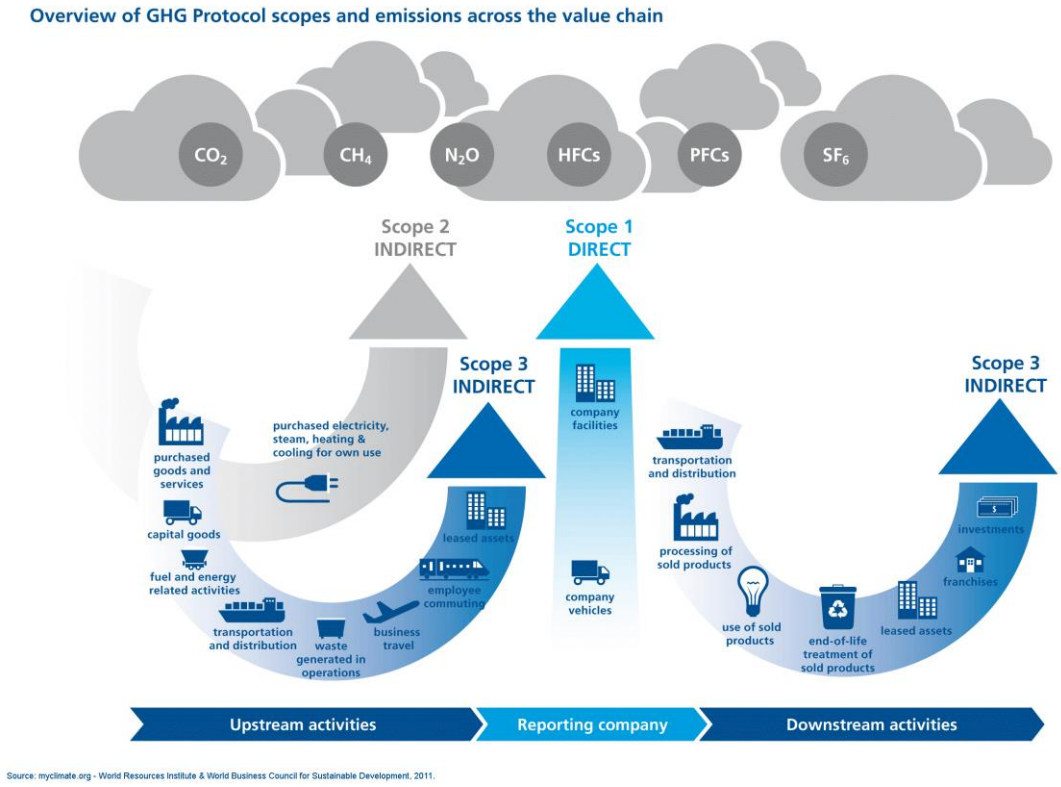



*Figure 7-7 Greenhouse Gas Emissions Scopes*

### *7.6.2 Methodologies*

*GHG CALCULATION METHODOLOGY*

GHG emissions for the SGR Project are calculated via the application of documented Emission Factors (EFs). These factors are calculated ratios relating GHG emissions to a proxy measure of activity at an emissions source. The IPCC guidelines (IPCC, 1996) refer to a hierarchy of calculation approaches and techniques ranging from the application of generic EFs to direct monitoring. Where any data gaps exist for the calculations, GHG emissions have been estimated using reasonable assumptions, e.g. about fuel mix, vegetation type, and distance travelled per train. The estimations for the operational stages of the Project assume full normal operability.
The GHG emissions estimates have been made using the following references:

1. Greenhouse Gas (GHG) Protocol: Corporate Accounting & Reporting Standard (World Resources Institute/World Business Council for Sustainable Development);
2. Greenhouse Gas (GHG) Protocol: Transport Tool, Version 2.6;

3. Intergovernmental Panel on Climate Change (IPCC) 2014 GHG Inventory guidelines;
4. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation;
5. IPCC WG3 AR5 Chapter 8: Transport;
6. Defra (2018 Guidelines to Defra's GHG conversion factors for company reporting);
7. EBRD Methodology for Assessment of Greenhouse Gas Emissions (2010);
8. Ecometrica: www.emissionfactors.com; and
9. IPCC Emissions Factors Database (EFDB), November 2017.

*IMPACT ASSESSMENT METHODOLOGY*

Impact assessments are normally conducted by determining how the proposed activity will affect the baseline environment in the project area. In the case of GHG emissions, however, the potential impact of GHG emissions occurs on a global basis and the specific source of GHG emissions cannot be linked directly to the future potential impact at a specific location. In the absence of such causal links, this section presents an alternative risk-based methodology per international good practice.

In general, the methodology for assessing GHG impacts is based on the evaluation of impact *Magnitude* and the *Likelihood*, which yields a resulting impact *Signficance*. The Likelihood factor, as explained further below, replaces the usual factor of "vulnerability".

Magnitude

Impact magnitude is a function of the potential intensity of the impact, moderated by the extent and duration of that impact. When considering GHGs, the extent and duration of the potential impact will always be the same. The *extent* is international as it is the total stock of world GHG emissions (leading to the greenhouse effect) that is directly increased due to the impact of the Project. The greenhouse effect is transboundary and so global emissions and national emissions are both directly affected. The *duration* of the impact is regarded as permanent as the persistence of carbon dioxide in the atmosphere ranges between 100 and 300 years[1] and continues beyond the life of the Project.

Table 7-18 shows a magnitude scale for project-wide GHG emissions that is in line with reporting thresholds adopted by a number of international lender

[1] Carbon Dioxide Information Analysis Centre (CDIAC)

organisations or groupings, such as the IFC Standards, the European Bank for Reconstruction and Development (EBRD) GHG assessment methodology and the Equator Principles.

*Table 7-18 Magnitude Scale for Project GHG Emissions*

| Project-Wide GHG Emissions / annum | Magnitude Rating |
|---|---|
| >1,000,000 $tCO_2e$ | Very Large |
| 100,000 – 1,000,000 $tCO_2e$ | Large |
| 25,000 – 100,000 $tCO_2e$ | Medium |
| 5,000 - 25,000 $tCO_2e$ | Small |
| <5,000 $tCO_2e$ | Negligible |

The IFC's Performance Standard 3 defines a reporting threshold for annual GHG emissions of 25,000 $tCO_2e$ per annum above which it requires developers to "*…consider alternatives and implement technically and financially feasible and cost-effective options to reduce project-related GHG emissions during the design and operation of the project*". This study, therefore, looks at the potential impact of the Project in relation to IFC thresholds and the likely implications of this.

Likelihood

To determine the significance of the potential impact from GHG emissions a risk classification approach is used in which risk significance is expressed as the magnitude of the impact (as described above) multiplied by the likelihood (probability) of the impact.

Likelihood is described according to the definitions outlined in *Table 7-19*.

*Table 7-19 Likelihood Definitions*

| Likelihood | Definition |
|---|---|
| Unlikely | Reasonable to expect that the consequence will not occur at this facility during its lifetime. |
| Occasional | Exceptional circumstances/conditions may allow the consequence to occur within the facility lifetime. |
| Likely | Consequence can reasonably be expected to occur within the life of the facility. |

In the case of the SGR Project, the likelihood of carbon emissions occurring during construction and operational phases is 100%, and therefore classified as "Likely" per the above table.

Determination of Significance

The combination of the *magnitude* of a potential impact and the *likelihood* yields the degree of the *significance* of a potential GHG impact. This is illustrated in *Table 7-20*.

***Table 7-20 Impact Significance Rating Matrix***

| | | Likelihood | | |
|---|---|---|---|---|
| | | **Unlikely** | **Occasional** | **Likely** |
| **Magnitud** | Very Large | MAJOR | MAJOR | MAJOR |
| | Large | MODERATE | MAJOR | MAJOR |
| | Medium | MINOR | MODERATE | MAJOR |
| | Small | NEGLIGIBLE | MINOR | MINOR |
| | Negligible | NEGLIGIBLE | NEGLIGIBLE | NEGLIGIBLE |

### *7.6.3 Construction Phase: GHG Assessment*

*CONSTRUCTION PHASE: ESTIMATION OF GHG EMISSIONS*

*MOBILE AND STATIONARY COMBUSTION*

During the construction phase there will be ongoing use of fuel for construction machinery and on-site power generation during the construction phase. The primary fuel that will be used for machinery, vehicles and equipment will be diesel. Monthly consumption of diesel is estimated to be approximately 3.3 million litres (or about 40 million litres per year). Given that the construction phase is 3.5 years, the total fuel demand would be approximately 140 million litres for the duration of construction. (In addition to diesel, small quantities of motor oil, hydraulic oil and grease will be required during construction; however, these GHG sources are not considered material in the overall emissions assessment and are omitted in this analysis).
Table 7-21 details the total estimated combustion-related GHG emissions per year for the Project.

*Table 7-21 Construction Phase: Annual Mobile & Stationary Combustion GHG Emissions*

| Item | Value/Amount | Units |
|---|---|---|
| Monthly diesel volume use | 3 300 000 | Litres |
| Annual diesel volume use | 39 600 000 | Litres |
| Density of diesel oil | 0.832 | Kg/l |
| Annual diesel mass use | 32 947 200 | kg |
| Diesel Emissions Factor ($CO_2e$) | 3 198 | g/kg fuel |
| **Annual GHG Emissions (rounded)** | **105 000** | **$tCO_2e$** |

*LAND USE CHANGE*

GHG emissions will arise as a result of land clearance (land use change) during the construction phase of the Project. Emissions resulting from land clearance have been estimated by making assumptions regarding the current use of the land and the quantity of carbon estimated to be stored within it. The exact land use for the railway route could not be precisely determined in this study and so it is assumed that the land to be cleared was a 50/50 split between wooded grassland and agricultural land. Total area was calculated by multiplying the railway length (ie 533 km) by the construction servitude width (60m).

*Table 7-22 Construction Phase: Annual GHG Emissions accountable to land-use change*

| Item | $tCO_2e$ per hectare | Area, hectares | Total $tCO_{2e}$ |
|---|---|---|---|
| Wooded Grassland | 165.0 | 1 623 | 267 795 |
| Agricultural Land | 49.5 | 1 623 | 80 339 |
| Aggregate $tCO_2e$ (in 3.5 yrs) | | | 348 134 |
| **$tCO_2e$ per year (rounded)** | | | **100,000** |

*CONSTRUCTION PHASE: GHG EMISSIONS IMPACT ASSESSMENT*

The summary of GHG emissions estimations for the Project construction phase is shown in

***Table 7-23 GHG Emissions Impact: Construction Phase***

| Emissions Source | Estimated $tCO_2e$ per annum |
|---|---|
| Stationary and mobile combustion | 105 000 |
| Land use Change | 100 000 |
| **TOTAL** | **205 000** |

The combined annual emissions from the construction phase, which is considered as those arising from both direct construction activity (combustion emissions) and land use change, is about **205 000 $tCO_2e$ per annum**. Over the estimated 3.5 year course of construction, the total emissions for construction of the Project are thus approximately **700 000 $tCO_2e$.**

As shown in the IFC Table, the annual value surpasses the 25,000 $tCO_2e$ threshold and corresponds to a *large* magnitude rating. Therefore, technically feasible and cost-effective mitigation options must in any case be considered.
As defined above, the probability/ likelihood of emissions occurring is s *likely*. With reference to the matrix of *Table 7-20*, therefore, it can be determined that the Significance Rating of GHG emissions during the project construction phase is considered to be *MAJOR*.

*CONSTRUCTION PHASE: MITIGATION MEASURES*

Mitigation of GHG emissions during the Project construction phase can be achieved through a series of measures that should be included within the Construction and Environment Management Plan. These mitigation measures are split between the various impacts, as identified in *Table 7-24*, and offer a qualitative rather than quantitative approach to mitigation due to a lack of data.

***Table 7-24 GHG Mitigation Measures: Construction Phase***

| Impact | Mitigation Measure |
|---|---|
| Emissions associated with transport of raw materials and construction activity | 1. Optimize transport logistics (locations/routes) to ensure efficient carriage of raw materials.<br>2. Reducing vehicle idling times through focus on scheduling of construction operations.<br>3. Prioritise the use of fuel efficient transportation vehicles and ensure regular maintenance of vehicles. |

| | |
|---|---|
| | 4. Provide efficient driving guidelines to transportation vehicle drivers to promote fuel efficiency.<br>5. Ensure that on-site power generation is designed, sized and operated for emissions performance as well as reliability. |
| Emissions associated with land use change | 1. Minimise the area of land clearance required.<br>2. Where tree-clearance involved, liaise with appropriate authorities to salvage commercial timber and fuelwood; this can later be sold (or donated) to local users.<br>3. Productive utilisation of biomass material (wood) subsequent to land clearance. |

## *OPERATIONAL PHASE: GHG ASSESSMENT*

### *OPERATIONAL PHASE: ESTIMATION OF GHG EMISSIONS*

The GHG emissions estimation for the operational phase of the Project draws upon the calculations made in the SGR Project Mainline Operation Plan (all phases: Dar es Salaam to Isaka) document number MDM-YMI-AL-GL00X-O-OT-REP-0001-0 and dated 12/02/19. Key assumptions made within the Plan are as follows:

- The line will be a standard gauge, single track railway and shall carry both passenger and freight traffic;
- Standard freight and passenger rolling stock parameters;
- A standard cost-effective freight locomotive with a 25 tons axle load and electric multiple units (EMUs) for passenger train configuration;
- Total freight load to be transported by 2029 is 12.9 million tons/year; and
- Total passenger load to be transported by 2029 is 1.1million passengers/year.

According to the Operational Plan, the maximum number of trains that is achievable on the line is twenty (20) freight and four (4) passenger trains per day. Due to limitations in the traction power system, the number of locomotives per train is limited to two and a total current of 800A for a freight train. According to train performance simulations, two locomotives will be able to haul up to 4 250 gross tons of freight train in optimum conditions[1].

[1] The Operational Plan indicates that at a 36km segment between Makutupora and Manyoni there will be the need to attach an additional diesel 'push-up' locomotive. However, this segment is beyond the Phase I and II (Dar es Salaam to Makutupora) sections of the Project, and therefore not considered in this assessment.

*PASSENGER TRAINS*

A minimum of four passenger trains per day (two trains in each direction) will be sufficient to carry more than 1.1 million passengers as stated in the feasibility study. Considering the length of a single EMU train set being approximately 100m, a three EMU set could be used and would be capable of carrying an annual capacity of 1.49 million passengers.
The Operational Plan has calculated the energy usage by passenger trains in each direction along the proposed railway line as shown in *Table 7-25*.

***Table 7-25 Passenger Train (EMU) energy consumption estimates***

| Direction and Length | MJ per trip | MWh per trip | kWh/km |
|---|---|---|---|
| Westbound (Dar es Salaam to Makutupora) 533km | 42 840 | 11.9 | 22.3 |
| Eastbound (Makutupora to Dar es Salaam) 533km | 34 920 | 9.7 | 18.3 |

Assuming each passenger travels the entire 533km length of either the westbound or eastbound route, the total effective passenger distance expected during operational Phases 1 and 2 will be 58 630 000 passenger kilometres per annum.

The calculated data above has been represented in *Table 7-26* to estimate the annual GHG emissions associated with passenger trains. The calculation uses the Grid Emissions factor (GEF) of the Tanzanian national electricity grid as reported by the International Energy Agency (IEA, 2017) at 0.4397 $kgCO_2e/kWh$. As shown, annual emissions from passenger trains are about **7000 $tCO_2e$.**

***Table 7-26 Passenger Train GHG emissions***

| Direction | MWh/trip | Trips/year | MWh/year | $tCO_2e$/year |
|---|---|---|---|---|
| Westbound 533km | 11.9 | 730 | 8 687 | 3 819 |
| Eastbound 533km | 9.7 | 730 | 7 081 | 3 113 |
| **TOTAL** | | **1 460** | **15 768** | **6 932** |

*FREIGHT TRAINS*

The freight train configuration shown in *Table 7-27* gives the gross weight per train and freight train numbers which would be required to meet the feasibility

study goals of 12.9million tons freight load per year. Westbound trains with a length of 1306m would be composed of 63 wagons with a gross weight of 3693 tons hauled by 2 electric locomotives. The eastbound train would have the same configuration but with reduced freight 2792 tons due to different and less freight demand.

*Table 7-27 Freight train configurations and numbers*

| Direction | Net Train Weight, t | Number Trains per year | Total Freight Mass, t | kt km |
|---|---|---|---|---|
| Westbound 533km | 2 283 | 3 520 | 8 035 968 | 4 283 170 |
| Eastbound 533km | 1 382 | 3 520 | 4 864 640 | 2 592 853 |
| **TOTAL** | | **7 040** | **12 900 608** | **6 876 023** |

The Operational Plan has calculated the energy usage by freight trains in each direction along the proposed railway line as shown in *Table 7-28*.

*Table 7-28 Freight Train energy consumption estimates*

| Direction and Length | MJ per trip | MWh per trip | kWh/km |
|---|---|---|---|
| Westbound (Dar es Salaam to Makutupora) 533km | 163 440 | 45.4 | 85.2 |
| Eastbound (Makutupora to Dar es Salaam) 533km | 131 040 | 36.4 | 68.2 |

The calculated data above has been represented in *Table 7-29* to estimate the annual GHG emissions associated with freight trains. The calculation uses the Grid Emissions factor (GEF) of the Tanzanian national electricity grid as reported by the International Energy Agency (IEA, 2017) at 0.4397 $kgCO_2e/kWh$. As shown, annual emissions from freight trains are about **127,000 $tCO_2e$.**

*Table 7-29 Freight Train GHG emissions*

| Direction | MWh/trip | Trips/year | MWh/year | $tCO_2e$/year |
|---|---|---|---|---|
| Westbound 533km | 45.4 | 3 520 | 159 808 | 70 268 |
| Eastbound 533km | 36.4 | 3 520 | 128 128 | 56 337 |
| **TOTAL** | | **7 040** | **287 936** | **126 606** |

*OPERATIONAL PHASE: GHG EMISSIONS IMPACT ASSESSMENT*

The summary of GHG emissions estimations for the project operational phase is shown in *Table 7-30*.

*Table 7-30 Scope 2 GHG Emissions Impact: Operational Phase*

| Emissions Source | Estimated $tCO_2e$ per annum (rounded) |
|---|---|
| Scope 2 GHG Emissions: Passenger Rail | 7 000 |
| Scope 2 GHG Emissions: Freight Rail | 127 000 |
| **TOTAL** | **134 000** |

The combined annual emissions from the operational phase of the Project which is considered as Scope 2 emissions arising from transportation activities (freight and passenger combined) are about 134 000 $tCO_2e$ per annum. This value surpasses the IFC standard threshold and places the operational phase emissions within the *large* magnitude rating. Therefore, technically feasible and cost-effective mitigation options must be considered.

As described in Section 4.2, the magnitude of the potential negative impacts is considered to be *large* during the Project's operational phase. In addition to this, the probability that the consequence can reasonably be expected to occur within the life of the facility is regarded as *likely*. With reference to *Table 7-20*, therefore, it can be determined that the Significance Rating of GHG emissions during the Project operational phase is considered to be *MAJOR*.

*OPERATIONAL PHASE: MITIGATION MEASURES*

GHG emissions associated with the operational phase of the SGR Project are primarily associated with the use of electric rolling stock (EMUs) and locomotives. A small number of measures for supporting the further efficiency of operations are set out in *Table 7-31*.

*Table 7-31 GHG Mitigation Measures: Operational Phase*

| Impact | Mitigation Measure |
|---|---|
| Emissions associated with operations of trains | 1. Prioritise the procurement of highly efficient locomotives<br>2. Undertake the selection and procurement of all traction units on a lifecycle cost of ownership basis<br>3. Use regenerative braking systems on all trains<br>4. Minimising idling time all locomotives<br>5. Provide comprehensive efficient driving guidelines to locomotive operators, to promote fuel efficiency |

The alternatives assessment has been undertaken for the operational phase of the Project only, and is based upon the key parameters of the Operational Plan, i.e. 12.9 million tons/year freight transported and 1.1million passengers/year transported. For each of these it is assumed that the total transportation distance will be 533km (Dar es Salaam to Makutupora, or return). The SGR project operational GHG emissions have been assessed against three alternative scenarios/options as follows:

1. 100% passengers and 100% freight are transported using the existing diesel-powered MGR railway system;
2. 100% passengers and 100% freight are transported by road transport only. This scenario assumes the use of bus transportation for passenger movement and the use of mixed heavy/medium-weight goods vehicles for freight movement; and
3. A 50/50 modal split between Options 1 and 2 above.

The further assumptions are that all transportation within the alternative options will be by diesel vehicles (i.e. bus, truck, HGV or locomotive). The emissions factors used for this analysis have been taken from the GHG Protocol and are as shown in *Table 7-32*.

***Table 7-32 GHG emissions factors for Alternatives Analysis***

| Type | Rail | Road | Units |
|---|---|---|---|
| Passenger | 0.115 | 0.067 | Kg $CO_2e$/passenger km |
| Freight | 0.017 | 0.204 | Kg $CO_2e$/tonne km |

The comparison of SGR operations to the three alternative options is shown below in *Table 7-33*.

*Table 7-33 GHG emissions factors for Alternatives Analysis*

| ITEM | Basecase SGR | Option 1 MGR | Option 2 Road | Option 3 MGR & Road |
|---|---|---|---|---|
| Passengers per annum | 1 100 000 | 1 100 000 | 1 100 000 | 1 100 000 |
| Freight per annum | 12 900 000 | 12 900 000 | 12 900 000 | 12 900 000 |
| Km/trip | 533 | 533 | 533 | 533 |
| Passenger km per annum | 586 300 000 | 586 300 000 | 586 300 000 | 586 300 000 |
| Freight tonne km per annum | 6 875 700 000 | 6 875 700 000 | 6 875 700 000 | 6 875 700 000 |
| Passenger EF ($tCO_2e$/passenger km) | 0.012 | 0.115 | 0.067 | 0.091 |
| Freight EF ($tCO_2e$/tonne km) | 0.018 | 0.017 | 0.204 | 0.115 |
| Passenger $tCO_2e$ per annum | 6 932 | 67 424 | 39 282 | 53 353 |
| Freight $tCO_2e$ per annum | 126 606 | 116 886 | 1 402 642 | 759 764 |
| **TOTAL $tCO_2e$ per annum (rounded)** | **134 000** | **184 000** | **1 440 000** | **813 000** |

The above table shows that overall, the SGR operations will result in lower $CO_2e$ emissions than the other three options assuming the same volumes of passengers and freight are transported along the Project route.

**Conclusions of Alternative Assessment**

**GHG Savings:** The absolute and percentage savings of SGR operations as compared to the three alternative options are shown below in *Table 7-34*.

*Table 7-34 GHG emissions savings against alternatives*

| ITEM | Basecase SGR | Option 1 MGR | Option 2 Road | Option 3 MGR & Road |
|---|---|---|---|---|
| TOTAL $tCO_2e$ per annum | 134 000 | 184 000 | 1 440 000 | 813 000 |
| GHG saving of SGR against alternatives as absolute $tCO_2e$ per annum | - | 50 000 | 1 300 000 | 680 000 |
| GHG saving of SGR against alternatives as percentage per annum | - | 27 | 90 | 84 |

As shown, the SGR operations would result in savings of GHG ranging **between 27 and 90 percent**, depending on the compared option.

In reality, the existing MGR railway (Option 1) would not have sufficient capacity (nor is it technically designed) to handle the given freight and passenger volumes as foreseen for the SGR Project; similarly the Option 2 Road transport is not easily feasible (e.g. one SGR freight train of 2280 t would require about 230 lorries at 10 t/vehicle; at about 10 trains per day each direction, that would mean about 2300 lorries underway – daily). As such, the more realistic comparison for this assessment is Option 3, a mix of MGR and road transport. In this respect, compared to Option 3 the SGR operations would provide an absolute savings of about **84%, or 680,000 $tCO_2e$** per annum.

**Efficiency**: The efficiency (or energy intensity) of the SGR operations can be compared to the alternatives in terms of transporting the given volumes of passengers and freight along the 533 km route. The GHG emission factors (EFs) given in Table 7-40 can be used as a proxy for an overall efficiency/intensity factor. As discussed above, the more realistic of the alternatives for comparison is Option 3 – mix of MGR and Road transport.

*Table 7-35 Evaluation of Efficiency*

| ITEM | Basecase SGR | Option 3 MGR & Road |
|---|---|---|
| Passenger EF ($tCO_2e$/passenger km) | 0.012 | 0.091 |
| Freight EF ($tCO_2e$/tonne km) | 0.018 | 0.115 |
| Efficiency advantage of SGR - Passenger | - | 87 |
| Efficiency advantage of SGR - Freight | - | 84 |

### *7.6.4 Conclusions*

The GHG emissions assessment has yielded the following estimates of emissions magnitude which will arise due to the project activities:

- During construction phase: 205 000 $tCO_2e$ per annum (100% accountable to Scope 1); over the assumed 3.5 years of construction, this yields about **700,000 $tCO_2e$** in total.
- During full operational phase: **134 000** $tCO_2e$ per annum (100% accountable to Scope 2)

Given the *magnitude* and *likelihood* of the emissions projections for each Project phase, the *impact significance* of both construction and operational phases is considered *MAJOR*.

A number of GHG mitigation options have been proposed for the construction and operational phases, with an emphasis on the construction phase. Whilst there are a small number of mitigation routes for the operational phase, these are limited to efficient equipment selection and operator training. The emissions during SGR operations will largely depend on the Tanzanian national grid emissions factor, namely the fuel-mix used in the power plants generating the electricity for the Tanzanian national grid, from which the SGR obtains its electricity. As this overall fuel-mix becomes less carbon-intensive in future (eg gas replacing oil, more renewables), the SGR carbon emissions will decrease correspondingly.

In general, the use of the electric-fueled SGR will yield a significantly reduced GHG emissions/climate impact compared to the diesel-fueled rail or road alternatives.

When comparing to alternative options, the SGR project has been calculated to offer the following GHG reduction potential:

- Compared to diesel rail/MGR: 50 kt$CO_2$e per annum (28% reduction)
- Compared to Road: 1 300 kt$CO_2$e per annum (90% reduction)
- Compared to MGR/Road mix: 680 kt$CO_2$e per annum (84% reduction)

In addition, the specific efficiency improvement (in terms of $CO_2$e per unit of transport) of the SGR is about 84-87% as compared to the MGR/Road mix alternative, with this option considered the more realistic comparison.

## *7.7 CLIMATE CHANGE RISK ASSESSMENT*

The predicted impacts to the climate as a result of the proposed Project are described in this *Section*.

### *7.7.1 Overview*

Climate change, and the associated political and social response, is already presenting material risks and opportunities to business and industrial sectors. These risks and opportunities have grown in prominence over the last five to ten years and are expected to increase significantly in scale and coverage in the next decade.

The physical impacts of climate change are accelerating and pose a threat to business operations and financial earnings through extreme weather events

such as storms, floods and droughts. The effect of these changes could result in business interruption through damage to physical assets and disruption to supply chains and distribution of networks. Understanding the nature of these risks will allow new facilities to be designed in a manner which increases resilience and takes advantage of opportunities from the outset thereby reducing costs going forward.

*IFC Performance Standard 1* requires:

- the risks and impacts identification process to consider the emissions of greenhouse gases, the relevant risks associated with a changing climate and the adaptation opportunities, and potential transboundary effects, such as pollution of air, or use or pollution of international waterways.

*IFC Performance Standard 3* requires:

- measures for improving efficiency in consumption of energy, water, as well as other resources and material inputs;
- options to reduce project-related GHG emissions during the design and operation of the project; and
- for projects > 25,000 tCO2e/year quantification of direct greenhouse gas emissions within the physical project boundary and indirect emissions associated with off-site production of energy (i.e. purchased electricity).

### *7.7.2 Methodology*

*Desktop Review and Data Collection*

The project team reviewed data relating to the existing and future climate in the area. This included framing of:

1. **The baseline climate assessment**
   Overview of historic climate (such as temperature and precipitation) and extreme weather conditions (such as floods). These were gathered through desktop research of sources which outline past and present climate across Tanzania and within the specific region of focus.

2. **Future projections of climate change**
   Compilation of climate change projections for 2030, 2050 and 2080 for a range of metrics as set out in Baseline Section (1). The source for this

(1) Note that no detailed climate change modelling or downscaling was undertaken as part of this study and reliance was placed on reports with published climate change projection data.

information is the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report open source data from the Coupled Model Inter-comparison Project (CMIP5), which provides climate change projections across a wide range of parameters related to precipitation, drought and temperature. The project team used the pathway shown for RCP8.5 – the most emissions intensive route that the IPCC considers, which assumes that emissions continue to rise throughout the 21st century and therefore reflect their worst-case scenario for the physical impacts of climate change. As the project covers multiple regions of the IPCC dataset, the team gathered data for 7 points along the project route and identified the upper and lower levels of each climate parameter.

*Climate Change Resilience Assessment*

Climate change will have an impact on the integrity of the Project's infrastructure through changing frequency and severity of weather events.
The climate change resilience assessment is based on a high level climate change risk assessment. It uses the broad descriptions of changes in long-term, seasonal averages and extreme weather events provided in the IPCC climate change projections to qualitatively assess the effects of climate change on the infrastructure and assets which comprise the project, which are interpreted using professional expertise and judgement. The assessment:

- was carried out at a Project-wide level and included both construction and operation stages;
- considered that the Project will be designed to be:
  - resilient to impacts arising from current weather events and climatic conditions and
  - designed in accordance with current planning, design and engineering practice and codes.
- the assessment also identified any relevant resilience measures for each risk either already in place or in development for the Project's infrastructure, as outlined in the project's description and supporting documentation.

Using the baseline assessment, an analysis was completed of the key project-specific climate change risks in terms of interruptions to operations and damage to assets, such as heat, precipitation, floods, etc.

The identified climate risks were then overlaid with the various operational and infrastructure components associated with the project in a risk matrix in order

to identify key climate and weather-related risks to the project. This included, for example, increased likelihood of drought leading to water shortages during certain seasons; or higher maximum temperatures reducing the efficiency of certain equipment.

Following this stage, professional judgement was applied to the risks to determine those that were considered most significant. This shorter list of risks was placed through an impact assessment process.

*Impact Assessment Methodology*

The significance of the short list of key climate-related risks to the project was determined through an assessment of the magnitude of an effect against the vulnerability of the receiving environment and the likelihood and frequency of occurrence. The impact assessment considered impacts against three key parameters, as shown below.

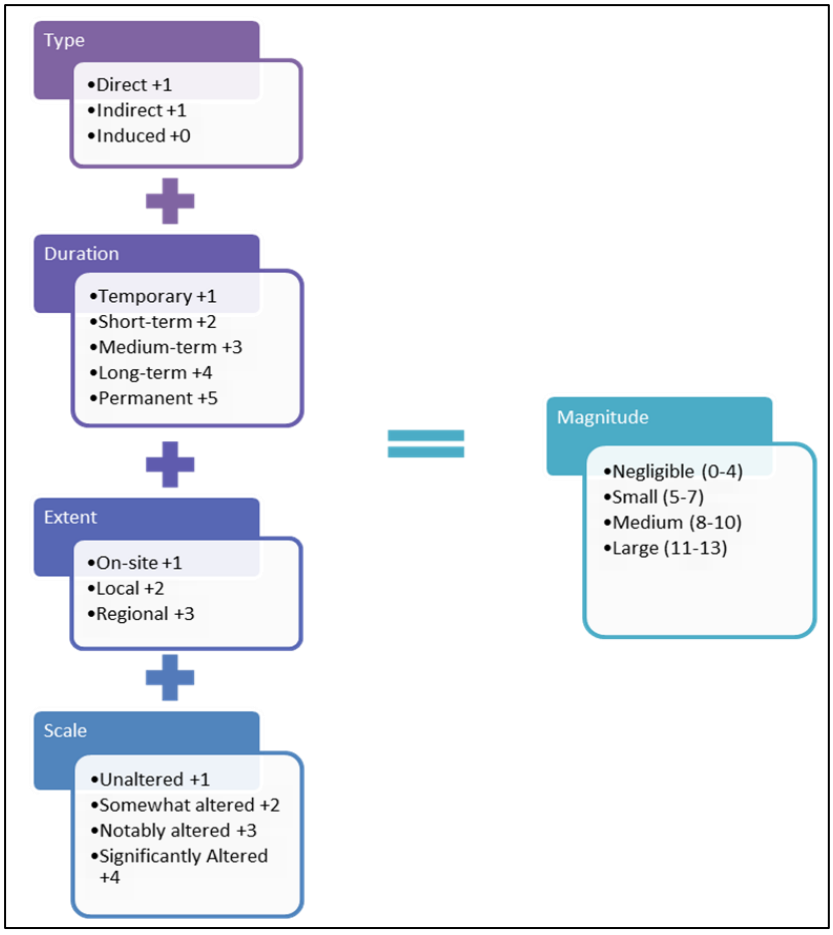
*Magnitude*

Magnitude is determined according to type, extent, duration and scale of the potential impact (the 'characteristics' of the risk), with designations given in *Table 7-36* below. Following this, for potential negative impacts an overall rating of '**negligible**', '**small**', '**medium**', or '**large**' is given. The approach to rating magnitude is outlined in *Figure 7-8.*

*Table 7-36 Characteristics for Assessing Magnitude*

| Characteristic | Definition | Designation |
|---|---|---|
| Type | A descriptor indicating the relationship of the effect on the project (e.g. pathway). | - **Direct –** Effects that result from a direct interaction between a climate event and the project (e.g. heavy rainfall flooding the facility)<br>- **Indirect –** Effects on the project which is not the result of a climate event affecting the project (e.g. community health affecting workforce)<br>- **Induced –** does not apply |
| Duration | The time period over which the project is affected. | - **Temporary –** less than one day<br>- **Short-term –** one day to one week<br>- **Medium-term –** longer than one week, shorter than a month<br>- **Long-term –** longer than one month<br>- **Permanent –** impact to sustain a number of years and up to the entire life of the facility |
| Extent | The spatial dimension of the potential effect. | - **On-site –** Effects that are limited to the project site<br>- **Local –** Effects that are limited to the project site and adjacent properties<br>- **Regional –** Effects that affect communities/properties at a regional scale (with implications for the project) |
| Scale | The severity of the effect on the project. | - **Unaltered –** Project functions and/or processes remain unaltered, e.g. heat stress affects part of workforce<br>- **Somewhat altered –** Project functions and/or processes are somewhat altered, e.g. wind delays construction/maintenance activities<br>- **Notably altered –** Project functions and/or processes are notably altered, e.g. flooding results in a one day shutdown<br>- **Significantly altered –** Project functions and/or processes are significantly altered, e.g. flooding results in a two week shutdown |

*Figure 7-8 Risk Magnitude Scoring Approach*




*Vulnerability*

Vulnerability is determined according to a factor of frequency and likelihood shown below in *Table 7-37*. Frequency refers to the frequency of the potential extreme weather event occurring over time and likelihood describes the probability of a project experiencing a negative consequence as a result of the extreme weather event.

*Table 7-37 Frequency and Likelihood Definitions for Extreme Event Effects*

| Characteristic | Definition | Designation |
|---|---|---|
| Frequency | Measure of the periodicity of the extreme weather event. | **(>10)** – Occurs once in ten years or more.<br>**(5-10)** – Occurs once in five to ten years.<br>**(1-5)** – Occurs once in one to five years.<br>**(<1)** – Occurs once a year or more. |

| Characteristic | Definition | Designation |
|---|---|---|
| Likelihood | The probability of the project experiencing a consequence as a result of the extreme weather event. | **Unlikely** – the event is unlikely to result in the project experiencing a potential consequence.<br>**Possible** - the event may well result in a consequence for the project.<br>**Likely** – the event will result in one or more potential consequences for the project. |

The vulnerability of the project to the potential impact of a climate-related risk has then been determined based on the frequency and likelihood of the effect, and has been described as being 'low', 'medium' or 'high', as set out in *Table 7-38* below.

***Table 7-38 Impact Vulnerability Rating Matrix***

| | | Frequency of extreme event | | | |
|---|---|---|---|---|---|
| | | > every 10 years *(>10)* | Every 5 – 10 years *(5 – 10)* | Every 1 – 5 years *(1-5)* | Once a year or more *(<1)* |
| **Likelihood of experiencing a negative impact** | **Likely** | **Medium** | **Medium** | **High** | **High** |
| | **Possible** | **Low** | **Low** | **Medium** | **High** |
| | **Unlikely** | **Low** | **Low** | **Low** | **Medium** |

*Significance*

Significance is a factor of vulnerability and magnitude. Again, a rating between 'negligible' and 'large' has been applied. This has been completed only for the negative impacts and not the positive. The matrix for calculating this is shown in *Table 7-39.*

*Table 7-39 Risk Significance Ratings Matrix*

| | | Vulnerability | | |
|---|---|---|---|---|
| | | Unlikely | Seldom/Occasional | Likely |
| Magnitude of Impact | Large | Moderate | Major | Major |
| | Medium | Minor | Moderate | Major |
| | Small | Negligible | Minor | Minor |
| | Negligible | Negligible | Negligible | Negligible |

The risks were evaluated twice during this stage: once for the baseline, i.e. present, context for both construction and operation stage risks and then a second time within a future climate change context for operations stage risks only.

*Potential Adaptation Measures*

Following these two risk evaluations, where possible measures for mitigating the identified risks (known as 'adaptation measures') were recommended. The impact assessment was then undertaken for a final time against the future climate context to illustrate the extent to which implementation of these adaptation measures can enhance the resilience of the facility to the future impacts of climate change.

### *7.7.3 Climate and the Project*

*The Climate Baseline*

Please refer to Chapter 4: Baseline Environmental and Social Conditions for a detailed breakdown of the climate historical data baseline.

*Potential Future Climate Risks*

Please refer to Chapter 4: Baseline Environmental and Social Conditions for a detailed breakdown of the future climate projections and their subsequent risks.

### *7.7.4 Climate Impact Assessment*

The project team identified what were considered to be the key impacts of (a) present climate and (b) future climate change to the Project. This was completed using information included in:

- the proposed plant's design documentation;
- literature outlining the climate-related risks faced by railway; and
- the baseline climate and future climate projections outlined in *Chapter 4*.

A summary of the project aspects considered and the related climate change risks are shown in *Table 7-40* below. Those which are in bold have been identified as those risks likely to be of greater materiality and will be considered in detail through later stages of assessment.

*Table 7-40 Risks of Future Climate Scenarios on Resources and Operations related to the SGR Project*

| Impact | Potential future scenario | Construction Stage | | | | | | | | Operation Stage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Vehicles & tarred access roads | Construction equipment | Construction materials, including water source | Temporary buildings, infrastructure and fencing on edge of RoW | Human | Supply source: borrow pits, quarry sites, sand source | Blasting (earthwork activities and quarrying) | Bridges, overpass, underpass, culvert, viaducts | Railway track, trains, stations, marshalling yards and fencing on RoW |
| **Extreme temperatures and long periods of droughts** | Increase in maximum temperature of up to 1.26°C in 2030, 2.13°C in 2050 and 3.92°C by 2080.<br>Warm spell durations are expected to increase by up to 59 days by 2030, up to 119 days by 2050, and up to 215 days by 2080 | **T1: Days of extreme and prolonged heat periods cause cracks and potholes in the road surface.** | T3: Heat may cause overheating of equipment | T4: Delays in getting materials due to health issues | T6: Increased use of air conditioning at staff sites over an increased period | **T7: Heat impacting workers, resulting in health issues and restricted working hours** | | T8:Potential negative effect on explosives due to high temperatures | **T9: Heat stress to steel in bridges and other infrastructure by thermal expansion** | **T10: Heat stress to steel in bridges and other infrastructure by thermal expansion** |
| | | T2: Extreme heat causing overheating of vehicles. | | T5: Decrease in surface water used for construction. Reservoir will decrease in depth and area if dry spells are longer leading to water shortages. | | | | | | T11: Extreme heat could damage water supply infrastructure to stations |
| **Storms, extreme precipitation, flash flooding & riverine flooding** | Increase in precipitation from December to February up to 91.30mm more per season in 2080.<br>Increase in precipitation exceeding the 95th and 99th percentile by up to 83.33mm/day and 51.06mm/day by 2080 respectively.<br>Increase in days with at least 10 mm of precipitation, by up to 1.93 by 2030, 3.34 by 2050 and 3.98 by 2080. | P1: Storms causing surface runoff on access roads | P5: Potential lightning strikes causing damage to equipment and electrical disruptions. | P7: Material handling difficulties (slippage, spillages and blockages)– | P10: Potential lightning strikes causing damage to building. | P13: Safety risk from lightning for construction workers | **P17: Instability of slopes and erosion at borrow pits, quarry and sand source sites.** | P19: Drilling and blasting complications and blasting interruptions due to lightning | P22: High winds during storms causing road closure | P24: Maintenance of track difficulties. |
| | | P2: Waterlogging of road surface during storms, creating surface cracking | P6: Damage to equipment and possible washing away of equipment during flooding. | P8: Potential delays in raw material delivery due to wet roads | **P11: Damage to buildings by flood waters** | P14: Overburden of sewerage systems in communities | **P18: Flooding of burrow pits, quarries and sand source sites.** | P20: Drilling and blasting delays and blasting interruptions due to flooding | **P23: Increased risk of gradual scouring of bridge footings infrastructure, damage to underpass and overpass caused by high peak flow** | P25:Train disruptions and delays due to storms and precipitation |
| | | P3: Inability to use vehicles, including risk of being damaged | | P9: Loss of materials which are washed away | F12: Flooding causes damage to fencing. | **P15: Risk of injuries due to both surface and flowing water** | | P21: Instability of slopes at borrow pits due to blasting | | P26: Extreme flooding could damage water supply infrastructure |
| | | P4: Blockage of road from debris carried in storm | | | | P16: Potential spread of waterborne disease as a result of standing water | | | | P27: Flooding causes damage to fencing and damage to trains. |
| **Wildfires** | Reduction in soil moisture by up to 81% in both 2030 and 2050. Increase in evaporation up to 32.97 mm a season by 2080. | W1: Restricting access to roads, potential delays to construction work | W2: Possible damage to equipment. | W3: Delays in getting materials to site due to access problems | W4: Damage to fencing due to fires. | **W5: Possible health issues or risk to life from smoke inhalation** | | W6: Drilling and blasting delays and blasting interruptions due to fires | W7: Possible fire damage to supporting infrastructure | **W8: Potential melting and damage to tracks. Damage to stations and trains.** |
| | | | | | | | | | | W9: Damage to fencing due to fires. |

| Impact | Potential future scenario | Construction Stage | | | | | | | | Operation Stage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Vehicles & tarred access roads | Construction equipment | Construction materials, including water source | Temporary buildings, infrastructure and fencing on edge of RoW | Human | Supply source: borrow pits, quarry sites, sand source | Blasting (earthwork activities and quarrying) | Bridges, overpass, underpass, culvert, viaducts | Railway track, trains, stations, marshalling yards and fencing on RoW |
| **Landslides** | Larger increase in precipitation change per season than evaporation per season of up to 58.33 mm by 2080 in Dec to Feb. Increase in days with more than 10mm precipitation up to 23% by 2080. Alternatively reduction in soil moisture by up to 81% in both 2030 and 2080. | L1: Loss of access and damage to roads | L2: Equipment being buried due to landslides | L3: Delays in getting materials to site due to access problems | L4: Damage to fencing due to landslides.<br>L5: Damage to or loss of buildings | **L6: Risk of loss of life or serious impacts to health** | | | **L7: Damage to bridges, overpass and underpass and blockage from debris carried in landslide** | L8: Damage to fencing and marshalling yards due to landslides.<br>**L9: Damage and blockage of track, trains and stations from debris carried in landslide** |

Note: The impacts shown in **orange** are the impacts that have been identified as likely to be of greater materiality. The project has already identified mitigation measures for those impacts.

### *7.7.5 Quantification of Climate Change Related Risks*

This *section* analyses how the key risks outlined in the above section were quantified against the baseline climate situation and future climate scenarios.

Note that the quantification of risks assumes that any risks identified in the impact assessment above are unmitigated against unless adaptation measures are specifically outlined in the project design documents.

*Extreme Temperatures and Long Periods of Drought*

Increased temperatures during the construction phase may result in overheating of vehicles and equipment. There is a possibility that in the dry seasons there may be decrease in the availability of surface water used for construction. High temperatures will lead to heat stress if employees will work for long periods of the heat. Which in turn will result in extender duration of construction and delay in transporting material to and from site.

Extreme high temperatures can cause road surface material to soften and expand, which can result in rutting and potholes. High temperatures increase the probability of road surfaces developing cracks more easily. In addition, long periods of higher temperatures and increased solar radiation are likely to reduce the lifetime of asphalt road surfaces

Extreme heat in both the construction and the operating phases can also cause stresses to other road infrastructure, such as steel in bridges through thermal expansion and movement of bridge joints. Additionally its effect on overpasses, underpasses, culverts and viaducts.

*Storms, Extreme Precipitation, Flash Flooding, & Riverine Flooding*

Projected higher levels of future precipitation is likely to lead to access roads more easily developing potholes, or for existing potholes to deepen quickly. Waterlogging of the road can result in cracking of the road surface.

"Road assets are particularly vulnerable to climate stressors such as higher temperatures, increased precipitation, or flooding."[1]

[1] http://www.worldbank.org/en/topic/transport/publication/enhancing-the-climate-resilience-of-africas-infrastructure-the-roads-and-bridges-sector

In storm conditions, debris carried by flood waters could obstruct the road, whilst lightning could pose a threat to worker safety and risk damaging equipment and buildings during construction phases. In addition, high winds from storms could cause road closures during operation, especially in locations with bridges and raised road surface. These concerns are not currently addressed in the project plan. During construction flooding will be very disruptive, potentially washing away materials, damaging equipment, vehicles, worker camps, buildings, fencing and flooding burrow pits, sand sources and quarries. If the severity and extent of the flooding is sufficiently intensive, it could result in road closures during operations due to driving being unsafe. During the operation's phase flooding can disrupt the train tracks, the stationery trains, the buildings and infrastructure located at stations. Additional damage may be caused to fencing along the RoW and the marshalling yards.

There will also likely be an increased risk of damage to bridges, underpass and overpasses, culverts and viaducts infrastructure during peak flow, and there can be a risk of destruction to the road from debris and flood waters. If flood waters rise significantly this can result in injuries to people from flowing water, and waterborne diseases could be spread as a result of standing water.

In Tanzania during the years from 2014 to 2017, floods affected critical infrastructure from the coast to the highlands, destroying roads, bridges and public and private buildings. [1]

Affecting the site seasonal rivers such as Mpiji, Ngerengere, Kidete, Kidimo and Mzase can be impacted if construction works shall proceed during rainy seasons. Culvert construction may stir riverbed deposits into suspension. Though the large particles may settle quickly, the finer ones will increase the turbidity of Rivers.

*Wildfires*

When extreme heat is combined with a reduction in precipitation the risk of wildfires increases. For the construction stage, this poses an immediate risk to the possible delay in construction due to limiting the access of vehicles to sites or result in road closures. Wildfire could cause fire damage to temporary buildings during construction, where flammable materials and fuels are particularly dangerous.

[1] https://www.climatelinks.org/sites/default/files/asset/document/20180629_USAID-ATLAS_Climate-Risk-Profile-Tanzania.pdf

During operation, wildfires could damage the train tracks, and damage other infrastructure such as bridges, culverts, overpasses and underpasses.

The impacts of wildfires in the operating and the construction phases may cause destruction to roads, equipment, vehicles, buildings, fences, trains, tracks and marshalling yards. Due to most of them being stationery objects that can get affected by the moving fires.

The impacts of wildfires were not originally identified in the construction planning of the site but it is an important aspect that needs to be considered as a result of extreme temperature changes and longer spells of droughts, coupled with higher evaporation rates.

*Landslides*

Landslides occur as a consequence when specific conditions prevail, notably following high precipitation and when soil is saturated, landslides can occur. However such a risk can also occur where there is low soil moisture content and a lack of precipitation, resulting in unstable soil and landslides. There occurrence can lead to road repair and reconstruction needs greater than those from other climatic events. The most likely impacts are expected to be loss of access to site due to damaged roads, disruption to construction, loss of materials and damage to infrastructure, equipment and buildings. There can also be a risk of loss of life or serious impact to health.

During the construction phase landslides will also be prevalent in areas like quarries, sand sources and borrow pits. They have a bigger risk or erosion and landslides due to the piling up of material or loss of material for construction use. In the operating phase the greatest threat of landslides is the damage to the tracks, trains the station buildings and all the bridges, overpasses, underpasses, culverts and viaducts along the route. The biggest damage will be at the bridges and culverts which will be found near rivers.

Taking into consideration that project sites passes through a drainage basin which is the Wami/Ruvu basin (in Dar es salaam and Morogoro). This is mostly likely to happen if construction is undertaken during the months of February - May when most of the project areas experience heavy rains. Also soil erosion is expected at the quarry sites and borrow pits.

### *7.7.6 Impact Assessment*

Certain impacts were identified as likely to be of the greatest materiality. The significance of these more significant impacts identified above on the highway have been assessed three times:

1. Firstly against the baseline risk for both the construction and operation stage, as shown in *Table 7-42* below.

2. Then the assessment is carried out for future climate risk during operation using 2030, 2050 and 2080 data as shown in *Table 7-43*. The data for a later time period is typically better for seeing trends in projected changes and, in the case of the railways, will be a long term standing project.

3. The assessment is then undertaken a third time in having accounted for the suggested adaptation measures. This is against the baseline climate scenario for construction risks and the future climate change scenario for operational risks.

The project has already identified adaptation / mitigation measures for several risks and hence these were not further analysed in the impact assessment below. The impacts identified predominantly resided in the construction phase as shown in the table below.

The mitigation measures include the Health & Safety (H&S) Plan and the Sedimentation and Erosion control Plan for the below impacts.

*Table 7-41 Impacts with existing mitigation measures*

| Impact | Construction Stage | |
|---|---|---|
| | Human | Supply source: borrow pits, quarry sites, sand source |
| **Extreme temperatures and long periods of droughts** | **T7: Heat impacting workers, resulting in health issues and restricted working hours** | |
| **Storms, extreme precipitation, flash flooding & riverine flooding** | **P15: Risk of injuries due to both surface and flowing water** | **P17: Instability of slopes and erosion at borrow pits, quarry and sand source sites.** |
| | | **F18: Flooding of burrow pits, quarries and sand source sites.** |
| **Wildfires** | **W5: Possible health issues or risk to life from smoke inhalation** | |
| **Landslides** | **L6: Risk of loss of life or serious impacts to health** | |

*Table 7-42 Risk Assessment Using Current Baseline: Current Risks to Construction & Operation*

| Risk | | Type | Duration | Extent | Scale | Magnitude Rating | Frequency | Likelihood | Vulnerability Rating | Risk Significance |
|---|---|---|---|---|---|---|---|---|---|---|
| **T1** | **Days of extreme and prolonged heat periods cause cracks and potholes in the road surface.** | Direct | Short-term | Local | Somewhat altered | Small | Occurs once a year or more | Unlikely | Medium | Minor |
| **T9 & T10** | **Heat stress to steel in bridges and other infrastructure by thermal expansion** | Direct | Short-term | On-site | Somewhat altered | Small | Occurs once in ten years or more | Likely | Medium | Minor |
| **P11** | **Damage to buildings by flood waters** | Direct | Short-term | Local | Notably altered | Medium | Occurs once in one to five years | Possible | Medium | Moderate |
| **P23** | **Increased risk of gradual scouring of bridge footings infrastructure, damage to underpass and overpass caused by high peak flow** | Direct | Long-term | On-site | Significantly altered | Medium | Occurs once in ten years or more | Likely | Medium | Moderate |
| **W8** | **Potential melting and damage to tracks. Damage to stations and trains.** | Direct | Short-term | On-site | Notably altered | Small | Occurs once in one to five years | Possible | Medium | Minor |

| Risk | | Type | Duration | Extent | Scale | Magnitude Rating | Frequency | Likelihood | Vulnerability Rating | Risk Significance |
|---|---|---|---|---|---|---|---|---|---|---|
| **L7** | **Damage to bridges, overpass and underpass and blockage from debris carried in landslide** | Direct | Short-term | Local | Notably altered | Medium | Occurs once in one to five years | Possible | Medium | Moderate |
| **L9** | **Damage and blockage of track, trains and stations from debris carried in landslide** | Direct | Short-term | Local | Notably altered | Medium | Occurs once in one to five years | Possible | Medium | Moderate |

*Table 7-43 Risk Assessment Using Future Climate Scenario-Risks to Operation*

| Risk | | Type | Duration | Extent | Scale | Magnitude Rating | Frequency | Likelihood | Vulnerability Rating | Risk Significance |
|---|---|---|---|---|---|---|---|---|---|---|
| **T10** | **Heat stress to steel in bridges and other infrastructure by thermal expansion** | Direct | Long-term | On-site | Notably altered | Medium | Occurs once in ten years or more | Likely | Medium | Major |

| Risk | | Type | Duration | Extent | Scale | Magnitude Rating | Frequency | Likelihood | Vulnerability Rating | Risk Significance |
|---|---|---|---|---|---|---|---|---|---|---|
| **W8** | **Potential melting and damage to tracks. Damage to stations and trains.** | Direct | Short-term | On-site | Notably altered | Small | Occurs once in one to five years | Possible | Medium | Minor |
| **L9** | **Damage and blockage of track, trains and stations from debris carried in landslide** | Direct | Short-term | Local | Notably altered | Medium | Occurs once a year or more | Likely | High | Major |

### *7.7.7 Potential Adaptation Measures*

This section outlines a number of potential adaptation measures which could be taken to reduce the potential impact of risks related to climate. These are shown in Table *7-44*, and Table *7-45* and *Table 7-46* shows the effect that these are likely to have on the scenarios.

### *Table 7-44 Potential Adaptation Measures*

| Risk | | Adaptation Measure | Reason for Adaptation Measures |
|---|---|---|---|
| T1 | **Days of extreme and prolonged heat periods** cause **cracks and potholes in the road surface.** | Minimal mitigation except for using an asphalt which is as heat resistant as possible. Maintenance should be routine and frequent to avoid cracks developing into potholes. Ensure to consider this in the detailed design phase of the project. | More frequent small repairs are less expensive and can be done overnight when roads are quieter. If roads are allowed to deteriorate enough repairs are more expensive and take longer causing major disruption to the operation, such as lane or road closures. |
| **T9 & T10** | **Heat stress to steel in bridges and other infrastructure by thermal expansion** | As the design is already using reinforced steel, it is recommended to carry out regular checks to identify potential damage and stress as a result of thermal expansion before major damage to infrastructure occurs such as bridge failure. Further assessment may be required to take this potential risk into consideration during the detailed design stage. | It is not possible to prevent thermal expansion occurring, but by regularly having workers checking on the condition of the infrastructure, this increases the chance of any early stage damage or stress being identified and therefore repaired. This in turn minimises the risk and costs. |
| P11 | **Damage to buildings by flood** waters | Assess potential flood risk and determine if additional flood defence measures are required, for example, raised platforms for equipment, sandbags to stop flood waters entering buildings, extra drainage or barriers to divert flood waters. | Vulnerability to flooding will vary depending on location, further assessment will be required to determine the best flood measures to put in place and where. |

| Risk | | Adaptation Measure | Reason for Adaptation Measures |
|---|---|---|---|
| **P23** | **Increased risk of gradual scouring of bridge footings infrastructure,** damage **to underpass and overpass caused by high peak flow** | Regularly check the bridge footings for scour, and remove any debris which builds up which could increase the rate of scour. Further assessment may be required to take this potential risk into consideration during the detailed design stage. | Scour is one of the main causes for bridge failure. It is important any scouring is identified early so it can be addressed and repaired. Any engineering techniques which could reduce scour should be considered. |
| **W8** | **Potential melting and damage to tracks. Damage to stations and trains.** | Ensure a fire policy is in place, and staff are trained and practise drills. | Training staff on fire risk is important and can significantly improve safety and awareness reducing the overall risk. |
| **L7** | **Damage to bridges, overpass and underpass and blockage from debris carried in landslide** | Ensure any cut throughs, bridges and passes are stable, by undertaking surveys and then installing measures which reduce the risk of landslides such as rock anchors and retaining walls. Roads or tracks should then be cleared of debris and repaired urgently to reduce disruption to operation as much as possible. | The design will already consider slope stability of cut throughs, bridges and passes, but it is important to ensure rockfalls cannot occur by using rock anchors and retaining walls. The design includes drainage, reducing the risk of 'wet' mudflow style landslides, but 'dry' rockfall style landslides are still a risk. Natural landslides cannot be prevented but monitoring will allow early response, closing roads if time allows. Removing debris and making repairs as quickly as possible once it is safe to do so will help reduce disruption. |

*Table 7-45 Risk Assessment Using Future Climate Scenario after Implementation of Adaptation Measures*

| Risk | | Type | Duration | Extent | Scale | Magnitude Rating | Frequency | Likelihood | Vulnerability Rating | Risk Significance | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **T1** | **Days of extreme and prolonged heat periods cause cracks and potholes in the road surface.** | Direct | Medium-term | Local | Notably altered | Medium | Occurs once every five to ten years | Likely | Medium | Moderate | Regular inspections and maintenance is required |
| **T9** | **Heat stress to steel in bridges and other infrastructure by thermal expansion** | Direct | Long-term | On-site | Notably altered | Medium | Occurs once in ten years or more | Possible | Low | Minor | Regular inspections and maintenance is required |
| **P11** | **Damage to buildings by flood waters** | Direct | Medium-term | Local | Notably altered | Medium | Occurs once in one to five years | Possible | Medium | Moderate | |
| **P23** | **Increased risk of gradual scouring of bridge footings infrastructure, damage to underpass and overpass caused by high peak flow** | Direct | Long-term | On-site | Significantly altered | Medium | Occurs once in ten years or more | Possible | Low | Minor | Regular inspections and maintenance is required |
| **L7** | **Damage to bridges, overpass and underpass and blockage from debris carried in landslide** | Direct | Short-term | Local | Notably altered | Medium | Occurs once a year or more | Likely | High | Major | Will be dependent on the flood defences introduced |

*Table 7-46* *Risk Assessment Using Future Climate Scenario after Implementation of Adaptation Measures*

| Risk | | Type | Duration | Extent | Scale | Magnitude Rating | Frequency | Likelihood | Vulnerability Rating | Risk Significance | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **T10** | **Heat stress to steel in bridges and other infrastructure by thermal expansion** | Direct | Long-term | On-site | Notably altered | Medium | Occurs once in ten years or more | Possible | Low | Minor | Regular inspections and maintenance is required |
| **W8** | **Potential melting and damage to tracks. Damage to stations and trains.** | Direct | Short-term | On-site | Notably altered | Small | Occurs once in one to five years | Possible | Medium | Minor | Regular inspections and maintenance is required |
| **L9** | **Damage and blockage of track, trains and stations from debris carried in landslide** | Direct | Short-term | Local | Notably altered | Medium | Occurs once a year or more | Likely | High | Major | Will be dependent on the flood defences introduced |

# 8 IMPACTS TO THE BIOLOGICAL ENVIRONMENT

Observed and predicted impacts to the ecological environment as a result of the SGR Project are described in this *Chapter*.

## 8.1 IMPACTS TO PROTECTED AREAS

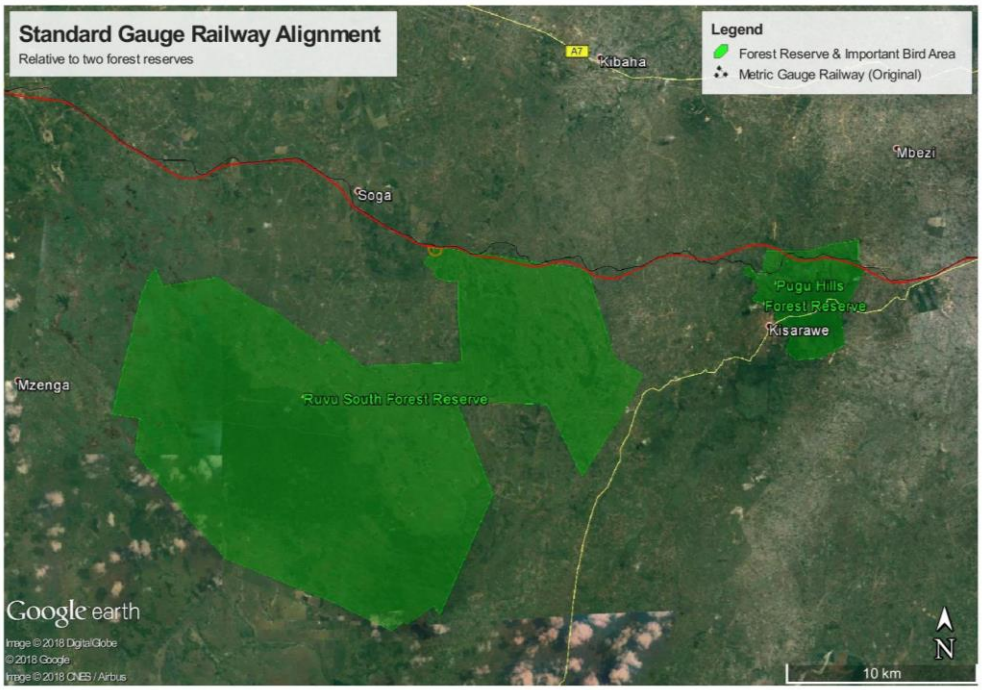
*Description of the Baseline Environment*

The ecological section in *Chapter 4* presents an overview of the various protected areas that are potentially impacted by the proposed SGR route. Many of these are forest reserves, although some are additionally recognised as AZE sites and Important Bird Areas (IBAs).
Most of these areas are not impacted by the SGR, and this impact assessment therefore focusses on the impact to the Pugu Hills and Ruvu South Forest Reserves. The proposed route passes alongside and marginally through the Pugu Hills and Ruvu South Forest Reserves (*Figure 8-1*). Approximately 11% of the Pugu Hills Forest Reserve will be fragmented off the main block, while the route passes along the northern boundary of the Ruvu South Forest Reserve. These reserves are, however currently impacted by the existing and similar MGR route, although the alignment through the Pugu Hills Forest Reserve is different.

*Sensitive Resource / Receptors*

The Pugu Hills and Ruvu South Forest Reserves protect important remnants of the Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion, which harbour some of the highest densities of plant species in the world. This area is important for a diversity of small fauna that is increasingly becoming threatened by loss of habitat across the ecoregion. This fauna includes Endangered and Critically Endangered species. Impacts to those species are addressed in ***Section 8.5***.

*Figure 8-1* ***Proposed alignment of the SGR route through the Pugu Hills and Ruvu South Forest Reserves***




*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact to Protected Areas will be a "**Major Negative Impact**" pre-mitigation

The Pugu Hills and Ruvu South Forest Reserves qualify as a critical habitat feature and an AZE site and therefore have a very high sensitivity. They are also relatively small areas and will be significantly impacted by construction of the SGR which follows a different alignment from MGR for much of the route associated with the Pugu Hills Forest Reserve.

*Residual Impact (Post-mitigation)*

A broad range of mitigation measures are presented within the BAP, of which the majority are relevant to protected the biodiversity of the forest reserves. However there is no regular mitigation that will alter the actual impact to these protected areas, and the residual impact therefore remains unchanged. Various additional conservation programmes have therefore been proposed, as required by the PS6. Such programmes will not alter the impact, but rather serve as a form of compensation for the impact.

*Table 8-1 Rating of Impacts Related to Protected Areas (Pre- and Post-Mitigation*

| Type of Impact | | | | |
|---|---|---|---|---|
| Direct Negative Impact | | | | |
| Rating of Impacts | | | | |
| | Pre-mitigation | | Post-mitigation (Residual) | |
| | Designation | Summary of Reasoning | Designation | Summary of Reasoning |
| Extent | Local | The impact will be restricted to the boundaries of these protected areas. | Local | The extent of impact is not expected to change. |
| Duration | Permanent | The ecology of these areas cannot be restored, and the impact is considered to be permanent. | Permanent | The duration of impact is not expected to change. |
| Scale | 11.6% / 13.2 km | 11.6% of the Pugu Hills Forest Reserve will be fragmented by the SGR route, which will extent for a combined distance of 13.2 km through or along the boundaries of the Pugu Hills and South Ruvu Forest Reserves respectively. | 11.6% / 13.2 km | The scale of impact is not expected to change. |
| Likelihood | Very likely | Loss of habitat and ecosystem functionality will be impacted. | Very likely | The likelihood of impact will remain the same. |
| Magnitude | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Moderate Magnitude | | | Moderate Magnitude | |
| Sensitivity/Vulnerability/Importance of the Resource/Receptor | | | | |
| High Sensitivity | | | | |
| The Pugu Hills and South Ruvu Forest Reserves comprise the Kisarawe District Coastal Forest Important Bird Area, which is recognised by the IUCN as a key Biodiversity Area and qualifies as a critical habitat. | | | | |
| Significant Rating Before Mitigation | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Major Impact | | | Major Impact | |

*Mitigation Measures*

Details of mitigation measures are presented in the Biodiversity Action Plan (BAP), however the following list of measures have relevance to the Pugu Hills and Ruvu South Forest Reserves:

- Limit the extent of the SGR footprint as per procedures presented in the BAP
- Declare the Pugu Hills and Ruvu South forest reserves as No Go Areas for workers during the construction phase
- Respect regulated buffer zones around rivers, streams, water bodies and seasonal wetlands (referred to as water sources)
- Minimise loss of fauna during vegetation clearing
- Ban the use of illegal charcoal but develop strategies to promote sustainable charcoal production and procurement techniques
- Prevent contamination through good chemical handling
- Implement an effective dust suppression strategy
- Develop and implement biodiversity protection policies
- Enforce vehicle speed limits to protect fauna
- Reduce light contamination into natural habitats at night
- Rehabilitate disturbed terrestrial sites promptly
- Restore destroyed and degraded wetlands along the SGR route, based on delineation exercises for each wetland and a comprehensive wetland restoration plan
- Develop and implement an invasive alien species control plan
- Implement controlled access along the SGR service road during operations

*Additional Conservation Actions*

Additional conservation actions have been proposed in the BAP to achieve No Net Loss of Biodiversity, Net Gains for Critical Habitat (CH) features and to address the requirements for protected areas stipulated within the PS6. The following additional conservation actions are relevant to the Pugu Hills and Ruvu South Forest Reserves:

- Support Tanzania Forest Conservation Group (TFCG) to implement sustainable charcoal programmes

- Re-establish lost dry coastal forest by planting trees within the Pugu Hills Forest Reserve
- Create additional bat roost caves as replacement for a lost tunnel
- Provide support to the Tanzania Forestry Service Agency (TFSA)
- Improved conservation management of the Pugu Hills and Ruvu South Forest Reserves

## *8.2 LOSS OF NATURAL HABITAT AND FAUNA*

*Description of the Baseline Environment*

The SGR route traverses various types of habitats that include natural vegetation, settlements and degraded cultivated land. The baseline reveals that much of the route has been modified to some extent, and natural habitats occur sporadically. The natural vegetation along the corridor supports a high diversity of plant species with conservation value, although the extent of these habitats has not been accurately determined.

*Proposed Project Activities*

According to the Railways *Act No. 4 of 2002*, the Project will require a cleared RoW of no less than 15 metres from the centre line of the railway on both sides (left and right) in towns and cities while in other areas outside the towns the RoW is 30m. Within this RoW no structures or buildings can be established. The proposed SGR will be constructed parallel to the existing MGR, except for bypasses in urban areas and diversions necessary to accommodate a high speed rail. For those sections of the proposed SGR alignment that are within the existing MGR RoW, a small area of no more than 15 m will be permanently taken on one side (only) of the proposed SGR to compensate the used portion of the RoW. Where the SGR passes completely out of the existing MGR RoW a 60 m RoW will be required (i.e. 30 m on either side of the centre line). All trees within the required sections have already been removed, and the average width of the SGR construction corridor for Phase 1 exceeds 68 meters.

During construction works temporary land take is required for construction compounds and work sites along or close to the rail route, and space for storage of plant, materials and locating site offices. Contractors may temporarily require land for other facilities such as Borrow Areas and Spoil Dumping Areas, Concrete Batching Plants, Aggregate Crushing Facilities, Haulage Routes, Labour & Workforce Accommodation, and Construction Laydown Areas.

*Sensitive Resource / Receptors*

The natural vegetation in the project area varies from coastal forest mosaic vegetation, Acacia-miombo woodlands, scrub forest, bushed grassland (i.e. grasses, trees, shrubs and forbs) with groups of scattered trees mainly baobabs (*Adansonia digitata*) and Commiphora. Also, there are miombo forests, and other patches of natural forest.

Habitats along the SGR route have been classified into modified and natural habitats based on Google Earth satellite imagery. Areas supporting natural vegetation are clearly identifiable by the absence of settlement and cultivation. Where sufficiently large areas of continuous natural vegetation occur on both sides of the SGR route, that stretch of the route has been classified as natural habitat. Some ground-truthing has been conducted by the University of Dar es Salaam and results demonstrate that the initial classification from satellite imagery has been correct.

Based on this analysis, 61% of the Phase I route passes through natural habitat, while only 36% of the Phase II route is natural (*Table 8-2*). *Table 8-3* presents the actual start and end locations areas of natural habitat along the route. All other areas are classified as Modified Habitat.

***Table 8-2 Linear Lengths (km) of the SGR Route classified as Modified or Natural based on the Status of Surrounding Vegetation without considering the impact of the SGR***

| Construction Phase | Modified Habitat | | Natural Habitat | | Total |
|---|---|---|---|---|---|
| Phase I (Lot 1) | 78.72 | 39% | 123.29 | 61% | 202.00 |
| Phase II (Lot 2) | 213.64 | 64% | 119.05 | 36% | 332.69 |
| Total | | | | | 534.69 |

***Table 8-3 Start and End Points of Areas of Natural Habitat for both Phases of the SGR Route from Dar es Salaam to Makutopora***

| Phase I (Lot 1) | | | Phase II (Lot 2) | | |
|---|---|---|---|---|---|
| Start | End | Length (km) | Start | End | Length (km) |
| 20+350 | 25+949 | 5.60 | 210+000 | 248+699 | 38.70 |
| 26+175 | 44+159 | 17.98 | 271+500 | 317+699 | 46.20 |
| 45+210 | 48+680 | 3.47 | 341+600 | 351+300 | 9.70 |
| 51+570 | 55+380 | 3.81 | 369+149 | 373+750 | 4.6 |
| 55+950 | 61+450 | 5.50 | 460+449 | 464+699 | 4.25 |
| 62+299 | 66+560 | 4.26 | 492+399 | 494+899 | 2.50 |

| Phase I (Lot 1) | | | Phase II (Lot 2) | | |
|---|---|---|---|---|---|
| **Start** | **End** | **Length (km)** | **Start** | **End** | **Length (km)** |
| 69+250 | 124+859 | 55.61 | 507+500 | 512+600 | 5.10 |
| 129+900 | 156+949 | 27.05 | 517+799 | 524+549 | 6.75 |
| | | | 528+600 | 529+850 | 1.25 |

*Analysis of the Impact*

The expected footprint for Phase 1 of the SGR construction has been calculated from spatial data, and covers an area of 1 374 ha, with an average width of 68 meters. This area covers the actual SGR construction, earthworks for cut and fill operations and the adjacent service road. A review of imagery on Google Earth reveals that the SGR footprint increases where the route passes through hilly terrain, as shown in *Figure 8-2* as the additional cut and fill earthworks needed to construct a level track, and extends beyond the expected footprint area. An additional footprint of 79.8 ha has been added for surplus soil dumps, although this is considered an underestimate of the actual footprint exceeding the expected area.

***Figure 8-2 Mapped Example of the Terrestrial Footprint Calculation***


Red line shows expected footprint extent, pink and purple shading represents MGR modified habitat.

Results of calculations in *Table 8-2* reveal that 61% of the Phase I SGR route passes through natural habitat based on the status of surrounding vegetation. The SGR is constructed adjacent to the MGR, which represents a modified habitat. A 45-meter corridor associated with the MGR is considered to be a modified habitat, and overlaps between this buffer and the SGR footprint are classified as modified habitat. The resulting area of natural and modified habitats for Phase I are presented in *Table 8-4* and reveal that most of the affected habitat was natural. The extent of modified habitat resulting from the proximity of construction activities to the MGR has been minimal.

***Table 8-4 Area of Modified and Natural Habitat Impacted by the Phase I Footprint of the SGR***

| SGR Footprint Component | Area (ha) | Percentage |
|---|---|---|
| Modified Habitat | 437.92 | 30.1% |
| Natural Habitat | 1,016.06 | 69.9% |
| Total Area | 1,453.98 | |

Spatial data for the Phase II footprint area has not been available, but assuming the same 68 meter width, the total footprint is estimated at 2,262.3 ha. Calculations above reveal that only 36% of the Phase II SGR route passes through natural habitat based on the status of surrounding vegetation. The area of impacted natural habitat is therefore estimated to be 814.4 ha, which is considerably less than the natural habitat impacted by Phase I.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact from loss of natural habitat will be a "**Major Negative Impact**" pre-mitigation.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures the significance of the impact from loss of natural habitat will be a " **Moderate Negative Impact**" post mitigation.

*Table 8-5 Rating of Impacts Related to Loss of Natural Habitat (Pre- and Post-Mitigation)*

| Type of Impact | | | | |
|---|---|---|---|---|
| Direct Negative Impact | | | | |
| Rating of Impacts | | | | |
| | Pre-mitigation | | Post-mitigation (Residual) | |
| | Designation | Summary of Reasoning | Designation | Summary of Reasoning |
| Extent | Regional | The impact extends over a total distance of 541 km. | Regional | The extent of the impact will not change. |
| Duration | Permanent | Natural habitats cannot be restored. | Permanent | Rehabilitation will occur, but will not restore natural habitats |
| Scale | 50 km (9.3%) | Phase I and II route realignments to accommodate the SGR pass through natural habitats for an estimated total distance of 50 km. | 50 km (9.3%) | The length of the impact will not change, but mitigation to minimise clearance will reduce the width of the impacted area |
| Likelihood | Will occur | This is a planned event | Will occur | Likelihood remains unchanged |
| Magnitude | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Medium to Small Magnitude | | | Small Magnitude | |
| Sensitivity/Vulnerability/Importance of the Resource/Receptor | | | | |
| Medium Sensitivity | | | | |
| Natural habitats are considered to have a sensitivity located between critical habitat (high) and modified habitat (low). | | | | |
| Significant Rating Before Mitigation | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Major Impact | | | Moderate Impact | |

*Mitigation Measures*

Details of mitigation measures are presented in the BAP, however the following list of measures have relevance to addressing the impacts associated with loss of natural habitat:

- Limit the extent of the SGR footprint as per procedures presented in the BAP
- Respect legislated buffer zones around rivers, streams, water bodies and seasonal wetlands (referred to as water sources)
- Minimise loss of fauna during vegetation clearing
- Ban the use of illegal charcoal but develop strategies to promote sustainable charcoal production and procurement techniques
- Prevent contamination through good chemical handling
- Implement an effective dust suppression strategy
- Develop and implement biodiversity protection policies
- Enforce vehicle speed limits to protect fauna
- Reduce light contamination into natural habitats at night
- Rehabilitate disturbed terrestrial sites promptly
- Restore destroyed and degraded wetlands along the SGR route, based on delineation exercises for each wetland and a comprehensive wetland restoration plan
- Develop and implement an invasive alien species control plan
- Implement controlled access along the SGR service road during operations

*Additional Conservation Actions*

Additional conservation actions have been proposed in the BAP to achieve No Net Loss of Biodiversity, Net Gains for Critical Habitat (CH) features and to address the requirements for protected areas stipulated within the PS6. The following additional conservation actions are relevant to the compensation for loss of natural habitat:

- Support TFCG to implement sustainable charcoal programmes
- Re-establish lost dry coastal forest through the planting of trees within the Pugu Hills Forest Reserve
- Create additional bat roost caves as replacement for a lost tunnel
- Provide support to TFSA
- Improved conservation management of the Pugu Hills and Ruvu South Forest Reserves

## 8.3 *FRAGMENTATION IMPACTS TO WILDLIFE CORRIDORS*

*Description of the Baseline Environment*

A rich diversity of vertebrate fauna (exceeding 800 species) potentially occurs within the area that the project is located. The highest diversity is expected to occur in the vicinity of Morogoro due to the presence of the Uluguru Mountains which hosts a rich diversity of endemic species. Birds and bats represent approximately 66% of this diversity, and are expected to be less impacted than non-flying faunal species.

Of particular concern is the large wildlife. The ESIA, following communication with the Tanzania Wildlife Research Institute (TAWIRI) noted the existence of wildlife migration routes between conservation areas that will be intersected by the SGR. A TAWIRI (2009) report describes two wildlife corridors that will be intersected by the SGR, namely between the Mikumi National Park- Wami Mbiki Wildlife Management Area (WMA) and the Selous Game Reserve - Wami Mbiki WMA.

*Analysis of the Impact*

The SGR will be a high-speed railway, and will need to be fenced to keep people, livestock and wildlife away from the railway line. This has raised concern that wildlife migration routes could be cut, leading to fragmentation of the affected populations.

These wildlife corridors were investigated, and evidence of regular elephant movement across the SGR route confirms their continued existence. Key elephant crossing points occur at the Ngerengere River (SGR location 131+272), the Mkata River (SGR location 227+915) and the adjacent Kinonge River tributary (SGR location 226+762).

Underpass structures with a 3 m height are considered the minimum that elephants are likely to utilise. Elephant bulls have a shoulder height of 3.2 m to 4.0 m, while adult females have a shoulder height of 2.2 m to 2.6 m. Bridges are included within the design criteria for the SGR for the above-mentioned key crossing points with heights of 5 meters, 9 meters and 7 meters respectively. Numerous additional bridges, culverts and underpasses are also included within the design criteria for adjacent stretches of the SGR. *Table 8-6* and *Table 8-7* present the locations and dimensions of various underpass structures proposed within the Ngerengere and Mkata areas respectively.

*Table 8-6 Proposed Bridges, Culverts and Livestock Crossings with three meters heights or greater within the vicinity of the Ngerengere Circle (Lot 1)*

| Design Code | Description | Location | Width (m) | Height (m) |
|---|---|---|---|---|
| CUL_120-1 | Culvert: In-situ cast multi-cell (2 cells) | 120+224 | 3 | 3 |
| UP-CC_126-1 | Underpass: Pedestrian, Livestock and Drainage | 126+840 | 3.7 | 3 |
| BB_129-3 | Box Bridge | 129+495 | 2 x 5.3 | 5 |
| UP-CC_131-1 | Underpass: Pedestrian, Livestock and Drainage | 131+218 | 3.7 | 3 |
| **BR_131-2 *** | **Bridge Over Ngerengere River (key elephant crossing)** | **131+272** | **72** | **5** |
| UP-CC_132-1 | Underpass: Pedestrian, Livestock and Drainage | 132+476 | 3.7 | 3 |
| CUL_136-3 | Culvert: In-situ cast multi-cell (2 cells) | 136+698 | 3 | 3 |
| UP-CC_139-1 | Underpass: Pedestrian, Livestock and Drainage | 139+160 | 3.7 | 3 |
| CUL_141-3 | Culvert: In-situ cast multi-cell (2 cells) | 141+806 | 3 | 3 |
| CUL_142-1 | Culvert: In-situ cast multi-cell (2 cells) | 142+267 | 3 | 3 |
| BR_144-3 | Bridge Over Stream: pre-cast (4 beams - 3 spans) | 144+992 | 72 | 5 |
| CUL_148-5 | Culvert: In-situ cast multi-cell (2 cells) | 148+975 | 3 | 3 |
| UP_149-1 | Underpass: Road under Rail | 149+658 | 11 | 5.5 |
| CUL_156-1 | Culvert: In-situ cast single-cell | 156+967 | 3 | 3 |

* Key elephant crossing point

*Table 8-7 Proposed Bridges, Culverts and Livestock Crossings with three meters heights or greater within the vicinity of the Mkata Circle (Lot 2)*

| Design Code | DESCRIPTION | Location | Width (m) | Height (m) |
|---|---|---|---|---|
| LS02 | Underpass: Livestock Crossing | 213+198 | 12.1 | 3 |
| BR01 | Bridge: CS-(SC19) | 216+858 | 20.6 | 9 |
| LS03 | Underpass: Livestock Crossing | 218+628 | 12.1 | 3 |
| LS04 | Underpass: Livestock Crossing | 223+168 | 12.1 | 3 |
| **BR02 *** | **Bridge: 2/B (Mkata tributary – key elephant crossing)** | **226+762** | **65.5** | **9** |
| **BR03 *** | **Bridge: 2/B (Mkata River – key elephant crossing)** | **227+915** | **65.5** | **7** |
| LS05 | Underpass: Livestock Crossing | 228+164 | 12.1 | 3 |
| LS06 | Underpass: Livestock Crossing | 233+074 | 12.4 | 3 |
| LS07 | Underpass: Livestock Crossing | 238+091 | 11 | 3 |
| LS08 | Underpass: Livestock Crossing | 243+264 | 10 | 3 |

| Design Code | DESCRIPTION | Location | Width (m) | Height (m) |
|---|---|---|---|---|
| * Key elephant crossing points | | | | |

*Proposed Project Activities*

The first 20 km of the Phase I section of the proposed SGR will be fenced, which extends from the start of the SGR within Dar es Salaam to eastern boundary of the Pugu Hills Forest Reserve. The entire length of the Phase II section, from Morogoro to Makutupora will be fenced. Specifications on the design of this fence is not available, but it is assumed to be adequate to prevent the movement of large wildlife. Fences could therefore result in the complete obstruction and loss of wildlife movement.
Fences will be constructed to pass over the top of culverts and underpasses, so that they do not obstruct wildlife, livestock, and human or vehicle movements through these structures. Bridges will not be fenced.

The proposed bridges, culverts and underpasses will be adequate to accommodate elephants and all other forms of wildlife, with the exception of giraffe; however, there has been no evidence that giraffe are present in the study area.

The current SGR design is not expected to severely fragment wildlife populations, and no design changes are therefore proposed. This permeability for wildlife is however dependent on these bridges, culverts and underpasses being kept free of debris, not being occupied as shelters by people or used as vehicle parking facilities.

An inherent risk of underpass structures is that wildlife crossing the SGR are forced to pass through narrow passages, which may increase their vulnerability to illegal hunters. This effect will be limited by the wide bridges across the Mkata River and its tributary (65.5 meters), and by the presence of underpass structures elsewhere.

In addition, it must be noted that fences do not present a complete barrier to the movement of animals, and instances do occur where individuals are able to pass through fences. The SGR will be fenced on both sides, and a risk is therefore created by double fences, where animals may penetrate one fence and then become trapped between fences. The Kenya Wildlife Service (KWS) have observed herds of elephant getting trapped between fences along the SGR in Kenya, and when a train passes they panic, leading to unpredictable behaviour

that can result in serious accidents. A report by Save the Elephants (2017) documents such events and numerous instances of fence breaking by elephants.

*Significance of Impact (Pre-mitigation)*

Analysis of the Project design reveals that sufficient permeability of the SGR is incorporated in the areas where wildlife movements across the route could occur. No additional design changes have therefore been requested, and the fragmentation impact has a low significance pre-mitigation.

*Residual Impact (Post-mitigation)*

Limited mitigation is presented to maintain permeability of the SGR underpasses, but will not affect the significance of the impact, and the residual impact remains unchanged from the pre-mitigation impact.

*Table 8-8 Rating of Impacts Related to Fragmentation of Wildlife Corridors (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| Direct Negative Impact | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| Extent | Regional | Wildlife movements cover large areas | Regional | Wildlife movements cover large areas |
| Duration | Permanent | Future cumulative impacts are likely to prevent any recovery, although wildlife movements are evolve over long periods, and are lost once they are cut. | Permanent | Future cumulative impacts are likely to prevent any recovery, although wildlife movements are evolve over long periods, and are lost once they are cut. |
| Scale | Low | Actual fragmentation will be limited by the availability of many bridges, culverts and underpasses for livestock crossing. | Low | Actual fragmentation will be limited by the availability of many bridges, culverts and underpasses for livestock crossing. |
| Likelihood | Will occur | Long linear fencing will obstruct wildlife corridors | Will occur | Long linear fencing will obstruct wildlife corridors |
| **Magnitude** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Low Magnitude | | | Low Magnitude | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| High Sensitivity | | | | |
| Sensitivity is tentatively stated as High as maintenance of the wildlife corridors influences important conservation areas on either side of the SGR | | | | |
| **Significant Rating Before Mitigation** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Low Impact | | | Low Impact | |

*Mitigation to Address Wildlife Fragmentation*

Details of mitigation measures are presented in the BAP, however the following list of measures have relevance to addressing the impacts associated with fragmentation of wildlife corridors:

- Erect Elephant-proof Fencing of the SGR in the Ngerengere and Mkata Areas

Elephant-proof fencing will be erected and maintained where there is potential elephant presence. The following recommendations are provided for elephant proof fencing:

- Elephant-proof fences need to electrified at all times.
- Such fences need to be constructed with wooden poles, as metal and reinforced concrete posts disseminate the electrical current and sufficient voltage cannot be maintained.
- Fences need to be erected with numerous high tensile steel wires rather than mesh fencing, as elephants quickly learn to push down mesh fences.
- Maintenance needs to be sustained on an ongoing basis. Fence maintenance teams need to be established and resourced with the appropriate transport, equipment and training.

- Maintain Permeability of Underpasses for Wildlife Movement
    - Bridges, culverts and underpasses must be monitored on a regular basis to ensure they are free of debris, and are not occupied by people, vehicles or other obstructions.
    - Install warning signs and speed control signs at all animal crossing corridors as identified by the design engineer and in consultation with local community.

## *8.4 IMPACTS TO AQUATIC ECOLOGY*

*Description of the Baseline Environment*

The SGR crosses numerous permanent and seasonal rivers, streams and wetlands. The aquatic health and water quality of 12 large aquatic systems was assessed for this ESIA, and the condition of these systems ranged from largely natural to critically modified. *Table 8-9* presents the results of assessments of aquatic health, and *Table 8-10* presents the results of water

quality tests. None of the fish species recorded are classified as threatened on the IUCN Red List (*Table 8-11*).

***Table 8-9 Results of Aquatic Ecological Sampling conducted where Suitable Conditions Prevailed***

| Site | Number of Invert. Taxa | TARISS Score | ASPT Score | Present Ecological Status |
|---|---|---|---|---|
| A Ruvu River | 6 | 33 | 5.5 | D - Largely modified |
| B Ngerengere River | 8 | 43 | 5.38 | D - Largely modified |
| D Ngerengere River, Morogoro | 5 | 13 | 2.6 | E- Critically modified |
| F2 Mkata River | 12 | 93 | 7.75 | B - Largely Natural |
| G Mkondoa River | 9 | 66 | 7.33 | B - Largely Natural |
| I River at Msagali village | 8 | 48 | 6 | D - Largely Modified |
| K1 Bubu River | 10 | 52 | 5.2 | D - Largely Modified |
| K2 Bubu River | 13 | 76 | 5.85 | C - Moderately Modified |
| L Mponde River | 10 | 49 | 4.9 | E - Critically Modified |
| Key: TARISS - Tanzania River Scoring System; ASPT - Average Score per Taxon. | | | | |

***Table 8-10 Site Locations and Water Quality Data collected where Surface Water was Available to Analyse***

| Site | UTM (Zone 37M) | | pH | DO (% saturation) | DO (ppm) | EC (µS/cm) | TDS (ppm) | Temp. (°C) | Salinity (Psu) |
|---|---|---|---|---|---|---|---|---|---|
| | North | East | | | | | | | |
| A1 Ruvu River | 459264 | 9248157 | 8.1 | 80.6 | 5.89 | 146 | 73 | 31.89 | 0.07 |
| A2 Ruvu River | 459264 | 9248157 | 8.09 | 81.5 | 5.55 | 166 | 83 | 36.3 | 0.08 |
| B Ngerengere River | 407812 | 9249285 | 8.16 | 77 | 5.6 | 1111 | 555 | 33.58 | 0.54 |
| C Mgolole River | 360009 | 9248945 | 6.67 | 5.2 | 0.4 | 599 | 299 | 25.82 | 0.29 |
| D Ngerengere River, Morogoro | 356657 | 9252291 | 9.27 | 21 | 1.7 | 2734 | 1366 | 27.34 | 1.41 |
| F1 Kitanange River | 320046 | 9252682 | 8.29 | 63 | 5.1 | 613 | 307 | 27.35 | 0.3 |
| F2 Mkata River | 318897 | 9252698 | 8.14 | 67 | 4.93 | 447 | 223 | 28.78 | 0.21 |
| G Mkondoa River | 271856 | 9251736 | 8.34 | 65.4 | 5.13 | 376 | 188 | 24.28 | 0.18 |
| H Lumuma River | 246112 | 9264364 | 7.04 | 39.4 | 2.89 | 1249 | 624 | 27.29 | 0.62 |
| I River, Msagali village | 199006 | 9296127 | 7.92 | 60 | 4.38 | 402 | 201 | 28.89 | 0.19 |
| K1 Bubu River | 754950 | 9339795 | 7.9 | 54.3 | 3.5 | 306 | 154 | 33.95 | 0.14 |
| K2 Bubu River | 754950 | 9339795 | 8.35 | 82.3 | 5.22 | 948 | 474 | 34.67 | 0.46 |
| L Mponde River | 738155 | 9355843 | 8.1 | 77.7 | 5.42 | 1683 | 840 | 28.98 | 0.85 |

Key: DO - Dissolved oxygen, EC - Electrical Conductivity; TDS - Total Dissolved Solids; Temp - Temperature

*Table 8-11 Fish species recorded during assessments along the SGR*

| Fish species | Common Name | Threatened Status |
|---|---|---|
| *Bagrus orientalis* | | LC |
| *Citharinus latus* | | LC |
| *Clarias gariepinus* | African Catfish | LC |
| *Labeo* sp | | |
| *Oreochromis niloticus* | Nile Tilapia | LC |
| *Schilbe moebiusii* | | LC |
| *Synodontis punctulatus* | Squeaker | LC |

Construction of the SGR will require the storage, handling and use of dangerous or hazardous materials during the construction phase. Some of the dangerous and hazardous materials include:

- Hydrocarbons (including diesel, greases, oils and other lubricants);
- Hazardous chemicals (*viz.* paints, etc.*)*;
- Wastewater, including sewage; and
- Concrete batch plant and concrete washout.

The presence and use of such dangerous and hazardous chemicals increases the probability of accidental spills or releases of minor quantities of these materials into the receiving hydrological and geohydrological environments. In addition, the washing of equipment and vehicles, as well as dirty water run-off from different Project components has the potential to contaminate surface and groundwater resources if not managed appropriately. Further, site preparation activities and associated construction of infrastructure can result in increased sediment loads in receiving watercourses.
Further, the construction activities associated with Project infrastructure across rivers, minor non-perennial watercourses and riparian habitat can result in increased sediment loads in these ephemeral rivers.

*Sensitive Resource/ Receptors*

Much of the SGR passes through dry environments, with many of the rivers being seasonal in nature. Water is a scarce commodity and a key resource to sustain communities, livestock, wildlife and various ecosystem services. Avoiding long-term destruction of aquatic ecosystems is therefore essential to sustain surrounding communities and ecological functionality.

*Significance of Impacts (Pre-mitigation)*

Based on the analysis made above, the impact to aquatic life will be moderate to **"Moderate Negative Impact"** pre-mitigation.
Though the aquatic species especially fish, are not classified as threatened on the IUCN Red List, they will be impacted and the development might disturb the ecology of these aquatic species found in these rivers. In worst-case scenario, this disturbance might cause fatalities, fish migration, which might results decreased fish diversity and/ or population in the area of development.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the residual impact to aquatic habitats will be of "**Minor Negative Impact**".

*Table 8-12 Rating of Impacts Related to Aquatic Ecology (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| Moderate to Negative Impact | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| Extent | Local | The extent of impact to riparian habitats will be restricted to the crossing points of rivers. Impacts to aquatic ecosystems could extend downstream as a result of drainage impacts, sediment build-up and contamination. | Local | The extent of the SGR alignment will remain unchanged. |
| Duration | Long term | Impacts at the local footprint will be permanent. The risk of contamination is highest during construction, but could extend for the long term during the SGR operational period. | Short term | Impacts at the local footprint will be permanent. The risk of contamination is highest during construction, but substantially reduced if all drainage is designed such that it cannot interact with aquatic environments. |
| Scale | Medium to low | Many of rivers that are potentially affected are medium river systems, and the area is relatively arid resulting in rivers being widely separated. | Low | The scale of unintended contamination and sediment build-up can be greatly reduced through implementing best practice activities and control measures. |
| Likelihood | Constant | Impacts to water courses are applicable primarily for the construction phase of the SGR, and will be constant throughout this phase. During operation, assuming the adequate design of water infrastructure, the frequency of impact will be greatly reduced. | Rare | Likelihood of contamination incidents can be reduced through diligent implementation of best practice activities and control measures. |
| **Magnitude** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| **Medium Magnitude** | | | | |
| **Sensitivity Receptor** | | | | |
| Medium Sensitivity | | | | |

| | |
|---|---|
| A single definition of sensitivity is difficult to define, but affected habitats will include the full range of modified, natural and critical types. | |
| **Significant Rating Before Mitigation** | |
| Pre-mitigation | Post-mitigation (Residual) |
| **Moderate Impact** | **Minor Impact** |

*Mitigation Measures*

Details of mitigation measures are presented in the BAP, however the following list of measures have relevance to protecting aquatic habitats:

- Limit the extent of the SGR footprint as per procedures presented in the BAP
- Respect regulated buffer zones around rivers, streams, water bodies and seasonal wetlands (referred to as water sources)
- Prevent contamination through good chemical handling
- Implement an effective dust suppression startegy
- Develop and implement biodiversity protection policies
- Rehabilitate disturbed terrestrial sites promptly
- Restore destroyed and degraded wetlands along the SGR route, based on delineation exercises for each wetland and a comprehensive wetland restoration plan
- Develop and implement an invasive alien species control plan

## *8.5 IMPACTS TO CRITICAL HABITAT FEATURES*

*Description of Baseline Environment*

The IFC PS6 defines critical habitats to represent the highest levels of biodiversity sensitivity. Critical habitats are a subset of either modified or natural habitats, and five specific criteria are specified for their recognition. The higher levels of protection of protected areas, based on the IUCN Management Categories, can also define critical habitat. Gazetted protected areas that are classified by the IUCN as Management Category I and II, and internationally recognised areas that are recognised by the IUCN as Key Biodiversity Areas (KBAs) qualify as critical habitat. Based on the above criteria, the following gazetted protected areas and KBAs that are potentially impacted by the project will qualify as critical habitat features:

- Pugu Hills Forest Reserve and Ruvu South Forest Reserve, which together form the Kisarawe District Coastal Forest IBA;

*Criteria for Recognising Critical Habitat*

The PS6 (paragraph 16) further defines the following criteria for recognition of critical habitat:

(vi) Habitat of significant importance to Critically Endangered and/or Endangered species;

(vii) Habitat of significant importance to endemic and/or restricted-range species;

(viii) Habitat supporting globally significant concentrations of migratory species and/or congregatory species;

(ix) Highly threatened and/or unique ecosystems; and/or

(x) Areas associated with key evolutionary processes.

The critical habitat assessment for the SGR route (Chapter 4) has confirmed seven critical habitat features (CH features) that are relevant to the Project, as summarised in *Table 8-13*. Additional species of high significance have a high likelihood of occurrence, but are not included as CH features. The Pugu Hills and Ruvu South Baseline Report (Enviro-Insight) provides additional detail on these CH features and other sensitive biodiversity.

***Table 8-13 Summary of Critical Habitats Features along the SGR Route from Dar es Salaam to Makutopora***

| Common Name (Species) | IUCN Status | Status of Occurrence | Habitat Requirement |
|---|---|---|---|
| **Criterion i: Habitat of significant importance to Critically Endangered and/or Endangered species** | | | |
| Rondo Dwarf Galago (*Galagoides rondoensis*) # | CR | Presence confirmed from sightings and calls. | Forest |
| African Wild Dog (*Lycaon pictus*) # | EN | Reliably reported present by communities | Savanna |
| Ruvu Spiny Reedfrog (*Hyperolius ruvuensis*) # | CR | Presence unconfirmed, but likely based on suitable habitat | Wetland |
| Pugu Striped Grasshopper (*Rhainopomma wapugu*) | EN | Considered present from interim identification | Forest |
| Pugu Forest Grasshopper (*Parodontomelus verticulus*) | EN | Considered present from interim identification | Forest |
| **Criterion ii: Habitat supporting globally significant concentrations of migratory species and/or congregatory species** | | | |
| Large Cave-dwelling Bat Congregations # | | Two very large bat roosts present | Caves |
| **Protected and Key Biodiversity Areas** | | | |
| Pugu Hills and Ruvu South Forest Reserves # | | | |
| **Important Biodiversity considered to be Near Critical Habitat Features** | | | |

| Common Name (Species) | IUCN Status | Status of Occurrence | Habitat Requirement |
|---|---|---|---|
| Tanzania Woolly Bat (*Kerivoula africana*) | EN | Presence unconfirmed, but likely based on suitable habitat | Forest |
| Madagascar Pond Heron (*Ardeola idea*) | EN | Presence unconfirmed, but likely based on suitable habitat | Wetland (Migratory) |
| Basra Reed Warbler (*Acrocephalus griseldis*) | EN | Presence unconfirmed, but likely based on suitable habitat | Wetland (Migratory) |
| Spotted Ground Thrush (*Geokichla guttata*) | EN | Presence unconfirmed, but likely based on suitable habitat | Forest |
| White-backed Vulture (*Gyps africanus*) | CR | Confirmed present as occasional transit visitor | General (Wide ranging) |
| Martial Eagle (*Polemaetus bellicosus*) | VU | Estimated two breeding pairs present | Savanna |
| # - Denotes key CH features that are considered as flagship features | | | |

Flagship species/features within each important habitat have been identified as key CH features (*Table 8-13*) on the assumption that mitigation measures that aim to protect the habitat (ecological processes) of the key CH features will similarly benefit the lesser features sharing the same habitat. The BAP therefore presents approaches to assess the achievement of net gains for the key CH features only. Key CH features include Rondo Dwarf Galago, Ruvu Spiny Reedfrog and large cave-dwelling bat congregations. African wild dog are included as a Key CH feature, however this is a wide-ranging and unpredictable species, which makes demonstration of net gains not practical.

*Impacts to Rondo Dwarf Galago (Galagoides rondoensis) and other Forest-dependent Critical Habitat Features*

This critically endangered Rondo Dwarf Galago is dependent on dense coastal dry forest where it feeds on fruit and insects. These forests are being impacted by the SGR Project in the following ways:

- Illegal and unsustainable charcoal production takes place widely within the villages of the Project region, as there is a widespread dependence on charcoal as a source of energy for cooking and alternative energy sources are limited, particularly in rural areas. There is a dependence on charcoal for cooking by informal food vendors catering for the many job-seekers and other persons waiting at the gates of their camps. The use of unsustainable charcoal by Project-induced vendors is considered a high impact for the Rondo Dwarf Galago considering its critically endangered status, near-AZE status and it is extremely restricted distribution. YM have stated that they have implemented a complete ban on the use of charcoal within their camps.

- Use of locally harvested timber products occurs widely in a similar manner to charcoal use.
- Dust accumulations on vegetation south of the SGR service road extend into the forest habitat occupied by these Galagos (*Section 8.7*).

Other affected forest-dependent CH features include the Spotted Ground Thrush (EN), Sokoke Pipit (EN), Pugu Striped and Pugu Forest Grasshoppers (both EN). Improved conservation of the Rondo Dwarf Galago is expected to benefit these species too.

*Impacts to Ruvu Spiny Reedfrog and other Wetland-Dependent Critical Habitat Features*

The Ruvu Spiny Reedfrog, Madagascar Pond Heron and Basra Reed Warblers are endangered species that are dependent on wetlands in the Project area. There has been widespread loss and degradation of wetlands within the SGR footprint, but impacts associated with sedimentation, reduced fertility of the soils and highly turbid water extend beyond the SGR footprint.

Large trees associated with riparian vegetation fringing wetlands is targeted for illegal charcoal production and timber harvesting, which has been boosted due to the demand for charcoal and timber by informal vendors attracted to the outskirts of construction camps. Loss of the riparian vegetation adversely affects wetlands and has a direct impact on the CH features dependent on those wetlands.

*Impacts to Large Cave-dwelling Bat Congregations*

Two old mine shafts provide roosts to large numbers of insectivorous bats, including mostly *Triaenops afer* (Trident bat), *Mops* (free-tailed bats) and *Rhinolophus* (Horseshoe bats) species. There is also an old railway tunnel that was constructed during colonial times but is no longer used by the MGR. Communities in the area stated that this tunnel supported large numbers of bats, but there were no bats roosting there when investigated during field studies. This was attributed to the eastern end having recently been closed off by a soil dump, and bridge construction at the western end. This tunnel will be destroyed for further construction of the SGR. The tunnel has a different internal structure and a very large opening compared to the two old mine shafts, and the tunnel is likely to have formerly supported a different bat community composition compared to the mine shafts, for example Hildegarde's Tomb Bat (*Taphozous hildegardeae* - VU) may have roosted there.
Bats will be impacted in the following ways:

- The permanent loss of a roost site. New tunnels will not provide suitable replacement roosts as the regular movement of high-speed trains will disturb bats attempting to roost at these sites.
- Bats from these sites feed on flying insects over a wide area, and are therefore impacted by habitat alterations caused by loss of habitat to the SGR footprint, loss and degradation of wetlands and charcoal production within their foraging range.

Bridge and culvert construction for the SGR are likely to create roost habitat for Hildegarde's Tomb Bat (*Taphozous hildegardeae* - VU), which typically roosts under eaves of houses and small shallow crevices. The Endangered Tanzania Woolly Bat (*Kerivoula africana*) is a forest bat that roosts in trees and will not be impacted in the same way as cave-dwelling bats.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided, the impact to CH features will be a "**Critical Negative Impact**" pre-mitigation, largely due to the extremely high sensitivity of the Rondo Dwarf Galago (Table 8-14).

*Residual Impact (Post-mitigation)*

A broad range of mitigation measures are presented within the BAP, of which many have relevance to protection of CH features. However few of these regular mitigation measures will greatly alter the impact to CH features, and the residual impact therefore remains "**Major Negative Impact**". Various additional conservation programmes have therefore been proposed, as the PS6 requires that Net Gain is demonstrated for CH features. Such programmes will not alter the impact, but rather serve as a form of compensation for the impact.

*Table 8-14 Rating of Impacts to Critical Habitat Features (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| Direct Negative Impact | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| Extent | Regional | The impact extends over a total distance of the SGR Phases I and II | Regional | The impact extends over a total distance the SGR |
| Duration | Permanent | The Rondo Dwarf Galago qualifies as a near AZE species, as there are a couple of other sites within Tanzania where the species barely survives. Loss of the Pugu Hills population likely causes this primate to become extinct. | Permanent | Duration will remain unchanged. |
| Scale | Indirect | There are no direct impacts to critical habitat features but many indirect activities have unintended consequences. | Indirect | Scale will remain unchanged. |
| Likelihood | Likely | Many indirect construction activities have unintended consequences that are likely to impact CH features. | Likely | Likelihood will remain unchanged. |
| **Magnitude** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| High Magnitude | | | High Magnitude | |
| **Sensitivity of the Receptor** | | | | |
| Very High Sensitivity | | | | |
| The Rondo Dwarf Galago qualifies as a near AZE species, as there are a couple of other sites within Tanzania where the species barely survives. Loss of the Pugu Hills population likely causes this primate to become extinct. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Critical Impact | | | Major Impact | |

*Mitigation Measures*

Details of mitigation measures are presented in the BAP, however the following list of measures have relevance to addressing the impacts to CH features:

- Limit the extent of the SGR footprint as per procedures presented in the BAP.
- Declare the Pugu Hills and Ruvu South Forest Reserves as No Go Areas for workers during the construction phase.
- Respect regulated buffer zones around rivers, streams, water bodies and seasonal wetlands (referred to as water sources).
- Minimise loss of fauna during vegetation clearing.
- Ban the use of illegal charcoal but develop strategies to promote sustainable charcoal production and procurement techniques.
- Provide alternative sources of energy (such as kerosene or electricity) and appropriate cooking devices to vendors catering for job-seekers at the gates of camps to compensate the ban on charcoal use.
- Prevent contamination through good chemical handling.
- Implement more effective dust suppression strategies.
- Develop and implement biodiversity protection policies.
- Enforce vehicle speed limits to protect fauna.
- Reduce light contamination into natural habitats at night.
- Rehabilitate disturbed terrestrial sites promptly.
- Restore destroyed and degraded wetlands along the SGR route, based on delineation exercises for each wetland and a comprehensive wetland restoration plan.
- Develop and implement biodiversity protection policies.
- Enforce vehicle speed limits to protect fauna.
- Reduce light contamination into natural habitats at night.
- Rehabilitate disturbed terrestrial sites promptly.
- Restore destroyed and degraded wetlands along the SGR route, based on delineation exercises for each wetland and a professionally and comprehensively developed wetland restoration plan.
- Develop and implement an invasive alien species control plan.

- Implement controlled access along the SGR service road during operations.
- Erect elephant-proof fencing of the SGR in the Ngerengere and Mkata areas.
- Maintain permeability of underpasses for wildlife movement.

*Additional Conservation Actions*

Additional conservation actions have been proposed and described in the BAP to achieve Net Gains for CH features as required by the PS6. The following additional conservation actions are relevant to critical habitat features:

- Support TFCG to implement sustainable charcoal programmes. TFCG have a developing programme that is currently being piloted in selected villages in Ngerengere, Kilosa and Dodoma. This programme provides greater efficiency in charcoal production through improved techniques and is implemented according to a predetermined and sustainable harvesting plan. This programme needs support to be rolled out to more villages to save biodiversity. Additional details are provided in the BAP.

- Re-establish lost dry coastal forest within the Pugu Hills Forest Reserve through assisting TFSA to plant a diversity of locally indigenous trees where forests have been recently lost. Procedures to be followed and the expected quantification to achieve net gains are provided in the BAP.

- Create additional bat roost caves as replacements for a lost tunnel previously used as a bat roost.

- Provide support to TFSA to improve their management capacity and ability to conserve and protect the resources of the forest reserves. Support measures include improvements to the forest management plans, boundary demarcation reinforcement, equipping and training forest guards, together with other actions presented in the BAP.

- Additional Studies are proposed for:
  - Academic research into the ecology of the Rondo Dwarf Galago, as many prominent zoology authors have noted the urgent need to understand the population ecology and threats to this highly threatened species.
  - Field studies of forest-dependent and wetland migratory birds need to be conducted at times when they are expected to be present.
  - Field studies to confirm the presence and understand the distribution of the Ruvu Spiny Reedfrog

- Identification of insect samples need to be confirmed.
- Support studies into the distribution of endangered grasshoppers and crickets in the Pugu Forests.

## 8.6 IMPACTS ON ECOSYSTEM SERVICES CAUSED BY THE SGR PROJECT

The IFC PS6 describes priority ecosystem services as (i) those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to affected communities; and/or (ii) those services on which the project is directly dependent for its operations.
The following priority ecosystem services have been identified for the SGR project:

- Water provision from wetlands and rivers for potable use, agriculture, fishing and livestock watering; and
- Use of forest products, including the production of charcoal.

*Water Provision From Wetlands and Rivers*

Humans receive multiple goods and services from freshwater ecosystems. Water use for domestic water supplies is given the first priority in the Tanzania Water Resources Management Act of 2009. River resource use is summarised in Table 8-15 below.

***Table 8-15 River Resource Use***

| River Resources | Resource Use | |
|---|---|---|
| **Fresh water** | Domestic use<br>Irrigation<br>Livestock | Recreation (swimming)<br>Industrial use<br>Cultural/Religious practices |
| **Fish** | Food | Connectivity (fish migration) |
| **Vegetation** | Timber/poles for harvesting<br>Habitat for Wildlife<br>Climate regulation<br>Charcoal/firewood for fuel | Medicine<br>Wood for furniture/boat making<br>Materials for mats, baskets<br>Cultural practices (e.g. worship) |
| **Soil and Stones** | Building materials<br>Road construction | Bridge construction<br>Dam construction |
| **Livestock** | Water for drinking | Floodplain grazing |
| **Wildlife** | Food<br>Floodplain grazing for wildlife | Tourist attractions (wildlife)<br>Hides |
| **River ecosystems** | Cultural practices | Floodplain for agriculture |

During field surveys it was observed that communities rely on wetlands and rivers/streams as a source of water supply, for livestock watering, fishing, and

reeds and other fibrous plants are being harvested for use in thatching, weaving and other important livelihood activities.
Focus group discussions with pastoralists of the Maasai and the Bargaig communities highlighted important areas for access to water points and grazing on both sides of the SGR. There areas include the Magindu and Miziguni Villages in Kibaha District, Costal Region; in Kinonko and Kidugalo Villages, Morogoro Rural District, Morogoro Region; and Parakuyo and Mbwade villages in Kilosa District, Morogoro Region.

*Observed Impacts*

Human activities such as tree cutting for timber and charcoal making, land clearing for agriculture, illegal fishing, bush fires, illegal mining, and unsustainable use of water irrigation activities are the major causes of declining river resources. Some of these livelihood activities and water supply are dependent on functioning of the riverine system, and hence impacts to such systems needs to be minimised.
Wetlands adjacent to the SGR serve as easy sites for dumping surplus soil due to their open terrain. Examples of wetland loss have been described in the vicinity of Soga and Ruvu South, but is indicative of the situation along many parts of the SGR route where irregular terrain requires extensive earthworks for levelling of the railway. Earth embankments along the SGR have widely been topped with dark topsoil removed from nearby wetlands, for planting of *Eragrostis teff* grass to control erosion. The topsoil in these wetlands have been depleted, with uncertain potential for the wetlands to recover.
The adverse effects of soil erosion are observed in the wetlands and aquatic ecosystems where there is an accumulation of sediments and high turbidity of the water. Most of this sediment originates from erosion of infertile subsoils, and sediment accumulations result in wetlands becoming infertile. Light no longer penetrates the turbid water, which suppresses growth of aquatic plants, leads to die-off of fish and aquatic invertebrates and has knock-on effects to many dependent food chains. Important wetland-dependant CH features associated with the SGR Project include the Ruvu Spiny Reedfrog, Madagascar Pond Heron and Basra Reed Warbler, which are adversely affected by severe soil erosion.

*Charcoal Production and Timber Harvesting*

During field studies, extensive illegal charcoal production was observed within the Ruvu South Forest Reserve and to an extent in the Pugu Hills Forest Reserve. Charcoal is widely used in villages as the standard cooking fuel, and charcoal production is widespread along the SGR route, particularly in the Kilosa area. Although prohibited by YM company policies, use of limited

charcoal was observed by informal vendors cooking food for job seekers at the camp entrance.

The adverse effects of charcoal production adversely affects virtually all of the CH features and many other highly threatened species likely to occur but not confirmed, as in the following examples:

- Charcoal production is destroying habitat for all of the forest-dependent CH features, which includes Rondo Dwarf Galago (CR), Spotted Ground Thrush (EN) and forest grasshoppers (EN). Highly threatened species not confirmed present include the Sokoke Pipit (EN) and Tanzanian Woolly Bat (EN).
- Charcoal production targets the larger emergent trees, which are the essential nesting requirement for White-backed Vulture (CR) and Martial Eagle (VU). These trees are largely lost in the general landscape and are becoming scarce in the Ruvu Forest Reserve. Other raptors not listed as CH features, but important biodiversity features include Steppe Eagle (EN), Tawny Eagle (VU), Hooded Vulture (CR), Lappet-faced Vulture (EN), Secretarybird (EN), White-headed vulture (CR) and Bateleur (NT).
- Charcoal production targets riparian vegetation that impacts wetlands, and wetland dependent CH features, which include the Ruvu Spiny Reedfrog (CR), Madagascar Pond Heron (EN) and Basra Reed Warbler (EN).
- Charcoal production is a major threat to integrity of both forest reserves listed as CH features.

*Bushmeat Hunting*

Bushmeat hunting was investigated but does not appear to be a priority ecosystem service. Communites engaged indicated that subsistence hunting takes place, but there was no convincing evidence of their dependence on this service. There was also no evidence of involvement of the SGR Project in bushmeat consumption. These observations were supported by sightings of monkeys in a relaxed state in both the Pugu Hills Forest Reserve and at the Mkata River. It was clear that monkeys were not overly afraid at the presence of human observors. Where such animals are heavily hunted, it is normally difficult to get even a brief sighting of them.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact to Protected Areas will be a "**Major Negative Impact**" pre-mitigation.

The Pugu Hills and Ruvu South Forest Reserves are critical habitats, and have a high sensitivity. They are also relatively small areas and will be significantly impacted by construction of the SGR which follows a different alignment from the MGR for much of the route associated with these reserves.

*Residual Impact (Post-mitigation)*

A broad range of mitigation measures are presented within the BAP, of which the majority are relevant to protect biodiversity of the forest reserves. However there is no regular mitigation that will dramatically alter the actual impact to these protected areas, and the residual impact therefore remains the same. Various additional conservation programmes have therefore been proposed, as required by the PS6. Such programmes will not alter the impact, but rather serve as a form of compensation for the impact.

*Table 8-16 Rating of Impacts Related to Protected Areas (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| Direct Negative Impact | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| Extent | Regional | Impacts extend far beyond the footprint of the SGR | Regional | Impacts extend far beyond the footprint of the SGR |
| Duration | Long term to Permanent | The ecology of affected areas cannot be restored, and the unmitigated impact has the potential to be permanent, although some recovery is possible. | Medium term | Mitigation measures can reduce the SGR dependence of ecosystem services while additional conservation actions have the potential to restore some services. |
| Scale | Large | Ecosystem services are impacted along the full length of the SGR. | Large | Ecosystem services are impacted along the full length of the SGR. |
| Likelihood | Very likely | Loss of habitat and ecosystem functionality will be impacted. | Very likely | Loss of habitat and ecosystem functionality will be impacted. |
| **Magnitude** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Moderate Magnitude | | | Moderate Magnitude | |
| **Sensitivity of the Receptor** | | | | |
| Medium to High Sensitivity | | | | |
| Many communities are dependent on the priority ecosystem services, which are underpinned by biodiversity. Impacts to ecosystem services are affecting critically endangered CH features. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| **Moderate to Major Impact** | | | **Moderate** | |

*Mitigation Measures*

Details of mitigation measures for management of ecosystem services are presented in the BAP, however the following list of measures have relevance to ecosystem services associated with the SGR:

- Respect legislated 60-meter buffer zones required by the Tanzanian Environmental Management Act of 2004 around rivers, streams, water bodies and seasonal wetlands (referred to as water sources)
- No extraction of soil, dumping of surplus soil, equipment laydown areas, development of access tracks is to be allowed within those buffer areas, within the exception of the authorized SGR route and adjacent service road.
- Restore destroyed and degraded wetlands based on the field delineation of wetlands and development of a comprehensive wetland restoration plan
- Specific access across the SGR to reach water and grazing resources needs to be provided through the provision of overpasses and underpasses, and the confirmation of such through targeted stakeholder engagement, specifically with the Maasai and the Bargaig communities in the:
    - Magindu and Miziguni Villages in Kibaha District, Costal Region;
    - in Kinonko and Kidugalo Villages, Morogoro Rural District, Morogoro Region; and
    - Manyuki, Parakuyo and Mbwade villages in Kilosa District, Morogoro Region.
- Prevent contamination through good chemical handling
- Potential contaminated sites such as fuel and chemical storage areas, heavy equipment parking and maintenance stations, or those that develop as a result of accidental spills, should be tested for contamination prior to closure, and remediated according to a comprehensive Spill Management and Response Plan.
- Develop and implement an invasive alien species control plan
- Declare the Pugu Hills and Ruvu South forest reserves as No Go Areas for workers during the construction phase
- Ban the use of illegal charcoal but develop strategies to promote sustainable charcoal production and procurement techniques.
- Rehabilitate disturbed terrestrial sites promptly.
- Implement controlled access along the SGR service road during operations

*Additional Conservation Actions*

Additional conservation actions have been proposed in the BAP to achieve No Net Loss of Biodiversity, Net Gains for Critical Habitat (CH) features and to address the requirements for protected areas stipulated within the PS6. The following additional conservation actions are relevant to the management of ecosystem services:

- Support TFCG to implement sustainable charcoal programmes
- Provide support to TFSA

These additional conservation measures are better described within the Impacts to CH features (***Section 8.5***) with additional details presented in the BAP.

## *8.7 IMPACT OF DUST EMISSIONS*

*Description of Baseline Environment*

Field surveys were conducted during hot dry weather in March 2019 and extensive dust emissions were observed all along the construction road adjacent to the SGR route. The prevailing wind during that season was southwards, and severe dust deposition could be observed on leafy vegetation beyond a 120-meter distance from the road. The extensive dust deposits on the vegetation suppresses primary production, has an adverse impact on vegetation and associated fauna, and ultimately leads to dramatic increase in invasive alien plant (IAP) infestations.

*Proposed Project Activities*

An extensive and costly dust suppression programme was being implemented, with many water bowsers extracting water from wetlands and spraying this on the roads. This dust suppression programme was not effective in controlling dust emissions, but was having an adverse impact on the wetlands and associated biodiversity.

*Sensitive Resource/ Receptors*

Dust deposits emanating from construction site negatively affect leafy vegetation. This supresses primary production which has an impact on vegetation and fauna leading to spread of invasive species.

*Significance of Impact*

Based on the analysis made above, the impact of dust emission is **"Moderate Negative Impact"** pre-mitigation, but can be reduced to a "**Minor Impact**" with implementation of an effective dust mitigation strategy.

*Table 8.16 Rating of Impacts Related to Dust Emissions (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| Direct Negative Impact | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| Extent | Local | Dust from construction site spreads in excess of 120 meters | Local | Mitigation measure implemented is not effective in supressing dust; however, it has negative impact on wetlands where the water is extracted. |
| Duration | Short term | Dust emission is expected during construction phase | Long term | Impact on wetlands might be permanent |
| Scale | Small to medium | Dust emission spreads in excess of 120 meters from the road and SGR | Small | Implementing an effective dust suppression strategy will reduce the severity |
| Likelihood | Certain | Dust from roads and construction site is certain | Likelihood | Certain |
| **Magnitude** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Medium Magnitude | | | Small Magnitude | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Medium Sensitivity | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Moderate Impact | | | Minor Impact | |

*Mitigation Measures*

Revise the Dust Management Programme

- The current dust management programme is not effective in controlling dust emissions, but is implemented at a high financial cost and adversely impacts wetlands. More effective mitigation strategies need to be developed and implemented.
- A revised dust suppression needs to be implemented.

## 8.8 *RISK OF INVASIVE ALIEN SPECIES INFESTATION*

*Description of the Baseline Environment*

The Convention on Biological Diversity (CBD) defines an invasive alien species as one that is established outside of its natural past or present distribution, and whose introduction and/or spread threatens biological diversity. The IUCN Red List of Threatened Species rates the presence of invasive alien species globally as the second most significant threat to biodiversity, and there is a growing global awareness of the problems associated with alien and invasive species. Alien species can be introduced either accidentally or intentionally. Although only a small percentage of alien species have the potential to become invasive, their impact is marked and usually is irreversible, displacing native species and leading to degradation of habitats.

A wide variety of invasive alien plants is expected along the proposed SGR alignment the proposed SGR (*Table 8-17*).

***Table 8-17 Invasive Alien Plant Species occurring along the Alignment of the Proposed SGR***

| Species Name | Common Name | Comment |
|---|---|---|
| Altenanthera pungens | Paperthorn | Prostrate growing weed where human foot traffic occurs |
| Amaranthus retroflexus # | Pigweed | Abundant and widespread species |
| Argemone ochroleuca # | Mexican Poppy | Widespread in project AoI where soil disturbance occurs |
| Calotropis procera # | Soddom's Apple | Widespread invasive species |
| Datura stramonium # | Thorn apple | Widespread invasive species where soil disturbance occurs |
| Ipomoea sp | White Morning Glory | Widespread invasive species |
| Lantana camara | | Widespread invasive species, notably along drainage lines |

| Species Name | Common Name | Comment |
|---|---|---|
| Leucaena leucocephala # | | Considered one of the 100 worst invasive species by the IUCN. |
| Nicotiana glauca # | Wild Tobacco | Widespread invasive species |
| Opuntia ficus-indica | Prickly Pear cactus | Dispersed by people and livestock |
| Opuntia vulgaris | | Confirmed during baseline studies |
| Ricinus communis # | Castor oil bush | Widespread invasive species |
| Solanum sp. | | Widespread invasive species |
| # denotes highly invasive species that are expected to require specific control programmes during construction and operation. | | |

*Proposed Project Activities*

Construction activities will include bush clearing, heavy machinery involved in cut and fill activities, blasting where appropriate, and construction machinery movement. Quarries and borrow pits will also be required at intervals along the alignment, as will Construction Camps, housing many workers at the peak of construction activities.
Of most relevance to this potential impact, is bush clearing, soil disturbance and the transport of large volumes of soils for cut and fill, as well as the transport of construction materials from quarries and borrow pits.

*Sensitive Resource / Receptors*

Site clearance and soil disturbances create opportunities for invasive alien plants to establish. Extensive soil disturbance will occur during the construction phase and creates abundant potential for the establishment of invasive plants. Large infestations of IAPs can develop, and if not controlled can serve as source populations for the spread into new areas.
Construction vehicles can accidentally gather invasive plant material and disperse seeds through normal movements. Construction equipment and vehicles, landscaping or rehabilitation could potentially introduce IAPs.
Invasive species in the project area are associated with modified habitats, which have a low ecological sensitivity.

*Significance of Impact (Pre-mitigation)*

Based on the analysis provided above, the impact of an increased risk of invasive alien species infestation will be a "**Moderate Negative Impact**" pre-mitigation (refer to *Table 8-18*).

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact of a risk of invasive alien species infestation will be a "**Minor Negative Impact**" post mitigation (refer to *Table 8-18*).

*Table 8-18 Rating of Impacts Related to the Risk of Invasive Alien Species Infestation (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| Direct Negative Impact | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| Extent | Regional | The spread of invasive species is expected to be restricted to the construction footprint and areas of soil disturbance. | Regional | The extent of the area exposed to disturbance will not change. |
| Duration | Long Term | Many invasive species infestations are extremely persistent once established, unless active control measures are implemented. | Short Term | Effective control measures will reduce the duration of infestation by invasive species. |
| Scale | Large | A diversity of invasive species are likely to present a risk of being spread. Each species has its own unique patterns of infestation, invasiveness and level of impact to the affected environment. Invasive species infestation can occur on a large scale without proper control. | Medium | With adequate controls in place, and follow up rehabilitation and control, the spread and infestation of invasive species can be controlled. |
| Likelihood | Constant | Invasive species infestation will occur constantly on disturbed sites and will multiply if inadequately controlled. | Often | The frequency and intensity of control measures will decline if effectively implemented |
| **Magnitude** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| Medium Magnitude | | | Small Magnitude | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Medium Sensitivity | | | | |
| A single definition of sensitivity is difficult to define, but affected habitats will include the full range of modified, natural and critical types. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| Pre-mitigation | | | Post-mitigation (Residual) | |
| **Moderate Impact** | | | **Minor Impact** | |

*Mitigation Measures*

- An invasive alien species management plan will be developed for the Project to guide the control of IAPs.
- Control IAPs using Biological or Mechanical Control Measures. Biological control measures would only be applied if these specific measures have been approved for application in Tanzania. Alternatively, labour intensive manual control of IAPs would be applied in preference to application of herbicides or other chemicals.
- All Plant Material that is removed through control measures is to be burnt on Site
- Vehicles and construction equipment will be kept clean and washed regularly to minimise distribution of seeds and invasive plant material.
- Tyre checks of vehicles should be conducted daily to check that seeds, thorns and vegetative material is not being distributed.
- Source areas such as quarries, borrow pits, vehicle parking and construction camps should be kept clean of invasive species to minimise the presence of seeds that can be dispersed unintentionally.
- Disturbed areas would need to be rehabilitated at the earliest opportunity to minimise the establishment of IAPs.
- Regular and ongoing monitoring of the presence of invasive species should be conducted within construction and rehabilitated sites and invasive species removal operations implemented according to the results, based on areas as per the above objectives.

## *8.9 ACHIEVEMENT OF NO NET LOSS AND NET GAIN REQUIREMENTS*

The IFC PS6 requires that No Net Loss of biodiversity (NNL) is demonstrated where impacts to natural habitats occur. Where critical habitats are impacted, Net Gains (NG) must be demonstrated for the biodiversity values for which the critical habitat was designated.

The PS6 defines NNL as the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts (if any), on an appropriate geographic scale. NG are based on a similar concept, but applies specifically to the critical habitat features, and the biodiversity gains exceeding the loss resulting from the impact.

NNL and NG are achieved through application of the mitigation hierarchy, whereby impacts are avoided to the extent possible, followed by measures to minimise impacts, and thereafter to rehabilitate. If residual impacts remain, these are then addressed through additional conservation actions and/or offsets.

*Potential to Achieve No Net Loss of Biodiversity*

The primary causes of biodiversity loss within the landscapes surrounding the SGR alignment are attributed to deforestation caused by unsustainable charcoal production and the loss and degradation of wetlands. These two impacts relate directly to important ecosystem services that are underpinned by biodiversity. Affected biodiversity features include all of the CH features identified in this report and a wide diversity of other terrestrial and aquatic flora and fauna.

Two important actions identified to address these causes of biodiversity loss are:

- Wetland restoration along the SGR alignment; and
- Support TFCG to develop and implement sustainable charcoal programmes in miombo woodlands.

Wetlands are crucial to support a broad diversity of species and ecosystem services important to local communities. Restoring the damage done to wetlands will substantially raise the capacity of ecosystems to recover, including ecosystems associated with the SGR alignment and downstream environments. Effective wetland restoration is therefore considered an essential step towards achieving no net loss of biodiversity, although considerable effort will need to be invested to achieve this.

Wetland delineation is a straight-forward process where wetlands have not been smothered with soil dumps, however there are forensic delineation techniques applicable to situations where wetlands have bene smothered. A comprehensive delineation exercise will reveal the extent of restoration required, based on which a restoration plan can be developed. YM have the capacity to restore wetlands according to a plan, and this activity is possible if there is the required commitment.

Support to sustainable charcoal programmes has the potential to improve biodiversity across a broad landscape. The TFCG sustainable charcoal programme is still in a stage of early development and early support for the programme will have wide-reaching benefits. The BAP proposes supporting

the roll out of sustainable charcoal programmes across an additional 20 villages (pending the acceptance and selection of villages by TFCG). TFCG have indicated their willingness to collaborate but implementation arrangements need to be developed. Opinion generated through development of this BAP, is that No Net Loss of Biodiversity is achievable through restoration of wetlands and expansion of sustainable charcoal programmes.

*Potential to Achieve Net Gain of Critical Habitat Features*

The critical habitat assessment for the SGR route has confirmed seven CH features that are relevant to the SGR Project, but a reduced list of key CH features has been developed as many of the CH features share the same habitats but are little understood or cryptic species and not easily monitored. Measures that are developed to protect key CH features will achieve gains for lesser species sharing the same habitats. The BAP identifies the key actions to address impacts to these features, and provides a discussion on the capacity to achieve net gains for each key CH feature.

The conclusion of the BAP is that no net loss of biodiversity and net gain for key CH features is possible. There is confidence in this statement as some of the key actions to achieve these targets are scalable. Scalable actions include:

- The number of villages selected for rollout of a sustainable charcoal programme,
- Extent of the area that is planted with indigenous coastal dry forest species, and
- The extent of support provided to TFSA.

Action-specific targets are presented for some of the key actions (roll out sustainable charcoal programmes in 20 villages and re-establish forest equivalent to 15% of the existing forests occupied by the Rondo Dwarf Galago). Monitoring measures are outlined, to measure the success of mitigations, and results must guide the extent of effort invested into scalable actions.

Investigation of net gain approaches has revealed many data deficiencies, which limit the capacity to guide the achievement of net gains, and the additional studies are recommended within the Bap to support these procedures:

- Research into the Rondo Dwarf Galago Ecology
- Botanical Composition and Sensitivity of the Pugu Hills and Ruvu South Forest Reserves
- Identification of Insect Specimens

The BAP also proposes development of internal biodiversity capacity to implement the above.

Making a commitment to achieving NNL (and NG) will provide YM and TRC with a solid environmental reputation and provide convincing evidence that no net loss of biodiversity combined with poverty alleviation is achievable for development of future phases of the SGR. Demonstrating capacity to align to multiple performance standards is likely to facilitate future applications for international finance.

# 9 IMPACTS TO THE SOCIAL ENVIRONMENT

## 9.1 INTRODUCTION

This *Chapter* assesses the predicted socio-economic, health and cultural heritage (social) impacts (both positive and negative) associated with the proposed SGR project. These include the following:

- Impacts on Land Acquisition and Physical and Economic Displacement;
- Impacts associated with Displacement of Community Infrastructure;
- Impacts associated with Severances;
- Impacts associated with Transmission of Vector Borne and Communicable Diseases;
- Impacts associated with Transmission of Sexually Transmitted Infections;
- Impacts associated with Construction and Operations Traffic Movement;
- Impacts associated with Community Health, Safety and Security;
- Impacts associated with Social Cohesion;
- Impacts on Labour and Working Conditions;
- Impacts on Employment, Procurement and the Economy;
- Impacts on undiscovered Archaeological Resources and Built Heritage; and
- Impacts on Living Heritage.

## 9.2 SOCIOECONOMIC IMPACTS

### 9.2.1 *Impacts on Land Acquisition and Physical and Economic Displacement*

The SGR Project will involve permanent land-take for the construction of the RoW, train stations and marshalling yard. Temporary land is required for access roads, borrow pits, dumping areas and mobile campsites.

This chapter details the anticipated physical and economic displacement impacts resulting from Project land-take. The chapter includes:

- Impacts to physical resources, including assets (housing, non-residential structures) including:

- Permanent loss of livelihoods and household income for farmers as a result of permanent land take for the construction and operation of the railway.
- Permanent loss of livelihoods and household income for pastoralists as a result of permanent land take for the construction and operation of the railway and severance from fencing
- Physical displacement of households and residential structures.

- Impact on collection of forest products from clearance of existing land and vegetation for the construction of the SGR.

No additional impacts are expected with regard to land and livelihoods in the operations phase.

*Project Design Considerations*

As detailed *in Section 2.5.1* (Project Description), according to the Railways *Act No. 4 of 2002*, the Project will require a cleared RoW of no less than 15 metres from the centre line of the railway on both sides (left and right) in towns and cities while in other areas outside the towns, the RoW is 30m. Within this RoW no structures or buildings can be established.

The proposed SGR will be constructed parallel to the existing MGR (except for bypasses around Morogoro Town and Dodoma Town). Construction was started in May 2017 and is expected to continue for a period of approximately 3,5 years. For those sections of the proposed SGR alignment that are within the existing MGR RoW, a small area of no more than 15 m will be permanently taken on one side (only) of the proposed SGR to compensate for the used portion of the RoW. Where the SGR passes completely out of the existing MGR RoW (ie the bypasses at Morogoro and Dodoma) a 60 m RoW will be required (ie 30 m on either side of the centre line). All structures, trees, crops within the required sections shall be permanently removed. In addition, the railway construction will require the implementation of safety fencing of some sections of the railway corridor during operations to prevent pedestrian access onto the SGR. This being said, livestock and pedestrian crossings will also be constructed during construction and operation to allow access at specific locations identified based on consultations with communities along Phase II of the route (See Implementation of Social Monitoring in ESMP).

The SRG rail will require permanent land acquisition comprising approximately 3,692 hectares (1,500 hectares for Lot 1 RoW and 2,192, hectares for Lot 2 RoW).

Additionally the Project will require temporary acquisition of land outside the RoW for the establishment of borrow pits, dumping sites, quarry sites, construction of marshalling yards and campsites. These represent additional 1,157 hectares of land (784 hectares in Lot 1 and 373 hectares in Lot 2). These additional facilities are located at distances of up to 2 km from the SRG line.

The proposed construction works and associated temporary and permanent land acquisition will result in the displacement of physical structures including residential, commercial and public services currently used by the communities in the villages crossed by the proposed railway line. During the operational phase, no land acquisition and physical and economic displacement activities will be required.

*Sensitive Resource / Receptors*

At the time of writing this ESIA, for the Phase I of the proposed SGR, the legal procedure (valuation of properties and disclosure) for permanent land take was completed while for the Phase II this procedure was in progress (final stages).

Valuation of properties for about 165 km of the Phase I alignment has been completed and the valuation results have been disclosed to the Project Affected Peoples (PAPs). The valuation for the remaining 40 km is in progress. The Government of Tanzania (through TRC ) is soliciting funds for compensation of the valued properties.

The number of affected households will be determined in the final RAP documents.

Sources of income in the affected areas range from casual employment, formal employment, business (trading), farming and livestock keeping. Land acquisition for the Project construction will trigger physical and economic displacement of those land users, causing in rural areas, significant losses of arable land and in urban areas significant losses of infrastructures, as well as, income generation sources.

The presence of indigenous peoples (IPs) along the Project footprint has been confirmed. Maasai and Barabaig communities have been identified in Kilosa and Morogoro Rural districts mainly. These are pastoralist groups highly dependent on natural resources, in particular surface water sources and grazing areas.

*Impact 1: Loss of Livelihoods and Household Income for Farmers*

From the results of the asset inventories undertaken for the purpose of RAP development, the amount of land that will be lost by each household varies significantly from one household to another and between settlements. Agriculture and livestock rearing is one of the primary income generating activities along the SGR line, especially in rural areas where it is the main livelihood activity. Typically, households will tend to rely on agricultural production as their main source of food and income. Poorer households supplement their crop incomes by working on better-off household's farms. In urban areas or closer to urban centres, economic activities are more diverse, ranging from temporary jobs, formal employment, trading, farming and livestock keeping. Trading, temporary jobs, and formal employment tend to be the main livelihood activities in urban areas.

Households will lose crops or trees on their land due to clearance for construction. This includes the loss of perennial crops (e.g. fruit trees), annual crops (e.g. cassava), and seasonal crops if the households are not able to harvest crops and trees before the land is acquired. The surveys conducted confirmed the presence of a number of encroachers cultivating crops or trees on parcels that they did not legally own.

It is estimated that approximately 30% of the land inside of Lot 1 RoW and 40% in Lot 2 RoW is under cultivation (crops and trees). This represents approximately 14% of the cropland used for agriculture in the Social Area of Influence (500 m corridor along the SRG line). Agricultural areas to be temporarily acquired for the establishment of facilities outside the RoW (borrow pits, dumping sites, quarry sites, construction of marshalling yards and campsites) represent 16% of the total land for Lot 1 facilities and 37% for the total land for Lot 2 facilities.

During construction of the SGR, there may be construction activities that temporarily cause a restriction of access from the road to houses, between houses and other structures, or between houses and resources (e.g. agricultural land) that is used for livelihoods.

<u>Assessment of impact significance</u>

Indeed, due to the heavy reliance on land based activities and the small plot sizes, the level of impact from loss of land will be determined not only by the proportion of land lost by individual households, but also by their level of dependence on the land, access to alternative land and livelihood activities and their current income levels. Households that have little access to alternative

livelihood activities and/or are on a very low income, will experience a greater level of impact than those with access to alternative resources, including savings, and are therefore considered particularly vulnerable to potential land-related impacts. Impacts on livelihoods from loss land is discussed in more detail in the Resettlement Action Plans for Phase I and Phase II of the SGR route.

The permanent land take and restrictions to trees and crops is a direct negative impact which is permanent in nature. The amount of land where restrictions will apply represents over ten percent of the cultivation land available in around the settlements (500 m corridor), which suggests that land could be available. According to local leaders there should be sufficient available replacement agricultural land for most of the economically displaced households within their own settlements. It should however be noted that although replacement land should be available, additional efforts will be necessary for households to prepare new agricultural plots, and the Project will need to verify that the replacement land is of an equal productivity level. Receptor sensitivity is considered ***high*** considering the level of dependence on agriculture and livestock herding as the primary sources of subsistence and livelihoods, especially in rural areas. The potential (unmitigated) impact significance is therefore considered ***Major.***

*Impact 2: Loss of Livelihoods and Household Income for Pastoralists*

It is known that livestock on which these groups base their livelihood cross the current railway line freely in search of pasture. There may be informal tracks or pathways used by community members and pastoralists for moving livestock to water or grazing. These tracks or pathways may also vary by season in particular during the dry season when seasonal rivers, streams and associated water pans become dry and grazing is limited.

As such, construction activities and then fencing during the operation phase will restrict current access routes that wildlife and livestock use when searching for pasture and breeding grounds. During the operational phase, this impact will be reduced through the provision of underpasses and overpasses that shall be used by people and animals for crossing the railway line. Access to water sources has been assessed in *Section 7.1.5*.

Pastoralist groups such as the Maasai and Barabaig (who identify as indigenous people) are considered particularly vulnerable to this impact as mobility and transhumance is central to their livelihood system and way of life to access resources across variable environments and also allow for different pastures to rest at different times of the year. In addition, both

groups have reportedly been subject to land grabbing and forceful evictions (see Section 4.7.3).

Indigenous communities use land for which they have customary rights of occupation. Some of them, for example in the Mikese village (Morogoro Rural), occupy land that they bought from mainstream communities. Parakiyo and Mbwade (Kilosa District) are the only villages inhabited uniquely by indigenous communities. However, findings from the Indigenous Peoples study state that these groups were found to be much assimilated into the broader community and while they continued to undertake traditional pastoralist activities, their lifestyles were sedentarized.

According to the indigenous people's field study by a local specialist, pastoralist's settlements are part of greater rangelands and livestock graze in the whole land. The distance covered depends on the availability of natural resources (pastures, water and salt) from their settlements.

These groups also tend to engage in some food cultivation when possible, which sometimes leads to conflict with farmers over resources (mainly in Kibaha and Mgorogoro districts). Permanent severance during operations may also exacerbate such conflicts. However, IP field study reported that severance and loss of land are considered not to be significant since pastoralist groups will not lose access to land. Provided access is guaranteed through appropriate crossings they will not lose access to their grazing land. Potential for land fragmentation can be reversed through appropriate crossings.

In the field consultations by a local specialist, the leaders of the villages of Parakuyo and Mbwade (Kilosa District, mid-east part of Phase I) expressed the following; "*We need four crossings in the following places: Genge 39 (KM 232), Manyuti Ngaite (KM 234), Before Genge 40-also known as Kwa Tayai (KM 237) and Nguzo mbili (KM 265)".*

Assessment of impact significance

The permanent land take during construction and operations and associated access restriction is a direct negative impact, which is permanent in nature. The length of the railway route over which restrictions will apply is approximately 500 km for Phase I and Phase II combined, however livestock crossings will be established during construction and operations to allow access at specific locations identified based on consultations with communities and Project stakeholders. It should be noted however that such consultations have only

been undertaken to date along Phase II of the route and not Phase I. Similarly, loss of access to water sources due to severance and impacts to habitats is of high importance to these groups.

Receptor sensitivity is considered ***high*** given the importance of mobility for pastoralism and transhumance and the semi-nomadic lifestyle, and the level of dependence on pastoralism as the primary source of livelihood for Maasai and Barabaig indigenous communities. The magnitude of the impact is considered medium. The potential (unmitigated) impact significance is therefore considered ***Major***.

*Impact 3: Physical displacement of households as well as residential and commercial structures.*

The new SGR alignment will be designed to largely pass on the existing Right of Way (RoW) of the existing Metric Gauge Railway (MGR), which limits resettlement and other impacts. This being said, the alignment of the proposed SGR will deviate significantly away from the MGR line to bypass Morogoro Town and Dodoma Town. There are also multiple other divergences from MGR along the route in order to reduce curvature.

As such, a number of structures along the bypasses and divergence sections will be affected by the proposed railway line. This section addresses the impacts related to the physical displacement of residential and business structures. Community infrastructures and access to services are discussed separately in *Section 9.2.2*.

The final number of residential structures that will need to be removed and the number of affected households and people will be confirmed as part of the final RAP documents. No relocation of pastoralists communities is foreseen for the SRG project.

Importantly, physically displaced households and business are expected to resettle within their home settlements (in-fill resettlement) and as such, physically displaced households will be able to continue to cultivate existing unaffected landholdings outside of the RoW. Similarly it is expected that business will be able to re-establish in the same area.

<u>Assessment of impact significance</u>

Considering the number of residential structures and business to be displaced, the magnitude of the impact is considered ***high***.

The receptors sensitivity is also considered ***high*** given the low incomes and presence of households with disabled and elderly household members as well as female or child-headed households. The potential (unmitigated) impact significance is therefore considered ***Major***.

*Impact 4: Impact on collection of forest products from clearance of existing land and vegetation for the construction of the SGR.*

Collection of forest products such as firewood for cooking and energy generation is common in rural areas in villages located close to forests. Forest related activities include timbering, the collection of firewood, the production and sale of charcoal, fishing, and wild honey production.

Access restrictions during construction and operation will result in loss of access to forest products and related livelihoods and ecosystem services due to loss of habitat and severance. Impacts to ecosystem services are addressed in more detail in Section 7.1.5. As previously discussed, all vegetation shall be permanently removed within the following sections:

- Small area of 15 m on one side (only) of the proposed SGR for those sections of the alignment that are within the existing MGR RoW.
- A 60 m RoW (30 m on each side) of the proposed SGR sections that pass completely out of the existing MGR RoW (ie the bypasses at Morogoro and Dodoma).

This implies permanent loss of access to natural resources within the areas that will be temporarily and permanently acquired for the establishment of the SRG RoW and the different infrastructures. The establishment of the right of way will involve the loss of 1,429 hectares of forest and shrub areas and very limited (2 hectares) of wetlands present in Lot 1. This area represents 14% of the forest and shrub land areas in the Social Area of Influence. These restrictions will result in limited reduction of areas available for forest-related livelihoods.

Wood is the main source of fuel for heating and cooking throughout the Social Area of Influence. Collection of forest products is common in villages located close to forests. Along Phase I, villages around Pugu Forest Reserve (Kisarawe District Council and Ilala District) collect firewood from the forest. Firewood collection is also common in villages around the Ruvu South Forest (Kibaha District Council), and in Morogoro Rural District. Forest related activities are complementary sources of income.

Overall, the level of impact is therefore dependent on level of clearance in a single area and access to alternative areas as well as on reliance on wood. In the case of fuel wood specifically, Districts such as Kibaha, Morogoro Rural or Chamwino where wood and charcoal are the main sources of energy for cooking, receptor sensitivity would be higher than in urban centres, where electricity reliance is higher. Similarly, villages around Pugu Forest Reserve (Kisarawe District Council and Ilala District), the Ruvu South Forest (Kibaha District Council), and in Morogoro Rural District, which are exposed to larger areas of forest may be more heavily impacted by the reduced access to other forest resources such as timbering or wild honey production.

The initial assessment has confirmed that no hunter-gatherer indigenous groups are present in the Project area.

Assessment of impact significance

The forested area clearance is a direct negative impact, which is permanent in nature. Given the amount of forest areas clearance is relatively small in the overall context of corridor extension, the impact magnitude is considered ***low***. Receptor sensitivity is considered ***high*** considering the level of dependence on firewood for cooking and energy generation, especially in rural areas.
The potential (unmitigated) impact significance is therefore considered M***oderate***.

*Mitigation / Management Measures*

In order to mitigate the above-described impacts to physical and economic displacement, a Resettlement Action Plan (RAP) with a Livelihood Restoration component is currently under development. The RAP is being developed to adequately manage impacts related to land acquisition and economic and physical displacement. In addition, a Stakeholder Engagement Plan (SEP) and Community Grievance Mechanism (CGM) is also developed to ensure adequate and timely communication with project stakeholders at all levels, including affected communities. The objective of this SEP and GM will be to ensure proper disclosure and consultation with stakeholders taking into account community feedback and to identify and address potential grievances early on (e.g. grievances regarding loss of livelihoods, access restrictions, etc.).

The nature of the impacts to be experienced by indigenous pastoralist communities in particular livelihood and cultural related impacts suggest the need for development of a specific plan to manage adverse impacts including livelihood impacts due to loss of access to grazing areas and severance in a comprehensive manner. The *Pastoralist Communities Management Plan* (PCMP)

should be developed with the affected communities and involve significant engagement and consultation [1].

The RAPs should include the following components:

- Assessment of alternatives to minimise or avoid displacement;
- Identification of affected households and land users that will be affected by physical and / or economic displacement. This should include a comprehensive mapping process to identify affected areas;
- Vulnerability assessment to identify vulnerable households and individuals that may require assistance;
- Census and asset inventory to assess compensation measures for those affected and to act as a basis to monitor the success of the RAP;
- Assessment of eligibility and entitlements for those affected;
- Compensation for loss of assets at replacement cost and for the loss of income opportunities from seasonal and permanent crops. This also includes community-level compensation for the loss of community resources such as firewood and charcoal collection and related livelihood and losses (timber sale and wild honey production). The Project will commit to replacing the lost trees and providing support for them to mature. The best approach for doing so will be discussed internally based on community feedback.
- Identification of host sites for housing and farmland;
- Participatory physical planning for housing, including design of structures, access to water points, sanitation etc.;
- Identification of gender differentiated and sustainable livelihood improvement and / or restoration measures (these may include but are not limited to financial literacy training, training on improved farming practices etc.);
- Provisional implementation budgets and provisional schedule;

[1] Consultations with indigenous peoples within the Project area were conducted in March – April 2019 and detailed in an assessment commissioned by ERM. At the writing of this document, the report is still in the process of finalization however preliminary insight into the preferences of indigenous peoples with regards to the Project have been provided. While the primary purpose of the report was to confirm Project impacts on indigenous peoples, initial findings indicate that a preferred option to mitigate Project impacts to the livelihoods of indigenous peoples is to construct livestock crossings. TRC will consider additional measures as revealed through additional stakeholder feedback that will be developed and disclosed as part of the PCMP.

- Roles and responsibilities, including details of an institutional structure; and
- Reporting and monitoring and evaluation requirements

It should be noted that at the time of writing of the present ESIA update, the Project is also updating and finalising the RAPs for Phase I Dar es Salaam to Morogoro and Phase II (Morogoro to Makutopora).

The Stakeholder Engagement Plan and Community Grievance Mechanism will include the following measures:

- The Project will adequately engage with affected households based on the principles of informed consultation and participation regarding severance impacts and mitigation (See Implementation of Social Monitoring in ESMP).
- The Project/ Contractor will undertake consultation with communities and pastoralist groups (in particular Maasai and Barabaig) to identify areas where livestock crossings are required for both the wet and dry seasons (See Implementation of Social Monitoring in ESMP)
- A Grievance Mechanism will be developed, whereby affected people can raise issues and concerns associated with severance during construction and operation, including any unforeseen impacts. The GM will be accessible to all including vulnerable people and pastoralis/IPs groups.
- The project proponent should monitor the success of any new tracks or crossing points through engagement and implement any corrective measures as needed.

Additional measures to minimise negative impacts from access restrictions include (see *Section 9.2.3* for detailed assessment of severance impacts):

- Local tracks, routes and crossing points will be identified and mapped out for both the wet and dry season based on feedback collected during engagement with communities and pastoralist groups. Where needed, tracks will also be upgraded near these crossing points to ensure continued safe access for people and livestock.
- During operations, mitigation measures will include the following:Monitoring and providing the necessary follow-up to support households to restore their livelihoods throughout the operations phase.
- The grievance mechanism established during the construction phase will be maintained during operations to ensure that local communities and stakeholders have an adequate channel to voice concerns.

*Residual Impact (Post-mitigation)*

The assessment of impacts from land acquisition and economic and physical displacement pre and post mitigation measures is summarised in *Table 9-1*, *Table 9-2, Table 9-3* and *Table 9-4* below.

*Table 9-1 Permanent Loss of Livelihoods and Household Income for Farmers and Business*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Approximately 3,700 hectares of land in total will be restricted. These restrictions will result in reduced areas available for cultivation and other livelihoods. | Local | The impact will be experienced by farmers along the Project direct footprint. Development and implementation of a Resettlement Action Plan (RAP) developed in line with PS5 (Land Acquisition and Resettlement), will target those affected by the loss of livelihoods and household income. |
| **Duration** | Long-term | While the acquisition of land will be one-off, economic displacement impacts will be long-term. | Temporary | With the implementation of the proposed mitigation measures, affected farmers will be supported to receive livelihood restoration support (including, but not limited to farmer training, livestock rearing programmes, financial literacy training, vocational training etc.). As such impacts will be experienced temporarily as farmers should be able to find alternative land in most instances. |
| **Scale** | High | The Project will require agricultural land of approximately 1,292 hectares, which represents 14% of the total agricultural area in the social Area of Influence. | High | The RAP will target the same area. |
| **Frequency** | Constant | While the acquisition of land will be one-off, impacts will occur permanently for the duration of the land take and economic displacement (construction and operation phase) | One-off | The RAP and ESMP will be implemented once, over a period of at least 12 months, with at least 24 months of monitoring thereafter to ensure that farmers' households do not become impoverished as a result of land restrictions and loss agricultural resources. |

| | | | | |
|---|---|---|---|---|
| **Likelihood** | Likely | Land restrictions and loss of agricultural resources is likely to occur. | Likely | If the RAP is implemented by a team of experts in line with national and international requirements, those affected will adjust their grazing areas to land available nearby and benefit from livelihood support measures. However, land restrictions and loss of agricultural resources are a very sensitive process and can represent an important loss of household income, particularly for vulnerable groups. As such the impact will still be felt. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Medium Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| High Sensitivity | | | | |
| Communities along the proposed alignment rely on land and natural resource based livelihoods. The primary sources of subsistence and livelihoods, especially in rural areas are agriculture and livestock herding. If not managed correctly, land take can result in an important loss of agricultural resources and household income, which can impoverish households. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Major negative Impact** | | | Moderate Impact | |

*Table 9-2 Rating of Impacts on Pastoralists due to Permanent Land Restrictions and Loss of Agricultural Resources (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Approximately 2,300 hectares (1900 3,700 hectares in the RoW and 411 hectares in areas where facilities will be built) of grazing and shrub land in total will be restricted. These restrictions will result in reduced areas available for grazing | Local | The impact will be experienced by pastoralist groups (i.e. Maasai and Barbaig) along the Project direct footprint. Development of a Pastoralist Communities Management Plan (PCMP) developed in line with PS7 (Indigenous People) and PS5 (Land Acquisition and Resettlement), will target those pastoralists affected by the loss of livelihoods and household income. Additionally a Severance Management Plan will be also developed |
| **Duration** | Long-term | While the acquisition of land will be one-off, livelihood displacement impacts will be long-term. | Temporary | With the implementation of the proposed mitigation measures (crossings and boreholes), affected pastoralists will be supported to re-establish their livelihood (i.e. access to grazing areas etc.). As such, with special management plan implementation, impacts will be experienced temporarily. |
| **Scale** | High | The Project will require land restriction of approximately 2,300 hectares of grass and shrub land. | High | The Pastoralist Communities Management Plan will target the replacement of all the areas that will be restricted in case these are essential mainteinance livelihoods |
| **Frequency** | Constant | While the acquisition of land will be one-off, impacts will occur permanently for the duration of the land take and economic displacement (construction and operation) | One-off | The PCMP, Severance Management Plan and ESMP will be implemented to ensure that pastoralist groups do not become impoverished as a result of land restrictions and agricultural resources |

| | | | | |
|---|---|---|---|---|
| **Likelihood** | Likely | Land restrictions and loss of agricultural resources will likely occur. | Likely | If the PCMP is implemented by a team of experts in line with national and international requirements, those affected will adjust their grazing areas to land available nearby and benefit from livelihood support measures. However, land restrictions and loss of agricultural resources are a very sensitive process and can represent an important loss of household income, particularly for vulnerable groups. As such the impact will still be felt. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Moderate Magnitude** | | | **Medium Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| High Sensitivity | | | | |
| Communities along the proposed alignment rely on land and natural resource based livelihoods. Pastoralist groups such as Maasai and Barbaig (who identify as indigenous people) are considered particularly vulnerable to this impact as mobility and transhumance is central to their livelihood system and way of life to access resources across variable environments and also allow for different pastures to rest at different times of the year. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Major negative Impact** | | | Moderate Impact | |

*Table 9-3 Rating of Impacts related to Physical Displacement of households as well as residential and commercial structures (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | The land taken during construction activities may lead to the permanent relocation of residential and non-residential structures. Potential loss of employment and livelihoods related to economic structures needs consideration. | Local | The impact will be experienced by the land users and resident households along the Project direct footprint. Development and implementation of a Resettlement Action Plan (RAP) developed in line with PS5 (Land Acquisition and Resettlement), will target those affected by physical and economic displacement. |
| **Duration** | Long-term | While the acquisition of land will be one-off, physical and economic displacement impacts will be long-term. | Temporary | With the implementation of the proposed mitigation measures, affected land users and households will be supported to move to alternative locations as well as receive livelihood restoration support (including, but not limited to farmer training, livestock rearing programmes, financial literacy training, vocational training etc.) including participatory physical planning for housing, design of structures, access to water points, sanitation etc. As such, with RAP implementation, impacts will be experienced temporarily. |
| **Scale** | High | The Project will require land restriction of approximately 3,700 hectares. | High | The RAP will target the same people. |
| **Frequency** | Constant | While the acquisition of land will be one-off, impacts will occur permanently for the duration of the land take and physical and economic displacement. | One-off | The RAP and ESMP will be implemented to ensure that households do not become impoverished as a result of displacement. |

| | | | | |
|---|---|---|---|---|
| **Likelihood** | Likely | Land acquisition and physical and economic displacement will likely occur. | Likely | If the RAP is implemented by a team of experts in line with national and international requirements, after a period of time, those affected will adjust to their new locations and benefit from livelihood support measures. However, resettlement is a very sensitive process and can be a traumatic experience, particularly for vulnerable groups and people that have been living in the same place their whole lives. As such the impact will still be felt. |

| **Magnitude** | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **High Magnitude** | **Medium Magnitude** |

| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** |
|---|
| High Sensitivity |
| Communities along the proposed alignment rely on land and natural resource based livelihoods. Additionally, a large portion of affected people will be physically displaced, including vulnerable groups. Vulnerable groups primarily comprise of female-headed households, child-headed households, elderly, those with disabilities and low income or subsistence households. Displacement could lead to long-term hardship and impoverishment if not managed effectively. |

| **Significant Rating Before Mitigation** | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Critical Negative Impact** | Major Negative Impact |

*Table 9-4 Rating of Impacts on Collection of Forest Resources (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Potential reduction in forest-related livelihood activities due to a direct interaction between the Project (i.e. land taken) and forest land users. | Local | The impact will be experienced by the villages living in the vicinities of forested areas and by forest users. Development and implementation of a Resettlement Action Plan (RAP) developed in line with PS5 (Land Acquisition and Resettlement), will target those affected by loss of forest-related resources. |
| **Duration** | Long-term | Forest clearance will have long-term impacts, as trees will not be reinstated and matured in a short-term basis. | Temporary | With the implementation of the proposed mitigation measures, affected forest users and households will be compensated for the loss of assets and will receive livelihood restoration support and possibly access to other forest areas. |
| **Scale** | Medium | The Project will require land acquisition of approximately 1,430 hectares of natural areas (forest and shrub areas, as well as a small wetland area). | Medium | The Project will require land acquisition of approximately 1,430 hectares which represents approximately 14% of the forest and shrub land areas in the Social Area of Influence. |
| **Frequency** | Constant | While the acquisition of land will be one-off, forest-related impacts will occur permanently for the duration of the land take. | One-off | The RAP and ESMP to ensure that trees are being reinstated in a proper manner, and that support is provided for them to mature. |
| **Likelihood** | Likely | Land take and forest clearance will likely occur. | Likely | If the RAP is implemented by a team of experts in line with national and international requirements, after a period of time, trees will be reinstated and will mature, which will provide communities with new forest- related resources. However, land clearance is a very sensitive process, as people have been relying in these natural resources for a long period of time. |

| Magnitude | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Low Magnitude** | **Low Magnitude** |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | |
| High Sensitivity | |
| Communities along the proposed alignment rely on forest resources livelihoods. The level of dependence on firewood and charcoal for cooking and energy generation is really high in the Social Area of Influence. | |
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| Moderate Impact | Minor Impact |

### 9.2.2 *Impacts associated with Displacement of Community Infrastructure and Access to Basic Services*

*Description of the Baseline Environment*

Within the affected wards and villages are a number of public services that will likely be affected by the proposed railway line. These include water sources (eg wells and pumps), electric and telephone poles and lines, stations, dispensaries, schools, vocational training centres, market, public buildings, religious buildings and cemeteries.

*Proposed Project Activities*

As described in *Section 2.5.2* the Project construction phase will entail several activities such as survey works, geotechnical and geophysical works, resettlement, clearance of existing land and vegetation, earth works, civil works (including underground and tunnelling works), construction of culverts, track works, catenary works, signalling and telecommunication works, building and bridges works, as well as, commissioning works. Those proposed construction works will require and entail temporary and permanent land acquisition resulting in the displacement of public services currently used by the communities in the districts and wards crossed by the proposed railway line.

During operational phase, displacement of public services will not be required.

*Sensitive Resource / Receptors*

Community assets and infrastructure generally have low sensitivity, as they consist of simple buildings, which could easily be re-provided. However, there absence would negatively affect the community who often lack access to alternative facilities. Graves are likely to be locally important (to a household or community) and the movement or displacement of graves is likely to be sensitive.

See *Table 9-5* below for the community assets and infrastructures affected by the Project for Phase I and Phase II.

*Table 9-5 Infrastructures affected by the Project*

| AFFECTED INFRASTRUCTURES | |
|---|---|
| **PHASE I** | **PHASE II** |
| ***Education facilities*** | |
| Msua Village Primary School – Ilala District | Kidete Secondary School – Kilosa District |
| Amani Primary School – Ilala District | Munisagara Primary School – Kilosa District |
| Rosehill Secondary School – Ilala District | Kidete Primary School – Kilosa District |
| Ukonga Vocational Training Centre – Ilala District | Mzaganza Primary School – Kilosa District |
| Brothers Special Academy - Ilala District | Godegode Secondary School – Mpwapwa District |
| Livestock Training Centre in Ngerengere | Igandu primary school – Chamwino District |
| Guluka Primary School – Ilala District | Meriwa secondary school – Dodoma District |
| ***Health facilities*** | |
| Guluka Kwalala Dispensary – Ilala Municipal | Mzaganza dispensary – Kilosa District |
| 2 health dispensaries and health centers – Ilala Municipal | Munisagra dispensary- Kilosa District |
| 2 dispensaries and health centers – Morogoro Rural | Gulwe dispensary - Mpwapwa |
| ***Religious facilities*** | |
| Masjid Fisabil Llah Mosque – Ilala District | Two (2) Mosques in Kimabila – Mvomero District |
| Masjid Makuti Mosque – Ilala District | Two (2) Mosques in Kimabila – Kilosa District |
| Masjid Minazi Mikinda 1 Mosque – Kibaha District | Five (5) Churches (from which 4 are open land) – Kilosa District |
| Masjid Minazi Mikinda 2 Mosque – Kibaha District | Two (2) churches (from which 1 is open land) and One (1) mosque - Mpwapwa District |
| The Mount of Deliverance Baptist Church | One (1) church open land – Chamwino District |
| Chuo cha Biblia (ESBC), EAGT – Morogoro Municipality | Eight (8) churches (from which 7 are open land) – Dodoma District |

| AFFECTED INFRASTRUCTURES | |
|---|---|
| **PHASE I** | **PHASE II** |
| ***Local Government Authorities*** | |
| Guluka Kwalala Sub Ward Office – Ilala District | Local government office in Kasiki – Kilosa District |
| Chama cha Mapinduzi offices – Ilala District | Two (2) old and new local government offices in Igandu – Chamwino District |
| ***Water sources*** | |
| Three (3) Wells in Guluka Kwalala – Ilala District | Muungano "B" water points – Dodoma District |
| One (1) well with hand pump in Ruvu Station - Kibaha | Two (2) water reservoirs – Manyoni District |
| Two (2) public wells in Msua – Ilala District | |
| Two (2) Community wells in Lukobe – Morogoro Urban District | |
| One (1) church-owned well (serves the community too) in Lukobe - Morogoro Urban District | |
| Water network, including a tank and pipeline network in Minizai Mikinda | |
| ***Power lines*** | |
| Power lines in residential areas in Pugu and Ruvu Wards – Kibaha District | |
| ***Others*** | |
| Mikinda fish market – Kibaha district | |
| Tanzania Forest Reserve Agency – Ilala District | |

Source: RAP Report Lot 1 and Lot 2 (Updated version), 2019.

*Significance of Impact (Pre-mitigation)*

The impact of displacement of public services will be "**Direct"** and "**Negative"** affecting a significant proportion of users and employees that rely on the facilities. The displacement of public services will be one-off while its impacts on the affected communities who rely on them will be **long-term, as it will take time to relocate and restore the services and livelihoods of those affected**
With that, the impact magnitude of the displacement of public services is considered "**Large**".
The receptor sensitivity is considered "**High**".

Based on the analysis provided above, the (unmitigated) impact significance from public services displacement will be **Major** (*Table 9-6*).

*Mitigation / Management Measures*

The minimisation of impact on public serves will be included in the RAPs for both Phases of the Project. This includes the following:

- The Project should seek to avoid or minimise the impact to services, including assessing alternative locations of the alignment in these areas;
- Affected public services should be properly identified through GPS mapping and satellite imagery;
- As part of SEP implementation, the sensitivity of such facilities needs to be assessed through consultation with affected users, including employees and households residing in affected areas (See Implementation of Social Monitoring in ESMP)
- The asset surveys needs to capture these services to assess the scale and cost of the impact to the Project;
- Host site options for relocation of services should be carried out with affected users, employees, utility companies and the government; as required;
- A sustainability plan for all facilities needs to be prepared to set out how the relocation, restoration and maintenance of such services will be managed;
- The RAP needs to include a provisional implementation budget and schedule; and
- The RAP should include reporting, monitoring and evaluation requirements for resettlement of public services.

As mentioned above, both the draft RAP for Dar es Salaam to Morogoro (Phase I) and the RAP for Morogoro to Makutopora (Phase II) were being updated at the time of writing this ESIA.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact of displacement of public services will be a "**Minor Negative Impact**" post mitigation (refer to *Table 9-6*).

*Table 9-6 Rating of Impacts Related to Displacement of Public Services (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Households using public services, as well as employees and other users, will experience significant impacts from the displacement of these. | Local | The local community and the government will play a role in actively participating in the relocation and restoration of the affected services, in particular the school, religious buildings, water supply and the market. |
| **Duration** | Long-term | The displacement of public services will be one-off; however, its impacts will be long-term affected a large proportion of the population. | Temporary | The impact will be temporary as the facilities will be restored through RAP implementation and collaboration with local utilities companies, the government, non-governmental organisations and other key stakeholders. |
| **Scale** | Medium | The displacement of public services has the potential to impact the quality of life to a large proportion users that will be impacted by the displacement of services, as well as livelihoods/employees of such facilities. | Medium | The impact of the RAP will be medium scale targeting a large number of people. |
| **Frequency** | Constant | While the displacement of public services will be one-off, its impacts will occur in a long-term. | One-off | The impact on public services will be one-off during the construction period. |
| **Likelihood** | Likely | Displacement of public services will likely occur. | Unlikely | With the implementation of the RAP and once affected services are relocated and restored, the impact will unlikely be felt. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Large Magnitude** | | | **Small Magnitude** | |

| Sensitivity/Vulnerability/Importance of the Resource/Receptor | |
|---|---|
| Medium Sensitivity | |
| Communities along the proposed railway line who rely on affected public services as well as the employees of such services could potentially experience the unavailability of those until they are fully re-established on relocation areas. Vulnerable groups that will most experience the impact will be students/children using schools, parents of these children, women that rely on power for cooking and other means, and the elderly and disabled hat may experience longer distances to access water and religious buildings. | |
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Major Negative Impact** | **Minor Negative Impact** |

### *9.2.3 Impacts on Restrictions to Access Routes and Severance*

*Description of the Baseline Environment*

Currently, communities freely cross the existing railway to access neighbouring communities, villages, shopping, market areas, schools, churches, cattle dips, etc. Additionally, it is known that livestock and wildlife also cross the current railway line freely in search of pasture.

The Maasai and Barabaig, who are pastoralists are present in the Districts traversed by the Project. In particular, in Chamwino District (Dodoma Region) and Kilosa District (Morogoro Region). As such, they may be impacted by access restrictions and severance, which can compromise severely their livelihood and traditional lifestyle.

*Proposed Project Activities*

The railway construction will require the implementation of safety fencing, security measures, as well as, placement of construction equipment along construction areas restricting current access routes.

In its operation phase, it is proposed that certain sections of the new railway line corridor will be fenced restricting current access routes that wildlife and livestock are used to when searching for pasture and breeding grounds.

This being said, cattle and pedestrian crossing underpasses will also be constructed. The locations of these facilities have been defined according to the design requirements and stakeholder meetings.

*Sensitive Resource / Receptors*

During the construction phase, safety fencing, security and equipment associated with the construction phase may restrict current access pathways extending the distance that people in communities (along Project direct footprint) have to travel to neighbouring villages, shopping, market areas, schools, churches, cattle dips, etc. It will also restrict current access that wildlife and livestock have when searching for pasture and breeding grounds.

There may be informal tracks or pathways used by community members to access infrastructure or for moving livestock to water or grazing. These tracks or pathways may also vary by season in particular during the dry season when seasonal rivers, streams and associated water pans become dry and grazing is limited.

Particularly vulnerable groups include:

- **Livestock Herders**: who may lose access to grazing land and water sources, which are seasonally important or will have to walk significant distances to access these services.
- **Children**: if the distances they need to walk to school are increased due to loss of short cuts.
- **Women**: who may feel unsafe walking through underpasses or additional distances to access resources.
- **Elderly and those with Physical Disabilities**: who are less able physically to walk increased distances to services.

During the operational phase, this impact will be reduced somewhat through the provision of underpasses and overpasses that shall be used by people and animals for crossing the railway line.

*Significance of Impact (Pre-mitigation)*

The impact of restriction to access routes will be "**Direct**" and "**Negative**" affecting the communities, livestock and wildlife along the direct footprint of the Project (districts and wards crossed by the proposed railway line).

The restriction to access routes will be "**Short-term**" considering lasting during construction phase. With that, the impact magnitude of the restriction of access routes is considered "**Small**" and receptors sensitivity is considered "**Medium**".

Based on the analysis provided above, the impact from restriction of access routes will be a "**Minor Negative Impact**" pre-mitigation (*Table 9-7*).

*Mitigation / Management Measures*

In order to minimise negative impacts from restriction to access routes, the following mitigation measures should be applied:

- As part of the SEP, the Project/ Contractor will undertake consultation with communities in areas/access routes potentially affected during construction to establish the best alternative routes and measures that the Project should put in place to minimize impacts related to access restrictions.

- During construction, temporary crossing points should be provided for communities. The distance between the crossing points may vary depending on the Section and existing land uses but should not require people to walk more than an additional 2km in total to access services etc.
- Boreholes sunk during construction should be handed over to communities along the SGR alignment. If required, water user committees should be established to manage these boreholes.
- Borrow pits and quarries created during construction have the potential to act as water pans for the community. Such pits should be assessed on a case by case basis to determine if it is appropriate to leave them to form pans taking into account existing surrounding land uses, land ownership and the potential for human –wildlife conflict (as wildlife may also access such pits) bringing them in close proximity with humans and livestock.
- The Project/Contractor will develop a Traffic Safety and Road Infrastructure Management Plan including the following specific measures:

- Local tracks, routes and crossing points will need to be identified and mapped for both the wet and dry season using engagement (with communities and livestock grazers) and remote sensing. In addition, the infrastructure, services, water pans etc. that people accessing should be mapped. Based on this information, crossing points should be identified. Where needed, tracks will also be upgraded near these crossing points to ensure continued safe access for people and livestock.
- The project proponent should monitor the success of any new tracks or crossing points through engagement and implement any corrective measures as needed.

- Restoration Planning for construction sites, Construction Camps, laydown areas etc. should be undertaken early to ensure that any facilities that are damaged or become inaccessible during construction can be restored as early as possible.
- The Project should adequately engage with affected households based on the principles of informed consultation and participation regarding severance impacts and mitigation (See SEP and Implementation of Social Monitoring in ESMP)
- A Grievance Mechanism is developed, whereby affected people can raise issues and concerns associated with severance during construction and operation, including any unforeseen impacts.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact of restriction of access routes will be a "**Negligible Negative Impact**" post mitigation (*Table 9-7*).

*Table 9-7 Rating of Impacts Related to Restriction to Access Routes (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Negative Direct Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | The impact will affect communities, livestock and wildlife along the Project direct footprint. | Local | The communities along the proposed railway line will experience the impact. With the proposed mitigation measures communities, livestock and wildlife will not experience any impact of restriction of access routes as a one-off event as part of a transition period. |
| **Duration** | Short-term | The restriction of access routes will last only during construction period. | Temporary | With the implementation of the proposed mitigation measures, affected communities, livestock and wildlife will be supported to ensure that such impacts will only be experienced temporarily. |
| **Scale** | Medium | The restriction of access routes have the potential to interfere with current access patterns along the railway alignment. | Low | With the implementation of the proposed mitigation measures such impacts will only be experience temporarily. |
| **Frequency** | Constant | The impact will be constant during the construction phase. | Occasional | Due to the mitigation measures provided, affected communities, livestock and wildlife will not experience any impact of restriction of access routes as a one-off event as part of a transition period. |
| **Likelihood** | Likely | Restriction of access routes is will likely occur. | Unlikely | With the implementation of the proposed mitigation measures, negative impacts from access routes restriction are unlikely to be felt by the affected communities. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Small Magnitude** | | | **Negligible Magnitude** | |

| Sensitivity/Vulnerability/Importance of the Resource/Receptor | |
|---|---|
| Medium Sensitivity | |
| Restriction of access routes will affect communities, livestock and wildlife mainly during construction phase through the change of current access patterns along the railway alignment. Those can experience unavailability of access routes until alternatives for the construction phase are established. | |
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Minor Negative Impact** | **Negligible Negative Impact** |

### 9.2.4 *Impacts associated with Transmission of Vector Borne and Communicable Diseases*

*Description of the Baseline Environment*

Communicable diseases are caused by viral, bacterial, parasitic and fungal pathogens that are airborne or that are transmitted through an infected person, animal or environmental source. Communicable diseases include malaria, tuberculosis (TB), measles and bacterial infections such as colds, gastric infections (eg diarrhoea) and the like.

Communicable diseases along the Project direct footprint (districts of Ilala, Kisarawe, Kibaha, Morogoro Rural, Morogoro Urban, Mvomero, Kilosa, Mpwapwa, Dodoma Rural, Chamwino and Manyoni) include Malaria, tuberculosis, gastroenteritis, diabetes, pneumonia, acute respiratory infection, diarrhoea, etc., as identified in the baseline. HIV/AIDS and other sexually transmitted diseases are presented separately in *Section 9.2.5*.

Some of these diseases are water borne and caused by poor sanitary conditions and poor quality drinking water. UNICEF (2016) report that around 10%of the total population were not using any toilet facilities at all, against 55% using unimproved facilities, 16% using shared toilet facilities, with only 19% using improved and unshared toilet facilities.

*Proposed Project Activities*

The presence of an external workforce living in camps where interaction with nearby communities is possible could lead to the increased transmission of communicable diseases within these communities. The profile of any disease transmission will be influenced by the existing disease profile of communities along the proposed SGR alignment, and the diseases profile of the countries and other parts of Tanzania workers are sourced from.

In addition, if opportunistic workers (those hoping to find employment on the Project or from related activities) migrate to work fronts or Construction Camps this could also impact on the transmission of communicable diseases. During the construction phase, permanent and temporary (mobile) camps for workforce accommodation will be disbursed along the proposed railway alignment. Permanent campsites will be placed in Ilala, Soga, Ngerengere, Kilosa and Ihumwa Dodoma.

Finally, overcrowding or living in close quarters both within worker camps and in communities (if people rent out rooms etc.), poor hygiene and sanitation at

Construction Camps and poor waste management can also facilitate the spread of communicable diseases. There is the potential for increased transmission between workers living and working in close quarters and then onwards into national workers' families and the communities through interactions. Children will be at particular risk of diarrhoeal diseases due to their poor sanitary behaviours, while the elderly will be at risk of more severe health outcomes as a result of their frailty.

During construction, modifications to the environment and in-migration into the area are likely to increase the risk of transmission of malaria. Modifications to the environment can create small water pools (e.g. wheel ruts and footprints) offering new mosquito breeding grounds and leading to increased vector densities and human-vector interaction. Any influx of people into the area may play an indirect role in increasing the malaria burden. This may result from an increase in pressure on medical facilities, inadequate waste management and establishment of make-shift housing (reducing natural protection from mosquitoes). The highly endemic nature of malaria means that the proposed SGR alignment is unlikely to significantly add to the already high disease burden of the community during the wet season. However, modifications to the environment may change the breeding patterns of mosquitoes extending the high risk malaria season for transmission from its peak.

As above, poor hygiene, sanitation and waste management can all result in increased risk of transmission of water borne communicable diseases such as Hepatitis A and E and Typhoid through increased risk of contamination of water and food with faecal matter. In addition, these factors can also result in increased number of pests, such as rats, which can contribute to disease transmission.

*Operations Phase*

Once operational, the risk of transmission of communicable and vector borne diseases is likely to return to baseline levels. This is because as outlined above the proposed SGR alignment is being constructed close to the existing railway line, which already provides a transit route for disease transmission.

*Sensitive Resource / Receptors*

Communicable diseases have the potential to impact Project workforce and communities on the direct footprint of the proposed project in the districts of Ilala (Ukonga, Gongo la Mboto and Pugu wards), Kisarawe (Kisarawe ward) Kibaha (Ruvo, Kwala, Msua and Magindu wards), Morogoro Rural (Kidugalo, Gwata, Mikese and Ngerengere wards), Morogoro Urban (Lukobe ward),

Mvomero (Lubungo ward), Kilosa (Chanzuru, Mabwerebwere, Kimamba 'A', Mkwatani, Mbumi, Kasiki, Magomeni, Masanze and Kidete wards), Mpwapwa (Gode, Kimagai, Mazae and Chunyu wards), Dodoma Rural (Gandu, Handali, Msamalo, Kigwe, Chikola, Mpamantwa and Bahi wards), Chamwino and Manyoni (Kintinku and Maweni wards).

It is anticipated that during the construction period the workforce (phase I and II) will comprise up to 7,000 employees, both skilled and unskilled. It is currently estimated that 80 percent of the workforce will be local Tanzanians and 20 percent expatriates. Local labour will (as far as possible) be sourced from villages along the alignment of the proposed railway. Permanent and temporary (mobile) campsites will be placed along railway alignment.

*Significance of Impact (Pre-mitigation)*

The impact on communicable diseases will be "**Direct**" and "**Negative**" having the construction phase the potential to increase existing rates of communicable diseases, affecting communities and workforce along the railway alignment.

The impact will be "**Temporary**" likely to be experienced during construction phase in construction peak periods, when the number of workers and activities is high.

The risk for increased vector or communicable diseases will be constant hroughout the construction however, it is likely to occur "**Occasionally**". With that, the impact magnitude is considered "**Medium**" and receptors sensitivity is considered "**Medium**".

Based on the analysis provided above, the impact from increased communicable diseases will be a "**Moderate Negative Impact**" pre-mitigation (*Table 9-8*).

*Mitigation / Management Measures*

In order to minimise negative impacts from communicable diseases, a *Worker Health and Safety Management Plan* will be developed and will include the following mitigation measures:

- Develop and implement pre-employment screening measures for workers, which will cover applicable diseases. Individuals found to be suffering from communicable diseases will need to seek treatment prior to mobilisation to site. However, no one should be denied employment because of their health

status as long as they are able to undertake the required duties (following treatment if relevant).

- Workers should receive training as part of their induction and then at least every 6 months on potential high risk communicable and vector borne diseases, symptoms, preventative measures and transmission routes as well as treatment options. This will be particularly important for diseases with which non-local workers are unfamiliar and in case of any emerging disease outbreaks.
- A Worker Code of Conduct should be developed providing a camp code of behaviour including worker-worker interactions, worker-community interactions and development of personal relationships with members of the local communities. This would apply to all Project workers and visitors to any Construction Camps.
- Accommodation should be provided to workers in accordance with international good practice on workers' accommodation, including IFC standards to prevent transmission of diseases associated with poor living conditions.
- In the event of a new disease, increased transmission or outbreak compared to the baseline, the Project should interact with local health care facilities and workers to ensure there is an appropriate response in place. This involves community education and awareness, training of health care workers etc (See ESMP).
- For all contractors and sub-contractors, at worker accommodation and sites the following will be implemented at a minimum in order to minimise disease transmission:
    - Providing workers with appropriate sanitary facilities which are appropriately designed to prevent contamination.
    - Developing a robust waste handling system to avoid the creation of new vector breeding grounds or attracting rodents to the area.
    - Implementing measures to reduce the presence of standing water onsite through environmental controls and source reduction to avoid the creation of new breeding grounds.
    - Ensuring the worker camp is kept clean and free from any accumulation of wastes as well as supplied with clean potable water.
    - Ensuring appropriate food preparation and monitoring measures are in place.

- Providing insecticide-impregnated bed nets as a physical barrier to repel and kill mosquitos for workers that have been provided accommodation.
- Monitoring to ensure that all standards are being met by the relevant departments.

- The workforce will be provided with access to treatment at health facilities on site/ at camps. The requirements for these health facilities should be based on a risk assessment taking into account access to existing health facilities and travel time to facilities that offer international standards of care. Access to health care should include direct employees, sub-contractors and employees of the supply chain working on based on site.
- The Project should prepare and implement a Vector Borne Disease Management Plan focusing on malaria, which includes vector control, avoidance, diagnosis, treatment and training.
- The Project should implement TB prevention measures including testing and referral for treatment for all personnel working on the Project. This approach should be explained clearly to the workforce along with making it clear that there are no consequences for their employment.
- The Project should monitor the emergence of major pandemics through World Health Organisation (WHO) alerts and in the event of a pandemic review mobilisation and demobilisation of ex-patriate Project personnel and / or implement appropriate control measures and Emergency Response Plans.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact from increased communicable diseases will be a "**Minor Negative Impact**" post mitigation (*Table 9-8*).

*Table 9-8 Rating of Impacts Related to Communicable Diseases (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Impacts are likely to affect wards and villages along the railway alignment (which crosses five different regions), where the majority of construction activities will occur. | Local | Impacts are likely to affect wards and villages along the railway alignment, where the majority of construction activities will occur. |
| **Duration** | Temporary | Impacts are likely only to be experienced during peak construction periods, when the number of workers and activities is at the highest. | Temporary | Impacts are likely only to be experienced during peak construction periods, when the number of workers and activities is at the highest. |
| **Scale** | Medium | The impact is likely to affect a significate number of wards and villages crossed by the railway alignment. | Low | With implementation of the proposed mitigation, measures such impacts will have the potential to affect a small portion of wards and villages. |
| **Frequency** | Occasional | The risk for increased communicable diseases will be constant throughout the construction. However, it is likely to occur occasionally. | Occasional | The risk for increased communicable diseases will be constant throughout the construction. However, it is likely to occur occasionally. |
| **Likelihood** | Likely | The risk for increased communicable diseases is likely to occur during construction phase. | Unlikely | With the implementation of the proposed mitigation measures, the risk of increased communicable diseases during construction phase is unlikely to occur. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Small Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Medium Sensitivity | | | | |

A significate number of communities and Project workers along the proposed railway, which crosses five different regions, could potentially experience impacts of increases on communicable diseases.

| **Significant Rating Before Mitigation** | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Moderate Impact** | **Minor Impact** |

### *9.2.5 Impacts associated with Transmission of Sexually Transmitted Infections*

*Description of the Baseline Environment*

The annual incidence of HIV in Tanzania among adults, ages 15 to 64 years, is 0.29 percent (0.40 percent among females and 0.17 percent among males). This corresponds to approximately 81,000 new cases of HIV annually among adults, ages 15 to 64 years, in the country.

In addition, prevalence of HIV among adults, ages 15 to 64 years, in Tanzania is 5.0 percent (6.5 percent among females and 3.5 percent among males). This corresponds to approximately 1.4 million people living with HIV (PLHIV), ages 15 to 64 years in Tanzania.

The HIV/AIDs prevalence rate in Dar es Salaam, Pwani, Morogoro and Dodoma regions, through which the railway will traverse, is 4.7 percent, 4.2 percent and 5.0 percent respectively.

*Proposed Project Activities*

It is anticipated that during the construction period (phase I and II), the necessary workforce will comprise up to 7,000 people, to be accommodated in construction camps disbursed along the railway line.

*Construction Phase*

The Project could result in increased transmission of STDs including HIV/AIDS during construction due to:

- Presence of a mainly male workforce, with higher incomes, who may engage in high risk sexual activities with Commercial Sex Workers (CSWs), in particular in larger urban centres and near to Construction Camps.
- Workers establishing casual relationships with young girls in communities near the Construction Camps. This may result in transactional sex or circumstances where the women assume they are in a more serious relationship, which will end in marriage.
- Engagement in casual high-risk sexual activity by transport drivers along their routes and at their end destination. Transport drivers typically have higher rates of STDs and HIV/AIDS than the general population.
- Increased numbers of CSWs, who may have higher infection rates of STDs and HIV, near construction sites and Construction Camps.

- In-migration, resulting in the mixing of people with higher HIV/AIDS or STD prevalence rates than the host community, which may promote the transmission of the disease.

CSWs may be better placed than other women to negotiate safe sex practices, such as the use of condoms, but may also be willing to waive their use for a fee. Any increase in the prevalence of STDs and/or HIV/AIDS along the proposed SGR alignment is a risk to the health of the community including the men who engage in these activities, CSWs, the wives of married men and children through vertical transmission pathways.

While there is access to treatment for STIs including HIV/AIDS in the communities, it is limited in terms of quality. Furthermore, there are significant taboos around STDs, which may influence peoples willingness to access treatment. Any lack of access to treatment could affect the long-term health of those who contract STDs other than HIV, including fertility, damage to internal organs and long-term disability or even death.

Increased transmission of STDs including HIV/AIDS has the potential to affect households along the proposed SGR alignment but in particular near to the construction camps. However, impacts could spread regionally due to vehicle movements and the presence of CSWs in larger towns.

The increase in risk of STDs including HIV/AIDS will be long-term, as it can take time for prevalence/ incident rates to return to baseline levels. Furthermore, those infected with HIV/AIDS will have health effects, which last beyond the duration of the construction activities.

*Operations Phase*

Once operational, the risk of transmission of sexually transmitted diseases is likely to return to baseline incidence rates although the prevalence rates may remain higher due to any increase in disease transmission during construction.

*Sensitive Resource / Receptors*

The presence of the workforce and expectations regarding job opportunities creating influx of workers has the potential to create an increase in STI/HIV and other sexual related diseases prevalence in the communities crossed by the railway alignment, due to worker-community interactions with young women seeking to better their lives through income generation, or relationships with the workforce (expatriates or Tanzanians).

*Significance of Impact (Pre-mitigation)*

The presence of workforce and the potential for influx are likely to influence an increase in HIV/AIDS and other sexual related diseases, representing a "**Negative**" impact to the potentially affected people/communities.

This impact is likely to be experienced "**Temporarily**" during construction phase, affecting local communities along the railway line. The risk for increased HIV/AIDS and other sexual related diseases is considered "**Occasional**".

Being the Project workforce accommodated in campsites disbursed along the proposed railway line during the construction phase, it is expected to the Project to have the potential to create a significant increase on HIV/AIDS and other sexual related diseases prevalence.

Therefore, the impact magnitude is considered "**Large**", considering the direct footprint of the Project, which crosses five districts. Community sensitivity is also considered "**High**".

Based on the analysis provided above, the impact from increases in HIV/AIDS and other sexual related diseases will be a "**Critical Negative Impact**" pre-mitigation (*Table 9-9*).

*Mitigation / Management Measures*

The following mitigation measures are recommended:

- Development of a Code of Conduct / rules for worker-community interaction and on-site behaviour.
- The Project should develop an STD Management Plan designed to minimise the spread of HIV infection and other STDs. The plan should be prepared with the assistance of a specialist in sexually transmitted diseases. A typical plan would include, among other things, the following measures:
  - An HIV/AIDS training course and on-going education on transmission of HIV/AIDS and STDs, to employees, through workshops, posters and informal information sessions;
  - Encouragement of employees to determine their HIV status;
  - Supply of condoms/ femidoms at the construction site(s)/ Construction Camps; and

- Development of a comprehensive Construction Camp Management Plan, including rules for on-site behaviour, entrance and exit policies and prohibition of sex workers on site.

- As part of STD Management Plan, information should be provided to workers on STD prevalence rates in Tanzania and/ or the relevant Counties as well as the expectations of local communities if a women is made pregnant by a worker (e.g., marriage, financial implications etc.).
- Workers should have access to confidential health care for the treatment of STDs through medical facilities/ health care at Project sites.
- The Project should partner with other NGOs and CBOs to support the provision of information, education and communication campaigns around safe sexual practices and transmission of STDs. These activities should be focussed in locations where construction camps are located or where drivers (construction and supplier drivers) rest.
- As part of the SEP, the Project should consult with local leaders such as Area Chiefs and village elders, amongst others. The consultations should be aimed at finding ways of ensuring social vices such as prostitution are minimised either through punitive or rehabilitative measures for the CSWs and their clients (See Implementation of Social Monitoring in ESMP)
- A Grievance Mechanism should be developed, whereby affected people can raise issues and concerns associated with social vices, prostitution and the behaviour of workers and drivers.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact of increased HIV/AIDS and other sexual related diseases will be a "**Major Negative Impact**" post mitigation (*Table 9-9*).

*Table 9-9 Rating of Impacts Related to Increased HIV/AIDS and Other Sexual Related Diseases (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Impacts are likely to affect people along wards and villages along the railway alignment (which crosses five different regions), where the majority of construction activities will occur. | Local | Impacts are likely to affect people along wards and villages along the railway alignment (which crosses five different regions), where the majority of construction activities will occur. |
| **Duration** | Temporary | Impacts are likely only to be experienced during peak construction periods, when the number of workers and activities is at the highest. | Temporary | Impacts are likely only to be experienced during peak construction periods, when the number of workers and activities is at the highest. |
| **Scale** | High | The impact is likely to affect a significate number of people along wards and villages crossed by the railway alignment. | Medium | With the implementation of the proposed mitigation measures, the impact is unlikely to affect a significate number of people along wards and villages crossed by the railway alignment. |
| **Frequency** | Occasional | The risk for increased HIV/AIDS and other sexual related diseases will be constant throughout the construction. However, it is likely to occur occasionally. | Occasional | The risk for increased HIV/AIDS and other sexual related diseases will be constant throughout the construction. However, it is likely to occur occasionally. |
| **Likelihood** | Likely | The risk for increased HIV/AIDS and other sexual related diseases is likely to occur during construction phase, affecting communities and Project workforce. | Unlikely | With the implementation of the proposed mitigation measures the increase on HIV/AIDS and other related diseases is unlikely to be experienced by communities and Project workforce |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Large Magnitude** | | | **Medium Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| High Sensitivity | | | | |

| The impact of increased HIV/AIDS and other sexual related diseases have the potential to affect a significant number of people along the railway alignment. | |
|---|---|
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Critical Negative Impact** | Major Negative Impact |

### *9.2.6 Impacts associated with Community Health and Safety and Security, including Construction and Operations Traffic Movement*

The Project may change the community exposure to safety risks and impacts arising from construction activities and operations activities, such as equipment accidents, traffic accidents, collisions, structural failures, releases of hazardous materials, and pedestrians crossing the railway line. To minimize these potential impacts on the community, TRC and the EPC Contractor should develop and implement a Community Safety Management Programme in line with the requirements of the "IFC EHS Guidelines for Railways", to identify, assess and manage the potential risks to Community Health, Safety and Security, during the design, construction and operations phases of the Project.

*Design Phase*

Community safety will be crucial during the operation of the railway since most of the accidents will potentially occur due to pedestrians and livestock crossing the railway line. In line with the recommendations made in the IFCs EHS Guidelines for Railways, TRC has decided to include the below listed structures based on community needs, which were identified during stakeholder meetings provided in Annex C.

| Type of Structure | Number of Structures in Lot 1 | Number of Structures in Lot 2 |
|---|---|---|
| Bridges | 30 | 50 |
| Overpasses | 19 | 28 |
| Underpasses | 33 | 32 |
| Livestock Crossings | 13 | 40 |

The underpass locations are designed to be at essentially all existing roadways and farm roads/paths. In other words, a sufficient number of underpasses will be installed at appropriate locations to facilitate the existing transport routines/passage and to thus avoid any motivation for attempting an illegal crossing of the railway itself.

The structure designs as listed above are in accordance with good international industry practice and are/will be equipped with adequate warning systems for pedestrians, that include voice alarm systems, use of closed circuit system to monitor the locations where pedestrian movements are high.

In addition to above mentioned structures, TRC also decided to fence about 51km of Lot 1 (Dar es Salaam to Morogoro) and the entire length of Lot 2 (Morogoro to Makutupora) along the alignment, on both the left and right sides of the RoW. Fencing will also be in urban areas, around passenger stations, freight facilities and marshalling yards at Lot 1.

Construction Phase

Impacts on the health and safety of the community may arise during construction as a result of noise, vibration, dust and other emissions from earth moving activities, and operation of equipment and vehicles which have been already been addressed in different chapters of the ESIA Chapter 7.2.1 **"***Impacts on Noise and Vibration from Construction Activities" and* Chapter 7.3.2 "Impacts on Air Quality Related to Construction Equipment Emissions".

Other risks involving the public associated with construction could include physical accidents on sites, impacts from construction traffic, and accidents involving the handling of hazardous materials during construction. Children and youths are amongst those vulnerable to the physical hazards associated with construction activities, including falls from unguarded areas at height, and construction traffic, especially in the event of unauthorised entry.

The EPC Contractor's ongoing stakeholder engagement activities in accordance with Project "Stakeholder Engagement Plan" will serve to inform the local communities regarding potential health and safety issues during the construction period. Stakeholder engagement activities will include ongoing community meetings with the vulnerable and marginalized groups such as children and young persons (including visits to schools) and press releases and local postings to inform the public regarding the relevant hazards associated with construction activities that will be relevant to their particular locations. These stakeholder engagement requirements are detailed in the project SEP, provided in Annex G.

*Mitigation / Management Measures*

The EPC Contractor has already developed a Community Safety Management Procedure (DSM-YME-AL-GL00X-G-EN-PRO-0016-0), which should be updated to include the following key mitigation measures to protect the community from adverse effects during construction impacts:

- Adopting best transport safety practices across all aspects of the project and the adoption of a Traffic Safety Management Plan, including for sub-

contractors, to prevent, minimize and control risks and adverse impacts from traffic accidents. Measures will include:

  - Obligatory road safety training of all drivers, including familiarization with the relevant requirements of this ESIA and the ESMP (including rules on truck movements in villages);
  - Obligation that all drivers are appropriately licensed;
  - Obligation that all vehicles are safe and have current inspection certificates;
  - Adopting limits for trip duration and arranging driver schedules to avoid overtiredness;
  - The rush hours of the access roads will be considered and usage of the access roads will be avoided during rush hours (especially during hours that children are travelling to and from school).
  - Monitoring driver behavior, especially for routes that are subject to frequent accidents, and implement corrective action to prevent recurrence.

- Minimizing pedestrian interactions with the construction vehicles through fencing, flagmen, warning signs, etc.;
- Improving local traffic signage by collaboration with the responsible local authorities and communities;
- Collaborating with local communities on education concerning traffic and pedestrian safety;
- Coordinating with emergency responders to ensure that appropriate first aid is provided in the event of accidents;
- Developing and implementing a series of security measures including the installation of sufficient and adequate site boundary and access controls near settlements to prevent unauthorized entry to construction sites, especially by children.
- Managing/controlling of explosives (if required), by restricting unauthorized access to explosive materials; only allowing qualified personnel in the initiation of the explosives; and taking other measures to reduce impacts from ground acceleration and overpressure on surrounding habitations. Nearby properties will be inspected prior to and after the blasting to assess its impacts. Residents of the local communities will also be notified in advance of a nearby blasting.

*Hazardous Material Safety during Construction*

Hazardous materials, such as fuels, oil, paints, and solvents are likely to be used during construction. The storage, handling, transport and disposal of all hazardous materials should comply with Project requirements, and with adoption of good construction site practices (e.g., appropriate locked storage and sign-posting of hazardous materials).

Access control/restrictions to the construction site should be provided, and thus the risks to the community through exposure to any such hazardous materials during construction of the railway, are expected to be very limited.

Details with respect to the anticipated quantities of hazardous materials to be used on site and the locations of where such materials are stored should be elaborated in the detailed site layout and management plans, to be produced by the EPC Contractor.

The large majority of construction waste and spoil will be inert and suitable for disposal in normal disposal areas. Only a limited amount of waste (e.g. oily waste, containers with hazardous residues etc.) is expected to be disposed of as hazardous waste. Again, adoption of good construction waste management practices (e.g., placement in appropriate containers and sign-posted temporary hazardous waste storage sites, with restricted access, regular removal of waste) will ensure that risks to the public are very low.

*Operation Phase*

One year prior the operation of the railway, TRC should develop a standalone Community Health and Safety Operations Management Plan to address the mitigation measures required during the operation of the railway, aimed at protecting the community and livestock from accidents with trains. The Plan should be in line with the IFCs EHS Guidelines for Railways, and will address the following aspects:

- General Operational Rail Safety (train collision preventive systems, inspection and maintenance of the rail lines, safety programmes, etc.)
- Transport of Dangerous Goods (safe handling and transportation of dangerous goods, safe packaging to prevent leakages, spill prevention and response procedures, emergency preparedness and response, safe refueling requirements, etc.)
- Level Crossing Safety measures (installation of automatic gates at crossing locations, signals and warning systems, etc.)

- Pedestrian Safety (installation of warning signs, fencing, barriers, monitoring systems, alarm systems, community awareness training, etc.)

The Plan also should include;

- Community Safety Training Programmes to raise awareness amongst the communities with respect to the risks of the railway such as unauthorized railway crossings, electrical risks, livestock crossings, etc.
- Emergency Preparedness and Response Plan to address the actions to be taken in case of accidents, spills, floods, etc.

*Security*

Security personnel will be employed at the site to protect assets and prevent community members entering restricted areas. In the event of protests, trespass or other actions by community members or other stakeholders there is the potential for unlawful or abusive interaction between security guards and community members especially if site security are not adequately trained.

Community safety and security risks have the potential to impact Project workforce and communities on the direct footprint of the proposed project; in the districts of Ilala (Ukonga, Gongo la Mboto and Pugu wards), Kisarawe (Kisarawe ward) Kibaha (Ruvo, Kwala, Msua and Magindu wards), Morogoro Rural (Kidugalo, Gwata, Mikese and Ngerengere wards), Morogoro Urban (Lukobe ward), Mvomero (Lubungo ward), Kilosa (Chanzuru, Mabwerebwere, Kimamba 'A', Mkwatani, Mbumi, Kasiki, Magomeni, Masanze and Kidete wards), Mpwapwa (Gode Gode, Kimagai, Mazae and Chunyu wards), Dodoma Rural (Gandu, Handali, Msamalo, Kigwe, Chikola, Mpamantwa and Bahi wards), Chamwino and Manyoni (Kintinku and Maweni wards).

In order to minimise negative impacts from security, the following mitigation measures should be applied:

- A Grievance Mechanism should be developed, whereby affected people can raise issues and concerns associated with vehicle movements, driver behaviors and report accidents or damage to property they feel are caused by Project vehicles. Raise awareness to communities regarding the Grievance Mechanism to deal with community concerns and issues in a timely manner to avoid issues escalating. This will include the use of the Community Liaison Officers (CLOs) who will be present around the Project Site pre and during construction.

- The Project should develop a Traffic Safety Management Plan to prevent, minimize and control risks and adverse impacts from traffic accidents.
- Project security should comply with Tanzanian laws and regulations as well as the requirements of the Voluntary Principles for Security and Human Rights. The security should include, among other things, selection or personnel based on a careful background screening, training with regards to human rights requirements, and monitoring of performance.
- The Project should implement a Community Health and Safety Management Pland and a Security Management Plan for both construction phase and operation phase containing measures to protect the Project facilities and personnel against potential violent protest or social unrest and to train security personnel in safeguarding of community human rights.
- High-risk or value elements of construction sites should be fenced to minimise the risk of trespass and robbery. In addition, clear and visible signage should be put in place where appropriate to advise community members of the risk of site trespass.
- Sensitise local community members prior to the commencement of the construction phase so that they are aware of presence and role of security guards, the risk of site trespass and how to interact with the Project in the event of any concerns or issues.
- The Project should consult with local leaders such as Area Chiefs and village elders. As part of the SEP, the consultations should be aimed at finding ways of ensuring site trespass and robbery are minimised either through punitive or rehabilitative measures (See Implementation of Social Monitoring in ESMP)

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact to community safety and security will be a "**Minor Negative Impact**" post mitigation (*Table 9-10*).

*Table 9-10 Rating of Impacts Related to Community Health, Safety and Security (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Impacts are likely to affect workforce and communities through wards and villages along the railway alignment (which crosses five different regions), where the majority of construction activities will occur. | Local | Impacts are likely to affect workforce and communities through wards and villages along the railway alignment (which crosses five different regions), where the majority of construction activities will occur. |
| **Duration** | Long-term | Impacts are likely to be experienced during Project construction and operational phases. | Long-term | Impacts are likely to be experienced during Project construction and operational phases. |
| **Scale** | Medium | The impact is likely to affect a significate number of workforce and communities along wards and villages crossed by the railway alignment. | Low | With implementation of the proposed mitigation, measures such impacts will have the potential to affect a small portion of workforce and communities along wards and villages crossed by the railway alignment. . |
| **Frequency** | Occasional | The number of incidents that can occur are likely to be occasional. | Occasional | The number of incidents that can occur are likely to be occasional. |
| **Likelihood** | Likely | Community safety and security incidents are likely to occur during construction and operational phases of the Project. | Unlikely | With the implementation of the proposed mitigation measures, community safety and security, incidents are unlikely to occur during construction and operational phases of the Project. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Small Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Medium Sensitivity | | | | |

A significate number of communities and Project workers along the proposed railway, which crosses five different regions, could potentially experience impacts on community safety and security.

| **Significant Rating Before Mitigation** | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| Moderate Negative Impact | **Minor Negative Impact** |

### *9.2.7 Impacts associated with Social Cohesion*

*Description of the Baseline Environment*

In the case of the Ilala District, the rapid economic growth of the city also attracts an influx of people from different corners of the country and from outside the country. In Morogoro District, most immigrants include the Wachaga, Wamasai, Wasukuma and Wapare tribes. Likewise, in Morogoro, there are those who immigrate within the Districts such as the Maasai, who are pastoralists, who move between villages in search of pasture for their cattle. Also the people within Districts also move for different reasons, such as good soil, climate, business opportunities, job opportunities etc.

*Proposed Project Activities*

The SGR railway Project will require a workforce for its construction activities. It is anticipated that during the construction period the workforce (phase I and II) will comprise up to 7,000 people, skilled and unskilled. It is currently estimated that 80 percent of the workforce will be local Tanzanians and 20 percent expatriates. The presence of the Project will attract immigrants from different districts and regions in the pursuit of employment opportunities.

Non-local workers, both Tanzanian and third party nationals will be brought into the Construction Sites along the proposed SGR alignment through a managed process of recruitment and transportation. In addition to the directly hired Project labour, it is also possible that people could move towards the proposed construction activities in the hope of finding work directly with the Project, or to gain benefit from the indirect economic opportunities that the Project may bring, such as selling goods or services to the Project or its workforce. Such influx would be unmanaged but is unlikely to be significant due to its relatively short construction phase in any one location and proactive recruitment and local content measures. Regardless, any migration is likely to place additional pressure on the limited services and infrastructure in the local settlements and can also contribute to the expansion of negative social vices (alcoholism, use of drugs) and petty crime (theft).

There is a high degree of expectation that the proposed Project will bring local and District benefits. The main expectation for benefits is access to employment opportunities, improvements to infrastructure, and delivery of Corporate Social Responsibility (CSR) Projects. Due to the extent of these expectations, there is potential for unmet expectations especially if workers from other parts of Tanzania are on site. Furthermore, employment will need to be shared between

communities along the proposed SGR alignment and that any CSR activities will be proportionate to the scale of the Project.

Infrastructure Projects often raise tensions within communities (intra-community tension) or between communities (inter-community tension). The causes of such tensions include:

- Lack of engagement with communities in particular ensuring that everyone and not just leaders have access to information;

Actual or perceived inequitable distribution of negative impacts and / or benefits;

- Land take and compensation payments especially where there are unclear boundaries and perceptions of winners and losers; and
- The simple stress of change and of interacting within the community and with the Project. Often factors such as short timelines for decisions, lack of information, or lack of clarity of such information exacerbate these tensions.

Despite limited tensions and conflicts being reported as part of the baseline, going forward there is potential for increased tension with the Project and between communities, in particular around benefits and access to compensation. This will be particularly true if there appear to be gatekeepers controlling access to benefits, which may include those who are supposed to represent their communities.

*Sensitive Resource / Receptors*

The proposed SGR railway line will impact communities particularly in the Districts crossed by the alignment (Ilala, Kisarawe, Kibaha, Morogoro Rural, Morogoro Urban, Mvomero, Kilosa, Mpwapwa, Dodoma Rural, Chamwino and Manyoni).

The population along the proposed SGR alignment is generally poor and therefore vulnerable, owing to their dependence on rain-fed agriculture, grazing and natural resources for subsistence. Within this general context of vulnerability some households are more vulnerable and include:

- Single person households composed of widowed or elderly women;
- People with disabilities or incapacitating chronic diseases;
- Single mothers/ female headed households, who are burdened by domestic workloads; and

- Women in general as they generally have low or no education levels.

These groups would be less able to adapt to changes in social cohesion and are less likely to be able to access development benefits associated with the Project.

*Loss of Community Cohesion due to physical displacement*

Displacement directly affects the social and economic dynamics of the community, damaging community cohesion. Women and child-headed households, and those who lack physical mobility or who have mental health issues may be vulnerable to changes and have more difficulties adapting to new contexts. RAP Lot 1 also reported dependency ties between elderly people and people living in the neighbourhoods, as they assist and support their living in many ways. This was observed during the RAP Phase I field survey for an old couple with no children living in Kinonko Village (Morogoro Rural District, west part of Phase I), who gets assistance on food, farming, water collection and medical care from the people in the village.

Thus, within these groups, displacement impacts related to restriction on land access or need to replace housing could be particularly challenging. The loss of a local market will affect those that use it as a location of trading, and also as a space for social interaction.

Considering the number of people to be displaced, the magnitude of the impact is considered ***high***. The receptors sensitivity is considered ***high*** given the reported dependency ties between elderly people and their neighbours, who assist and support their living. Impact significance is therefore considered ***Major***.

*Significance of Impact (Pre-mitigation)*

The impact on influx/ community cohesion will be "**Direct**" and "**Negative**" affecting the communities along the direct footprint of the Project (districts and wards crossed by the proposed railway line).

The impact will be "**Long-term**" lasting during both the construction and operations phases. With that, the impact magnitude on influx is considered "**Medium**" and receptors sensitivity is considered "**High**". Based on the analysis provided above, the impact from influx/community cohesion will be a "**Moderate Negative Impact**" pre-mitigation (*Table 9-11*).

*Mitigation / Management Measures*

In order to minimise negative impacts from influx/ community cohesion, the following mitigation measures should be applied:

- The Project should consult with local leaders such as Area Chiefs and village elders, amongst others. As part of the SEP, the consultations should be aimed at finding ways of ensuring social cohesion is maintained and that people have equal access to development benefits (See Implementation of Social Monitoring in ESMP)
- The Project should develop and implement a Community Grievance mechanism to address any grievances related to social cohesion and equitable sharing of benefits including recruitment of employees.
- The Project should communicate its recruitment strategy in line with its *Local Content and Employment Plan* early and broadly to minimise opportunistic migration this should include:
  - No hiring of job seekers on site or at the gate;
  - No procurement on site or at the gate;
  - Employment selection should involve local leadership to verify people are from the area; and
  - Maximising local content in procurement i.e. from local people and towns, whenever possible, and whenever project requirements are met.
- In line with the Local Content and Employment Plan, the Project will also develop an Influx Management Plan which will include the following measures:
  - The Local Content and Employment Plan will define target locations for recruiting local unskilled labour targets.
  - The Local Content and Employment Plan will outline and require a fair and transparent recruitment process for all openings.
- The Project will provide clear information on the number and limited timescales of employment opportunities.
- **Information Meetings**: Information meetings should be held with Local Government and District leadership, explaining the negative impacts of population influx, the company's recruitment policy and verification process for appointing only local people for unskilled work, harnessing their support to reduce influx of work and opportunity seekers.
- All unskilled employment should be from affected Counties. Fair and transparent selection processes should be developed and communicated.

- Community leaders and residents may have expectations that the proposed Project will play a supporting and developmental role within the area and that the Project will have other positive economic benefits. In order to encourage realistic expectations, close communication should be maintained between local communities and the Project to manage such expectations.

- Land issues will be managed through the *Land and Easement Acquisition Framework* (LEA), which creates transparent and equal management of impacts for communities and affected landowners/users.

- As such, the Project can seek to replace the lost residential land plots within the same settlements (in-fill resettlement), if alternative land is available in the affected settlements. This will prevent the negative effects of the loss of community cohesion.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact from influx/ community cohesion will remain a "**Moderate Negative Impact**" post mitigation (*Table 9-11*).

*Table 9-11 Rating of Impacts Related to Influx / Community Cohesion (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Negative Direct Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | The impact will affect communities along the Project direct footprint. | Local | The communities along the proposed railway line will experience the impact. |
| **Duration** | Long-term | Impacts of influx/ community cohesion will be felt mainly during the construction phase, where influx of people looking for employment opportunities can be verified. During operational phase, influx can be verified as the result of people looking for better living conditions. | Long-term | With the implementation of the proposed mitigation measures potential affected communities, will be supported to ensure that such impacts will be experienced in a reduced scale. |
| **Scale** | Medium | People influx have the potential to interfere with current socioeconomic conditions along the communities crossed by the railway alignment. | Medium | With the implementation of the proposed mitigation measures such impacts will only be experience in a reduced scale. |
| **Frequency** | Constant | The impact will be constant mainly during the construction phase as a result of people looking for employment opportunities. | Occasional | The impact will be occasional mainly during the construction phase because of people looking for employment opportunities. |
| **Likelihood** | Likely | Influx and its effects on community cohesion are likely to occur. | Unlikely | With the implementation of the proposed mitigation measures, negative impacts from people influx and its effects on community cohesion are unlikely to occur. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Medium Magnitude** | | | **Medium Magnitude** | |

| Sensitivity/Vulnerability/Importance of the Resource/Receptor | |
|---|---|
| High Sensitivity | |
| Communities crossed by the proposed railway line have the potential to suffer impacts from influx of people looking for employment opportunities during the construction phase and from people looking for better life conditions during the operational phase. | |
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| Moderate Impact | **Moderate Impact** |

*Table 9-12 Loss of Community Cohesion due to Physical displacement (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Negative Direct Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | The land taken during construction activities may lead to the physical displacement of the affected people, causing a damage to community cohesion | Local | The impact will be experienced by the land users and resident households along the Project direct footprint. Development and implementation of a Resettlement Action Plan (RAP) developed in line with PS5 (Land Acquisition and Resettlement), will target those affected by physical and economic displacement. |
| **Duration** | Long-term | Impacts on community cohesion will be felt mainly during the construction phase, where physical displacement is going to take place. However, while the acquisition of land will be one-off, physical displacement impacts on community cohesion will be long-term. | Long-term | With the implementation of the proposed mitigation measures, affected land users and households will be supported to move to alternative locations as well as receive livelihood restoration support (including, but not limited to farmer training, livestock rearing programmes, financial literacy training, vocational training etc.). As such, the impact will still be felt. |
| **Scale** | High | The Project will require land acquisition and physical displacement of a considerable amount of people. This entails the loss of the social cohesion networks created within neighbourhoods and communities. | High | With the implementation of the proposed mitigation measures such impacts will still be felt for the affected people. |
| **Frequency** | Constant | While the acquisition of land will be one-off, physical displacement impacts on community cohesion will be long-term. | One-off | The RAP and ESMP will be implemented to ensure that the needs of vulnerable people are not diminished due to the loss of community cohesion |

| | | | | |
|---|---|---|---|---|
| **Likelihood** | Likely | The loss of community cohesion due to physical displacement is likely to occur. | Likely | If the RAP is implemented by a team of experts in line with national and international requirements, after a period of time, those affected will adjust to their new locations and benefit from livelihood support measures. However, resettlement is a very sensitive process and can be a traumatic experience, particularly for vulnerable groups and people that have been living in the same place their whole lives. As such the impact will still be felt. |

| **Magnitude** | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **High Magnitude** | **High Magnitude** |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | |
| High Sensitivity | |
| Vulnerable groups along the proposed alignment rely on social cohesion for supporting their needs. Displacement could lead to long-term hardship and a complete loss of community cohesion if not managed effectively. | |
| Significant Rating Before Mitigation | |
| **Critical Negative Impact** | **Major Negative Impact** |
| **Critical Negative Impact** | Major Negative Impact |

### *9.2.8 Impacts on Labour and Working Conditions*

*Description of the Baseline Environment*

According to the European Foundation for the Improvement of Living and Working Conditions (2012), whilst labour laws have influence in the United Republic of Tanzania with regards to minimum standards, the actual working conditions are often not in line with the legal provisions. The substance of labour law is often undermined and employees are subjected to conditions well below the specified minimum working conditions.

Subsistence farming (crop growing and livestock rearing) are the main economic activities along the proposed SGR alignment. Formal employment is limited. Lack of employment is an issue in the communities especially the youth. As such, many people will lack knowledge and experience of formal employment and associated requirements.

However, Yapi Merkezi is determined to ensure a transparent, professional and equal employment opportunity system in place to hire local job seekers. Unskilled workers should be employed from each village where the construction works are undertaken and to source and engage the skilled workers nationwide[1].

*Proposed Project Activities*

*Construction Phase*

Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labour abuses and to ensure fair treatment, remuneration and working and living conditions. These issues should be considered not only for those who are directly employed by the Project, but also their sub-contractors and those within the supply chain. Yapi Merkezi engages with fair labour and working conditions in its Yapi Merkezi, Human Resources Policies and Procedures. 2018

*Worker Health and Safety*

Bearing in mind the nature of the activities being undertaken during construction, worker health and safety is a key risk area with the potential for accidents that may result in injuries and potentially fatalities as well as lost man-

[1] Yapi Merkezi, Human Resources Policies and Procedures. 2018 - YM SGR TZ - R.00 Yapi Merkezi Construction and Industry, Inc. Yapi Merkezi Insaat ve Sanayi A.S.

hours. Many national companies may currently not meet international safety requirements and standards. Employees working informally and those with limited or without awareness of their rights (for example, migrant workers, or those newly entering the labour market) are likely to be most at risk.

*Worker Rights*

The labour laws in Tanzania are generally in line with international labour laws and Tanzania has ratified the eight core International Labour Organisation (ILO) conventions:

- Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87);
- Right to Organise and Collective Bargaining Convention, 1949 (No. 98) ;
- Forced Labour Convention, 1930 (No. 29);
- Abolition of Forced Labour Convention, 1957 (No. 105);
- Minimum Age Convention, 1973 (No. 138);
- Worst Forms of Child Labour Convention, 1999 (No. 182);
- Equal Remuneration Convention, 1951 (No. 100) ; and
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111).

However, the implementation of workers' rights is unlikely to be fully aligned with these requirements. Enforcement of laws is also often limited. There is therefore a risk that some subcontractors/ suppliers on the proposed SGR alignment may not be fully compliant with Tanzanian legal requirements related to labour conditions.

Forced labour and child labour are unlikely to occur in sub-contractor organisations but may occur in the supply chain particularly in relation to provision of food supplies.

Discrimination is likely to occur as women are generally not employed in construction activities and may not be selected by contractors. However, Yapi Merkezi Human Resources Policies and Procedures (2018) seeks to apply gender diversity principles in all the phases of recruitment, selection, training, development and promotion of all employees

*Sensitive Resource / Receptors*

Sensitive receptors for this impact will be Project employees especially the unskilled employees who have a poor understanding of the requirements of Occupational Health and Safety (OHS) standards and their labour rights as enshrined in the law.

*Significance of Impact (Pre-mitigation)*

During construction and operation phases if not properly managed, workforce can be subject to poor labour and working conditions representing a "**Negative**" impact. Labour and working conditions has the ability to create delays to the project, cause reputational risk and create poor worker.

Additionally, poor occupational health and safety can cause injury or fatalities. The impact will "**Local**" and remain throughout the Project development, being a "**Long-term**" impact.

The workforce will comprise up to 7,000 workers during its construction phase, therefore the magnitude is considered "**Large**". Receptors vulnerability is considered "**High**".

Based on the analysis provided above, the impact from labour and working conditions will be a "**Critical Negative Impact**" pre-mitigation (*Table 9-13*).

*Mitigation measures*

In order to minimise negative impacts from labour and working conditions, the following mitigation measures should be applied:

*Employment and Procurement*

The Project shall develop a Local Content and Employment Plan as well as specific recruitment policies and procedures, specifically:

- The Project should prioritise the recruitment of workers and procurement of goods and services from within the Districts then to national companies. This will not apply to the provision of highly technical equipment. The Project should develop a fair and transparent employment and procurement policy and processes to avoid any potential for nepotism or favouritism. The policy should be shared with the local community members and leadership.

- A Local Recruitment Procedure shall be developed by Yapi Merkezi which outlines the percentage of skilled, semi-skilled and unskilled employment that should be sourced from the Locations and Districts along route. For unskilled workers this target should be set as high as possible ie at least 90%. The procedure will also include requirements for recruitment of vulnerable groups (women, indigenous people and disabled workers) to ensure equal opportunities, involvement of local Chiefs in ensuring local employment is achieved, no hiring of workers at the gate etc. The requirements of this procedure will form part of the Conditions of Contract with sub-contractors.
- Yapi Merkezi will notify identified representatives of the District Government and Local Administration (i.e. the Location Chiefs) of the specific jobs and the skills required for the Project, prior to the commencement of construction phase. This will give the local population time to prepare and apply for the available job opportunities on time. This is mainly applicable to unskilled and semi-skilled workers who will be locally sourced.
- Employment and procurement opportunities will be publically advertised in appropriate newspapers, public libraries, District Offices and Chiefs Offices and in all relevant languages in a timely manner, to allow fair competition.
- There will be no requirement for applicants to make payments for applying for, or securing, employment on the proposed Project.
- The Project will ensure that recruitment procedures are transparent and monitored to ensure that those recruited present their actual experience, geographical location, health status, and age and that requirements for local employment are being met.
- The Project will develop and implement a program of up-skilling, training and development for workers to assist them in accessing opportunities associated with the Project and in finding work following completion of their contracts.
- The Project will provide training on health and safety and quality standards required by the Project for provision of goods and services to the Project to ensure that local businesses have the opportunity to benefit.
- The Project will ensure that contracts are unbundled to allow a number of small businesses to provide goods and services rather than the supply being monopolised by one larger sub-contractor.
- The Project will develop a Workers Grievance Mechanism.

*Management System*

The Project should develop a Human Resources Policy and Plans. This should include a Labour and Employment Plan and Worker Grievance Mechanism. These requirements should also be passed on to any sub-contractors. Key issues with the Human Resource (HR) management will include, but not be limited to the following:

- Provision of clear and understandable information regarding rights under national labour and employment law, and any applicable collective agreements, including those related to hours of work, wages, overtime, compensation, etc.
- Provision of reasonable working conditions and terms of employment.
- Provision of adequate accommodation (where relevant).
- Provision of employment, compensation/remuneration and working conditions, including working hours, based on equal opportunity and fair treatment, avoiding discrimination on any aspects.
- Provision of adequate welfare facilities on site.
- Implementation of a grievance mechanism for the Project workers.
- Adoption and implementation of a sexual harassment policy.
- Adoption of open attitude towards freedom of association.

The Project will develop a H&S programme which will include risk assessments (such as working at heights, confined space machine guarding), work permit systems and a H&S management system, in line with industry best practice, including worker performance safety tracking (safety observations) to assure worker safety. All workers will receive induction and continuous training regarding this system (See Implementation of Social Monitoring in ESMP)

The Project should develop a Retrenchment Plan to assist workers in finding alternative work following completion of the construction activities relevant to each Section of the proposed SGR alignment.

*Sub-Contractor and Supplier Management*

- Subcontractor and Supplier Contracts should make explicit reference to the need to abide by Tanzanian law, international standards (in particular IFC PS 2) and the ratified ILO conventions and the Project Proponent's policies relating to health and safety, labour and welfare standards.

- As part of the subcontractor and supplier selection process, Yapi Merkezi should take into consideration performance with regard to worker management, worker rights, health and safety as outlined in Tanzanian law, international standards and the Proponent's policies.
- Yapi Merkezi should provide support to sub-contractors and suppliers to ensure that labour and working conditions are in line with Tanzanian legislation and IFC PS 2 through gap analysis, awareness raising and information provision, as necessary.
- Regular checks / audits by Yapi Merkezi should be undertaken to ensure the relevant labour laws are adhered to at all times.

*Workers' Rights*

- Yapi Merkezi should ensure no employee or job applicant is discriminated against on the basis of his or her gender, marital status, nationality, ethnicity, age, religion or sexual orientation.
- All workers (including those of subcontractors) should, as part of their induction, receive training on worker rights in line with Tanzanian legislation to ensure that positive benefits around understanding labour rights are enhanced. This process should be formalised within the Code of Conduct that would be provided by Yapi Merkezi (See Implementation of Social Monitoring in ESMP).
- All workers (including those of subcontractors and suppliers) should have contracts, which clearly state the terms and conditions of their employment and their legal rights. These contracts should be aligned with Tanzanian labour law, the ILO core conventions and the requirements of IFC PS2. Contracts should be verbally explained to all workers where this is necessary to ensure that workers understand their rights. Contracts should be in place prior to workers leaving their home location if applicable.
- The Project should put in place a worker grievance mechanism that should be accessible to all workers, whether permanent or temporary, directly or indirectly employed. The worker grievance mechanism should be open to Yapi Merkezi and the subcontractor workforce in the event that their grievance is not adequately resolved by their direct employer. Yapi Merkezi would then have the authority to act to resolve this grievance.
- All workers (including those of Yapi Merkezi and the subcontractor) should have access to training on communicable diseases and STDs and community interactions in general.
- Accommodation should be provided to workers in accordance with international good practice on workers' accommodation, including IFC

standards to prevent transmission of diseases associated with poor living conditions.

- Yapi Merkezi should undertake surveillance and assurance that no children or forced labour is employed directly, and to the extent possible by third parties related to the Project and primary suppliers where such risk may exist.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact on labour and working conditions will be a "**Major Negative Impact**" post mitigation (*Table 9-13*).

*Table 9-13 Rating of Impacts Related to Labour and Working Conditions (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Non-compliant labour and working conditions has the ability to create delays to the project, cause reputational risk and create poor worker. Additionally, poor occupational health and safety can cause injury or fatalities. | Local | Non-compliant labour and working conditions has the ability to create delays to the project, cause reputational risk and create poor worker. Additionally, poor occupational health and safety can cause injury or fatalities. |
| **Duration** | Long-term | The risk will remain throughout the life of the project. | Long-term | The risk will remain throughout the life of the project. |
| **Scale** | Medium | The impact is likely to affect significant proportion of the workforce. | Low | With implementation of the proposed mitigation, measures such impacts will have the potential to affect a small portion of workforce. |
| **Frequency** | Constant | The risks associated with poor labour and working conditions could be constant. | Occasional | The number of incidents that can occur are likely to be occasional with the implementation of the proposed mitigation measures. |
| **Likelihood** | Likely | Community safety and security incidents are likely to occur during construction and operational phases of the Project. | Unlikely | With the implementation of the proposed mitigation measures, community safety and security, incidents are unlikely to occur during construction and operational phases of the Project. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Large Magnitude** | | | **Medium Magnitude** | |
| **Sensitivity/Vulnerability/Importance of the Resource/Receptor** | | | | |
| Medium Sensitivity | | | | |
| The estimated workforce of the project comprise up to 7,000 workers. Those workers can be largely impacted if no proper labour and working conditions are in place. Moreover, communities along the railway line can also be affected. | | | | |

| Significant Rating Before Mitigation | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Critical Negative Impact** | **Moderate Negative Impact** |

### *9.2.9 Impacts on Economy and Employment*

*Description of the Baseline Environment*

The Tanzanian economy depends on agriculture, which accounts for slightly less than one-quarter of GDP and employs about 65% of the work force, although gold production in recent years has increased to about 35% of exports (CIA, 2018).

Girls and women are generally responsible for housekeeping and cooking activities, childcare, farming, gathering and pounding maize, etc., placing less value on their educational and economic attainment, whilst men engage primarily with income generating activities.

Tanzania has over 50 universities, which each year produces a number of graduates, but few of these graduates finds employment in the related sector of field of study. Tanzania also has several technical colleges, graduates of whom can be employed by the Project. Form 6 and form 4 leavers who are not yet employed, may also be utilised by the Project. Tanzanian education facilities have therefore produced some expertise that will meet the needs of the Project, and these graduates will be employed where there is a need, and where possible.

Education levels along the proposed SGR alignment are, however mainly limited to completion of secondary school only, with very few people having completed tertiary education. Despite this, most adults of both genders reported that they could read and write although this is mainly in their dominant language(s) in particular Kiswahili. (The adult literacy rate for the United Republic of Tanzania was 80.4 percent in 2015).

Formal employment levels are low in communities along the proposed SGR. The majority of people are farmers who cultivate small-scale agricultural plots, or who are livestock grazers.

Access to employment and training opportunities is of key importance to local stakeholders, especially to local communities. Expectations around employment, training and equitable distribution of employment opportunities across affected communities were raised in the majority of stakeholder meetings.

*Proposed Project Activities*

*Temporary Direct and Indirect Employment during Construction*

Most of the direct economic and employment impacts from the proposed SGR can be expected to occur during the construction phase. It is during this period that the Project will need to hire the majority of workers and purchase goods and services.

Temporary employment during the construction phase includes people directly employed by contractors and subcontractors needed to build the proposed SGR. It also includes jobs supplying goods and services needed to support the construction process, including food and transport services and support staff at Construction Camps.

In order to comply with Tanzanian legislation and ILO Conventions, Yapi Merkenzi will act according to its Human Resources Policies and Procedures[1]. According it, Yapi Merkenzi is required to engage 80% of skilled-semi skilled labor and 20% key personnel from citizens of Tanzania in its construction activities.

The construction workforce will amount to approximately 7,000 (at peak), and will consist of skilled, semi-skilled and unskilled personnel. Although unskilled employees will be Tanzanians from the vicinities, it is expected that skilled work may include a higher percentage of staff from other regions in Tanzania, or expatriate staff in particular where specific skill sets are required.

The duration of employment for the construction workforce will be variable depending on the length of the section of the proposed SGR, and the ability of workers to work on subsequent sections. This will be influenced by expectations for employment along the entire proposed SGR alignment and potential for conflict if preference is given or perceived to be given to workers from different Districts or even Locations. As such, workers could be employed for as long as three years or as little as 18 months or less for an individual section of the proposed SGR.

The purchase of goods and services during construction will also generate some local employment, mainly in the larger towns, where such goods and services can be found.

[1] Yapi Merkezi, Human Resources Policies and Procedures. 2018 - YM SGR TZ - R.00 Yapi Merkezi Construction and Industry, Inc. Yapi Merkezi Insaat ve Sanayi A.S.

Self-sufficient Construction Camps will also be developed, and will enable unskilled and semi-skilled employment for individuals and companies involved in housekeeping, meals, security and transport services.

Although workers will be able to visit larger towns on days off, in a controlled manner, spending outside the Construction Camps is not anticipated to be significant enough in terms of spend or duration to result in induced job creation.

The percentage of supplies that will be procured at a District level is unknown. However, it is not uncommon for such goods to be procured from national companies. The total amount of job creation associated with national level procurement is expected to be moderate.

Stakeholders, in particular at the community level, expressed that they should receive some benefit from the proposed SGR, since they will be receiving most of the impacts; local employment is one of the most important benefits that people expect. In addition, they expect to be considered in procurement of goods, services and supplies.

*Taxes, Royalties and Inflation during Construction*

During construction, the provision of self-sufficient worker accommodation will also limit the negative economic impacts associated with construction projects, such as inflation in local housing prices or the cost of basic goods.

The proposed SGR will be required to pay a number of permitting fees and taxes during the construction phase. The majority of the benefit from taxes and fees is expected to accrue at the national level. The impacts of royalties, taxes and profit sharing are by definition a positive impact to net economic contribution; however, these revenues are paid nationally and therefore the way that the money is allocated to the Districts is outside of the control of the Project.

Land prices along the proposed SGR alignment are expected to increase over time associated with compensation paid for physical and economic resettlement and due to real and perceived benefits of living near the proposed SGR. Land values are likely to increase the most near to stations.

*Skills Upgrade during the Construction Phase*

During construction, subcontractors and workers will have the opportunity to receive training and receive skills upgrades which should assist individuals and

organisations to find work not only in subsequent stages of construction of the proposed SGR, but also on other construction projects in Tanzania.

*Employment and Economic Benefits during the Operations Phase*

During operation of the proposed SGR, employment opportunities will be created associated with operating the railway, at stations, and in the maintenance of the proposed SGR. While the number and type of opportunities will be limited this still has the potential to bring localised benefits. Furthermore, the proposed SGR itself is anticipated to bring about economic benefits associated with decreased travel times.

*Sensitive Resource / Receptors*

Due to the low levels of education and skills, and the high reliance on agriculture and livestock grazing, communities are considered to be ***highly*** vulnerable as they lack the opportunity to access alternative livelihood strategies and formal employment.

Those who will be least able to take advantage of opportunities include the elderly who are less able to carry out the tasks required and women (and residents within female-headed households) for whom it may not be culturally acceptable or feasible (given the requirements to attend to their primary care duties) to pursue formal employment.

Economic and employment opportunities have the potential to impact communities and local suppliers on the direct footprint of the proposed Project (in the districts of Ilala (Ukonga, Gongo la Mboto and Pugu wards), Kisarawe (Kisarawe ward) Kibaha (Ruvo, Kwala, Msua and Magindu wards), Morogoro Rural (Kidugalo, Gwata, Mikese and Ngerengere wards), Morogoro Urban (Lukobe ward), Mvomero (Lubungo ward), Kilosa (Chanzuru, Mabwerebwere, Kimamba 'A', Mkwatani, Mbumi, Kasiki, Magomeni, Masanze and Kidete wards), Mpwapwa (Gode Gode, Kimagai, Mazae and Chunyu wards), Dodoma Rural (Gandu, Handali, Msamalo, Kigwe, Chikola, Mpamantwa and Bahi wards), Chamwino and Manyoni (Kintinku and Maweni wards).

*Significance of Impact (Pre-mitigation)*

During construction the use of local workforce, as well as, local goods and services suppliers will create a "**Positive**" impact on local individuals, households and business.

The impact will "**Directly**" have a positive affect where individuals that are hired through Project or the EPC contractor, and an induced impact on local businesses catering for the needs of the workforce.

The impact will be "**Short-term**" mainly felt during construction phase, according to the need for workers, goods and services. Considering the creation of up to 7,000 job opportunities the magnitude is classified as "**Large**" and the receptors sensitivity "**High**".

Based on the analysis provided above, the impact from economic and employment opportunities will be a "**High Positive Impact**" pre-mitigation (*Table 9-14*).

In order to enhance this positive impact, the following *enhancement* measures are recommended:

- Yapi Merkezi should develop a Local Content and Employment Strategy Plan to prioritise the recruitment of workers and procurement of goods and services from within the Districts first, and then on to national companies. This will not apply to the provision of highly technical equipment.
- The Project should develop a fair and transparent employment and procurement policy and processes to avoid any potential for nepotism or favouritism. The policy should be shared with the local community members and leadership.
- A Local Recruitment Procedure shall be developed by Yapi Merkezi that outlines the percentage of skilled, semi-skilled and unskilled employment that should be sourced from the Wards and Districts along route. For unskilled workers this target should be set as high as possible (i.e., at least 90%). The procedure will also include requirements for recruitment of vulnerable groups (women, indigenous people and disabled workers) to ensure equal opportunities, involvement of local Chiefs in ensuring local employment is achieved, no hiring of workers at the gate etc. The requirements of this procedure will form part of the Conditions of Contract with sub- contractors.
- Yapi Merkezi will notify identified representatives of the District Government and Local Administration (i.e. the Location Chiefs) of the specific jobs and the skills required for the Project, prior to the commencement of construction phase. This will give the local population time to prepare and apply for the available job opportunities on time. This is mainly applicable to unskilled and semi-skilled workers who will be locally sourced.

- Employment and procurement opportunities will be publically advertised in appropriate newspapers, public libraries, District Offices and Chiefs Offices and in all relevant languages in a timely manner, to allow fair competition.
- The Project will develop and implement a program of up-skilling, training and development for workers to assist them in accessing opportunities associated with the Project and in finding work following completion of their contracts.

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures, the significance of the impact on economy and employment opportunities will remain a "**High Positive Impact**" post mitigation (refer to *Table 9-14*).

*Table 9-14 Rating of Impacts Related to Economy and Employment (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Positive Direct Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local | Job creation and use of local suppliers of goods and services will create a positive impact on some individuals, households and businesses in the local communities crossed by the railway alignment. | Local | With the implementation of the proposed enhancement measures, impacts will be better reflected in the local individuals, households and businesses. |
| **Duration** | Long-term | The impact will be felt mainly during the construction phase. During the operational phase as the need for workers and goods and services reduces, it will be felt in a reduced scale. | Long-term | With the implementation of the proposed enhancement measures, impacts will be better reflected in the local individuals, households and businesses. |
| **Scale** | Local | The impact will be felt in some households in local communities and business along the railway alignment. | Local | The impact will be felt in some households in local communities and business along the railway alignment. The implementation of the proposed measures will enhance their effects. |
| **Frequency** | Occasional | Benefits will be experienced mainly during construction phase, as the need for workers, goods and services will be high. During operational it will be experienced in a reduced scale. | Occasional | The implementation of the proposed measures will enhance the benefits from economic and employment opportunities. |
| **Likelihood** | Likely | The impact is likely to occur with more benefits during the construction phase. | Likely | Implementation of the proposed measures will enhance Project benefits on individuals, households and business. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Large Magnitude** | | | **Large Magnitude** | |

| Sensitivity/Vulnerability/Importance of the Resource/Receptor | |
|---|---|
| High Sensitivity | |
| The project will create up to 7,000 employment opportunities during its construction phase, creating linkages with local economy by the supply of goods and services. However, it will be reduced during its operational phase. | |
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **High Positive Impact** | **High Positive Impact** |

## 9.3 CULTURAL HERITAGE RESOURCES IMPACT ASSESSMENT

The predicted impacts to the cultural heritage resources as a result of the proposed Project are described in this Section.

### 9.3.1 General Approach

The main types of cultural heritage relevant for this assessment are:

- Undiscovered Archaeological Resources;
- Built Heritage Resources;
- Intangible Resources, and
- Living Heritage Resources.

Impacts to cultural heritage resources are typically divided into two broad categories: direct and indirect. Direct impacts consist of physical disturbance or damage to a resource that alters, positively or negatively, the resource's scientific or cultural value. Indirect impacts are the result of changes to a resource's environment or natural setting that alter its cultural value or Project activities that restrict or limit stakeholder access to a resource. Based on the proposed Project activities outlined in the Project Description, Table 9-15 provides a summary of the potential sources of direct and indirect Project impacts to cultural heritage resources.

*Table 9-15 Potential Direct and Indirect Project Impacts to Cultural Heritage Resources*

| Impact Type | Potential Sources of Impacts |
|---|---|
| Direct | Ground works such as vegetation clearance, grading, and excavation during the construction of the railway, associated facilities, and construction facilities could damage or destroy undiscovered archaeological sites and living heritage resources. |
| | The use of heavy machinery during construction and operation of the railway resulting in increased vibrations sufficient to damage built heritage resources. |
| | Project staff or subcontractor looting and/or vandalism of cultural heritage resources |
| Indirect | Project construction and operation activities could negatively alter the setting of built heritage and living heritage cultural heritage resources by changing the views to and from a resource (view shed impacts); increased noise levels at a resource; and/or the production of strong or offensive odors (eg exhaust) at or near a resource. |
| | Construction activities could temporarily alter or restrict stakeholder access to living heritage resources. |

### *9.3.2 Impacts to Undiscovered Archaeological Resources and Built Heritage*

*Description of the Baseline Environment*

The baseline study did not identify any known archaeological or built heritage sites within the proposed Project Area.

The distribution of archaeological resources across the country, however, suggests there is the *potential* for undiscovered Stone Age, Iron Age, and historical archaeological sites to found along the entire course of the Project right-of-way. These presently unknown sites could be subject to *direct* negative impacts during construction phase groundworks (Table 9-16).

*Proposed Project Activities*

Construction and operation of the Project could also cause direct negative impacts due to increased vibration associated equipment movement and construction works and passing trains during the operation phase. Ground vibrations are measured by measuring the movement of particles in the ground referred to as peak particle velocity (ppv) and recorded in millimeters per second (mm/s). Numerous governmental and non-governmental organizations have published guidance on the maximum continuous or intermittent vibration levels to which historic buildings can be subject before damage occurs. For example, the British Museum guidance states that historic buildings will suffer damage from continuous vibrations of 2.5 mm/s ppv and intermittent vibrations of 5.0 mm/s ppv (Higgit, 2010).

*Sensitive Resource / Receptors*

The baseline study did not identify any built heritage resources within the proposed Project Area. The study does suggest, however, that historic built heritage resources *could* be present within the proposed Project Area. These resources are most likely to be found within or near existing and/or historic settlements. Built heritage resources along the Project right-of-way, if present, could be subject to *direct* negative and *indirect* negative impacts (refer Table 9-17 and Table 9-18).

*Significance of Impact (Pre-mitigation)*

Impacts to undiscovered archaeological resources and built heritage would be "**Direct**" and "**Negative**". The impacts will be permanent with a scale that can range from "**Small**" to "**Large**" depending on the affected resource.

Based on the analysis provided above, the impact to undiscovered archaeological resources will be a "**Minor to Major Negative Impact**" pre-mitigation (Table 9-16).

Direct impacts to built heritage resources will be a "**Direct**" and "**Negative**" impact. The impact duration can be "**Permanent**" due to the partial or complete removal of built heritage resources during Project construction and "**Short-term**" due to construction phase vibrations.

Based on the analysis provided above, the impact to built heritage will be a "**Minor to Major Negative Impact**" pre-mitigation (Table 9-17).

Indirect impacts to built heritage resources will be a "**Direct**" and "**Negative**" impact. The impact will be "**Permanent**" as construction of the railway could permanently alter the visual setting and increase noise levels at built heritage resources to "**Short-term**" due to changes to the visual setting and noise levels of resources during construction.

Based on the analysis provided above, indirect impacts to built heritage resources will be a "**Minor to Moderate Negative Impact**" pre-mitigation (Table 9-18).

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation in Section 9.1.5 , the significance of the impact to undiscovered archaeological resources, and *direct* impacts to built heritage resources will be a "**Minor to Moderate Negative Impact**" post mitigation (Table 9-16 and Table 9-17). The significance of *indirect* impacts to built heritage resources post-mitigation will be a "**Negligible to Minor Negative Impact**" (Table 9-18).

*Table 9-16: Rating of Direct Impacts to Undiscovered Archaeological Resources (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local-Regional | Based on the size of the proposed Project Area, the extent of potential impacts to undiscovered archaeological resources could range from local to regional depending on the number of undiscovered archaeological resources subject to direct negative impacts. | Local-Regional | Avoiding archaeological sites identified before or during construction is the only management measure that will reduce the extent of direct negative impacts. If sites cannot be avoided, measures to minimize and/or mitigate impacts through salvage excavation will still result in impacts to resources. |
| **Duration** | Permanent | The duration of these impacts would be permanent due to the partial or complete removal of archaeological resources during Project construction. | No Duration to Permanent | If sites are avoided through Project re-design there will be no impacts. If, however, sites are excavated the impacts will remain permanent. Once an archaeological site is removed, by either construction activities or scientific excavation, it cannot be relocated or returned to its original state. |
| **Scale** | Small to Large | The scale of negative impacts would depend on how much of the resource was damaged, ranging from a small portion to complete removal of the resource, and the scientific and/or cultural significance of the resource. | None to Large | If sites are avoided, there will be no impacts. If sites require mitigation through salvage excavations the scale of residual impacts will depend on the proportion of the site that is excavated. If a small portion of the site is excavated the scale will be small whereas if the entire site is excavated the scale of the impact will remain large. |
| **Likelihood** | High | The length of the Project and the extensive period of human/hominid occupation of Tanzania suggests there is a high likelihood that undiscovered archaeological resources will be encountered at some point during Project construction. | Low to Medium | The likelihood of discovering and impacting archaeological sites during construction can be reduced through pre-construction archaeological surveys of the Project Area. Depending on the survey methods used (eg transect spacing, intrusive vs. non-intrusive surveys, etc.) the surveys could reduce the likelihood of encountering undiscovered archaeological resources from high to medium or low. |

| Magnitude | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Minor to Major Magnitude** | **Minor to Moderate Magnitude** |
| **Importance of the Resource/Receptor** | |
| **Low to High Importance** | |
| The importance of undiscovered archaeological sites could range from low to high based on the uniqueness of the site, its complexity, the scientific data contained within the site, and other individual characteristics. | |
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Minor to Major Negative Impact** | Minor to Moderate Negative Impact |

*Table 9-17 Rating of Direct Impacts to Built Heritage Resources (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local-Regional | Based on the size of the proposed Project Area, the extent of potential impacts to built heritage resources could range from local to regional depending on the number of resources subject to direct negative impacts. | Local-Regional | Avoiding built heritage identified before or during construction is the only management measure that will reduce the extent of direct negative impacts. If sites cannot be avoided, measures to minimize and/or mitigate impacts through documentation and relocation will still result in impacts to resources. |
| **Duration** | Permanent | The duration of these impacts would be permanent due to the partial or complete removal of built heritage resources during Project construction. | No Duration to Permanent<br><br>No duration | If resources are avoided through Project re-design there will be no impacts. If, however, sites are documented and removed or relocated the impacts will remain permanent. If a built heritage resource is removed, even after extensive documentation, or is relocated to a new location the attendant loss of historic value will still result in permanent impacts. |
| | Short Term | Short-term impacts due to construction phase vibrations. | | Vibration impacts can be sufficiently reduced or eliminated by using vibration reducing construction techniques, structure stabilization measures, and a vibration monitoring program near built heritage resources, if necessary. |
| **Scale** | Small to Large | The scale of negative impacts would depend on how much of the resource was damaged, ranging from a small portion to complete removal/destruction of the resource, and the associated loss of historic and/or cultural significance of the resource. | None to Large | If resources are avoided, there will be no impacts. If sites require mitigation through documentation and removal or relocation the scale of residual impacts will depend the mitigation action taken. The use of vibration reducing construction techniques, structure stabilization measures, and a vibration monitoring program near built heritage resources will minimize/mitigate vibration impacts. |

| | | | | |
|---|---|---|---|---|
| **Likelihood** | High | The length of the Project and the presence of built heritage resources across the country suggests there is a high likelihood that built heritage resources will be encountered at some point during Project construction. | Low to Medium | The likelihood of discovering and impacting built heritage during construction can be reduced through pre-construction surveys of the Project Area. Depending on the survey methods used and geographic extent of investigations, the surveys could reduce the likelihood of encountering undiscovered archaeological resources from high to medium or low. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Minor to Major Magnitude** | | | **Minor to Medium Magnitude** | |
| **Importance of the Resource/Receptor** | | | | |
| **Low to High Importance** | | | | |
| The importance of built heritage resources could range from low to high based on the uniqueness of the resource, its importance in local, regional, and/or national history, and its importance to local, regional, and/or national stakeholders. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Minor to Major Negative Impact | | | **Minor to Moderate Negative Impact** | |

*Table 9-18 Rating of Indirect Impacts to Built Heritage Resources (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Indirect Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local-Regional | Based on the size of the proposed Project Area, the extent of potential indirect impacts to built heritage resources could range from local to regional depending on the number of built heritage resources subject to indirect negative impacts. | Local-Regional | Avoiding impacts indirect impacts to built heritage resources through Project redesign will reduce the extent of direct negative impacts. If resources cannot be avoided and measures to minimize and/or mitigate impacts (screening, construction scheduling, etc.) will reduce the magnitude of impacts but will not eliminate them. |
| **Duration** | Permanent<br><br>Short term | The duration of these impacts would be permanent as construction of the railway could permanently alter the visual setting and increase noise levels at built heritage resources.<br><br>Changes to the visual setting and noise levels of resources during construction will result in short term impacts. | No Duration to Permanent | If resources are avoided through Project re-design there will be no impacts. If, however, resources are not avoided, construction of the railroad could permanently alter the visual and auditory environment of resources during operations. Management measures can be implemented to minimize the scale of indirect short term and permanent impacts but not eliminate them. |

| | | | | |
|---|---|---|---|---|
| **Scale** | Small to Medium | The scale of negative impacts would depend on the proximity of built heritage resources to the construction corridor and the completed railway line. Resources closer to the construction areas and finished line would be subject to larger scale changes to their visual setting and noise levels. The presence of an existing railway adjacent to the proposed railway suggests that the scale of any changes would be small to medium as resource setting already includes an active railway and railway associated noise. | Negligible to Small | If sites are avoided, there will be no impacts. If sites require mitigation (sound reducing construction techniques, vegetative screening to reduce noise and visual impacts, etc.). The scale of residual impacts can be reduced to negligible or small during construction and operation phases of the Project. |
| **Likelihood** | High | The length of the Project and the presence of built heritage resources across the country suggests there is a high likelihood that built heritage resources will be encountered at some point during Project construction. | Low to Medium | The likelihood of discovering and impacting built heritage during construction can be reduced through pre-construction surveys of the Project Area. Depending on the survey methods used and pre-construction avoidance, minimization, and/or mitigation techniques employed to protect resources the likelihood of impacts could be reduced to low to medium. |
| **Magnitude** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| **Minor to Moderate Magnitude** | | | **Negligible to Minor Magnitude** | |
| **Importance of the Resource/Receptor** | | | | |
| **Low to High Importance** | | | | |
| The importance of built heritage resources could range from low to high based on the uniqueness of the resource, its importance in local, regional, and/or national history, and its importance to local, regional, and/or national stakeholders. | | | | |
| **Significant Rating Before Mitigation** | | | | |
| **Pre-mitigation** | | | **Post-mitigation (Residual)** | |
| Minor to Moderate Negative Impact | | | **Negligible to Minor Negative Impact** | |

### *9.3.3 Impacts on Living Heritage*

*Description of the Baseline Environment*

The cultural heritage baseline study suggests the Project could cause negative direct and indirect impacts to known and undiscovered living heritage resources in the Project Area, in particular to graves, cemeteries and Baobob trees.

*Sensitive Resource / Receptors*

The cultural heritage baseline study team for this Project identified graveyards near or within the Project area of influence as defined in ESIA Chapter 4. Graves and cemeteries located within the proposed Project construction footprint would be subject to direct negative impacts (ie physical disturbance) while those adjacent to the finished Project could be subject to indirect negative impacts due to changing the resource setting/ambiance and accessibility for family members/visitors.

The baseline study also revealed the presence of Baobob trees in the Project Area which are considered as cultural heritage to people living in Dodoma region. Apart from providing fruits and shade, the trees are also used for spiritual and healing rituals. Several Baobab trees will need to be cut down during construction, in particular at the Chololo, Mnase, Msamalo, and Chimwaga villages.

*Significance of Impact (Pre-mitigation)*

Impacts on living heritage resources will be "**Direct**" and "**Negative**". The impacts duration will be "**Permanent**" due to the partial or complete removal of living heritage resources during Project construction.

Based on the analysis provided above, the *direct* impact on living heritage resources will be a "**Minor to Major Negative Impact**" pre-mitigation (Table 9-19).

Indirect impacts on living heritage resources will be a "**Direct**" and "**Negative**" impact. The impact will be "**Permanent to Short**" duration.

Based on the analysis provided above, *indirect* impacts on living heritage resources will be a "**Minor to Moderate Negative Impact**" pre-mitigation (Table 9-20).

*Residual Impact (Post-mitigation)*

Based on the implementation of the proposed mitigation measures in Section 9.1.5, *direct* impacts to living heritage resources will be a "**Negligible to Moderate Negative Impact**" post-mitigation (Table 9-19) and *indirect* impacts to living heritage resources will be a "**Negligible to Minor Negative Impact**" post-mitigation (Table 9-20).

*Table 9-19 Rating of Direct Impacts Related to Living Heritage Resources (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Direct Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local-Regional | Based on the size of the proposed Project Area, the extent of potential impacts to living heritage resources could range from local to regional depending on the number of living heritage resources subject to direct negative impacts. | Local-Regional | Avoiding living heritage sites identified before or during construction is the only management measure that will reduce the extent of direct negative impacts. If sites cannot be avoided, measures to minimize and/or mitigate impacts through salvage excavation will still result in impacts to resources. |
| **Duration** | Permanent | The duration of these impacts would be permanent due to the partial or complete removal of living heritage resources during Project construction. | No Duration to Permanent | If sites are avoided through Project re-design there will be no impacts. If, however, sites are removed or relocated and cannot be returned to their original location, the impacts will remain permanent. |
| **Scale** | Small to Large | The scale of negative impacts would depend on how much of the resource was damaged, ranging from a small portion to complete removal of the resource, and the cultural significance of the resource. | Negligible to Medium | If sites are avoided, there will be no impacts. If sites require mitigation through removal and relocation, the scale of the residual impacts will depend on whether or not the resource can still be used for its original cultural purpose and/or retains its original cultural significance. |
| **Likelihood** | High | The length of the Project and the proximity of the Project Area to numerous communities of varying sizes suggest there is a high likelihood that living heritage resources will be encountered at some point during Project construction. | Low to Medium | The likelihood of discovering and impacting living heritage sites during construction can be reduced through pre-construction living heritage surveys of the Project Area. Depending on the survey methods used and pre-construction avoidance, minimization, and/or mitigation techniques employed to protect resources the likelihood of impacts could be reduced to low to medium. |

| Magnitude | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Minor to Major Magnitude** | **Minor to Moderate Magnitude** |
| **Importance of the Resource/Receptor** | |
| **Low to High Importance** | |
| The importance of living heritage resources could range from low to high based on its importance to local, regional, and/or national stakeholders. | |
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Minor to Major Negative Impact** | Negligible to Moderate Negative Impact |

*Table 9-20 Rating of Indirect Impacts Related to Living Heritage Resources (Pre- and Post-Mitigation)*

| **Type of Impact** | | | | |
|---|---|---|---|---|
| **Indirect Negative Impact** | | | | |
| **Rating of Impacts** | | | | |
| | **Pre-mitigation** | | **Post-mitigation (Residual)** | |
| | **Designation** | **Summary of Reasoning** | **Designation** | **Summary of Reasoning** |
| **Extent** | Local to Regional | Based on the size of the proposed Project Area, the extent of potential indirect impacts to living heritage resources could range from local to regional depending on the number of resources subject to indirect negative impacts. | Local to Regional | Avoiding impacts indirect impacts to built heritage resources through Project redesign will reduce the extent of direct negative impacts. If resources cannot be avoided and measures to minimize and/or mitigate impacts (screening, construction scheduling, etc.) will reduce the magnitude of impacts but will not eliminate them. |
| **Duration** | Permanent to Short term | The duration of these impacts would be permanent as construction of the railway could permanently alter the visual setting and increase noise levels at living heritage resources as well as restrict user access to resources.<br><br>Changes to the visual setting and noise levels as well as restricting user access to resources during construction will result in short term impacts. | No Duration to Permanent | If resources are avoided through Project re-design there will be no impacts. If, however, resources are not avoided, construction of the railroad could permanently alter the visual and auditory environment of resources as well as restrict user access during operations. Management measures can be implemented to minimize the scale of indirect short-term impacts during construction and permanent impacts during operations but not eliminate them. |

| | | | | |
|---|---|---|---|---|
| **Scale** | Small to Medium | The scale of negative impacts would depend on the proximity of any living heritage resources to the construction corridor and the completed railway line. Resources closer to the construction areas and finished railways would be subject to larger scale changes to their visual and auditory settings. The presence of an existing railway adjacent to the proposed railway suggests that the scale of any changes would be small to medium as resource setting already includes an active railway and railway associated noise. | Negligible to Small | If sites are avoided, there will be no impacts. If sites require mitigation (sound reducing construction techniques, vegetative screening to reduce noise and visual impacts, construction scheduling etc.). The scale of residual impacts can be reduced to negligible or small during construction and operation phases of the Project. |
| **Likelihood** | High | The length of the Project and the presence of built heritage resources across the country suggests there is a high likelihood that built heritage resources will be encountered at some point during Project construction. | Low to Medium | The likelihood of discovering and impacting built heritage during construction can be reduced through pre-construction surveys of the Project Area. Depending on the survey methods used and pre-construction avoidance, minimization, and/or mitigation techniques employed to protect resources the likelihood of impacts could be reduced to low to medium. |

| **Magnitude** | |
|---|---|
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| **Minor to Moderate Magnitude** | **Negligible to Minor Magnitude** |
| **Importance of the Resource/Receptor** | |
| **Low to High Importance** | |
| The importance of living heritage resources could range from low to high based on its importance to local, regional, and/or national stakeholders. | |
| **Significant Rating Before Mitigation** | |
| **Pre-mitigation** | **Post-mitigation (Residual)** |
| Minor to Moderate Negative Impact | **Negligible to Minor Negative Impact** |

### *9.3.4 Overall Mitigation / Management Measures on Impacts on Cultural Heritage Resources*

To minimize the potential impacts on Cultural Heritage Resources, the Project should develop a Cultural Heritage Management Plan (CHMP) that is aligned with IFC PS 8 and the Tanzania Antiquities Act; also, the existing Chance Find Procedure (DSM-YME-AL-GL00X-G-EN-PRO-0004-0) needs to be updated accordingly.

The CHMP and updated CFP should address, among other issues, the provisions of the Law on Protection of Cultural Heritage and international treaties and include the following elements:

- Continuous stakeholder engagement prior to construction in line with actual construction progress to identify historically and culturally significant built and living heritage sites along the Project right-of-way and procedures to work with stakeholders to avoid, minimize, and/mitigate direct and indirect impacts.
- Engagement with Chololo, Mnase, Msamalo, and Chimwaga village leaders to agree on the actions to be taken before and during the removal of Baobab trees.
- Continuous engagement with the community along the SGR alignment about the intangible resources (such as celebrations, festivities, ceremonies, etc.) and re-schedule the construction activities considering their feedback.
- Operation of the updated Chance Find Procedure including:
  - Provision for a professional archaeologist(s), employed by the Project and holding a valid archaeological license, to monitor ground disturbing construction activities to identify archaeological resources;
  - Stopping the activities and evaluation of the find;
  - Taking necessary actions to secure the finding;
  - Informing the appropriate government ministry or department and follow their instructions.
- Training for all Project staff and subcontractor to foster their awareness on the importance of protecting cultural heritage and the Project's commitments to avoid, minimize, and/or mitigate impacts to cultural heritage resources.
- Marking of Vulnerable Cultural Heritage Sites where required.

- Development and implementation of an Operation Phase Vibration-Monitoring Program for any built heritage resources within 30 m of the right-of-way to assess potential short, medium, and long-term impacts and develop appropriate measures to avoid, minimize, and/or mitigate vibration impacts.

# 10 CUMULATIVE IMPACT ASSESSMENT

## 10.1 INTRODUCTION

This chapter presents the cumulative impact assessment (CIA) of the Project, comprising a description of the potential cumulative impacts of the Project with respect to other identified significant projects being developed within or near the sphere of influence of the Project ("Project Area"). It also sets out, where applicable, the mitigation measures to either prevent or minimise risks related to potential cumulative impacts in consideration also of those mitigation measures already planned within other topics of the ESIA

The international lender requirements of IFC PS1 specify that risks and impacts of a project are to be analysed in such a CIA, inter alia, with respect to cumulative impacts from (i) other existing projects or conditions, and (ii) other future developments (including future stages of the project itself) that are realistically defined at the time the ESIA is undertaken and for with the sphere of influence of the various projects or developments may overlap. Cumulative impacts are thus defined for this ESIA as impacts which result from incremental changes caused by the Project together with other presently ongoing, or reasonably foreseeable future planned actions/projects within the Project Area (1).

Depending on the type/characteristics of other identified projects and their specific impacts, the main issues of concern with respect to the CIA can thus include any type of impact that is considered in the ESIA.

The overall aim is to avoid/minimize any of the identified cumulative impacts.

## 10.2 ASSESSMENT METHODOLOGY

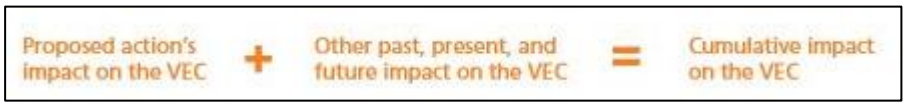
A CIA focuses on environmental and social components rated as "critical" by the affected communities and the scientific community (Valued Environmental and Social Components [VECs]), which are cumulatively impacted by the

(1) The definition is also based on that given in the EC Document "Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions", May 1999; in addition, the IFC Good Practice Handbook "Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets, 2013, was used to inform the assessment process.

Project, other projects, and sources of external pressure1. The development of a CIA requires the identification of VECs on the basis of the AoI of the Project; other existing, planned, and future projects; sources of external social and environmental pressure; and the results of consultation with stakeholders. For this ESIA, the CIA was conducted following the approach summarized (and displayed in *Figure 10-1*) in alignment with the IFC's Good Practice Handbook:

Step 1: Definition of the relevant spatial and temporal boundaries;
Step 2: Identification of key sensitive Receptors and Resources/ VECs;
Step 3: Screening/Identification of potentially relevant other projects in the region;
Step 4: Assessment of potential impacts and mitigation measures;
Step 5: Monitoring and follow-up.

***Figure 10-1 VEC centered approach for the CIA***




The above steps are carried out in the following sections. This CIA is based on information provided by baseline information generated in this ESIA, information available in the public domain, and information gathered during consultation process.

## *10.3 STEP 1 – SPATIAL AND TEMPORAL BOUNDARIES*

### *10.3.1 Spatial Boundaries*

The relevant spatial boundaries for this CIA are essentially the same as the specific Area of Influence (AoI) defined in the ESIA Report for each relevant topic; this area typically extends (depending on the topic) from about 1 m to 1000 m as measured from the centre-alignment of the Railway.

For the purpose of the subsequent Screening in Step 3, a regional approach is used considering a zone of about 10-15 km from the Project; the intent here in the screening is to be inclusive of projects that might reasonable be relevant for the CIA, and if doubtful they are included. For the impact assessment in Step 4, a more narrow focus is then made as appropriate for the relevant assessment topics.

(1) https://www.ifc.org/wps/wcm/connect/3aebf50041c11f8383ba8700caa2aa08/IFC_GoodPracticeHandbook_CumulativeImpactAssessment.pdf?MOD=AJPERES

### 10.3.2 *Temporal Boundaries*

The temporal boundary of the CIA formally encompasses the entire Project life-cycle, from construction through long-term operations. Nevertheless, the CIA process is inherently constrained by the ability to reasonably predict future events and trends, including (as will be discussed in the Screening in Step 3), the planning/implementation of other relevant projects in the region.

Therefore, for the purpose of this CIA, consideration is given of the construction phase and, for operations – to the extent feasible for discussion and assessment of cumulative impacts with the other projects.

## 10.4 *STEP 2 – VALUED ENVIRONMENTAL AND SOCIAL COMPONENTS (VECS)*

The ESIA process identified a number of receptors and resources (VECs) in the Project area that may be subject of potential impacts from the Project – and other relevant projects in a cumulative manner.

A summary of the main VECs is provided in the following table; this will constitute the basis for scoping of potentially relevant cumulative impacts of other projects. Full details of all receptors and potential impacts are described in the respective ESIA chapters. Please note that the list shows merely the potential project impacts, not counting the planned mitigation measures.

*Table 10-1 Valued Environmental and Social Components (VECs) of Project*

| ID# | Description | Potential Project impacts (examples) |
|---|---|---|
| 1 | Humans - Property owners at alignment subject to expropriation | • Reduced farming area/income<br>• Reduced access to property plots, potential drainage issues*<br>• physical relocations of residents, businesses*<br>• noise and pollution during construction and operation<br>• Increased safety risk during construction and operation: Accidents, injuries* |
| 2 | Humans – Property users and Residents living near the alignment and construction areas/access roads (outside of the boundaries of resettlement area) | • Noise, emissions during construction<br>• Increased safety risk during construction and operation: Accidents, injuries*<br>• Noise/emissions from operations<br>• Disturbed access to local infrastructure and properties*<br>• Risk for accidents during operation – pedestrian crossings* |

| ID# | Description | Potential Project impacts (examples) |
|---|---|---|
| 3 | Fauna – terrestrial and aquatic | Fragmentation of habitat:<br>• Loss of access to natural habitat, disturbance of (migration) routes<br>• Destruction of natural habitat |
| 4 | Flora – terrestrial and aquatic | • Physical destruction, deterioration<br>• Loss of biodiversity<br>• Pollution through increased waste during operation* |
| 5 | Water | • Deterioration due to sediment runoff, spills, etc.<br>• Change of flood risks<br>• Pollution, including from sewage and liquids during construction* |
| 6 | Soils | • Erosion, compaction<br>• Pollution |
| 7 | Air Quality | • Local pollution through emissions |
| 8 | Socio-economics | • Benefits due to jobs and growth of regional business base and trade<br>• Temporary influx of workers<br>• In-migration/influx of people from other areas<br>• Increased spread of diseases (workers camps)*<br>• Increased crime/ violence (workers camps)<br>• Increased accidents when crossing the rail<br>• Traffic congestion in towns at level crossings* |
| *Note: Items marked with * were specifically mentioned by public/stakeholders during public meetings in the ESIA process* | | |

## 10.5 STEP 3 – SCREENING OF OTHER PROJECTS IN REGION

### 10.5.1 Approach

The purpose of the Screening is to identify other projects and activities in the region that could potentially have impacts that overlap spatially and temporally (per Step 1) with impacts of the Project on any common VECs (Step 2).

A review of available information on existing and future projects located within the AoI was conducted. The following projects have been identified:

Intermodal & Rail Development Project: Rehabilitation of the Metre Gauge Railway (MGR) track and bridges between Dar es Salaam and Isaka1;
Tanzania Strategic Cities Project – Second Additional Financing2;

[1] http://projects.worldbank.org/P127241/intermodal-rail-development-project?lang=en&tab=overview

[2] http://projects.worldbank.org/P159489/?lang=en&tab=overview

East African Crude Oil Pipeline (EACOP)1;
Program for renewable energy efficiency2.

Note: A 220-KV transmission line is also being built by the Tanzanian Energy Supply Corporation (TANESCO) along the SGR route to provide electric power to the SGR and also to several villages near the route. This potential impacts of this transmission line project are considered separately in this ESIA as an "Associated Facility" of the SGR Project.

Each of the above projects was then screened for relevance in the CIA via the evaluation of the project characteristics (namely type of project, proximity to SGR Project, and expected timing of construction and operations) compared to a set of Screening Considerations to determine the potential for likely cumulative impacts:

- **Spatial Overlap**: Are the two projects close enough to each other that the Areas of Influence are likely to affect each other?
- **Temporal Overlap**: Do the timelines of key activities (namely Construction and Operations) overlap with each other?
- **Common Receptors/Resources**: Which receptors or resources may be affected cumulatively by both projects (considering the previous special and temporal factors)?

A qualitative conclusion was then given if the specific project is either "Screened In" or "Screened Out" of further consideration in this CIA

### *10.5.2 Results of Screening*

The screening of the above identified projects is displayed in the below table.

*Table 10-2 Screening of potentially relevant projects*

| | Screening Considerations | | | | | Result |
|---|---|---|---|---|---|---|
| **No** | **Name of the project** | **Details of the project** | **Spacial Overlap** | **Temporal Overlap** | **Common Receptors/ VECs** | **Screened in/out** |
| 1 | Intermodal & Rail | Key activity is the rehabilitation of the Metre Gauge | Yes – The SGR route is parallel to the existing MGR | Yes – the Project aims to finalized | Yes – the project impacts many common | **Screened in** |

[1] http://eacop.com/the-route/route-description-map/

[2] https://www.kfw-entwicklungsbank.de/ipfz/Projektdatenbank/Programm-erneuerbare-Energien-Energieeffizienz-30240.htm

| | Screening Considerations | | | | | Result |
|---|---|---|---|---|---|---|
| **No** | **Name of the project** | **Details of the project** | **Spacial Overlap** | **Temporal Overlap** | **Common Receptors/ VECs** | **Screened in/out** |
| | Development Project | Railway (MGR) between Dar es Salaam and Mwanza, via Isaka and the development of terminals in Isaka, Ilala and Dar es Salaam (port platform). | route from Dar es Salaam to Makutupora. | by May 31, 2021 Operations of the project are expected to have temporal overlap with SGR | VECs, details are given in section 10.6.3. | |
| 2 | Tanzania Strategic Cities Project (TSCP) – Second Additional financing[1] | The goal of the TSCP is to (i) expand access to urban infrastructure and services and (ii) strengthen the management and performance of Local Government Authorities (LGAs). The key activities of the second additional financing stage are to scale-up the critical infrastructure including urban roads, streetlights, drainage, public parks, bus/lorry stands/terminals, market and additional sanitary landfills. | Yes/partly – The targeted cities are: Mwanza, Arusha, Mbeya, Songea, Mtwara, Kigoma, Tanga,Iringa, Dodoma.Dodoma municipality is also relevant for the SGR project. All other selected municipalities are located >100 km away from the SGR project route. SGR runs south of Dodoma. | Yes – Activities related to the second additional financing have started in July 2018<br><br>Proposed closing date: May-2020 | Yes – common VECs during construction phases (e.g. noise distrubance, employment opportunities, soil/ water pollution, loss of biodiversity, etc.)<br>Overall, the TSCP should view the development of the SGR Project as positive addition, complimenting and enabling the TSCP goals by improving intra-city movements. | Screened out |
| 3 | East African Crude Oil Pipeline (EACOP) | The EACOP shall be constructed to transport crude oil from Kabale, Uganda to Tanga port in Tanzania (1.443 km). | No– the exact route of the pipeline can be found here.<br>If this route is final, it will be around 100 km north of the SGR | Possible – The construction is planned to commence in 2019 and to last for at least 32 | Yes – Soil and water pollution, destruction of habitat and biodiversity, employment availability. | Screened out |

[1] http://documents.worldbank.org/curated/en/771861468313238368/pdf/E23610v20EA0RE1isclosure01Jan020101.pdf

http://documents.worldbank.org/curated/en/763641488423710151/pdf/PAD1980-REVISED-Project-Paper-Document-Disclosable-Version-P159489-2017-02-08-corrected-03292017.pdf

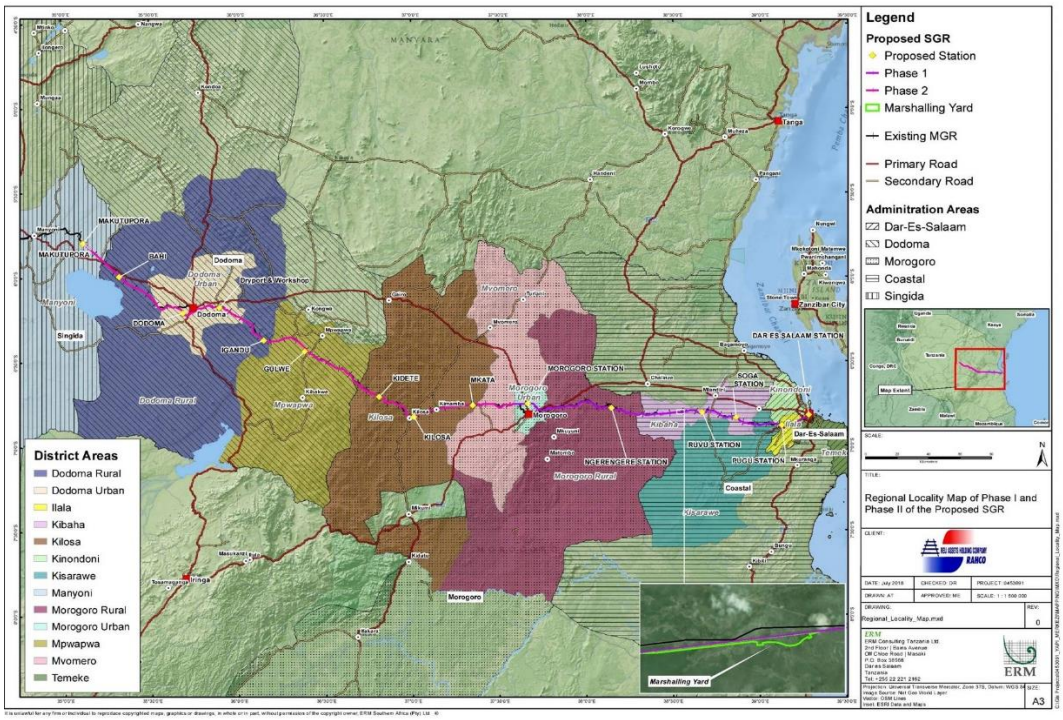
| | Screening Considerations | | | | | Result |
|---|---|---|---|---|---|---|
| **No** | **Name of the project** | **Details of the project** | **Spacial Overlap** | **Temporal Overlap** | **Common Receptors/ VECs** | **Screened in/out** |
| | | | line at the closest point. | months. *There is no recent verification of the construction dates available.* | | |
| 4 | Program for renewable energy efficiency | The aim of the project is an improved electiricty supply in the north West of Tanzania. Therefore, the expansion of the electricity network is necessary as well as the upgrading of transmission lines. | No – the project activities are mainly located in the north west of Tanzania, construction activities are planned in Mwanza Region and Kagera region (approx. 400 km north west of Dodoma). | Possible – the current program status is active, there is no publicly available information regarding construction operations. | Yes – employment opportunities, possibly soil pollution and accidents during construction. | Screened out |

A review of the information in the Screening Table shows that three projects are screened out for one or more reasons, eg: due to the relatively large distance to the SGR Project, eg. 100 km or more, which is well beyond the AoI of the Project and hence no Spatial Overlap expected; because the date of construction start is not known and cannot be predicted (no Temporal Overlap); and/or there are no apparent common VECs being impacted. Project no 2, Tanzania Strategic Cities Project (TSCP), shows an impact of common VECs with SGR Project, but the impacts are mostly of local nature and planning can be done locally to avoid interface with SGR – for the few areas of potential spatial overlap. Several of the impacts are positive and therefore, no mitigation measures are required.
As a result of the screening of the above listed four projects, only the MGR Project was identified as being screened in and thus relevant for further evaluation in the CIA:

- **Rehabilitation and revitalization of operations of the Metre Gauge Central Railway Line (MGR)** track and bridges between Dar es Salaam and Isaka

The route of the above project in relation to the SGR Project is displayed in *Figure 10-2.*

## *Figure 10-2 Railway routes of MGR and SGR*



## *10.6 STEP 4 – IMPACTS AND MITIGATION*

### *10.6.1 Approach*

For the screened in project identified in the preceding Step 3, a qualitative assessment of potential cumulative impacts is undertaken per the following sequence:

- Brief description of the relevant other project and location/activity, with reference made to respective ESIA Chapters for further information regarding Baseline conditions and other relevant data (if applicable);
- Assessment of key potential types of cumulative impacts involved and estimation of significance and magnitude (as compared to the impacts of the Project on its own);
- Description of potential mitigation measures and residual cumulative impacts.

### *10.6.2 Project Description*

**Rehabilitation and revitalization of operations of the MGR Line**

The MGR is an existing rail line of one-meter gauge, for which the GoT has received international funding (WorldBank) to provide an upgrade of the line. The development objective of the Intermodal and MGR project for Tanzania is to deliver a reliable open access infrastructure on the Dar es Salaam – Isaka rail segment. The project has four components.

1. Improvement of rail infrastructure: includes the **rehabilitation of key sections of the railway** track and other infrastructure improvements to guarantee a reliable service between Dar es Salam Port and Isaka terminal.

2. Rolling stock: includes the **procurement and leasing of locomotives and wagons**.

3. **Development** of intermodal container **terminals in the port of Dar es Salaam, in Ilala and in Isaka** to allow for more efficient modal transfers to and from the rail.

4. Institutional strengthening and capacity building: **support of the project preparation** and provision of additional **technical support** to the implementing agency.

More detailed information on the existing MGR line can be found in the Project description and baseline section (Chapter 2 and Chapter 4) of this ESIA.

### *10.6.3 Assessment of Potential Cumulative Impacts*

For the assessment of Cumulative Impacts, the rehabilitation activities (component 1 of the MGR project) are most relevant.

Note; given that the MGR line itself is an existing facility and for a majority of the SGR route is directly adjacent to the SGR alignment, the MGR line (physical aspects and operations) has been considered as part of the local baseline conditions during the impact assessment of the various topics in this ESIA. As such, the presence of the MGR line is duly reflected in the impact evaluation and subsequent determination of mitigation measures for each topic. The only activities relevant for this Cumulative Impact Assessment are thus the rehabilitation/ reconstruction activities of the MGR.
It is expected that following to the rehabilitation activities, the operational activities of MGR will change (e.g. possibly a higher volume of trains passing, higher speeds of the trains, etc.). As described above, the current operational baseline has been taken into account in earlier ESIA chapters. A future operational baseline, which differs from the current one, and related cumulative impacts will be considered in the final ESIA.

*Spatial overlap of MGR with SGR*

As described in the Project description section, the route of the SGR will run parallel within 15 m to the existing MGR for most of the route (as indicated in Figure 10-3). There will be bypasses and re-alignment with MGR of some railway sections. The main two bypasses shall be at Morogoro Town bypassing via Msamvu area (approx. 20 km north) and at Dodoma Town bypassing approx.6 km south. As the MGR route stretches from Dar es Salaam up to Mwanza, the route extends beyond the SGR route by approximately 700 km. All construction activities along the route from Makutupora to Mwanza are therefore not relevant for the purpose of this CIA as there is no spatial overlap. **For the route between Dar es Salaam until Makutupora, there is spatial overlap between the MGR and the SGR project activities.**

*Figure 10-3 Mobilisation of MGR/workers camp, at 230 km*

As currently known, a number of construction camps are already set up for the MGR activities. These camps are located along the SGR at K 183 km, 230 km and 518 km. These sections are close to the projected line of SGR, hence spatial overlap can be confirmed.

*Temporal overlap of MGR with SGR*

As described in *Figure 10-2*, it is expected that construction activities necessary for the rehabilitation of the MGR will be completed by 2021.
Construction camps have already been set up in specific sections in June 2018 (see above).
Schedules for exact project activities are currently unavailable. To define the temporal overlap between the MGR and the SGR, it will be necessary to identify the exact dates for construction/rehabilitation activities for each route section separately**.** Additionally, the operational phase of MGR is expected to commence one rehabilitation activities are completed. SGR is expected to begin its operation after the anticipated 30 months of construction is complete.
**It is expected that project activities (construction/rehabilitation and operation) will overlap with SGR activities and therefore, a temporal overlap is highly likely.**

### *10.6.4 Assessment and Mitigation of Cumulative Impacts*

The project activities of the rehabilitation of the MGR will impact several VECs common to the SGR Project. Even though the two projects are similar, the impact assessment of MGR differs substantially. The actual railway line of MGR is already existing. Therefore, all impacts related to the design and construction of a new railway line (SGR), such as loss of access to property, loss of habitat (fauna), etc., are largely not applicable to the MGR rehabilitation – except mainly for temporary construction needs. Correspondingly, the rehabilitation activities of MGR results in a limited range of impacts:

To undertake the required rehabilitation activities, the MGR project has set up a number of construction camps. Construction camps usually come along with a temporary influx of workers, the potential for an increased spread of disease, increased crime and gender-based violence. In addition, the physical structures of the camp impact flora and fauna with a destruction of habitat. Pollution from workers (solid/liquid waste management) and pollution from the rehabilitation activities (emissions, noise) is also impacting the location.

As noted above, the design of the SGR Project as well as the assessment in this ESIA already consider the existence of the MGR line. This assessment of cumulative impacts therefore does not include possible impacts of SGR such as increased barriers for people requiring access to land, creation of 'land – islands' with poor access between SGR and MGR, etc.

Specific project activities of MGR need to be considered to assess and identify the potential cumulative impacts. The above described possible impacts and the impacts of the SGR Project combined with considering the close proximity of the two projects as well as the overlapping timelines, result in a number of potential cumulative impacts.

The below table indicates the identified potential cumulative impacts, their qualitative rating in terms of impact significance (base on magnitude and receptor sensitivity) and suggested mitigation measures.

***Table 10-3 Cumulative Impacts and Mitigation Measures***

| ID # | **Topic/ Receptor Description** | **Potential Cumulative impacts of SGR and MGR** | **Rating** | **Mitigation Measures** |
|---|---|---|---|---|
| 1 and 2 | • Humans<br>• Property owners at alignment subject to expropriation<br>• Property users, residents living near the alignment and construction areas/access | Sections of MGR and SGR in the same area being worked on simultaneously, leading to:<br>• increased noise and pollution during construction/rehabilitation activities<br>• increased risk for accidents and injuries (safety)<br>or they can be worked on during different/sequential timeframes, leading to:<br>• prolonged construction times, and resulting prolonged disturbances, such as: | Magnitude: *Med to Larger* + Sensitivity: *High* =Significance : Major | YM Project manager to:<br>• Identify ideal activity schedule (time frame for activities simultaneously or apart)<br>• Coordinate local construction schedule between SGR and MGR (depending on desired activity |

| ID # | Topic/ Receptor Description | Potential Cumulative impacts of SGR and MGR | Rating | Mitigation Measures |
|---|---|---|---|---|
| | roads (outside of the boundaries of resettlement area) | - noise, emissions and pollution<br>- Increased traffic, accidents<br>- Disturbed access to local infrastructure | | schedule: simultaneous activities or separate time frames)<br>• Coordinate SEPs -> Include MGR project manager/liaison officer as stakeholder in SGR SEP (and vice-versa) |
| 4 | Flora – terrestrial and aquatic | • Increase of physical destruction (e.g. through multiple workers camps in the same areas)<br>• Increased pollution and waste during construction/rehabilitation activities | Magnitude: *Small* + Sensitivity: *Medium* = Significance: Moderate | • Coordinate activity schedule and if possible use same site for construction camps; use same access roads to project locations |
| 5, 6, 7 | Water, Soils and Air Quality | • Increased pollution through simultaneous project construction activities | Magnitude: *Minor* + Sensitivity: *Medium* = Significance: Moderate | • Measures as above to synchronize spatial overlap of overall activities<br>• each project enforces its own pollution prevention measures |
| 8 | Socio-economics | • Increased temporary influx of workers<br>• Increased spread of disease, crime and violence (e.g. through workers camps) | Magnitude: *Med-Large* + Sensitivity: *High* = Significance: Major | • Measures as above to coordinate project activity time frames and locations of the workers camps<br>• each project enforces its own risk management measures |

The key overall mitigation measure to minimize potential cumulative impacts during simultaneous rehabilitation works of MGR and new construction of SGR is for the YM Project Management to liaise with the MGR management to closely coordinate the timing of local field activities of the two projects. For example, the locations of construction camps and stakeholder engagement activities have to be coordinated within TRC in order to minimize the adverse impact on affected communities and the environment and to maximise the effectiveness of actions. Given the overlapping nature of the two projects, both spatially and temporally, TRC and YM will also liaise closely with respect to stakeholder engagement and grievance management. It is likely that many local residents/affected persons may not clearly differentiate between the two projects.
As both MGR and SGR projects are under the ultimate responsibility of TRC, the coordination of project activities and stakeholder management will be simplified and mutual benefits can be realised through central coordination.

Based on the assumption that mitigation measures for the SGR Project (as laid out in the previous ESIA chapters) and mitigation measures regarding the cumulative impacts are implemented as described above, the residual cumulative impacts will overall be of Minor significance, requiring no additional technical mitigation.

## *10.7 STEP 5 – MONITORING AND FOLLOW-UP*

The coordination of project activities between SGR and MGR will be monitored closely by TRC.
To monitor adverse effects of communities, TRC will keep a grievance log which will be monitored on a monthly basis. Grievances that concern both projects will be communicated to each project's responsible management entity.
TRC will give clear responsibilities to the Project Managers of each project (or other designated persons) to coordinate construction logistics, mitigation measures and other topics with their counterparts of the other project, and to include such parties in the Project SEP to enhance ongoing communication.
In the event that the Monitoring activities and feedback from stakeholders show that the above-mentioned mitigation measures do not adequately address the cumulative impacts, then the YM Project Manager of SGR must liaise with the MGR counterpart and TRC to mutually agree on the appropriate additional measures – and subject to approval by lenders.