yapı merkezi
İNŞAAT VE SANAYİ ANONİM ŞİRKETİ
CONSTRUCTION AND INDUSTRY INC.

Standard Gauge Railway – Dar es Salaam to Makutopora, Tanzania

Biodiversity Action Plan

18 July 2019

Project No.: 0462176

The business of sustainability

ERM

Document details	
Document title	Standard Gauge Railway – Dar es Salaam to Makutopora, Tanzania
Document subtitle	Biodiversity Action Plan
Project No.	0462176
Date	18 July 2019
Version	3.4
Author	Andrew Cauldwell, Samuel Laurence, Dr Cuthbert Nahonyo
Client Name	Yapi Merkezi

Document history

				ERM approval to issue	
Version	**Revision**	**Primary Author**	**Reviewed by**	**Name**	**Date**
Draft	1.0	Andrew Cauldwell		Mike Everett	15.04.2019
Draft	2.0	Andrew Cauldwell	Gizem Güngör (YM)	Raimund Vogelsberger	18.04.2019
Draft	3.0	Andrew Cauldwell	Gizem Güngör (YM), Hasan Çevik (YM), Magdalena Kitila (TRC)	Mike Everett	30.04.2019
Final	3.1	Andrew Cauldwell	Arup (Colette Curran, Neil Harwood, Pete Gabriel)	Mike Everett	22.05.2019
	3.2	Andrew Cauldwell	Neil Harwood (Arup)		28.05.2019
	3.3	Andrew Cauldwell	EKN and EKF		18.06.2019
	3.4	Andrew Cauldwell	EKN, EKF and Arup following Copenhagen meeting		18.07.2019

Signature Page

18 July 2019

Standard Gauge Railway – Dar es Salaam to Makutopora, Tanzania

Biodiversity Action Plan

Mike Everett
Partner

Andrew Cauldwell
Technical Director

Environmental Resources Management (ERM) Southern Africa (Pty) Ltd.

1st Floor, Building 32, The Woodlands Office Park, Woodlands Drive, Woodmead, 2148, Johannesburg,

South Africa

www.erm.com

CONTENTS

List of Tables

List of Figures

Acronyms and Abbreviations

Acronym	Description
AZE	Alliance for Zero Extinction
BAP	Biodiversity Action Plan
BEPP	Yapi Merkezi Biodiversity and Ecological Protection Procedure
BMEP	Biodiversity Monitoring and Evaluation Programme
BR	Bridge
CBD	Convention on Biological Diversity
CH	Critical habitat *(see glossary of terms)*
CR	Critically Endangered *(see glossary of terms)*
CRU	Climatic Research Unit
CUL	Culvert

Acronym	Description
DSM	Dar es Salaam to Morogoro
EHS	Environment Health and Safety
EMA	Environmental Management Act of 2004
EN	Endangered *(see glossary of terms)*
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
EWURA	Energy and Water Utilities Regulatory Authority
FRAI	Fish Response Assessment Index
GHG	Greenhouse Gasses
GIIP	Good International Industry Practices
GISD	IUCN Global Invasive Species Database
GN	Guidance Note to the IFC Performance Standards
IAP	Invasive Alien Plant
IBA	Important Bird and Biodiversity Area *(see glossary of terms)*
IBAT	Integrated Biodiversity Assessment Tool
IFC	International Finance Corporation
IUCN	International Union for the Conservation of Nature
KBA	Key Biodiversity Area *(see glossary of terms)*
KDCF	Kisarawe District Coastal Forest, listed as an IBA
KEC	Kibaha Education Centre
KWS	Kenya Wildlife Service
LC	Least Concern *(see glossary of terms)*
LS	Livestock Crossing
MGR	Meter Gauge Railway
MIRAI	Macro Invertebrate Response Assessment Index
MSDS	Material Safety Data Sheet
NEMC	National Environmental Management Council
NGO	Non-Government Organisation
NT	Near Threatened *(see glossary of terms)*
OSHA	Occupational Safety and Health Authority
PS6	Performance Standard 6
SASS	South African Standard System for macro-invertebrate assessment
SGR	Standard Gauge Railway
TANAPA	Tanzania National Parks Agency
TAWA	Tanzania Wildlife Agency
TAWIRI	Tanzania Wildlife Research Institute
TFCG	Tanzania Forest Conservation Group
TFSA	Tanzania Forestry Service Agency
TRC	Tanzania Railway Corporation
UNESCO	United Nations Educational, Scientific and Cultural Organization
UP	Underpass
VEGRAI	Vegetation Response Assessment Index
VU	Vulnerable (*see glossary of terms*)
WMA	Wildlife Management Area
WWF	World Wide Fund for Nature
YM	Yapi Merkezi

Glossary of Terms

This BAP is compiled to align with the requirements of the International Finance Corporation (IFC) Performance Standards (PSs), including Guidance Notes, on Environmental and Social Sustainability (2012), and the definitions of the IFC PSs apply. Below is a list of key terms used regularly within this document. Updated guidance notes to the PS6 (Feb 2019) have been considered here.

Term	Definition
Area of Influence	A geographical area wherein the developer is directly capable of influencing operations through implementation of mitigation measures.
AZE Site	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.
Biodiversity	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.
Biodiversity Offsets	Measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development and persisting after appropriate avoidance, minimisation and restoration measures have been taken.
Contractor	A person or firm that undertakes a contract to provide materials or labour to perform a service or do a job. Includes contractors retained by, or acting on behalf of the main applicant (client), are considered to be under direct control of the main applicant (client) and not considered third parties.
Critical Habitat	Areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) 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. (see IFC PS6, Paragraph 16). Protected areas and Key Biodiversity Areas can also influence critical habitat.
Critically Endangered	An IUCN status to indicate a species is very close to extinction.
Ecosystem Services	Defined as the benefits that people obtain from nature. These are typically divided into the following four categories (based on the IFC PS6, paragraph 2). • Provisioning services are the goods or products obtained from ecosystems, such as food, timber, medicines, fibre, and freshwater. • Regulating services are the benefits obtained from the control of ecosystem processes, such as climate regulation, surface water purification, carbon storage and sequestration, erosion, water flows, pollination, as well as protection from natural hazards. • Cultural services are the nonmaterial benefits obtained from ecosystems, such as natural areas that are sacred sites and areas of importance for recreation and aesthetic enjoyment. • Supporting services are the natural processes that maintain various ecosystem services, such as soil formation, nutrient cycling and primary production.
Endangered	An IUCN status to indicate a species is close to becoming extinct.
Endemic	A species that has ≥ 95 % of its global range inside the country or region of analysis (IFC Performance Standard 6 Guidance Note, paragraph GN79).
Environmental and Social Risk	A combination of the probability of certain hazard occurrences and the severity of impacts resulting from such an occurrence.
Environmental and/or social impacts	Any change, potential or actual, to (i) the physical, natural, or cultural environment, and (ii) impacts on surrounding community and workers, resulting from the business activity to be supported.

Term	Definition
Forensic delineation	A forensic delineation is used in this document to refer to wetland delineation that requires special skills, and is applied where wetland characteristics cannot be measured directly, for example deeper sampling below large soil dumps to determine composition of the original soils prior to disturbance.
Global Invasive Species Database	The Global Invasive Species Database an online searchable source of information about alien and invasive species that negatively impact biodiversity. It focuses on invasive alien species that threaten native biodiversity and natural areas and covers all taxonomic groups from micro-organisms to animals and plants. The GISD is managed by the Invasive Species Specialist Group (ISSG) of the IUCN Species Survival Commission. It was developed between 1998 and 2000 as part of the global initiative on invasive species led by the erstwhile Global Invasive Species Programme.
Good International Industry Practice	The exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally or regionally.
Habitat	A terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment.
Important Bird and Biodiversity Area	An Important Bird and Biodiversity Area (IBA) is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations. BirdLife International developed the IBA concept.
Internationally Recognised Area	Exclusively defined by the IFC Performance Standard 6 (paragraph 20) as UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, and wetlands designated under the Convention on Wetlands of International Importance (the Ramsar Convention).
IUCN Red List	This list has been developed by the International Union for Conservation of Nature (IUCN) and details the global conservation status of a wide range of Threatened species. (see website http:/www.iucnredlist.org)
Key Biodiversity Area	Key Biodiversity Areas (KBA) are sites that contribute significantly to the global persistence of biodiversity. The IUCN has established a Global Standard for the Identification of Key Biodiversity Areas based on globally agreed science-based criteria. Sites qualify as global KBAs if they meet one or more of 11 criteria, clustered into five categories: threatened biodiversity, geographically restricted biodiversity, ecological integrity, biological processes and irreplaceability. The KBA criteria can be applied to species and ecosystems in terrestrial, inland water and marine environments.
Key CH feature	A key critical habitat (CH) feature is a concept developed for this BAP, based on the selection of flagship species/features identified within each important habitat. Mitigation measures that aim to protect the habitat of the key CH features will benefit the lesser features sharing the same habitat. This BAP therefore presents approaches to assess the achievement of net gains for key CH features only. Key CH features include Rondo Dwarf Galago, African Wild Dog, Ruvu Spiny Reedfrog and large cave-dwelling bat congregations.
Least Concern	Least Concern, a status used by the IUCN to indicate a species is not threatened.
Mitigation	Measures designed to avoid, reduce or remedy adverse negative impacts.
Modified Habitat	An area that may contain a large proportion of plant and/or animal species of non-native origin, and / or where human activity has substantially modified the primary ecological functions and species composition. Habitat is considered modified “if it has existed in such condition for an extended period of time and is not otherwise likely to be returned to a natural state” (IFC Performance Standard 6 Guidance Note, paragraph GN42).
Monitoring	Monitoring is the process to ensure that environmental requirements stipulated in the impact assessment are being complied with, and allows for on-going impacts to be tracked to measure the effectiveness of the mitigation. The repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time to assess the efficiency of control measures.

Term	Definition
Natural Habitat	An area 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 functions and species composition. (IFC Performance Standard 6, paragraph 13).
Near Threatened	An IUCN status to indicate a species is close to being threatened.
Net Gain	Net gains are additional conservation outcomes that can be achieved for the biodiversity values for which a critical habitat was designated. Net gains may be achieved through the development of a biodiversity offset and/or, in instances where the client could meet the requirements of IFC Performance Standard 6, paragraph 17, without a biodiversity offset, the client should achieve net gains through the implementation of programs that could be implemented *in situ* (on-the-ground) to enhance habitat, and protect and conserve biodiversity.
No Net Loss of Biodiversity	No net loss is defined as the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimise the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale (e.g., local, landscape-level, national, regional). (IFC Performance Standard 6, paragraph 15).
Priority Ecosystem Services	Priority ecosystem services are two-fold: (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 (e.g., water).
Project Footprint	Refers to the surface area directly affected by the proposed development or activity.
Protected Area	The IFC Performance Standard 6 (paragraph 20) recognises legally protected areas that meet the IUCN definition: "*A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values*."
Tanzania Forest Conservation Group (TFCG)	The Tanzania Forest Conservation Group was established in 1985. With over 20 years of experience, they are the largest Tanzanian non-governmental organisation focusing on the conservation of natural forests. TFCG is a team of professional foresters, biologists and communicators determined to improve the way Tanzania's forests are managed and to support the livelihoods of those living close to the forests. TFCG focus on Tanzania's most important forests: the Eastern Arc Mountains and Coastal Forests.
Wetland	Wetlands refer to permanent water bodies, seasonal water bodies and seasonally waterlogged soils. Such areas are referred to as water sources in Tanzanian legislation. Wetland soils show characteristic signs of prolonged wetness and support a diversity of plants adapted to growing in wet conditions. Such plants are frequently referred to as wetland obligatory species.

PREFACE TO THE BAP

This Biodiversity Action Plan (BAP) has been compiled as part of an upgrade of the ESIA for the Standard Gauge Railway (SGR) construction from Dar es Salaam to Makutopora. The upgrade of the ESIA has been necessary to meet international best practice standards to support an application for finance. Construction of the SGR started prior to the ESIA upgrade and development of this BAP (construction of Lot 1 started in Feb 2017). A number of important biodiversity sensitivities were initially overlooked and have only come to light based on recent studies conducted for this BAP. The result of this situation has manifest itself in the following ways: (i) Construction of Lot 1 of the SGR has reached an advanced stage along a number of the biodiversity sensitive areas, which has reduced the capacity to advise on avoidance measures there. (ii) Various impacts have been observed in the field rather than predicted, which is not the typical approach to developing documents such as this. (iii) Some mitigation measures require urgent implementation to achieve compliance to standards. (iv) The rapid pace of construction has raised the urgency for finance and field studies to support the development of this document had to be conducted outside of the bird migration seasons, which has limited some results.

1. INTRODUCTION

Type of Operation

The current project will expand Tanzania's railway infrastructure from Dar es Salaam, on the Indian Ocean Coast to Mwanza on the edge of Lake Victoria. This is a single-track electrified railway constructed for a design speed of 160 km/h for passenger trains and 120 km/h for freight trains.

Two phases are under construction, Phase I extends from Dar es Salaam to the western side of Morogoro (201 km) and Phase II extends from Morogoro to Makutopora (333 km). Future phases will extend the SGR from Makutopora to Mwanza, which is approximately 678 km, but are not covered under this Biodiversity Action Plan (BAP).

Construction Components

The project follows a typical sequence for such development that include:

- Survey works and technical testing of route ,
- Expropriation and resettlement of homes, farms, business in the right of way,
- Clearance of land and vegetation ,
- Earth works and civil works (construction of culverts or drains and the track of bed),
- Placement of overhead wiring, signalling and telecommunication works,
- Construction of building and bridges,
- Electrification of the line and fencing,
- Establishment of temporary storage areas for spoil/ overburden materials, and
- Construction of new railway stations, campsites, storage yards, electricity substations and power transmission systems and access to roads.

Critical Dates

Phase 1: Envisaged construction period from February 2017 to November 2019;

Phase 2: Envisaged construction period from March 2018 to February 2021;

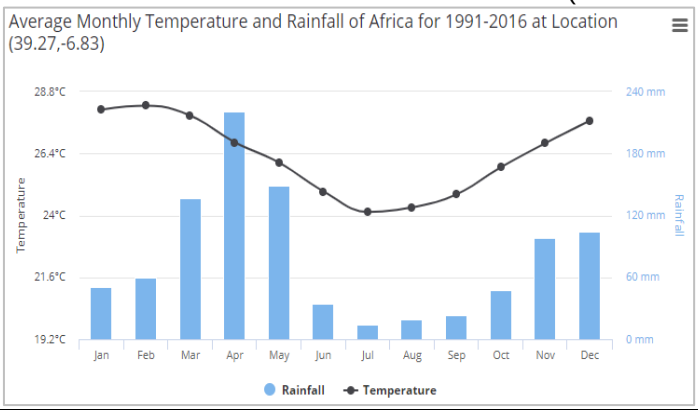
Operational start date: shortly after the completion of the railway

Climate

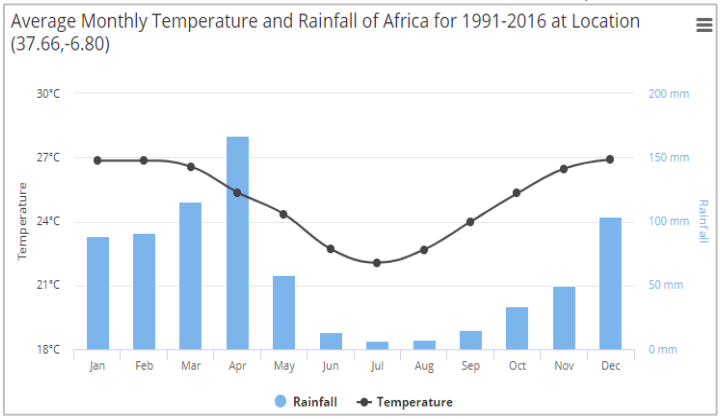
The climate varies considerably along the SGR route, with rainfall declining from 956 mm per annum in Dar es Salaam to 539 mm per annum in Dodoma. The dry season extends from May/June to October, and becomes increasingly dry in Kilosa and Dodoma. Modelled climate data for four stations along the SGR route is presented in ***Figure 1.1***.

Figure 1.1 Modelled Climate Data for Dar es Salaam, Morogoro, Kilosa and Dodoma

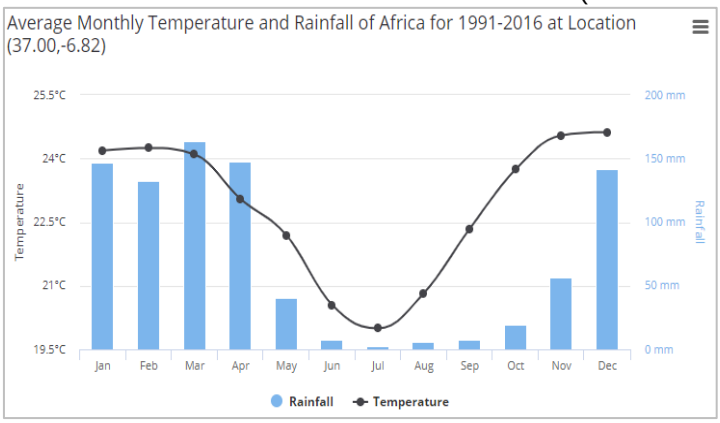
Dar es Salaam (Mean annual rainfall: 956 mm)



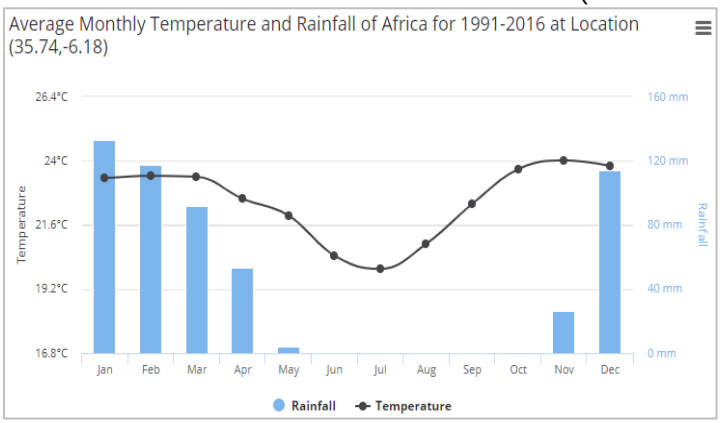
Morogoro (Mean annual rainfall: 758 mm)



Kilosa (Mean annual rainfall: 868 mm)



Dodoma (Mean annual rainfall: 539 mm)



Source: Data produced by the Climatic Research Unit (CRU) of University of East Anglia (UEA), sourced from the World Bank Group Climate Change Knowledge Portal, at: https://climateknowledgeportal.worldbank.org/

2. OBJECTIVES AND TARGETS FOR THIS BAP

The primary objective of the BAP is to promote the sustainable management of biodiversity resources, to maintain the ecological integrity of protected areas and to maintain the benefits from ecosystem services through the adoption of practices that integrate conservation needs and development priorities.

This BAP is developed to align with requirements of the IFC Performance Standard 6 (PS6). This standard requires habitats to be classified as modified, natural and critical, and uses this classification as a basis for establishing sensitivity of ecological features, including protected areas. Mitigation targets are specified by the PS6 based on these sensitivities, whereby no net loss of biodiversity is required for impacts to natural habitats, and net gains are required for the biodiversity values that define critical habitats.

This BAP explains where no net loss of biodiversity and net gain requirements (***Section 7***) are needed, and develops mitigation to achieve these targets. Monitoring measures are presented to measure the future achievement of these targets. ***Section 12*** presents an analysis of the capacity provided by the mitigation strategy to achieve these targets of no net loss of biodiversity and net gains for key biodiversity values that define critical habitats.

A precautionary approach has been applied for the development of this BAP regarding the assessment of sensitivities and setting of no net loss and net gain targets. There is a paucity of scientific data for some of the high biological sensitivities encountered along the proposed SGR route, and a precautionary approach has been applied so that implementation of this BAP is not impeded by this current lack of full scientific information. Measures have been included into this BAP to build scientific knowledge where this is lacking, and a key element of the precautionary approach has been the adoption of scalable mitigation measures that can be adapted to accommodate a future revision of identified impacts and/or additional impacts revealed by future studies.

2.1 BAP Development Team

ERM have been retained by TRC and YM as a professional team to revise the ESIA to guide the management of environmental and social issues associated with development of the SGR. This BAP is included as a part of the ESIA. This BAP is developed primarily by Andrew Cauldwell, who has extensive experience with implementation of the PS6, and his competence has been approved by the IFC to review their own projects.

Additional specialists involved in development of this BAP include:

- A team from Enviro-Insight, led by Samuel Laurence assessed the occurrence of critical habitat features associated with the Pugu Hills and Ruvu South Forest Reserves. The Enviro-Insight team were selected based on extensive experience with primate, ornithological and entomology surveys.

- Specialists from the University of Dar es Salaam (UDSM), led by Dr Cuthbert Nahonyo assessed the occurrence of natural habitats, wildlife presence and aquatic ecology along the SGR. The UDSM team were selected based on their local knowledge of Tanzanian terrestrial and aquatic ecology, and their recognised expertise in African wildlife issues.

- A wildlife officer, Deusdedith Fidelis of the Tanzanian Wildlife Research Institute (TAWIRI) led the assessment of wildlife corridors that were previously identified by TAWIRI. Deusdedith Fidelis is based in the nearby Mikumi National Park and has extensive local knowledge of the local wildlife ecology.

3. LEGAL AND OTHER REQUIREMENTS

3.1 Standards and Guidelines

This BAP is compiled to align with the ESIA, which is developed to meet requirements of the IFC Performance Standards. The IFC Performance Standards 1 and 6 have particular relevance to this BAP, which cover the following aspects:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 6 (PS6): Biodiversity Conservation and Sustainable Management of Living Natural Resources.

Implementation of the Performance Standards is assisted by Guidance Notes published by the IFC. Guidance notes to the PS6 have recently been updated (Nov 2018), to emphasise the importance of natural habitat, and provide some changes to the approach in which critical habitats are assessed. This BAP and its supporting documents are compiled to align with the latest revision of the Guidance notes to the PS6.

Links to the Performance Standards, guidance notes, related standards and data sources are provided in ***Section 15***.

3.2 Yapi Merkezi Policies and Procedures

Environmental and Social Policy

The Yapı Merkezi (YM) website reveals that the following policies are adopted to eradicate, reduce the adverse effects of the company activities and to leave a liveable clean environment for future generations with a growing environmental awareness:

- Complies with the laws, regulations, all applicable national and international legal and environmental requirements, practices an effective environmental management system accepted by all levels of the organization in order to improve its environmental performance,
- Acknowledges new standards and sets new goals with constant focus on development and continual improvement,
- Aims to collaborate with suppliers having environmental awareness,
- Requests for practicing this policy from its business partners and sub-contractors, and tries to implement same or similar policy for related parties and in its other projects,
- Contacts and establishes strong relationships with affected communities and neighbours,
- Aims to reduce and prevent potential adverse impacts on environment and society with a life cycle approach,
- Takes action to prevent possible environmental impacts arising from handling and disposal of waste and to commit on recycling,
- In order to minimize the risks and assess potential opportunities, takes into consideration the emergency cases and all possible environmental aspects and impacts while evaluating risks and opportunities,
- Plans projects by considering energy efficiency and aims to reduce energy consumption,
- Focuses on resource efficiency, reduces wastage,
- Monitors environmental performance while committing to continual improvement and development,

- Works to create environmental awareness at any grade,
- Ensures that all employees contribute to environmental protection,
- Fulfils social responsibility requirements with all its stakeholders and business partners and carries out all its activities to support the usage of sustainable resources,
- Takes into account the needs and expectations of related parties, while carrying out all these activities.

Source: Yapi Merkezi Environmental and Social Policy

Biodiversity and Ecological Protection Procedure - Design and Built for the Standard Gauge Railway (SGR) Line from Dar es Salaam to Morogoro Project (01.04.2019)

The Purpose of the Biodiversity and Ecological Protection Procedure (BEPP) is to mitigate adverse impacts on conservation of biodiversity and ecological conditions along the working environment.

This procedure applies to all YM Project Activities and requires subcontractors to apply the same site standards and covers information below:

- Actions to manage both the threats and the long term viability of species
- Information about planting programme

Responsibilities are allocated to the Project Manager, Department Manager, HSE Manager, Health Environmental And Social Chief, Environmental and Social Engineers and Technicians.

The BEPP applies to (i) construction sites (construction camps and construction sites), (ii) earthmoving and excavation, (iii) spoils and surplus or discarded materials, (iv) access roads and vehicles, (v) protected areas, (vi) gazetted protected areas and (vii) habitats.

All mitigation measures included within the BEPP are incorporated into this BAP.

Environmental and Social Monitoring Procedure (02.04.2019)

The Environmental and Social Monitoring Procedure presents the program for YM to monitor the SGR Project's performance in relation the full range of voluntary or regulation-based environmental and social management requirements. It covers monitoring of ecological, archaeological, rehabilitation, surface water, wastewater discharge, air quality, noise, potable water, groundwater, waste storage, sampling and social parameters.

This procedure states that YM are committed to monitoring the success of the ecological protection measures that have been implemented, and the implementation of corrective actions.

Resource Efficiency and Pollution Prevention Procedure (Draft - February 2019)

This Procedure has been developed in line with the Turkish regulatory framework, IFC Performance Standards, IFC EHS General and Sector Specific Guidelines, and YM Corporate Environmental and Social Management System Gap Analysis study.

The purpose of this Procedure is to identify measures and corporate targets to reduce resource consumption, to avoid or, when avoidance is not possible, minimize and control negative impacts on the environment resulting from environment and greenhouse gases.

According to the IFC PS 3, the objectives of this procedure is presented below

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from YM activities;
- To promote more sustainable use of resources, including energy and water;

- To reduce YM Projects related GHG emissions;
- To adopt the mitigation hierarchy approach to address adverse impacts on human health and the environment at the source;

The overall objective in accordance with IFC PS3 is to implement technically, financially and cost-effective measures for improving efficiency in the consumption of energy, resources and materials inputs during the YM Project activities. This objective can be achieved by the implementation of measures in order to:

- Avoid uncontrolled and unnecessary consumption of natural resources and energy;
- Prevent excessive consumption of natural resources through a correct choice of tools and equipment (back-up power generators, energy-saving lights etc.);
- Inform workers about measures to avoid/minimize the consumption of natural resources (e.g. engine turn-off, water consumption reduction etc.);
- Implement management controls (procedures, inspections, communications, training, and drills) to promote further resource efficiency and energy conservation actions;
- Monitor the consumption of natural resources in the Projects;
- Report the results of the periodic inspections and audits and provide for corrective actions, if necessary, to reach this Procedure's objectives;
- Reduce Project-related GHG emissions with management control measures.

Hydrogeological and Water Sustainability Procedure (Draft - February 2019)

This Procedure has been developed in accordance with YM policies, with the commitments undertaken in the ESAP, Turkish regulatory framework, IFC Performance Standards (in particular PS3) and IFC General and Sector Specific EHS Guidelines. Good International Industry Practices (GIIP) are adopted where no national regulation or international standard/guideline apply.

The purpose of this Procedure is to identify measures and corporate targets to manage groundwater usage and water sustainability, to avoid or, when avoidance is not possible, minimize and control negative impacts on the environment.

This Procedure aims to provide general framework for the HQ Corporate activities and YM Projects. The objectives of this procedure are:

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from YM activities;
- To adopt the mitigation hierarchy approach to address adverse impacts on human health and the environment at the source;
- To define the roles and responsibilities;
- To define the potential project commitments, operational procedures relevant to this procedure;
- To define monitoring and reporting procedure;
- To define the sensitive receptors (groundwater wells, surface water sources, fresh water sources, etc.) to the potential project activities and their monitoring schedule;
- To define the local – host country responsibilities/legislations to the potential projects;
- To assess the groundwater and water sources limit values in terms of local water users;
- Prevent excessive consumption of water sources through a correct choice of tools and equipment;

- Try to design the projects to have measures for adequate water collection, spill control and leakage control system;
- To understand the quality, quantity, frequency and source of the liquid effluents within the scope of projects;
- To identify the opportunities to prevent or reduce wastewater pollution through such measures as recycle/reuse within the project;
- To assess the compliance of wastewater discharge with the applicable discharge standards;
- To evaluate the potential adverse effects of groundwater withdrawal, including modelling of groundwater level changes and resulting impacts to surface water flows, potential land subsidence, contaminant mobilization and saltwater intrusion. Modify extraction rates and locations as necessary to prevent unacceptable adverse current and future impacts, considering realistic future increases in demand;
- To evaluate potential adverse effects of surface water withdrawal on the downstream ecosystems and use appropriate environmental flow assessment to determine acceptable withdrawal rates;
- To avoid construction of water intake structures in sensitive ecosystems;
- Inform workers about measures to avoid/minimize the usage of water sources;
- Monitor the consumption of water used in the YM Projects;
- Report the results of the periodic inspections and audits and provide for corrective actions, if necessary, to reach this Procedure's objectives.

3.3 Integration with other Management Plans

This BAP is part of a sequence of management plans developed to guide the environmental and social management of the SGR Project. The following list of management plans are being developed as components of the ESIA in addition to this BAP:

- Soil Management Procedure
- Surface and Groundwater Management Procedure
- Invasive Weed Management Plan
- Landscape and Reinstatement Procedure
- Contaminated Land Management Procedure
- Hazardous Material Management Procedure
- STD Management Plan
- Construction Camp Management Plan
- Security Management Plan
- Local Recruitment Procedure
- Labour and Working Conditions Plan
- Environmental and Social Operation Management Plan
- Community Safety Operation Management Plan

3.4 National Regulatory Approvals and Compliance relevant to Biodiversity

The SGR Project is implemented according to Tanzanian law and implementation procedures, which requires a range of authorisations and agreements with different institutions, organisations and communities. An overview of the permits and approvals required for implementation of the SGR Project and their status as of March 2019 are presented in ***Table 3.1***.

Table 3.1 Overview and Status of National Regulatory Approvals and Compliance Matters

Permit /Approval Type	Description of Permit / Approval Requirement	Description of Activity	Related Authority	Status
Environmental Certificate	Environmental Management Act, 2004	All Project Activities	National Environmental Management Council (NEMC)	Permit obtained.
Water Course Disturbance / Diversions	Water Resources Management Act, 2009	Construction activities within, and in close proximity to watercourses or waterbodies.	Ministry of Water and Irrigation – Appropriate Water Basin Office	Permit(s) are in progress, applied to Wami-Ruvu Water Basin Office.
Groundwater Drilling Permit	The Groundwater (Exploration and Drilling) Licensing Regulations, 2013 Water Resources Management Act, 2009	Borehole drilling for water abstraction	Ministry of Water and Irrigation – Appropriate Water Basin Office	Permits obtained
Water Use Permit	Water Resources Management Act, 2009	Water abstraction activities (from ground and surface water sources)	Ministry of Water and Irrigation – Appropriate Water Basin Office	Permits obtained
Sewage Disposal Area License	Water Resources Management Act, 2009: Environmental Management (Water Quality Standards) Regulations, 2007; Water Utilization (Control and Regulation) Act, 1974	Disposal of sewage waste	Kibaha Education Centre (KEC)	Permit approved
Licence to Collect, Store and Transport Hazardous Waste	The Environmental Management Act (No. 20), 2004 (Chapter 191) Section 133	Removal of hazardous waste from construction site	Vice Presidents Office – Division of Environment	Permit approved
Disposal of Waste at Dump Sites	The Environmental Management Act ,2004; Environmental Management (Solid waste Management) Regulations, 2009	Required for transport and disposal of waste at dumpsites.	Various District Councils	Permits approved.
Construction of Fuel Facility and Storage of Fuel	The Petroleum (Wholesale, Storage, Retail And Consumer Installation Operations) Rules, 2018	Construction of fuel facility and storage of fuel	Energy and Water Utilities Regulatory Authority (EWURA)	Permits approved.
Extraction of Materials from Quarries	The National Industries (Licensing and Registration) Act, 1967; Mining Act No. 4 (2010) and Mining Act, Cap. 123 (2017)	Operation of a facility to manufacture for sale of aggregates	National Environmental Management Council (NEMC)	Permits approved.
Extraction of construction materials from borrow	Mining Act No. 4 (2010) and Mining Act, Cap. 123 (2017)	Extraction of construction materials from borrow pits.	Various District Councils	Permits approved.

Permit /Approval Type	Description of Permit / Approval Requirement	Description of Activity	Related Authority	Status
pits (gravels, sands, etc.)				
Seed Import Permit	The Seed Act, 2003	Permit to import plant species for hydro-seeding.	Ministry of Agriculture Food Security and Cooperatives	Permits approved.
Working within a Forest Reserve	Forest Act, 2002; Forest Regulation, 2004	Clearance and disturbance of vegetation within a designated forest reserve.	Tanzania Forest Service Agency (TFSA)	TFSA has assessed the situation, and there is ongoing communication with TRC, YM and TFSA.
License for Explosives Store; Requirements for Storage Boxes; Blasting Certificate; License for Importation and Transportation of Explosives	The Explosives Act, Cap 45, R.E. 2002; The Explosives Act (No. 56), 1963; Explosive Regulations, 1964; The Explosives (Amendment) Regulations, 2010; License for Explosives Store; Requirements for Storage Boxes; Blasting Certificate;	Various related to the handling, storage and control of explosives	Tanzania Ministry Minerals	Permits approved.
Fire Safety	Fire and Rescue Act, 2007 (Act No. 14 of 2007); Fire and rescue force, (safety inspection and certificates Amendments Regulations, 2012	All activities on site.	Commissioner General for the Fire and Rescue Force	Permit obtained.
Registration of a Work Place	Occupational Safety and Health Act, 2003	Work place registration.	Occupational Safety and Health Authority (OSHA)	Permit obtained.
Occupational Health and Safety (OSH) Certification	Occupational Safety and Health Act, 2003	All activities on site.	Occupational Safety and Health Authority (OSHA)	Permit obtained.

4. BIODIVERSITY BASELINE DATA

4.1 Overview of Supporting Documents

This BAP is developed as part of the ESIA for the SGR Project from Dar es Salaam – Makutopora, Tanzania, compiled in April 2019. A first version of the ESIA was compiled to local standards by Ardhi University and is being upgraded to meet an international standard by ERM.

Various field studies were conducted to support the development of this BAP, and the following four documents contain important supporting information for this BAP:

1. **Confirmation of Wildlife Corridors Screening Study**

   A brief study was conducted by TAWIRI and ERM to investigate documented wildlife corridors across the SGR.

2. **Natural Habitat Baseline Assessment**

   A brief study has been conducted by ecologists from the University of Dar es Salaam to confirm the status of natural habitat at selected sites along the SGR alignment.

3. **Aquatic Ecology Assessment**

   An assessment of aquatic ecological health for 12 rivers crossed by the SGR has been compiled by ecologists from the University of Dar es Salaam.

4. **Pugu Hills and Ruvu South Baseline for the Critical Habitat Assessment**

   A baseline study of key sensitive biodiversity features in the Pugu Hills and Ruvu South Forest Reserves has been compiled for ERM by Enviro-Insight.

4.2 Field Survey Data

This BAP has been developed based on field surveys conducted for the original ESIA, and additional field studies for the BAP to address gaps. Dates of fieldwork conducted for the original ESIA are not specified but photographs indicate that surveys were conducted during peak rainfall periods, suggesting this was in January/Feb.

Field surveys conducted during dry and dusty conditions to address gaps include:

- Wildlife Migration Survey – 12 to 14 March 2019.
- Aquatic and Natural Habitat Surveys along the SGR Route – 14 to 22 March 2019.
- Baseline assessment of Pugu Hills and Ruvu South Forest Reserves – 15 to 23 March 2019.

All survey work has therefore focussed on the period from January to March, but this is not considered to be a limitation to the robustness of the assessment for the following reasons:

- General field studies of aquatic ecology and natural habitat occurrence are considered to yield minimal benefit and are therefore not supported.

- Critical habitat sensitivities are largely focused on the forest reserves close to DSM (Lot 1), where impacts have already occurred during the latter field surveys, and further general survey will not benefit the analysis. Section 11.2 outlines further studies that will be beneficial to raise the ecological understanding of CH features, to develop better mitigation. Most of these studies

require assessments over a longer period than is practical for ESIA development, and are therefore included as specific actions.

- Field surveys to confirm the presence of migratory forest birds and the Ruvu Spiny Reed Frog are likely to be inconclusive for arguing absence of such species due to their elusiveness and very short period of presence. Such studies are therefore unlikely to change the current mitigation.

4.3 Summary of Key Biodiversity Sensitivities

4.3.1 Summary of Relevant Ecoregions

The SGR route passes through three important ecoregions defined by WWF. Starting from the east, these are:

- Northern Zanzibar-Inhambane Coastal Forest Mosaic;
- Eastern Miombo Woodlands;
- 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 forest habitat in this ecoregion is highly fragmented and worsening as agriculture and other human activities spread. In Tanzania, forested areas are not larger than 40 km², and typically are much smaller. Most remaining forest patches are found within government controlled forest reserves, such as the Pugu Hills Forest Reserve. This habitat supports diverse mammals, birds, reptiles and amphibians, with moderate to high rates of endemism. There is therefore a high likelihood of critical habitat and biodiversity risk to the project. The Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion extends over the first 108 km of the SGR route.

Eastern Miombo Woodlands

The Eastern Miombo Woodlands form a part of a wide belt of miombo woodland, which is a species rich ecosystem on nutrient-poor soils. The ecoregion is thinly populated by humans, but is important to the livelihoods of the rural people who depend on 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, but even outside protected areas, the woodlands have remained largely intact. 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 is extensive, and the extent of largely natural habitat is estimated at approximately 30 percent. The extensive natural habitat can trigger no net loss requirements. The Eastern Miombo Woodlands ecoregion extends from 108 km to 311 km of the SGR route.

Southern Acacia-Commiphora Bushlands and Thicket

The ecoregion is located in northern and central Tanzania, and trees are dominated by *Acacia*, *Commiphora* and *Crotalaria* species. Rainfall is variable and the rangeland can become extremely parched, and many of the trees and bushes lose their leaves. Plant diversity is low, with most species having a wide distribution. This ecoregion has high numbers and diversity of large mammals, but

there are no endemic mammals. A review Google Earth imagery for the SGR route reveals that most of the area close to the railway line is cultivated, and biodiversity therefore presents a low risk to the Project. The Southern Acacia-Commiphora Bushlands and Thicket ecoregion extends from 311 km to the end of the Phase II of the SGR route.

4.3.2 Protected Areas

The IFC PS6 requires consideration of internationally recognised areas in addition to gazetted protected areas. These areas are covered in the discussion of gazetted protected areas and key biodiversity areas below.

Gazetted Protected Areas

The SGR route passes close to or through two forest reserves. There are also a number of larger protected areas in the greater vicinity, which have an influence on the biodiversity affected by the route. *Table 4.1* presents an overview of protected areas that are important to the Project from a biodiversity risk perspective.

Table 4.1 Overview of Protected Areas that have relevance to the SGR Route

Protected Area Name, (IUCN Management Category)	Comment and Relevance to the SGR Project
Pugu Hills Forest Reserve, (Not reported)	The SGR passes through this reserve. Boundaries available online appear to be a good representation of boundaries in the field. Corresponds to the Kisarawe District Coastal Forest (KDCF) IBA.
Ruvu South Forest Reserve, (Not reported)	The SGR passes along the boundary of this reserve. Boundaries available online appear to be a good representation of boundaries in the field. Corresponds to the KDCF IBA.
Wami Mbiki WMA, (Not reported)	Wami Mbiki Society comprises 24 villages, surrounding a 2500km² a wildlife rich core area in the districts of Mvomero, Morogoro and Bagamoyo. The Wildlife Management area (WMA) in 1997 as a pilot project to implement the wildlife conservation policy of Tanzania of 1998/2007. Source area for wildlife that migrates across the SGR
Mikumi National Park, (IUCN Management Category II)	This national park is well protected and is continuous with the vast protected ecosystem associated with the Selous Game Reserve. Source area for wildlife that migrates across the SGR

Key Biodiversity Areas

An analysis of the Project Area reveals that all Important Bird and Biodiversity Areas (IBAs) and Alliance for Zero Extinction (AZE) sites in the proximity of the SGR Project correspond to various gazetted protected areas.

The AZE 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. AZE sites present a very high level of biodiversity risk. The following two AZE sites are recognised in the vicinity of the SGR Project:

- 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. One mammal, six amphibians and two birds trigger this AZE site.

- Ukaguru Mountains - This AZE site overlaps the North Mamiwa Kisara Forest Reserve and shares the same boundaries as the Ukaguru Mountains IBA. Three amphibians trigger this AZE site.

The above AZE sites are located in mountainous terrain, and their species triggers are specifically associated with mountainous forest. The terrain and associated forest differs dramatically from the terrain traversed by the SGR, and are separated from the SGR by large urban areas associated with Morogoro town. It the view of this BAP that the above AZE sites are not impacted by the SGR Project.

The Pugu Hills and the Ruvu South Forest Reserves are key components of the Kisarawe District Coastal Forest IBA. The Pugu Hills Forest Reserve is an important site for the Rondo Dwarf Galago due to its critically endangered status and extreme range restriction, as discussed in ***Section 4.3.6***. This species considered to be indirectly impacted by the SGR project, as discussed in ***Section 5.1.13***.

Each of the above AZE and IBA sites are recognised as key biodiversity areas by the IUCN, and interpreted as critical habitat. Only critical habitats adversely impacted by the SGR Project are considered in the BAP.

4.3.3 Natural Habitats and Fauna

Habitats along the SGR route are classified into modified and natural habitats based on Google Earth imagery. Areas supporting natural vegetation are clearly identifiable by the absence of settlement and cultivation. Where areas of continuous natural vegetation occur on both sides of the SGR route, that stretch of the route has been classified as natural habitat. 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 4.2***). ***Table 4.3*** presents the actual start and end locations areas of natural habitat along the route. All other areas are classified as Modified Habitat.

Table 4.2 Linear Lengths (km) of the SGR Route classified as Modified or Natural based on the Status of Surrounding Vegetation

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 4.3 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
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

4.3.4 Aquatic Ecosystems

The SGR crosses a number of permanent and seasonal rivers between Dar es Salaam and Makutupora. Twelve aquatic systems and associated habitats were assessed, and results are presented in the following tables.

Table 4.4 Ecological Status of the Aquatic Ecology and Surrounding Habitats for 12 sites along the SGR Alignment

Site	Location	Aquatic Ecological State	Associated 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 4.5 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. (ºC)	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.

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, comprising eight 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.

4.3.5 Wildlife Migration and Corridors

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 report (2009) describes two wildlife corridors that are intersected by the currently constructed SGR, namely between the Mikumi National Park- Wami Mbiki Wildlife Management Area (WMA) and the Selous Game Reserve - Wami Mbiki WMA.

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 therefore investigated, and evidence of regular elephant movement across the SGR route provided in the Wildlife Corridors Screening report confirms their continued existence.

4.3.6 Critical Habitat Features

The revised critical habitat assessment for the SGR route has confirmed 12 critical habitat features (CH features) that are relevant to the project, as summarised in ***Table 4.6***. 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 considerable detail on these CH features and other sensitive biodiversity.

Table 4.6 Summary of Critical Habitats Features along the SGR Route from Dar es Salaam to Makutopora

Common Name (*Species*)	**IUCN Threat 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*) # *Provisional CH feature*	EN	Reliably reported present by communities	Savanna
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
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

Common Name (*Species*)	**IUCN Threat Status**	**Status of Occurrence**	**Habitat Requirement**
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, comprising mostly *Triaenops afer* (Trident bat), *Mops* (free-tailed bats) and *Rhinolophus* (Horseshoe bats) species #	All likely species are LC	Two large bat roosts present estimated at over 10,000 bats.	Caves
Protected and Key Biodiversity Areas			
Pugu Hills and Ruvu South Forest Reserves #			
Important Biodiversity considered to be Near Critical Habitat Features			
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

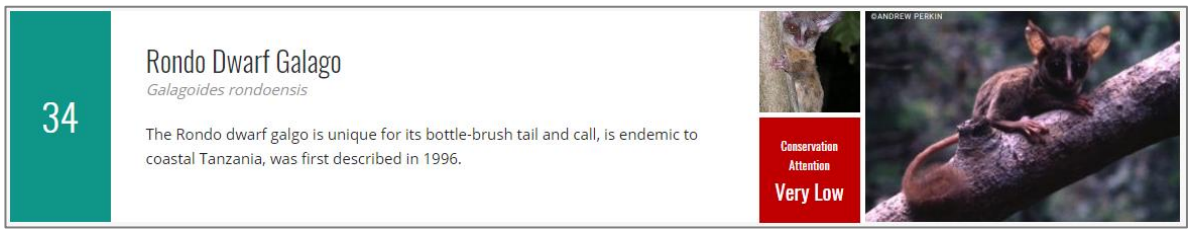
- Denotes key critical habitat features that are considered as flagship features (***See Section 7.1.3***)

* - Migratory birds were not confirmed present due to the season of assessment, but are not considered provisional CH features and not included into net gain targets. See text below.

The Rondo Dwarf Galago is a forest-dependent primate and its presence was confirmed within the Pugu Hills Forest Reserve, including forest adjacent to SGR construction activities. This little primate is one of the World's smallest primates, its threatened status is critically endangered and is highly range restricted. The little Rondo Dwarf Galago therefore deserves to be recognised as the highest priority species for conservation measures in the BAP.

The EDGE of Existence website describes this Galago as being among the World's 25 most endangered primates, and places it 34th in the list of 100 mammal species most threatened with extinction (***Figure 4.1***). Current conservation attention provided to this species is ranked as Very Low. It's known distribution covers 92 km² of coastal forest, in six separate point locations identified on the IUCN Red List. These are two locations north of Dar es Salaam, a cluster of three locations west of Lindi and the Pugu Hills Forest Reserve. The IUCN Red List states that the species is not expected to occur in the intervening areas, and the Pugu Hills Forest Reserve is the only protected area in which this species occurs. The ecology of this little Galago is poorly understood making it difficult to develop appropriate conservation measures, or to have confidence on the ability to achieve net gains. ***Section 11.2*** therefore proposes that additional studies are conducted into the ecology of this Galago.

Figure 4.1 Ranking of Extinction Threat to the Rondo Dwarf Galago



Source: EDGE of Existence website, available at: https://www.edgeofexistence.org/species/species-category/mammals/

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 does exist, 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 both wildlife corridors conducted by TAWIRI and natural habitat assessments conducted by UDSM 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 a known 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, and their annual migration involved 'hopping' from one forest patch to another. Small forest patches are therefore essential to sustain their migratory behaviour and to their survival. Field surveys were not able to confirm the presence of these birds as surveys were conducted prior to the main bird 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 Dar es Salaam Pugu Striped Grasshopper and Pugu Forest Grasshopper 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.

The Pugu Hills forests are expected to support important floral diversity as the Coastal Dry Forest is known to support a very rich diversity of plant species with high rates of endemism. However few of these species have bene classified with a threatened status and are therefore not listed on the IUCN Red List of Threatened Species. Reports generated by IBAT therefore do not include many plant species. Only 11% of the IBAT list of 1002 non-marine species generated for the site comprised plant species, and none of these were listed as threatened. Baseline studies to support the critical habitat assessment for the ESIA of the SGR Project therefore focussed on faunal species. Measures to conserve threatened fauna will yield benefits for the entire habitat, including the rich diversity of plant species.

4.3.7 Priority Ecosystem Services

The 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 based on importance to communities and use by the SGR Project:

- Charcoal Production
- Fishing
- Water provision from wetlands and aquatic ecosystems

Charcoal Production

Biomass energy is Tanzania's most important energy source and is predicted to comprise the majority of the national energy supply for at least the next 20 years. An estimated 96% of households in Tanzania use fuelwood or charcoal for cooking and heating, and 71% of urban households use charcoal for cooking (TFCG, 2016). Charcoal is a low cost energy source and poverty is a primary cause for the widespread dependence of charcoal.

Demand for charcoal and fuelwood in Tanzania currently exceeds the national, sustainable supply. The growing demand has resulted in the present situation where almost all charcoal is produced either illegally in reserves or from forests / woodland on village land for which no sustainable harvesting plan is in place (TFCG, 2016). Almost all charcoal reaching Tanzanian cities is produced inefficiently and unsustainably. As a result, charcoal production is a significant driver of forest degradation and deforestation in Tanzania. Traditional agriculture is however considered a greater driver of deforestation, as shifting cultivation is widely practiced, with regular clearing of new agricultural fields while extensive areas lie fallow. Charcoal may be produced as a by-product of this agricultural practice.

Miombo woodland is ecologically adapted to withstand disturbance, and has evolved to tolerate disturbance from fire. Strategies for sustainable charcoal production are possible within miombo woodland, however the coastal forests and forests of the Eastern Arc Mountain chain respond differently to disturbance, which results in a complete change in vegetation (TFCG, 2016).

Traditional charcoal production is inefficient, and the widespread approach is to clear cut an area of woodland with earth-based kilns established in the centre of the clearing. New village-based sustainable approaches are being piloted by the Tanzania Forest Conservation Group (TFCG) based on strategic harvesting of trees according to a predetermined plan and the use of mobile kilns. This approach is aimed at empowering village communities and alleviating poverty, and is discussed further in ***Section 9.1.1***.

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 4.7** below:

Table 4.7 River Resource Use

River Resources	Resource Use	
Fresh water	Domestic use Irrigation Livestock	Recreation (swimming) Industrial use Cultural/Religious practices
Fish	Food	Connectivity (fish migration)

River Resources	Resource Use	
Vegetation	Timber/poles for harvesting Habitat for Wildlife Climate regulation Charcoal/firewood for fuel	Medicine Wood for furniture/boat making Materials for mats, baskets Cultural practices (e.g. worship)
Soil and Stones	Building materials Road construction	Bridge construction Dam construction
Livestock	Water for drinking	Floodplain grazing
Wildlife	Food Floodplain grazing for wildlife	Tourist attractions (wildlife) 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 belonging to the Maasai and the Bargaig communities identified important areas that require access to water points and grazing across both sides of the SGR; these 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.

Fishing

Fish species known to occur at river sites crossing the SGR include *Clarias gariepinus*, *Bagrus orientalis*, *Oreochromis niloticus*, *Citharinus latus*, *Synodontis punctulatus* and *Schilbe moebiusii*.

Fishing was observed as being an important livelihoods activity, for both subsistence and as a source of income, at the following sites:

- Ruvu River at the main bridge along SGR line located at Ruvu;
- Mgolole River where there is an SGR proposed line located at Morogoro;
- Mkata River at SGR proposed line located at Mkata;
- Bubu River at MGR Bridge 1 located at Bahi, Singida; and
- Mponde River at MGR Bridge located at Makutopora/Saigoni, Dodoma.

To note though, is that human activities, including over-fishing, have resulted in impacts to the river ecology at these sites. This is more fully described in the water quality baseline.

4.3.8 Overview of Key Biodiversity Sensitivities

Numerous and diverse biodiversity sensitivities are associated with the SGR Project. Table 4.8 presents a brief summary of the key groups of sensitivities around which this BAP has been developed.

Table 4.8 Summary of Key Biodiversity Receptors and Sensitivities

Name	Area of Relevance	Risks and Vulnerabilities	Gaps and Unknowns
Ecoregions	Throughout, but highest sensitivities in the Northern Zanzibar-Inhambane Coastal Forest Mosaic ecoregion. (0 to 108+250)	High species diversity with a diversity of endemic species and high likelihood of critical habitat.	Very limited data is available on the species diversity and presence of endemics.
Protected areas	• Pugu Hills Forest Reserve (20+100 to 24+950); • Ruvu South Forest Reserve (35+350 to 43+750).	PS6 stipulates specific requirements that need to be addressed. Recognised by Birdlife as an IBA, therefore qualifies as a KBA and recognised as a CH feature.	Limited gaps in the ecology of these areas
Natural habitats and fauna	A number of parts of the SGR route, although natural habitats are more widespread within the two eastern ecoregions, namely Northern Coastal Forest Mosaic and the Eastern Miombo Woodlands.	PS6 stipulates specific requirements that need to be demonstrated, including achieving no net loss of biodiversity.	Natural habitats have not been accurately delineated in the field. Natural habitat was delineated from imagery and selected sites ground-truthed by UDSM ecologists.
Wetlands	Wetlands are scattered throughout the SGR route	Wetlands underpin important ecosystem services, and can influence CH features. Restoring widespread damage will require considerable effort.	Wetlands have not been delineated or described.
Aquatic ecosystems	Various locations along full length of the Phase I and II routes	Water is a priority ecosystem service to communities as well as SGR Project.	Limited data is available on the ecological health.
Wildlife migration and corridors	Key wildlife crossings at: • Ngerengere River (131+300); • Mkata River (228+000); • Kitanage River (226+780).	Migratory elephant present a significant safety risk if crossings are not accommodated.	Limited data is available on the status of locally affected elephant populations. BAP studies provide the first confirmation these corridors exist.
Critical habitat features (refer to ***Table 4.6***)	• Pugu Hills Forest Reserve (20+100 to 24+950); • Ruvu South Forest Reserve (35+350 to 43+750);	PS6 stipulates stringent requirements that need to be demonstrated, including net gain of CH features. Capacity to achieve alignment to the standard is a key element of this BAP.	Limited data is available on most CH features, and limited subsequent processing of invertebrate specimens.

Name	Area of Relevance	Risks and Vulnerabilities	Gaps and Unknowns
	• Mkata area (215+000 to 243+265).		
Priority ecosystem services	Throughout the length of the SGR route, with an emphasis on rural areas.	Priority ecosystem services include charcoal, surface water access and fishing.	Ecosystem services assessments to focus on selected priority services.

5. RISK ASSESSMENT

5.1 Identification of Threats and Impacts

A broad range of threats can impact the biodiversity sensitivities (***Table 4.8***), a number of which are further impacted by development of the SGR. The following threats and impacts have been observed as a result of the SGR, or as cumulative impacts associated with the SGR Project. These aspects are described below and some illustrated with photographic examples.

1. Development within protected areas and key biodiversity areas,
2. Terrestrial Natural habitat loss,
3. Wetland loss and degradation,
4. Aquatic habitat loss and contamination,
5. Faunal disturbance by construction,
6. Fragmentation of wildlife movement,
7. Dust emissions,
8. Community charcoal production and use,
9. Spread of alien and invasive species,
10. Soil erosion,
11. Disruption of other ecosystem services (such as livestock grazing).

5.1.1 Development within Protected and Key Biodiversity Areas

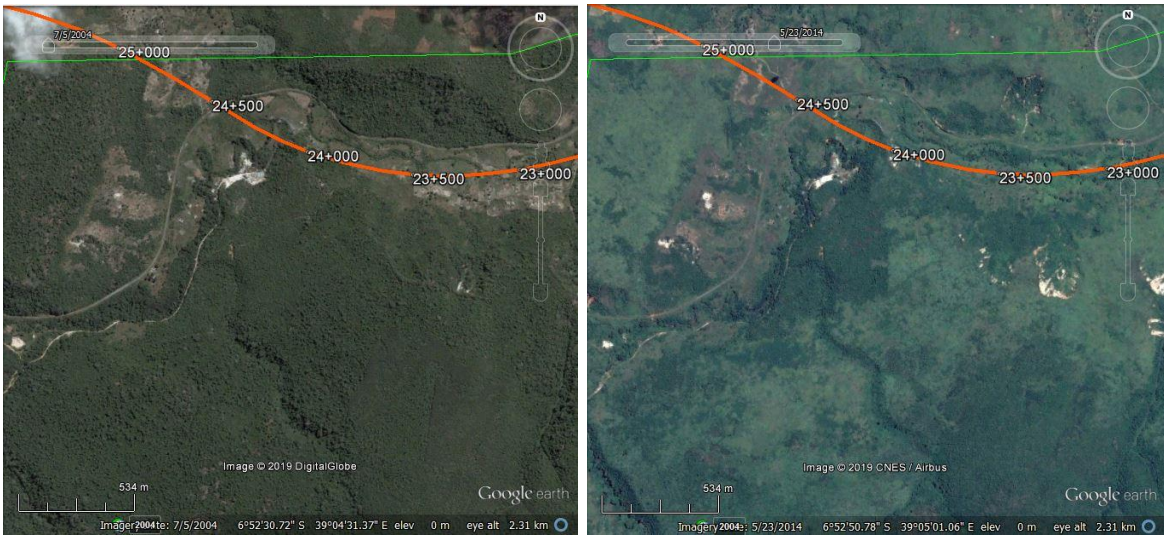
The SGR route passes through the Pugu Hills Forest Reserve, and along the northern boundary of the Ruvu South Forest Reserve. These forest reserves are recognized as critical habitat based on their status as an IBA, also because various highly threatened and congregatory species qualify as CH features. Construction activities through these areas had reached an advanced stage prior to development of this BAP. (The cover photo of this BAP illustrates the state of SGR construction along the boundary of the Ruvu South Forest Reserve.) Key construction impacts include loss of terrestrial habitat through loss of trees and creation of large surplus soil dump sites, loss, contamination and sedimentation of aquatic habitats, extensive noise and dust disturbance, soil erosion, light pollution at night, human habitation within the reserves, increased access and possible impacts to CH features. The direct footprint of the SGR represents 3.6% and 0.14% of the Pugu Hills and Ruvu South Forest Reserves respectively (***Table 5.1***). This is based on the same data described and illustrated in ***Figure 5.3***.

Table 5.1 Area of Land Take of Critical Habitat by the SGR Footprint

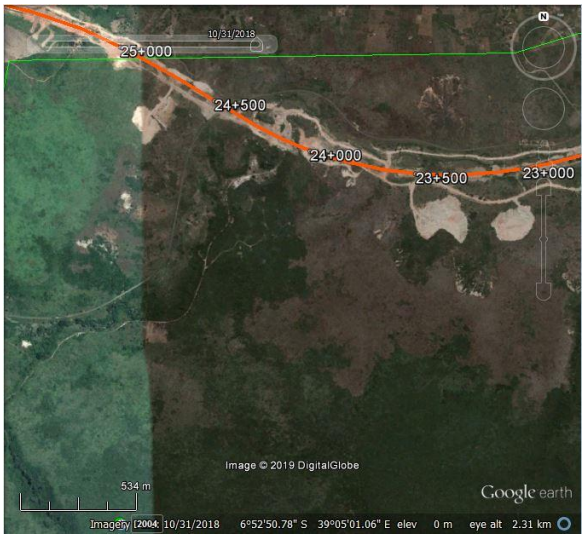
Forest Reserve	Forest Reserve Area	Direct SGR Footprint	Percentage of Reserve
Pugu Hills	2 418 ha	87.8 ha	3.63%
Ruvu South	30 154 ha	42.7 ha	0.14%

The above data reveals that approximately 4% of protected area habitat has been lost, but not all of this area represented Coastal Dry Forest, which is the unique vegetation type supporting the most important biodiversity values triggering critical habitat. ***Figure 5.1*** presents a sequence of three images for the dates July 2004, May 2014 and October 2018 showing the regression of forest cover within the north-eastern part of the Pugu Hills Forest Reserve relative to the SGR route. Images reveal that forest cover was widespread within this area in 2004, but shows a dramatic regression within the following 10 years. Limited change in forest cover has occurred during the following four years, which incorporates the period of SGR construction. Some mature forest cover has been lost as a result of construction activities between chainage locations 24+500 and 25+500, and is estimated to cover approximately 1 ha. Images reveal some loss of approximately 3.5 ha of woody vegetation at chainage location 23+500, but represents hillside scrub vegetation rather than mature forest cover. No other loss of forest habitat has occurred within or near the protected areas.

Figure 5.1 Sequence of Google Earth imagery revealing the regression of forest cover within the part of the Pugu Hills Forest Reserve where intact forest occurred adjacent to the SGR



July 2004 May 2014



October 2018

Legend Key to Google Earth Images

Green line – Northeastern boundary of the Pugu Hills Forest Reserve

Orange line – SGR route

Text – Chainage distance of SGR construction at 500 m intervals

Figure 5.2 Examples of Impacts to the Pugu Hills and Ruvu South Forest Reserves

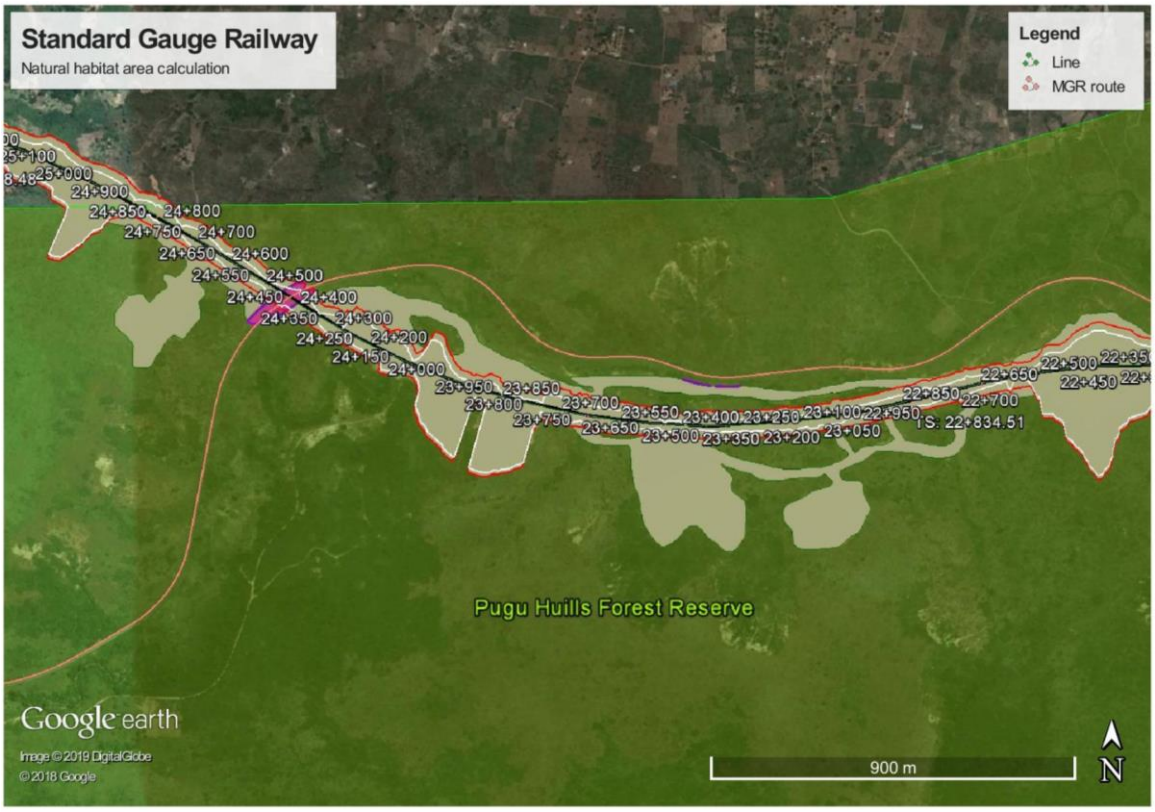
5.1.2 Terrestrial Natural Habitat Loss

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 5.3***. This is because of the additional cut and fill 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.

Calculations in ***Section 4.3.3*** 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 5.2*** 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.

Figure 5.3 Mapped Example of the Terrestrial Footprint Calculation



Red line shows expected footprint extent, pink and purple shading represents MGR modified habitat

Table 5.2 Area of Modified and Natural Habitat comprising 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 in ***Section 4.3.3*** 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.

5.1.3 Wetland Loss and Degradation

There are no Ramsar sites associated with the SGR alignment, but there are a number of small wetlands. The term 'Wetlands' is used in this document to refer to permanent water bodies, seasonal water bodies and seasonally waterlogged soils. Such areas are referred to as water sources in Tanzanian legislation. Wetland soils show characteristic signs of prolonged wetness and support a diversity of plants adapted to growing in wet conditions. Such plants are frequently referred to as wetland obligatory species.

Wetlands adjacent to the SGR serve as easy sites for dumping surplus soil due to their open terrain. Examples of wetland loss in the vicinity of Soga and Ruvu South is presented in ***Figure 5.4***, but is indicative of the situation along 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* and other grasses to control erosion. The topsoil in these wetlands have been depleted and subsoil horizons are exposed (***Figure 5.4***).

Figure 5.4 Examples of wetland habitat loss

The Tanzania Environmental Management Act of 2004 (EMA) states that the Environmental Management Council and the local government authorities responsible for environmental matters shall "*issue guidelines and prescribe measures for the protection of riverbanks, lakes and shorelines"* and the Minister may in consultation with other relevant ministries by notice published in the Gazette *"impose any restrictions as he considers necessary for the protection of the river, river bank and shorelines from environmental degradation*".

Section 57 of the EMA requires that '*No human activities of a permanent nature or which may, by their nature, likely to compromise or adversely affect conservation and, or the protection of ocean or natural lake shorelines, riverbank, water dam or reservoir, shall be conducted within 60 meters'*.

This requirement is supported by clause 34 within the Water Management Act of 2009, which states: "*Without prejudice to section 57 of the Environmental Management Act, the Minister may, by an order*

published in the Gazette, prohibit human activities to be conducted beyond sixty metres from a water dam or reservoir or a water source."

Wetlands qualify as natural habitats and the PS6 requires that no net loss of biodiversity is demonstrated through application of the mitigation hierarchy where impacts to natural habitats occur. Wetlands are essential for the maintenance of ecosystem services and are important for various CH features identified in ***Section 4.3.6***.

5.1.4 Aquatic Habitat Loss and Contamination

Impacts to aquatic habitats are largely the result of construction footprints associated with crossings of rivers and important wetlands. The Ruvu River is a large river that is flanked on either side by a large floodplain with unstable soils. The SGR needs to cross this important floodplain with impacts to hydrology and habitat fragmentation. Efforts are being taken by YM to reduce impacts to important rivers.

Figure 5.5 Example of Construction Activity at the Ruvu River

Fill material illustrated above has been removed from the site.

5.1.5 Faunal Disturbance by Construction

A rich diversity of vertebrate fauna (exceeding 800 species) potentially occurs within the area that the project is located (IBAT data). The highest faunal diversity is expected to occur in the vicinity of Morogoro due to the presence of the Uluguru Mountains, which host a rich diversity of endemic and threatened species. Birds and bats represent approximately 66% of this diversity, and are expected to be less impacted than non-flying faunal species.

Construction activities involve extensive movement of vehicles and heavy equipment along the service road adjacent to the SGR. This service road passes through extensive areas of natural habitat and through protected forest reserves where there is an abundance of lesser fauna. A number of the construction activities operate on a 24 hour cycle, and although many lesser mammal species

are nocturnally active, they remain exposed to risks of being run over by vehicles. Construction activities produce a lot of noise and dust, which displaces fauna from areas in the vicinity of the SGR. Strong lights are placed at regular intervals where construction activities continue after dark, which disrupts nocturnal fauna such as bats, terrestrial mammals, nocturnal birds, amphibians and a wide diversity of flying invertebrates.

5.1.6 Fragmentation of Wildlife Movement

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.

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.

These wildlife corridors were investigated, and evidence of regular elephant movement across the SGR route provided in the attached report 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 Kitanage River tributary (SGR location 226+762) Figure 5.7.

Figure 5.6 Elephant Footprints at Mkata and Negerengere

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 5.3 and ***Table 5.4*** present the locations and dimensions of various underpass structures included within project design in the Ngerengere and Mkata areas respectively.

Table 5.3 Proposed Underpass Crossings greater than 3 meters heights within the vicinity of the Ngerengere Circle (Lot 1), (Figure 5.7)

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 5.4 Proposed Underpass Crossings greater than 3 meters heights within the vicinity of the Mkata Circle (Lot 2) (Figure 5.8)

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

* Key elephant crossing points

The SGR will be fenced, but 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.

Figure 5.7 Overview of available crossings associated with the Ngerengere area along the SGR route

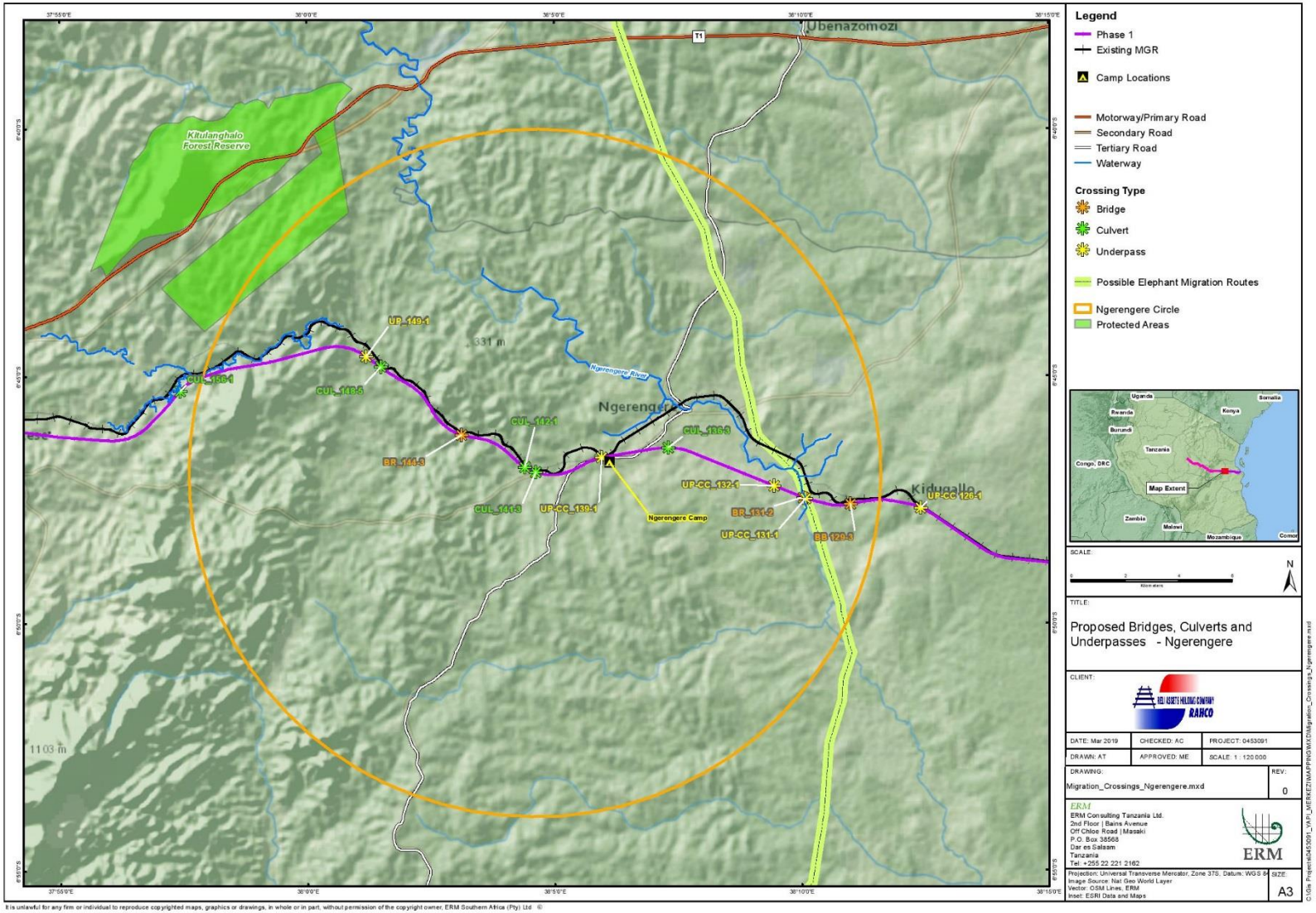
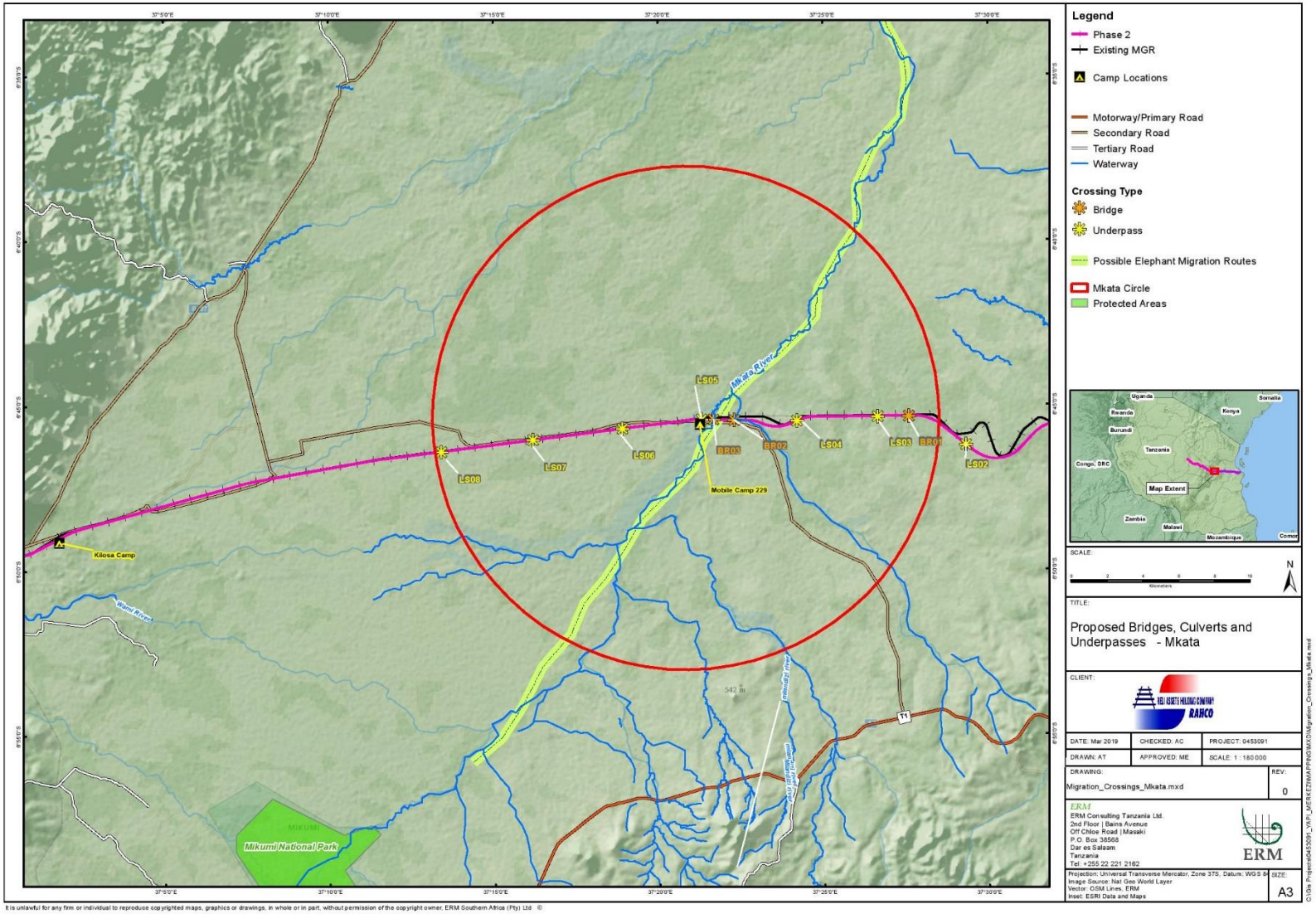


Figure 5.8 Overview of available crossings associated with the Mkata area along the SGR route



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.

Data has not been available on current poaching patterns or intensities along the SGR route. TAWIRI conduct all wildlife census in Tanzania, but have stated that the data does not exist for the project area or the Ngerengere Military area, as aerial wildlife censes are only conducted for protected areas and adjacent important wildlife areas. The Monitoring Illegal Killings of Elephants (MIKE) programme is implemented in Tanzania, but is heavily dependent on spotting elephant carcasses from the air and focuses on the areas where elephant census is done.

The lack of data, is however not considered a risk as there has been a major clampdown on elephant poaching in Tanzania in recent years, with a significant drop in elephant poaching incidents. The ease with which data on elephant movements were obtained for this study agrees with this trend. A precautionary approach is however followed with mitigation to monitor the use of underpasses by elephant, and community-based security guards will be encouraged to monitor and report any evidence poaching.

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.

5.1.7 Dust Emissions

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 (***Figure 5.9***) 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 faunal health, and ultimately leads to dramatic increase in invasive alien plant (IAP) infestations.

An extensive and costly dust suppression programme was being implemented, with a large number of water bowsers spraying water on the roads. Excess water of potable water treatment systems is used, and is also sourced from wetlands (***Figure 5.4***). This dust suppression programme does not appear to be effective in controlling dust emissions, but was having an impact on the wetlands and associated biodiversity.

Figure 5.9 Dust Deposition on Vegetation in the Ruvu South Forest Reserve

Photographs illustrated here were taken within 10 meters of the road edge, during dry conditions when dust accumulation is most prominent. Not all dust impacts are as severe as illustrated.

5.1.8 Use of Forestry Products

During field studies, extensive charcoal production by communities was observed within the Ruvu South Forest Reserve and to a lesser extent in the Pugu Hills Forest Reserve. Illegal and unsustainable charcoal production takes place widely, and there is a widespread dependence on charcoal as a source of energy for cooking, particularly in rural areas. Charcoal is not used within construction camps as cooking is done on gas, but there is a dependence on charcoal for cooking by food vendors catering for the job-seekers and other persons at the gates of the camps. YM have stated that they have implemented a complete ban on the use of charcoal within their camps.

The production of charcoal is considered an impact for the Rondo Dwarf Galago, and the impact is considered here because of its critically endangered status, its high listing on the Edge of Extinction list, and it's extremely restricted distribution. The large demand for charcoal in Dar es Salaam has a large impact.

The cumulative adverse effects of charcoal production directly or indirectly affects various CH features and 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 Pugu Striped and Pugu Forest Grasshoppers (both EN). Highly threatened species not confirmed present include the Sokoke Pipit (EN) and Tanzanian Woolly Bat (EN).
- Charcoal 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 within the Ruvu Forest Reserve. Other tree-nesting 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 protects wetlands, and therefore impacts wetland dependent CH features, which include the Ruvu Spiny Reedfrog (CR), Madagascar Pond Heron (EN) and Basra Reed Warbler (EN).
- Charcoal production are major threats to integrity of both forest reserves listed as CH features.

Addressing adverse effects of unsustainable charcoal production is therefore seen as a key step towards achieving no net loss of biodiversity and net gains for CH features, as required for alignment with the IFC Performance Standard 6 (***Section 9.1.1***).

Figure 5.10 Charcoal production by communities in Ruvu South Forest Reserve and charcoal purchased by vendors outside of the Soga Construction Camp

5.1.9 Spread of Invasive Alien Species

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 invasive alien 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 diversity of invasive alien plants has been observed along the SGR route (***Table 5.5***) and other alien species are expected to occur.

Table 5.5 Invasive Alien Plant Species occurring along the SGR route

Species Name	Common Name	Comment
Altenanthera sp.	Paperthorn	Prostrate growing weed where traffic occurs (***Figure 5.11***)
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	Lantana	Widespread invasive species, notably along drainage lines
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
Ricinus communis #	Castor oil bush	Widespread invasive species (***Figure 5.11***)
Solanum sp.	Poison apple	Widespread invasive species

# denotes highly invasive species that are expected to require specific control programmes during construction and operation.

Figure 5.11 Examples of Invasive Alien Plants along the SGR route

Castor Oil bush (*Ricinus communis*)

Paper thorn (*Alternanthera sp*.)

Any form of disturbance of the natural vegetation creates opportunity for the establishment of invasive plant species. Extensive soil disturbance occurs during the construction phase because of bush clearing, heavy machinery involved in cut and fill activities, blasting where appropriate, and construction machinery movement. Quarries, borrow pits and surplus soil dumps are required at intervals along the alignment, as are construction camps, housing workers at the peak of construction activities. Large infestations of invasive alien plants (IAPs) are developing, 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.

5.1.10 Soil Erosion

Construction of the SGR requires extensive earthworks, particularly where there is hilly topography. There is also extensive movement of heavy machinery and an abundance of vehicles. Various facets of the SGR construction lead to soil disturbances, which raises the risk of soil erosion. Dust emissions are severe (***Section 0***), which is a form of wind erosion. Small erosion gulleys were prominent in places where soils have been disturbed or placed on embankments or soil dumps.

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 might 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 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 potentially affected by soil erosion impacts.

Figure 5.12 Evidence of sediment accumulation (left) and erosion gulleys within Eragrostis teff planted on embankments (right) of the SGR

Grass Species Used for Hydro-seeding

Eragrostis teff and other grasses are being planted through hydro-seeding on a large scale to control erosion of embankments created for the SGR. Permits have been issued (April 2018) by the Tanzania Ministry of Agriculture Food Security and Cooperatives for the import of six species of grass seed hydro-seeding purposes. All of the grass species for which plant import permits have been issued are indigenous to Tanzania. The known invasive status of these grasses have been checked against the IUCN Global Invasive Species Database (GISD), and none are reported to be problematic in Africa. ***Table 5.6*** presents a brief overview of key online findings.

Table 5.6 Invasive Status of Grass Species Authorised for Hydro-seeding

Species	Common English Name	Comment
Cenchrus ciliaris	Blue buffalo grass	Good forage grass. Identified as problematic in Australia and Mexico.
Chloris gayana	Rhodes grass	Good forage grass. Not listed in the GISD, therefore not considered to be invasive.
Cynodon dactylon	Couch grass	Stoloniferous grass that is good for erosion control and palatable forage. Has a global distribution. Identified as a potential problem plant in Australia.
Eragrostis curvula	Weeping love grass	Abundant seed producer, and very competitive grass that competes strongly with other pasture species. Has been identified as problem species in Australia
Eragrostis tef	Tef	Widely cultivated as a staple food crop in Ethiopia Useful forage for some livestock Not listed in the GISD, therefore not considered to be invasive.
Panicum maximum	Guinea grass	Good forage grass Not listed in the GISD, therefore not considered to be invasive.

GISD – IUCN Global Invasive Species Database

5.1.11 Human Presence

People congregate at the gates of construction camps hoping to get contractual work, although YM policy is to not make random hires and all hiring is through district offices. Nevertheless, some job-seekers may not be fully aware of the policy or come to get jobs information. Catering for these groups is a cause for charcoal consumption.

Tanzanian legislation does not allow settlement within forest reserves, however, there are some old buildings associated with an abandoned kaolin mine in the Pugu Forest Reserve (***Figure 5.13***), which are occupied by caretakers. The nearby area supports healthy forest and night surveys for the critical habitat baseline revealed an exceptional abundance of rodents. These rodents attracted a number of Wood Owls (*Strix woodfordii*) that also prey on the Rondo Dwarf Galago. Vervet Monkeys were also attracted to these settlements, which will also prey on the Galagos. Domestic and feral dogs and cats add to the predator burden. There is concern that the increased abundance of predators increases the predation risk to the critically endangered Rondo Dwarf Galago. This Galago ranks amongst the world's most threatened primates (***Section 4.3.6***), and any risk is a concern for this species.

Figure 5.13 Old mine housing within forested habitat of the Pugu Hills Forest Reserve

Approximate Location: 24+100

5.1.12 Disruption of Ecosystem Services

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:

- Water provision from wetlands and rivers for potable use, agriculture and livestock watering;
- Fishing and hunting; and

- Use of forest products, including the production of charcoal.

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.

Apart from stream and river crossings, the SGR does also pass adjacent to and through wetlands. Specific impacts to wetlands are addressed in ***Section 5.1.3***.

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 dependent food chains. Issues relating to aquatic ecology are addressed in ***Section 5.1.4***.

Bushmeat hunting was investigated but does not appear to be a priority ecosystem service. Communities 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.

Subsistence fishing from river systems was observed, and a number of rivers support harvestable fish populations. Fish species known to occur at river crossed by the SGR include *Clarias gariepinus, Bagrus orientalis, Oreochromis niloticus, Citharinus latus, Synodontis punctulatus* and *Schilbe moebiusii*.

Fishing was observed as being an important livelihoods activity, for both subsistence and as a source of income.

Figure 5.14 Subsistence Fish Catch along the Ngerengere River

5.1.13 Impacts to Critical Habitat Features

Rondo Dwarf Galago (Galagoides rondoensis)

This critically endangered Galago is dependent on coastal dry forest where it feeds on fruit and insects. These forests are being impacted in the following ways because of the SGR Project:

- Charcoal production takes place, which is encouraged by induced charcoal consumption associated with the nearby Soga Camp and construction sites. TFCG have observed that sustainable charcoal production is not possible in coastal forests, as the forest does not regenerate to its original species composition. Charcoal production is therefore considered a critically high impact for the Rondo Dwarf Galago considering its critically endangered status and it is extremely restricted distribution.
- Dust accumulations on vegetation south of the SGR service road extend into the forest habitat occupied by these Galagos (***Section 0***).

The Rondo Dwarf Galago population within the Pugu forests has not been fragmented by construction of the SGR, as there is no suitable forest habitat on the north side of the route. Development of infrastructure to facilitate their crossing of the SGR is also considered technically unfeasible as Galagos are highly vulnerable to owl predation, and will avoid using exposed features such as a monkey bridge concept as advocated for fragmentation effects in forest habitats. Galagos are small and also highly vulnerable to a multitude of predators on the ground so would not use terrestrial crossings, and do not go underground, so would not use any underpass structures.

Large Cave-dwelling Bat Congregations

Two old mine shafts provide roosts to large congregations of insectivorous bats comprising mostly *Triaenops afer* (Trident bat), *Mops* (free-tailed bats) and *Rhinolophus* (Horseshoe bats) species. These species are not threatened but their large numbers are considered a likely CH feature based on criterion 3 for critical habitats within the Performance Standard 6 (paragraph 16). A critical habitat assessment presents an analysis of these criteria in the ESIA. Online documents state there were three important cave roosts. There is also an old railway tunnel that was constructed during colonial times but is no longer used by the MGR. Caretakers at the old mine houses stated that this tunnel formerly 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 (***Figure 5.15***). This tunnel will be destroyed by construction of a new tunnel for the SGR. The tunnel has a different internal structure and a very large opening compared to the two old mine shafts, and the tunnel may have formerly supported a different bat community structure compared to the mine shafts, for example Hildegarde's Tomb Bat (*Taphozous hildegardeae* - VU) in addition to the cave-dwelling species.

Bats will be impacted in the following ways:

- The permanent loss of a roost site. New tunnels will not provide suitable cave-dwelling bat 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 deforestation.

Bridges and culverts 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 crevices. This tomb bat is not a component of the cave-dwelling bat community described above. The Endangered Tanzania Woolly Bat (*Kerivoula africana*) is a forest bat that roosts in trees and also will not be impacted in the same way as the cave-dwelling bats.

Figure 5.15 Old German Colonial Tunnel that needs to be destroyed (left) and an Old Mine Shaft (right) that was likely used by large numbers of Bats

Location: 24+100

5.2 Biodiversity Risk Assessment

Biodiversity receptors are classified into eight groups in ***Table 4.8***. These receptors are impacted by 12 different types of threats described in ***Section 5.1***, which include existing background threats and impacts caused by the SGR Project. ***Table 5.7*** presents an overview of the threats affecting each group of biodiversity receptors and provides a high-level analysis of the pre-mitigated impact to those receptors.

Table 5.7 Summary of Key Biodiversity Receptors and Sensitivities

Key Biodiversity Receptors	**Threats Impacting the Receptor (*in approximate order of threat significance*)**	
Protected areas	• **Terrestrial natural habitat loss,** • **Wetland loss and degradation,** • **Charcoal production,** • Dust emissions, • Aquatic habitat loss and contamination.	• Faunal disturbance by construction, • Spread of invasive alien species, • Soil erosion, • Disruption of ecosystem services.
Natural habitats and fauna	• **Charcoal production,** • **Terrestrial natural habitat loss,** • Faunal disturbance by construction, • Fragmentation of wildlife movement,	• Dust emissions, • Spread of invasive alien species, • Soil erosion, • Disruption of ecosystem services.
Wetlands	• **Wetland loss and degradation,** • **Soil erosion,** • **Dust emissions,**	• Faunal disturbance by construction, • Spread of invasive alien species, • Disruption of ecosystem services.
Aquatic ecosystems	• **Aquatic habitat loss and contamination,** • **Soil erosion,** • Spread of invasive alien species,	• Dust emissions, • Disruption of ecosystem services.
Wildlife migration and corridors	• **Fragmentation of wildlife movement,** • Faunal disturbance by construction,	• Spread of alien and invasive species.
Priority ecosystem services	• **Charcoal production,** • **Wetland loss and degradation,** • Aquatic habitat loss and contamination, • Terrestrial natural habitat loss,	• Dust emissions, • Spread of invasive alien species, • Soil erosion, • Disruption of ecosystem services.

Key Biodiversity Receptors	Threats Impacting the Receptor (*in approximate order of threat significance*)	
Critical Habitat Features		
Forest Features: • Rondo Dwarf Galago, • Spotted Ground Thrush, • Pugu Striped and Pugu Forest Grasshoppers.	• **Development within protected areas,** • **Dust emissions,**	• **Terrestrial natural habitat loss,** • Faunal disturbance by construction,
Savannah Features: • African Wild Dog	• **Fragmentation of wildlife movement,** • Faunal disturbance by construction,	• Charcoal production.
Cave-dependent Features: • Large cave-dwelling bat congregations	• **Loss of roost habitat,** • Development within protected areas, • Terrestrial natural habitat loss,	• Faunal disturbance by construction, • Charcoal production, • Dust emissions.
Wetland Features: • Ruvu Spiny Reedfrog • Madagascar Pond Heron and Basra Reed Warbler	• **Wetland loss and degradation,** • **Charcoal production,** • Development within protected areas,	• Faunal disturbance by construction, • Dust emissions, • Spread of alien and invasive species.
Near-critical Habitat Features: • White-backed Vulture • Martial Eagle	• **Terrestrial natural habitat loss,** • Faunal disturbance by construction,	• Charcoal production, • Dust emissions.

6. STAKEHOLDER CONSULTATION AND COMMUNITY ENGAGEMENT

A broad range of stakeholders have been engaged through the development of this BAP. Stakeholders have included forestry authorities, established conservation NGOs, affected communities and YM staff. Interviews were undertaken with the communities with the use of questionnaires to evaluate their use of ecosystem services. A brief summary of important engagements is presented in ***Table 6.1***.

Table 6.1 Summary of Stakeholder Engagements specifically for development of this BAP

Stakeholder	Location & Date	Topics discussed	Objectives / Achievements
TFSA	Dar es Salaam January 2019	The SGR project was introduced to TFSA, with emphasis on the route through the Pugu Hills and Ruvu South Forest Reserves. PS6 requirements for protected areas (***Section 7.1.4***) were presented	TFSA provided recent management plans for both forest reserves. Field studies were conducted to guide the critical habitat assessment.
TAWIRI	Arusha / On site February 2019	Introduction of the SGR Project Existence of wildlife Corridors	Literature was sourced A collaboration was established to conduct a field screening assessment to confirm existence of wildlife corridors.
TFCG	Dar es Salaam, Kenya March 2019	Participatory Forest Management Sustainable Charcoal Initiatives Threatened species studies Minutes are available	Sourcing literature Identifying mitigation strategies
WWF	Dar es Salaam March 2019	Participatory Forest Management (PFM) Sustainable Charcoal Initiatives Threatened species studies. Minutes are available	Large amount of literature was provided to ERM on wildlife corridors, PFM and biodiversity of the affected forest reserves.
Communities in Ngerengere	Mikobola, Nguzombili, Sinyaulime, Kinonko, and Gwata villages	Presence of wildlife and existence of wildlife corridors across the SGR was discussed. Results are presented in the Wildlife Corridor Screening Report	The existence of local wildlife corridors was confirmed.
Communities in Mkata	Mbwade village, Mkata station, Parakuyo Ward Office, and Kimambila villages	Presence of wildlife and existence of wildlife corridors across the SGR was discussed. Results are presented in the Wildlife Corridor Screening Report	The existence of local wildlife corridors was confirmed.
YM HES staff	Ilala, Soga, Ngerengere, Mkata and Kilosa camps	Wide range of topics were discussed. Site visits were conducted with selected staff to see and discuss impacts relating to charcoal, dust and wetlands.	A general understanding of project activities was relayed.

Key engagement that has not been done is with the IUCN Primate Specialist Group regarding conservation of the Rondo Dwarf Galago. Recommendations are presented in ***Section 11.2.1*** to engage with this group.

7. MITIGATION REQUIREMENTS FOR ALIGNMENT TO INTERNATIONAL STANDARDS

This BAP is developed to align with requirements of the PS6, which requires habitats to be classified as modified, natural and critical, and uses this classification as a basis for establishing sensitivity of ecological features, including protected areas. Mitigation targets are specified based on these sensitivities. Extracts from the PS6 provided in boxes below explain the requirements for modified habitats, natural habitats, critical habitats and protected areas. These are followed by an analysis of how these requirements are applied to the SGR Project.

7.1.1 PS6 Requirements for Modified Habitats

Box 1 Requirements of the IFC Performance Standard 6 for Modified Habitats

Paragraph 12: The PS6 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. The client should minimize impacts on such biodiversity and implement mitigation measures as appropriate.

Analysis of Modified Habitat Requirements

Minimal requirements are stipulated by the PS6 for modified habitats, but requires that mitigation is applied to address impacts to biodiversity that does occur. A Project example of biodiversity within modified habitats is the large bat congregations within the kaolin mine shafts, although these populations are recognised as a CH feature and critical habitat requirements apply.

7.1.2 PS6 Requirements for Natural Habitats

Box 2 Requirements of the IFC Performance Standard 6 for Natural Habitats

Paragraph 14: The client will not significantly convert or degrade natural habitats, unless all of the following are demonstrated:

- No other viable alternatives within the region exist for development of the project on modified habitat;
- Consultation has established the views of stakeholders, including affected communities, with respect to the extent of conversion and degradation; and
- Any conversion or degradation of natural habitat needs to be mitigated according to the mitigation hierarchy.

Paragraph 15: In areas of natural habitat, mitigation measures will be designed to achieve no net loss of biodiversity where feasible. Appropriate actions to achieve no net loss of biodiversity include:

- Avoiding impacts on biodiversity through the identification and protection of set-asides;
- Implementing measures to minimize habitat fragmentation, such as biological corridors;
- Restoring habitats during operations and/or after operations; and
- Implementing biodiversity offsets.

No net loss is defined by the PS6 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 (e.g., local, landscape-level, national, regional).

Analysis of Natural Habitat Requirements

The ESIA, of which this BAP is a part, presents an analysis of alternatives to the SGR in Section 2.3, and concludes that development of the SGR is the best available option. Regarding alternative routing options, the SGR alignment follows the old MGR route, which long ago was found to be the most feasible route, and alternative options may therefore be limited. The MGR route is associated with modified habitat, and following this route is considered the best option to minimise the loss of natural habitat by the SGR. Some diversions are however necessary to avoid sharp bends and accommodate a high-speed rail. The current advanced stage of construction of the SGR has made an analysis of alternative options for localised footprints not possible for much of the route. Some alternative locations may have been possible for construction camps, quarries, placement of soil dumps and laydown areas, however these locations were established when field studies for this BAP were implemented.

Extensive consultation has taken place with stakeholders, including affected communities, with emphasis on wildlife corridors and ecosystem services (***Section 6***).

Sections 8, 9 and ***10*** present a mitigation strategy that follows the mitigation hierarchy, with emphasis on avoidance of impacts and rehabilitation requirements. Some examples of avoidance measures of this BAP include halting future degradation of wetlands, defining and respect buffers around wetlands and aquatic habitats, and declare forest reserves as no go areas.

Section 12 provides an analysis of the capacity provided by the mitigation strategy to achieve No Net Loss of Biodiversity. Offsetting is considered as a last resort and is not a preferred outcome as offsets are risky and seldom achieve their desired outcomes in practice. A rigorous application of minimisation and restoration measures is thus a preferred approach. Some practical recommendations for additional conservation actions are provided to increase the potential achievement of No Net Loss of Biodiversity at a landscape scale.

Paragraph 15 of the PS6 does state that “mitigation measures will be designed to achieve no net loss of biodiversity *where feasible*”. Updated guidance notes (2019) to the PS6 provide a detailed explanation of how to demonstrate no net loss. It makes the following statement with regard to the “where feasible” text:

> “*…the client should design and implement mitigation measures to achieve no net loss of biodiversity, where feasible, through the application of various on-site and offset mitigation measures. The client should consider the term where feasible as per footnote 3 of Performance Standard 3, and where it is not considered feasible, the client will document the technical, financial or other reasons why achieving no net loss is not feasible*.”

Footnote 3 of Performance Standard 3 states the following:

> “*Technical feasibility is based on whether the proposed measures and actions can be implemented with commercially available skills, equipment, and materials, taking into consideration prevailing local factors such as climate, geography, infrastructure, security, governance, capacity and operational reliability. Financial feasibility is based on commercial considerations, including relative magnitude of the incremental cost of adopting such measures and actions compared to the project’s investment, operating, and maintenance costs*.”

Section 12 of this BAP provides an analysis of the capacity to achieve No Net Loss of Biodiversity., and it is technically feasible.

7.1.3 PS6 Requirements for Critical Habitats

Box 3 Requirements of the IFC Performance Standard 6 for Critical Habitats

Paragraph 17: In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:

- No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;
- The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;
- The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time; and
- A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.

Paragraph 18: In such cases where a client is able to meet the requirements defined in paragraph 17, the project's mitigation strategy will be described in a Biodiversity Action Plan and will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.

Net gains are additional conservation outcomes that can be achieved for the biodiversity values for which the critical habitat was designated. Net gains may be achieved through the development of a biodiversity offset and/or, in instances where the client could meet the requirements of paragraph 17 of this Performance Standard without a biodiversity offset, the client should achieve net gains through the implementation of programs that could be implemented *in situ* (on-the-ground) to enhance habitat, and protect and conserve biodiversity.

Analysis of Critical Habitat Requirements

There has been no analysis of alternative options to avoid critical habitats for the same reasons explained in ***Section 7.1.2*** for natural habitats, notably the advanced stage of construction. Diversion around the Pugu Hills Forest Reserve would have been recommended had that option been available.

This BAP investigates impacts to the specific biodiversity values for which the critical habitat was designated (referred to in this document as CH Features), and considers the ecological processes supporting those biodiversity values. Mitigation measures are presented to minimise the likelihood that a net reduction in the population of any critically endangered or endangered species will occur because of the SGR Project.

Flagship species/features within each important habitat have been identified as key CH features (***Table 4.6***) 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. This 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 provisionally included as a Key CH feature, however this is a wide-ranging and unpredictable species, which makes demonstration of net gains not practical.

Demonstrating net gains for some species will be challenging, for example the forest-dependent migratory birds (Sokoke Pipit and Spotted Ground-thrush), as these are extremely elusive species with minimal background data available. The migratory behaviour of these birds involves hopping from one forest patch to another, and are expected to be present only for short intervals during their annual migration. The success rate of surveys to assess their presence is therefore likely to be low regardless of the effectiveness of mitigation to protect their habitat. These species share the same habitat as the Rondo Dwarf Galago, whose presence is relatively easy to detect. This Galago therefore represents a more practical species against which to demonstrate net gains, and any gains achieved for this species is expected to represent gains for other forest dependent species.

This BAP is robustly developed to align with the PS6 and presents a Biodiversity Monitoring and Evaluation Program (BMEP) in ***Section 11*** to be implemented over the long term.

Section 12 presents an analysis of the capacity provided by the mitigation strategy to achieve net gains for key CH features. It is however necessary to acknowledge that the achievement of net gains for critically endangered biodiversity features that were in a state of decline prior to establishment of the project can be challenging to achieve.

7.1.4 PS6 Requirements for Protected Areas

Box 4 Requirements of the IFC Performance Standard 6 for Protected Areas

Paragraph 20: In circumstances where a proposed project is located within a legally protected area or an internationally recognized area, the client will meet the requirements of the Performance Standard as applicable for modified, natural and critical habitat. In addition, the client will:

- Demonstrate that the proposed development in such areas is legally permitted;
- Act in a manner consistent with any government recognized management plans for such areas;
- Consult protected area sponsors and managers, Affected Communities, Indigenous Peoples and other stakeholders on the proposed project, as appropriate; and
- Implement additional programs, as appropriate, to promote and enhance the conservation aims and effective management of the area.

Analysis of Protected Area Requirements

The Tanzania Forestry Service Agency (TFSA) are responsible for management of the Pugu Hills and Ruvu South Forest Reserves. TFSA is a Government department that falls under the Ministry of Natural Resources and Tourism (MNRT). Development of the SGR is approved by the Tanzanian Government and TRC have officially engaged with the TFSA.

Official management plans were obtained from TFSA for the Pugu Hills and Ruvu South Forest Reserves, both dated July 2018. These plans were developed in advance of the SGR Project, and no plans were previously in existence. These management plans mention the SGR Project, but make no specific provisions for the Project. A zonation system is discussed, but there is no delineation or map of conservation zones, and it not possible to assess whether the SGR Project acts in a manner that is consistent with these plans.

TFSA have been consulted as discussed above. There are no indigenous people in the area according to the definition provided in the IFC Performance Standard 7. Sponsors engaged include the Tanzania Forest Conservation Group (TFCG) and the Tanzania office of the World Wide Fund for Nature (WWF) as outlined in ***Section 6***.

Sections 8, 9 and ***10*** present a mitigation strategy that addresses impacts to the protected areas and includes measures that extend beyond the immediate direct impact of the SGR Project, and aim to enhance the conservation aims and effective management of the forest reserves.

7.1.5 PS6 Requirements for Ecosystem Services

To ensure that any further information surrounding ecosystems is adequately captured for all Project Affected People (PAPs), all further consultation planned (e.g. for Indigenous People and as part of the Livelihood Impact Assessment (LIA)), will include further exploratory questions relating to use of ecosystems services. This information will then be fed into updated Resettlement Action Plans (RAPs), which will specify appropriate mitigation, including targeted livelihood restoration strategies where applicable.

8. BIODIVERSITY MITIGATION PLAN

Approximately 50 mitigation measures are presented here, classified into 17 groups and structured according to the mitigation hierarchy. There has been limited capacity to apply avoidance measures as construction activities have already advanced within Lot 1, however many of these measures can be applied to Lot 2.

Mitigation measures are presented here with additional details to guide implementation, but also presented in a summarised tabular format in Appendix A, separated into design, construction and operational phases.

8.1.1 Avoidance Measures

1. Limit the Extent of the SGR Footprint

- The clearance of natural vegetation will be limited to the strip of land needed for the occupation of the permanent way and the right of way of the future railway corridor and the adjacent working width, if needed;
- For the construction of railway station building, platforms, access roads, warehouses, parking places and utility service areas, clearance of vegetation will the limited to the surface occupied by these infrastructures;
- Avoiding locating of access roads, construction camps and materials processing plants within areas, which have significant vegetation or trees cover,
- Avoiding disposal of spoil/excess excavation materials on down-slope or in adjacent areas where it will affect vegetation/trees,
- Avoiding locating/selecting quarries and borrow pits at areas which have significant vegetation or trees cover, and.
- Haulage roads to get access to working areas and will be constructed with a width of 3.5 meters only where strictly necessary along with the necessary spots for passing and manoeuvering. As far as possible, the path of the haulage route shall avoid areas of highly sensitive vegetation;
- In forested areas, and especially those where the value of vegetation is high or very high each tree lying in the border of the construction site will be protected by covering its trunk with wood planks held in place with wires or similar which do not impinge on the trunk;
- Camps and garages should not be located in the dense forest areas.
- Contractor will be keen on environmental protection matters and prohibit unnecessary felling of trees

2. Declare Forest Reserves as No Go Areas for Workers during the Construction Phase

Settlement is prohibited within Tanzanian Forest Reserves, and access is controlled by TFSA. Access into these reserves beyond the immediate construction footprint of the project must be prohibited.

- Declare the Pugu Hills and Ruvu South Forest Reserves as No Go Areas for workers during the construction phase.

3. Ban the Use of Illegal Charcoal but Promote Sustainable Charcoal Production

- A ban on the purchase and use of charcoal must be implemented for Ilala Camp, Soga Camp and at satellite camps associated with long-term construction sites. There is no sustainable production of charcoal in these areas, and a complete ban must be implemented.

- Involve TRC and TFSA to implement a ban on the induced use of charcoal outside the perimeter of construction camps
- 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.
- Develop a policy that builds the staff skills and enables methods for recognizing legally sourced sustainable charcoal for Ngerengere, Mkata, Kilosa and Inhume Camps.
- Maintain a ban on charcoal use until a policy for sourcing legally sourced sustainable charcoal is developed and available for implementation.
- TRC are to implement a ban on the transport of unlicensed (unsustainably produced) charcoal on their trains during the operational phase of the SGR and other rail networks.

4. Respect Buffer Zones around Rivers, Streams, Water Bodies and Seasonal Wetlands

- The severe loss of wetlands based on soil dumping and degradation based on top soil removal for planting grass along the SGR needs to be arrested immediately.
- Adhere to the Tanzanian Environmental Management Act of 2004, which requires avoidance of that a 60-meter buffer designated from the high water mark around all rivers, streams, wetlands and water bodies.
- 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.

5. Erect Elephant-proof Fencing of the SGR in the Ngerengere and Mkata Areas

Fencing of the SGR in the vicinity of Ngerengere and Mkata will need to be elephant proof and require constant maintenance to safeguard both humans and elephants.

Lessons learnt by the Kenya Wildlife Service with fencing the SGR in Kenya include:

- Fences need to electrified to be elephant proof.
- Fences need to be built on wooden poles, as metal and reinforced concrete posts disseminate the electrical current into the earth and sufficient voltage cannot be maintained for elephant proof fencing.
- Fences need to be erected with numerous high tensile steel wires as elephants quickly learn to push down mesh wire fences.
- Fencing is only as effective as the maintenance thereof, and 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.
- Fences need to be monitored on a regular basis to test their effectiveness as a barrier to fauna, with designs modified based on the results achieved.
- The David Sheldrick Wildlife Trust have experimented extensively with different designs to develop effective elephant proof fencing for East African conditions.

8.1.2 Minimisation Measures

6. Maintain Permeability of Underpasses for Wildlife Movement

Key elephant crossing points have been identified at the Ngerengere River (SGR location 131+272), Mkata River (SGR location 227+915) and adjacent Kitanage River tributary (SGR location 226+762). Bridges are proposed within the SGR design that will provide adequate passage for the majority of elephants passing across the SGR. Additional underpass structures will also enable elephant and other wildlife to cross the SGR.

- 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.
- Wildlife authorities (TANAPA and TAWA) are to be encouraged to monitor these underpass structures and surrounding areas for evidence of illegal hunting of wildlife.
- Community-based security guards will be encouraged to monitor and report any evidence poaching.
- The contractor shall install warning signs and speed control signs at all animal crossing corridors as identified by the design engineer and in consultation with local community.

7. Minimise Loss of Fauna during Vegetation Clearing

Where vegetation clearing is required, thorough pre-clearing checks for all forms of fauna need to be conducted. A proactive approach is required to prevent the loss of fauna without obstructing construction activities. The following procedures should be applied (but not limited to):

- Areas of natural vegetation designated to be cleared should be checked by a competent faunal ecologist weeks in advance of clearing, and all fauna is be noted. Emphasis should be placed on breeding sites such as underground burrows and nests in trees (nests in branches and woodpecker-type holes in trees) and micro-habitats such as beneath rocks, fallen logs and loose bark.
- Underground burrows located within the construction path and a 50 m buffer thereof are to be monitored to determine if these are in use, the wildlife species involved and an estimate of the number of individuals. (Burrows may appear unused, but may be used by lesser species such as bats, birds or reptiles and would still need to be investigated.)
- Appropriate veterinary services would need to be involved in the translocation or forced movement of any medium-sized or large mammals, examples being animals having fallen into holes, become trapped or entangled by fences, crept inside vehicles or trapped within Construction Camps.
- Competent ecologists should be on site the day prior to vegetation clearing and during clearing operations to safely translocate any animals encountered that are not able to evacuate the site on their own accord. Examples of such animals might include young birds in nests, tortoises, chameleons, frogs, some snakes, invertebrates, fossorial species and any injured animals.

8. Prevent Contamination through Good Chemical Handling

- Implement measures to ensure safe handling of chemicals and fuels, in accordance with the Hazardous Material Management Procedure, with consideration of the following aspects:
  - Regular vehicle and machinery maintenance,
  - Correct storage and adherence to the manufacturer's Material Safety Data Sheets (MSDS) requirements,
  - Controlled access to and accountability in the use,
  - Staff training, induction and awareness programmes,

  - Regular auditing to control and account for the use of liquid fuels, oils and chemicals and minimise unintended loss and wastage.

- 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.
- A Method Statement should be developed and implemented that recognises the different forms of waste and guides their disposal in a manner that is not harmful to the local environment.
- 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.
- Waste management measures and facilities that avoid creating opportunities for food scavengers (such as baboon-proof dustbins) will be developed and implemented.

9. 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.

10. Develop and Implement Biodiversity Protection Policies

- Strictly prohibit unnecessary destruction of habitats, cutting of trees or vegetation found outside the area absolutely needed for the project.
- Prohibit hunting, trapping and intentional killing of wild animals by the project workers and drivers.
- Faunal protection policies should be developed and enforced that prohibit all forms of hunting, any killing of animals, purchase of bush meat and keeping of pets.

11. Implement Biodiversity Awareness Programmes for Contractors and Communities

- Induction programmes need to be developed for staff and contractors to raise the awareness of the diversity of animals present, risks associated with large wildlife and how to react when confronted by different species of large wildlife, and requirements to actively prevent the loss of any animals including snakes and species commonly considered to be vermin.
- Increase the awareness of drivers and equipment operators towards wildlife conservation and encourage them to avoid or minimise animal fatalities.
- The impacts due to poaching and intruders can be minimized through awareness creation among the employees and to the community of the area, setting regulations and employment obligations that prohibit poaching, illegal timber cutting and setting fire to the forest.
- Biodiversity awareness creating measures have to be taken both for the construction workers as well as to the surrounding community.
- Training needs to be delivered to constructions workers prior to the start and during construction works to increase their awareness and responsibilities concerning the surrounding natural values.

12. Enforce Vehicle Speed Limits to Protect Fauna

- Where free-ranging wildlife occurs, vehicle speeds are to be reduced through implementation of speed control measures and the regular enforcement.
- Post appropriate signs and apply speed limits for the sections passing through important wildlife areas by setting speed limits to safe levels, monitoring and enforcing it.
- Apply good site practices incorporating appropriate mitigation measures that reduce nuisance noise levels.

13. Reduce Light Contamination at Night

- Lighting for construction and security purposes should be inward and downward facing to minimise light pollution in remote areas, and to minimize the disturbance to nocturnal wildlife, birds and invertebrates.
- Reduce light contamination into natural habitats at night.

14. Implement Controlled Access along the SGR Service Road during Operations

- Use of the SGR Service Road will only be used by TRC for maintenance and operational purposes during the operation phase as included in the ESMP. This will reduce dust emissions and prevent opening up access to northern parts of the Pugu Hills and Ruvu South Forest Reserves.

8.1.3 Rehabilitation and Restoration Measures

15. Rehabilitate Disturbed Terrestrial Sites Promptly

- All areas that have been cleared of vegetation and/or where the soil surface has been disturbed need rehabilitation of the vegetation to minimise the establishment of IAPs, with consideration of the following aspects:
  - Revegetation of disturbed sites will be implemented within the same growing season, or within the upcoming growing season for disturbances occurring during the dry season.
  - Only non-invasive species are to be used for rehabilitation. Various grass species are being planted on embankments of the SGR. These grasses represent indigenous species, and are not listed as invasive in Africa by the IUCN Global Invasive Species Database (***Section 14***).
  - *Eragrostis teff* serves as an initial pioneer species, and a wide spectrum of weeds will appear in the first few years but the species diversity will stabilise gradually. The natural but gradual succession process from planted species to an increasingly natural diversity must be allowed to take place, with alien plant control measures within rehabilitation sites applied to only a pre-determined list of invasive species.

16. Restore Destroyed and Degraded Wetlands

Wetlands that have been destroyed during the construction phase need to be restored as close as possible to their original state, through addressing the following aspects:

- All wetlands along the entire SGR route need to be delineated and characterised to determine the extent of wetlands and the nature of impact to each wetland. Delineation should extend to 70 meters from the SGR centre line, but extended where the SGR footprint is wider than 70 meters. Delineation procedures are presented in ***Section 11.1.6***.
- Forensic delineations will need to be applied where wetlands have been smothered by soil dumps and are no longer easily traceable on the ground. A forensic delineation requires special skills, and is applied where wetland characteristics cannot be measured directly, for example deeper

sampling below large soil dumps to determine composition of the original soils prior to disturbance.

- Buffers of 60-meter width need to be applied (see ***Section 8.1.1***) to comply with requirements of the Environmental Management Act of 2004.
- Development within 60 meter buffers need to be avoided, and where non-essential developments exist, these need to be removed.
- Restoration action plans are required for each wetland based on extent of restoration, wetland type and the local hydrology, covering the following aspects:
  - The extent of soil dumps within wetland boundaries that need to be removed.
  - The extent of sediment accumulation from erosion and severe dust deposition needs to be removed through scraping the soil surface during the dry season and removing the pale-coloured accumulation. ***Section 1*** presents climate charts for each section of the SGR, which reveals a consistent dry season from June to September, but increases in duration on the western end of Phase II of the SGR construction.
  - Approaches to restoring wetlands where top soils have been removed for grass planting on SGR embankments
  - Establishment of indigenous wetland flora needs within wetlands cleared and/or where soils have been disturbed. Botanists will be required to compile species lists of locally indigenous wetland flora that can be propagated, and to determine which species are applicable to each wetland type, together with appropriate planting procedures.
- The magnitude of wetland restoration required is considerable, and professional advice is required. A over-riding wetland restoration plan is therefore required, compiled by a widely-recognised organisation with professional expertise and experience in this field.

17. Develop and Implement an Invasive Alien Species Control Plan

An alien and Invasive Species Control Plan will be developed and implemented for the SGR Project (***Section 3.3***), which should take cognisance of the following points:

- Biological control measures may 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 alien vegetative and/or seed bearing material that is removed through control measures should be burnt on site to prevent the distribution of seed and fertile vegetative material, regardless of the status of the surrounding areas.
- Vehicles and construction equipment should be washed on a regular basis and should be kept clean 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.

9. COMPENSATORY MEASURES AND ADDITIONAL CONSERVATION ACTIONS

Both the TRC Environment and Social Policy and the YM Biodiversity and Ecological Protection Procedure (BEPP) commit to addressing requirements of the PS6, specifically to implement additional programs, as appropriate, to promote and enhance the conservation aims and effective management of the area.

The BEPP describes additional programs as actions that support the protection of both the forestry resources and fauna of forest reserves, and requires engagement with relevant authorities to identify opportunities for additional programmes that can be implemented at a scale that will compensate for the impacts to these reserves.

This chapter proposes various practical compensatory measures needed to achieve net gains for key CH features relevant to the SGR Project.

9.1.1 Support Tanzania Forest Conservation Group (TFCG) to Implement Sustainable Charcoal Programmes

Charcoal has been consumed by private vendors outside of the YM construction and may influence the production of charcoal in surrounding areas. There is concern that critically endangered forest CH features may be impacted by community-based charcoal production, which has happened over a period of time.

TFCG have piloted a new village-based approach towards sustainable charcoal production based on strategic harvesting of trees according to a predetermined plan and the use of mobile kilns, and aims at empowering village communities and alleviating poverty. This programme is being piloted in Kilosa, Morogoro and Dodoma, in areas which are traversed by the SGR. TFCG (2016) state that sustainable charcoal production is possible from miombo woodland, but not possible within Coastal Dry Forests and the Eastern Arc Mountain Chain, as these forests respond differently to disturbance.

A sustainable charcoal programme needs to be rolled out more widely along the SGR route as a means to compensate for the charcoal consumption that has occurred. Approximately 200 km (40%) of the Phase I and Phase II SGR route passes through Miombo woodland, and a similar stretch passes through the Acacia-Commiphora Bushlands. Approximately 80% of the SGR route provides extensive opportunity for expanding the sustainable charcoal programme. Future phases of the SGR will pass almost exclusively through miombo woodland. Development of approaches now will facilitate the future sustainability of the SGR construction.

TFCG will need to be engaged to identify the types and extent of support will facilitate the roll out of this programme, in a manner that does not overlap other donor support to the programme.

In addition to supporting this programme, YM need to implement a policy of prohibiting the consumption of unlicensed (unsustainably produced) charcoal (refer to ***Section 8.1.1***). This BAP estimates that 20 additional villages will need to be brought into the sustainable charcoal programme to achieve an adequate level of biodiversity gain. Appendix B presents costs that have committed by YM for this activity.

TRC must maintain a ban on the transport of unlicensed charcoal on their trains during the operational phase of the SGR and other rail networks. Charcoal currently is only transported by train if there is a special permit from the Ministry of Natural Resources and Tourism.

9.1.2 Re-establish Lost Dry Coastal Forest within the Pugu Hills Forest Reserve

Rondo Dwarf Galago and various other CH features are dependent on forest habitat. These species are impacted by the SGR, and it is necessary to demonstrate net gains to align with requirements of the PS6 (***Section 7.1.3***). Development of sustainable charcoal production is not possible or appropriate in this habitat and a different approach is therefore required.

The only feasible option to achieve gains in the Coastal Dry Forest habitat is to re-establish this forest beyond the footprint of the SGR. The TFSA have extensive experience in tree planting, and the Pugu Hills Forest Management Plan (FMP) includes an action referred to as enrichment planting. The FMP advocates planting a variety of both indigenous and exotic species, with most of these species

selected for rapid growth or for their yield of hardwood timber, and are not typical components of the Coastal Dry Forests. Re-establishing forest habitats for the Rondo Dwarf Galago will require tree species typical of the coastal dry forests to be planted.

TFSA need to be supported to propagate a diversity of canopy species that are planted within the Pugu Hills Forest Reserve in areas where coastal dry forest has been lost through encroachment of fire, logging and/or past development. These areas will be identified based on soil structure capable of supporting forest, but currently depleted of forest. Google Earth historical imagery reveals a large decline in forest cover in and around the Pugu Hills Forest Reserve (***Figure 5.1***). This BAP estimates that similar forest habitat needs to be established covering an area equivalent to 15% of the current forest cover within the the Pugu Hills Forest Reserve north of the Kisarawe Road, pending the availability of suitable soils able to support forest cover.

Table 5.1 reveals that approximately 4% of the forest reserve is lost to the SGR footprint, but dust and other impacts do extend beyond this area, although their extent has not been determined. An area of 15% of the current forest cover in the northern Pugu Hills Forest Reserve represents an area of approximately 76 ha. This area represents approximately 50% of the protected area lost or disturbed by the SGR footprint but exceeds the loss of forest and woody vegetation cover by a factor of 16 (***Section 5.1.1***). Selection of the extent of reforestation area follows a precautionary approach primarily due to the observation by TFCG that Coastal Dry Forest does not naturally to its original state. Many of the important species may be difficult to propagate and/or transplant, and the success rate of establishing this forest type is uncertain.

A Pugu Forest Restoration Plan needs to be developed, this BAP advocates that TFCG be given the mandate to develop this plan. The Forest Restoration Plan should include (but not be limited to) the following steps:

- Map the soil potential, terrain and existing forest cover within the Pugu Hills Forest Reserve as a first step to identify suitable forest establishment areas
- Propagation experiments need to be conducted on a diversity of tree species using seed and other fertile material collected within the Pugu Hills Forest Reserve. Horticultural advice, such as from the University of Dar es Salaam (UDSM) Dept. of Botany or similar institution may be invaluable to advance this stage.
- Numbers of trees and the approximate mix of species needs to be determined, based on field surveys of the existing forest, and sufficient to expand the forest habitat by approximately 15% (76 ha, pending availability of suitable soil potential).
- An indigenous tree propagation nursery needs to be established under the supervision of TFSA. A tree nursery exists at the TFSA offices in Kisarawe.
- Develop a planting schedule that describes planting seasons, methods, equipment, personnel and safety procedures.
- Follow-up invasive alien plant control.
- Budget to implement the forest restoration programme.

Evidence of colonisation of established forest will be needed to accept that this measure achieves net gain for the little Rondo Dwarf Galago and other forest dependent species. These measures are discussed in ***Section 11.1*** and will need to be supported by additional studies described in ***Section 11.2***. Important additional studies will be botanical assessments of the Pugu Forests and ecological studies of the Rondo Dwarf Galago.

9.1.3 Create One or Two Bat Roost Caves to Replace the Lost Tunnel

An important bat roost is being lost by construction of the SGR through an old tunnel (***Section 5.1.13***). Large congregations of bats present in the Pugu Hills Forest Reserve are identified as a CH feature, and net gains need to be demonstrated for alignment to the PS6. Creation of one or two mine shaft-based caves where suitable kaolin rock faces exist within the Pugu Hills Forest Reserve is therefore proposed to compensate for the loss of the large tunnel, and the following aspects need to be considered:

- Suitable locations need to be identified, ideally where shaft openings can be placed high enough on a rock face to avoid easy human access to minimise future disturbances.
- The depth of the tunnels and size of the internal cavities need to provide safe bat roosting habitat. Measurements can be taken from the existing mine shafts used by bats (approx. 100 meter depth), together with advice from a competent bat specialist who will consider the requirements of expected bat species.
- The roof of the roost cavities needs to be irregular to provide abundant footholds from which roosting bats can hang, and needs to be advised by an appropriate bat specialist.

9.1.4 Conservation of the Pugu Hills and Ruvu South Forest Reserves

Support is required to improve the conservation of the Pugu Hills and Ruvu South Forest Reserves, but needs to be guided by management plans developed for those reserves. Management Plans have been provided for both forest reserves, but there is scope to upgrade and improve those management plans. This support will need to discussed with TFSA, although the following points are suggested to guide the initial discussion:

- The respective Forest Reserve Management Plans should be upgraded, specifically to include a delineation different zones to guide future development. Development and conservation zones are described, but are not spatially delineated in the current management plans.
- Management plans state that boundary are weakly demarcated (boundary beacons are spaced too far apart) and boundary demarcation reinforcement is required.
- Ranger Posts need to be constructed in different parts of the reserves, from which law enforcement operations can be launched.
- Support towards law enforcement activities is suggested, which could be in the form of providing and/or financing training, equipment or actual logistics support.
- Support the eviction of illegal occupation (as seen in the vicinity of the mine shafts close to the SGR alignment). Extensive RAP processes are developed for the SGR, and similar processes can be applied here with TFSA support.
- Investigate how income generating activities for the forest reserves can be enhanced without compromising the conservation value of the forest reserves, to raise the sustainability of these forests.

10. MANAGEMENT OF UNPLANNED CONDITIONS AND UNEXPECTED IMPACTS

Unexpected conditions do occur, and there are situations that could adversely impact the biodiversity. However due to their unplanned nature, this BAP is not able to predict every scenario that could occur. This section is designed to create contingency plans and link to YM's risk and contingency planning framework.

Some examples of possible unexpected conditions are described below, but serve as examples and are not an exhaustive list:

Unplanned Land Clearance and Loss of Sensitive Biodiversity

Unplanned land clearance could occur through a variety of causes, such as inadequate planning or coordination between the design team and construction teams. Some examples are:

- Inadequate planning may be a cause of unplanned land clearance and loss of sensitive biodiversity. Loss of wetlands provides an example of such a situation and this BAP includes measures to delineate wetlands and develop and implement comprehensive wetland restoration programmes.
- Emergency services and recovery procedures for severe vehicle accidents may require land clearance or additional access to be created at short notice.

Where unplanned land clearance occurs and impacts sensitive biodiversity, measures need to be taken to restore the damage to the biodiversity and affected habitats.

Dangerous Fauna in Trapped Situations

The SGR will be fenced but fences are never 100% effective in preventing animals from passing through. Where double fences occur, there is the risk that animals can become trapped between those fences. This includes both wildlife and livestock. Situations involving livestock are easily managed, but can be more complex in situations involving dangerous wildlife such as elephants or large predators. Veterinary support may be required and involvement of conservation authorities (TAWA) would also be necessary in such situations. Persons to be contacted should such a scenario develop need to be identified and their contact details need to be available. Procedures to follow need to be planned for a range of different scenarios. Animals may also become trapped within fenced camps, and similar procedures would apply.

A more likely scenario is venomous snakes attracted to rodents feeding on waste and kitchen scraps associated with camps. Onsite training should be available for the identification, safe capture and translocation of African venomous snakes. Camps should have contact details available (based on prior arrangement) for specialist advice to local doctors in the event of a venomous snake bite incident. Abundant experience reveals that few doctors have the knowledge to treat snake bites correctly. Anti-venom can be more dangerous than the actual snake bite and limbs are lost or patient fatalities occur due to incorrect treatment in hospitals. Professional advice is available, whereby doctors on site can call for advice and it saves lives and limbs.

Contaminated Discharges to the Environment;

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.

11. BIODIVERSITY MONITORING AND EVALUATION PROGRAMME

11.1 Monitoring Actions

The biodiversity monitoring requirements are designed to monitor the effectiveness of the application of mitigation measures designed to address threats or impacts to key biodiversity receptors. Effectiveness of mitigation measures to address impacts is a key determinant for measuring the achievement of no net loss of biodiversity and demonstration of net gains for CH features. However the achievement of no net loss and net gain targets are addressed in the BAP review processes.

The Biodiversity Monitoring and Evaluation Programme (BMEP) described for this BAP addresses the following components:

- Protected areas
- CH features
- Fauna
- Aquatic ecosystems
- Wetlands
- Footprint rehabilitation programmes
- Alien plant control

Guidance on monitoring procedures is presented below, but inadequate data is available for most of the above components to be able to present detailed monitoring procedures. Actual monitoring protocols will need to be developed for each component, covering actual procedures, monitoring intervals, locations, time allocations, appointed organisations, personnel and equipment needs and other requirements. These monitoring protocols need to compiled into a standalone BMEP.

11.1.1 Protected Areas

An adequate monitoring mechanism needs to be established to monitor the benefits achieved from conservation support to the Pugu Hills and Ruvu Forest Reserves. Support will be multifaceted and monitoring will therefore need to take on different forms. The following approaches are suggested, but this will need to be tailored to partnership agreement with TFSA and the actual support provided:

TFSA will need to submit reports on the extent of patrols conducted and success in terms of arrests for illegal logging, timber trade and charcoal making and convictions for culprits achieved through local courts.

- Remote sensing of satellite imagery at annual intervals will demonstrate appearance of localised spots of deforestation and/or forest recovery. Effects of boundary reinforcement would be measureable over a period time as reserve boundaries become increasingly defined by settlement and agricultural expansion outside of the reserves. Responsibility to arrange such surveys should rest with TFSA with funding from the tree planting activity.

11.1.2 Critical Habitat Features

Monitoring of CH features will need to be specific to the species concerned, and the following suggestions are included:

- Forest-dependent species will benefit from the expansion of their forested habitat, achieved through forest planting and from conservation support to the TFSA. Remote sensing of satellite imagery should be able to demonstrate where expansions of forest occur, however that alone is not evidence that new forest areas have been colonised by endangered and critically endangered species.
- ***Section 11.2*** highlights the need for additional studies, particularly for the Rondo Dwarf Galago. Such studies will provide the best mechanism for testing approaches that will improve the conservation status of these little primates and effective monitoring methods. Too little information is currently available to have confidence on effective monitoring methods for this species.
- Surveys will need to be repeated at annual intervals to monitor the presence of forest-dependent migratory birds (Sokoke Pipit and Spotted Ground-thrush and other species). These surveys can be conducted by the Zoology Dept of the UDSM, or other competent institutions, and should rely on surveys to determine presence/absence of these species. Surveys to assess abundance would need to be detailed, may be disruptive to the birds and have a reduced chance of success.

- Success of establishing bat roosts will need annual monitoring and can be coupled with forest bird surveys conducted by the Zoology Dept of the UDSM, or other competent institutions. This monitoring needs to identify the diversity bat species utilising existing roosts and created roosts. A total population size should be estimated based on observation, but not an accurate count as this would disturb the bat populations excessively and do more harm to the bats than the benefits that would be gained. Surveys of bats utilising culverts, bridges and the Soga station should be included in the bat monitoring programme.

11.1.3 Fauna

Faunal monitoring (not included in the CH features) is required to cover wildlife movement through underpass structures, occurrence of road kills and recording of any problem / relocation of fauna.

11.1.4 Monitoring Continuation of Migration

Wildlife use of corridors can be unpredictable, and establishing a reliable means of monitoring the use of underpass structures can therefore be challenging. A suggested method for effective monitoring is to identify members of local communities with personal integrity, have good standing with their fellow community members, are fully familiar with their surrounding areas and are willing to engage with conservation authorities. These persons can then be approached from time to time to obtain information of wildlife presence and known movement patterns. Most communities are willing to share their knowledge of wildlife, and information obtained in this manner is reliable to determine if wildlife is present, even at relatively low wildlife densities. The disadvantage is that information is not precise or quantitative.

Reliable community members should be encouraged to report incidents involving wildlife, such as damage to fences, breaching of fences, or animals trapped within the fenced SGR corridor.

Fences need regular maintenance (***Section 5.1.6***) and evidence of wildlife inflicted damage to fences observed during maintenance needs to be recorded, including date of observation, location and affected species (if identifiable).

Wildlife authorities (TAWIRI, TANAPA and TAWA) are to be encouraged to monitor underpass structures and surrounding areas where wildlife movements occur for evidence of illegal hunting of wildlife.

Monitoring data will provide quantified insights into wildlife movement patterns and population structure. Appropriate techniques need to explored and TAWIRI encouraged to maximise the use of these opportunities. Such monitoring would provide insights into the status of the elephant population residing within the Ngerengere Military controlled forests. Collaboration between TAWIRI and the Tanzania Military would be useful to better understand this largely unknown elephant population.

Table 11.1 Parameters and Methods Proposed for Monitoring Wildlife Corridor Use

Survey / Monitoring Component	Monitoring Parameters
General use of Corridors	Identify local community members with integrity and good standing among their peers, and engage with them to acquire local knowledge of wildlife movements. TAWIRI should be contracted by TRC to engage communities. Quarterly community engagements will allow analysis of seasonal patterns, although TAWIRI should advise TRC on the optimal frequency of engagement.
Effectiveness of fencing	Fencing maintenance teams are to be encouraged to record observations of wildlife-inflicted damage, including dates, location and wildlife species involved.
Use of underpass structures	Bridges, culverts and other underpass structures are to be monitored on a regular basis to detect evidence of use by

Survey / Monitoring Component	Monitoring Parameters
	wildlife. This monitoring is to be conducted by TAWIRI to corroborate data obtained through community engagement.
Consolidation of data	TAWIRI should be contracted to consolidate their data with observations by maintenance teams to generate insights into the extent of wildlife crossings across the SGR route. Insights will provide a valuable contribution to wildlife conservation in Tanzania.

11.1.5 Recording of Road Kills and Faunal Translocation Incidents

Any incidents involving fauna, such as release of wildlife between fences, translocation of snakes from construction sites, road kills or interesting sightings are to be logged and data maintained by HSE managers. Incidents must be photographed where possible and recorded data must include the date and time, location, observer's name, faunal species, details of the incident and actions taken to alleviate the situation or to prevent reoccurrence. Data on incidents needs to be consolidated and included into relevant monthly reports.

11.1.6 Aquatic Ecosystems and Wetlands

Baseline studies have established the benchmark conditions for water quality, macro-invertebrates and fish diversity of various aquatic ecosystems (***Section 4.3.4***), and monitoring needs to compare future conditions against these baseline conditions.

Wetlands ned to be delineated to determine their extent. Wetland delineation is based on specific soil and vegetation parameters. Field observations revealed that soil mottling is readily apparent within wetlands in the Project area. The South African Department of Water and Forestry provide a practical and defensible approach to delineating wetlands (DWAF, 2005), which will be applicable to local conditions, although other methods may also be available. ERM has experience in implementing this procedure and is able to guide such exercises for the SGR Project.

Wetlands identified through the delineation exercises will be monitored for a range of ecological parameters indicating the state of health of the wetland. Health of wetlands can be monitored based on Physical water parameters and signs of eutrophication, presence of aquatic macro-invertebrates, fish diversity and abundance, state of the riparian vegetation, and observations of the hydrological flow (where applicable). ***Table 11.2*** presents and overview of the monitoring parameters. Sites for regular monitoring will be based upstream and downstream of SGR crossing points, as indicated in ***Section 4.3.4***.

Table 11.2 Parameters and Methods Proposed for Wetland Monitoring

Survey / Monitoring Component	Monitoring Parameters		
Physical water parameters and signs of eutrophication	temperature	Dissolved Oxygen	pH
	conductivity	Total Dissolved Solids	turbidity
	hydrocarbons	nitrites	nitrates
	salinity	ammonia	sulphates
Aquatic macro-invertebrates	Recommended assessment methods include SASS [(a)] and MIRAI [(a)], with scores determined by a competent aquatic ecologist. However other methods may be applicable.		
Fish diversity and abundance	Diversity and size classes of the common fish species need to be monitored. The FRAI [(a)] monitoring procedure is recommended, however other methods may be applicable.		

Survey / Monitoring Component	Monitoring Parameters
Riparian vegetation	Riparian vegetation condition can be assessed using the VEGRAI [(a)] method, but other techniques developed by competent botanists may also be applicable.
Hydrological Flow within Wetlands	Reliable trends obtained from water level recording that correlate to rainfall records

[(a)] Denotes recommended South African methods for aquatic ecology monitoring, which are applicable to Tanzanian conditions, however these methods are not prescribed. References and links are available in ***Section 14***.

All monitoring of the wetlands will commence before the start of construction and cover both wet and dry seasons to quantify the seasonal variations of these wetlands. Monitoring will be undertaken throughout the execution phase of the Project. If significant variations from baseline conditions (obtained from the first monitoring event) are observed, the causes of these changes will be investigated and rectified. Competent botanists and ichthyologists will be required to conduct fieldwork, and a water analysis laboratory to be contracted and a collaboration with the University of Dar es Salaam (UDSM), or similarly competent local institution is recommended.

Physical water quality will be monitored on a monthly basis for two years post construction. Other assessments will be conducted every six months for two years post construction. Portable water meter, water sample bottles, handheld nets, plastic trays, tree, wild flower, fish and aquatic macro-invertebrate identification guides.

11.1.7 Rehabilitation Programmes

Effectiveness of rehabilitation programmes will need to be monitored following approaches developed within a rehabilitation plan. This plan needs to monitor trends in ground cover, soil erosion, occurrence of invasive alien species and faunal use as presented in ***Table 11.3***.

An important aspect of developing actions from the results of rehabilitation monitoring is to allow the natural succession processes to continue. Grasses are being planted to vegetate the SGR embankments, and has been approved by for hydro-seeding by the Ministry of Agriculture Food Security and Cooperatives (***Section 3.4***). These grasses are indigenous, and are not considered to be invasive (***Section 5.1.10***). These grasses will serve as initial pioneer species, and the gradual succession process from planted species to an increasingly natural diversity must be allowed. A wide spectrum of weeds will appear in the first few years, and may give the impression of limited rehabilitation success but the species diversity will gradually stabilise. Monitoring programmes to assess rehabilitation success must acknowledge the natural succession process when developing actions for follow-up control of unwanted alien and invasive species.

Table 11.3 Parameters and Methods Proposed for Rehabilitation Monitoring

Monitoring Component	Monitoring Parameters
Percentage Ground Cover Assessment	Percentage ground cover measured from at least 200 random points within representative sample plots.
Evidence of soil erosion	Presence of erosion in the form of sheet erosion, riffs and gulleys with measurements of dimensions (length, depth and width) where applicable. Percentage exposure of subsoil layers needs to be estimated. Photographs of erosion need to be saved for future comparison.
Plant Species Diversity	Number of different species and identified where possible. Classified into grasses, herbaceous and woody species. Photographs and twig samples of plants should be submitted to a competent botanist (e.g. Botany Dept. of the University of Dar es

Monitoring Component	Monitoring Parameters
	Salaam or similar institution) for identification and to determine if species are invasive aliens needing control or if they are a component of the natural succession process.
Occurrence of alien species and invasive status	Record the occurrence of invasive alien species that are known problem species for the SGR Project. Data to be recorded includes estimated number of plants and growth stage (seedling, immature plant, flowering, seeding, dead). Recommendations for control measures need to be developed.
Evidence of faunal presence	Any evidence of fauna need to be recorded, covering mammals, birds, reptiles and amphibians. Evidence includes direct sightings, spoor, carcasses or bones, feathers, burrows or other evidence of presence. Evidence to be photographed where possible and assistance acquired for identification where necessary.

11.1.8 Alien Plant Control

The BEPP commits to implementing plans to control of invasive alien species. Occurrence of invasive alien species needs to be monitored with a focus on the effectiveness of control programmes, and maintaining a watch for new appearances of undesirable species. Sites where control measures have been implemented need to be monitored for re-emergence of controlled species, and follow-up control measures applied as necessary. The frequency of follow-up monitoring will depend of the affected species and the control measures applied. Follow-up monitoring and controls will therefore need to be determined on a site by site basis.

The magnitude of the task to control invasive alien plants is large, and capacity to implement this needs to be established, in the form of a competent team with a budget, transport and equipment.

Table 11.4 Monitoring Requirements to Assess Effectiveness of IAP Control

Monitoring Component	Monitoring Parameters
Objectives	Develop capacity and monitor the effectiveness of the Invasive Alien Species control measures and guide the implementation accordingly.
Methodology and Monitoring Parameters	Emphasis of monitoring will focus on areas where control measures have been implemented. Follow recommended actions on chemical instruction sheets where relevant.
Duration/ Frequency	To be determined based on species and control measures applied. Chemical instruction leaflets provide guidance and abundant data is available online, such as the GISD.
Survey Area	Within SGR footprint, including the railway line, service road and other access road verges, construction camps, surplus soil dumps, quarries, borrow pits and other disturbed sites.
Equipment	Observations, GPS recordings and photographs
Observations needed	Record the occurrence of alien and invasive species that are known to be problem species for the SGR Project. Data to be recorded includes estimated number of plants and growth stage (seedling, immature plant, flowering, seeding, dead).

The appearance of new alien species needs to be monitored along the full length of the SGR Phases I and II. Botanical skills will be required to detect new invasive species as the control teams will not be familiar with these plants and will not recognize them as aliens. Alien species that appear as a result of the SGR development will be TRC's responsibility to control, and the cause of appearance of any new species will need to be determined based on the timing of its appearance and its occurrence in surrounding areas.

11.2 Additional Studies Required

Development of this BAP has highlighted some important data gaps, some of which reduce the confidence that net gain can be demonstrated, for example the Rondo Dwarf Galago. Some additional studies are therefore suggested to guide a better implementation of this BAP to achieve its objectives and targets.

11.2.1 Research into the Rondo Dwarf Galago Ecology

Very little is known about the ecology of the Rondo Dwarf Galago, and a series of references (Kingdon, 1997 & 2001; Edge of Existence, 2019; IUCN Red List, 2019) state that this species needs to be studied. The lack of ecological data on this species has limited the capacity to develop appropriate mitigation measures within this BAP.

This BAP proposes that the Rondo Dwarf Galago is used as a flagship species to spearhead a conservation programme for the SGR Project. An international university should be invited by TRC and YM to collaborate with the UDSM Zoology Dept. or similar local institution to conduct an in-depth of the ecology of this species. This ecology of this little primate is well suited to the use of new technologies such as camera traps and directional sound recordings to assess its population status, and the UDSM could greatly benefit from introduction of latest technologies.

The very high sensitivity of the Rondo Dwarf Galago does present challenges to the SGR Project, but these challenges also present an opportunity for YM to develop their internal biodiversity capacity, which will be beneficial to show alignment to future sustainability requirements. This little Galago is a charismatic species, and is listed among the World's 25 most threatened primates. Primates generate more international attention than any other species groups, and this little Galago would serve as a good flagship species to initiate that capacity development.

Engagement with the IUCN Primate Specialist Group (website: http://www.primate-sg.org/) is necessary to obtain guidance on the way forward regarding studies and the development of mitigation measures to protect this species.

11.2.2 Botanical Composition and Sensitivity of the Pugu Hills and Ruvu South Forest Reserves

Section 4.3.6 explains that the sensitivity and threatened status of the flora within the is not assessed. Many species have been described but their identification requires access to academic herbaria and advanced botanical skills. There is a high potential for discovery of additional species and known range expansions for poorly known plant species.

An improved understanding of the botanical composition of these forests will have a lot of value to guide a forest restoration plan proposed in ***Section 9.1.2***. Kew Gardens, based in the UK are leading botanical specialists for the taxonomy of the Coastal Forest Mosaic, and this BAP proposes that a local University Botany Dept. review existing botanical literature of the Pugu Hills forests with guidance from Kew Botanists, and to conduct field surveys to expand the botanical documentation of these forests.

11.2.3 Identification of Insect Specimens

Insect samples were collected during field surveys in April 2019 to generate baseline data to guide a critical habitat assessment. Time constraints caused by financial procedures for the SGR Project have prevented a proper analysis of these specimens, which are stored at the YM offices in Ilala, Dar es Salaam, and only preliminary identifications have so far resulted from that study. A proper identification of these samples is recommended to confirm current identifications, and are likely to lead to additional interesting findings. Findings of the invertebrate survey should be published in an appropriate scientific entomology journal, as these findings have enormous value to a poorly understood component of the Pugu Hills ecology.

Enviro Insight ecologists collected the samples and this BAP proposes that they complete the processes they have initiated, with any publications giving the appropriate acknowledgement to TRC and YM.

11.2.4 Assessment of Ecosystem Services

Further information regarding the use of both priority and non-priority ecosystems will be captured for all Project Affected People, and further consultation planned (e.g. for Indigenous People and as part of the Livelihood Impact Assessment (LIA)), will include further exploratory questions relating to use of ecosystems services. This information will be fed into updated Resettlement Action Plans (RAPs), which will specify appropriate mitigation, including targeted livelihood restoration strategies where applicable.

11.3 Development of Internal Biodiversity Capacity

This BAP proposes collaboration with external organisations academic institutions for specialist inputs and assessment, however implementation of the activities needs to be driven from within. Development of internal capacity to understand ecological sensitivities, interpret these in accordance with international best practice and implement conservation measures is necessary. YM will therefore recruit a competent Biodiversity Specialist with field management experience to oversee the implementation of this BAP.

Section 11.2 encourages YM to develop internal biodiversity capacity. High level biodiversity capacity should additionally be developed at the head office to guide and manage ecologist staff operating in the field at project level. YM should have the capacity to identify ecological sensitivities, such as have occurred in this project, in advance of implementation rather than discovering these risks through independent ESIA studies.

12. RESIDUAL IMPACT AND ACHIEVEMENT OF NO NET LOSS TARGETS

The objective of this BAP is to align to the PS6 and meet targets relating to no net loss of biodiversity and net gain of CH features. This Chapter describes the required approaches to meet these targets and presents an opinion on which of these targets are achievable.

12.1 Analysis of the 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.

No net loss of biodiversity needs to be demonstrated where impacts to natural habitats occur. Primary impacts leading to loss of natural habitat occur as a result of the SGR footprint, loss and degradation of wetlands and to a lesser extent the induced consumption of charcoal. Two important actions identified to address these causes of biodiversity loss are:

- Wetland restoration along the SGR alignment (***Section 8.1.3***); and
- Support TFCG to develop and implement sustainable charcoal programmes in miombo woodlands (***Section 9.1.1***).

Appendix B presents costs committed by YM to implementing these activities.

Wetland Restoration

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 associated with the SGR alignment and downstream environments to recover. 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 and characterisation exercises will be required to determine the extent of wetlands and how much restoration is required. A wetland restoration plan needs to be developed following the delineation exercises. YM have the capacity to restore wetlands according to a plan, and this activity is technically possible. A commitment to the budget is provided in Appendix B.

There is an important difference between restoration and rehabilitation. Rehabilitation programmes through hydro-seeding will create a planted monoculture, which qualifies as a modified habitat, and does not support the ecological functioning of a natural habitat. Restoration activities are required that restore the hydrology and indigenous wetland-obligatory vegetation, to encourage recovery of the ecological functioning. This approach is necessary to meet no net loss of biodiversity. ***Section 8.1.1*** requests that the loss and degradation of wetlands is arrested immediately, which is important to minimise the restoration task and improve the ability to achieve no net loss targets.

Control of invasive alien plants will overlap with wetland restoration activities and will assist the achievement of targets for No Net Loss of Biodiversity.

Sustainable Charcoal Programmes

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 will have wide-reaching benefits. ***Section 9.1.1*** 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.

This early support will also 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.

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.

12.2 Analysis of the Potential to Achieve Net Gain of CH Features

The critical habitat assessment for the SGR route has confirmed 12 CH features that are relevant to the SGR Project. ***Section 7.1.3*** has defined a reduced list of key CH features, as some of the CH features share the same habitats but are little understood or cryptic species and not easily monitored. Demonstrating net gains for elusive species with unpredictable presence will be extremely challenging regardless of the effectiveness of mitigation to protect their habitats. Measures are therefore developed to protect key CH features, and are expected to achieve gains for lesser species sharing the same habitats. ***Table 12.1*** lists the key CH features, 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.

Table 12.1 Discussion of Key Mitigation Measures to address Threats to CH Features

Key Critical Habitat Features	Key Actions to Address Impacts	Capacity to Achieve Net Gains of respective CH Features
Pugu Hills and Ruvu South Forest Reserves	Provide Support to TFSA; Conservation support for the Pugu Hills and Ruvu South Forest Reserves.	Support to TFSA and conservation support for the forest reserves address the requirements for protected areas (***Section 7.1.4***). These actions will raise the standard of management to protect forest resources, which will benefit the full spectrum of biodiversity within those reserves. Development of improved management plans will guide future conservation efforts.
Rondo Dwarf Galago	Re-establish lost coastal dry forest within the Pugu Hills Forest Reserve. Conservation support for the Pugu Hills and Ruvu South Forest Reserves.	Actions provided in ***Section 9.1.2*** propose the establishment of coastal dry forest with an area equivalent to 15% of the current coastal dry forest cover within the Pugu Hills Forest Reserve north of the Kisarawe Road (*pending the availability of suitable un-forested soils*). The extent of forest loss to charcoal production is not known, but this contribution exceeds the area impacted by dust. The timeframe for the growth of trees to create effective forest habitat and its colonisation by Rondo Dwarf Galagos is unknown, it is also not known how readily these Galagos will colonise new habitats. Gains will be further reinforced by support provided for conservation of the forest reserve, as provided in ***Section 9.1.4***. Net gain for this highly threatened primate may be possible, but further opportunities to better understand threats and improve the status of the population would be revealed through a broad-spectrum species-specific research programme supported by botanical studies, proposed in ***Section 11.2.*** Actions achieving net gains for the Rondo Dwarf Galago are expected to equally achieve gains for endangered forest birds (Spotted Ground Thrush and Sokoke Pipit) and insects associated with the same habitat, although timeframes for those benefits to be achieved are not known.
African Wild Dog	Maintain the permeability of	Insufficient data is available on the current status of African Wild Dog populations within the Project area to understand the current threats they face or the extent to which they will be impacted by

Key Critical Habitat Features	Key Actions to Address Impacts	Capacity to Achieve Net Gains of respective CH Features
(*provisional CH feature*)	underpasses for wildlife movement.	the SGR. However impacts are not expected to be damaging to this population. There is confidence on the presence of African Wild Dog, however this species is highly mobile and exhibits wide-range behaviour. Their presence at any one time is unpredictable and demonstrating net gain for this species is therefore not practical. Mitigation is already incorporated into the SGR design, and additional measures to demonstrate net gain are therefore advocated by this BAP.
Ruvu Spiny Reedfrog (*Hyperolius ruvuensis*)	Wetland restoration Conservation support for the Pugu Hills and Ruvu South Forest Reserves	Presence of the Ruvu Spiny Reedfrog has not been demonstrated due to short field surveys being conducted during a relatively dry period. However extensive wetlands do exist within the expected range of the Ruvu Spiny Reedfrog, and there is a moderate level of confidence that the species is present. Restoration of wetlands along the SGR alignment and improved conservation of the Ruvu South Forest Reserve will reduce illegal activities (primarily charcoal production) and will raise the ecological health of wetlands throughout the reserve, and will benefit this species. There is moderate confidence that studies to investigate the presence of this reedfrog during its breeding season (***Section 11.2***) will demonstrate an expansion of the species' known distribution.
Large Cave-dwelling Bat Congregations comprising mostly *Triaenops afer* (Trident bat), *Mops* (free-tailed bats) and *Rhinolophus* (Horseshoe bats) species	Create Two Bat Roost Caves as Replacement for the Lost Tunnel	Large numbers of bats have colonised old mine shafts which represent modified habitats. One bat roost within the modified habitat of an old railway tunnel is being lost, but there is confidence that development of two replacement mine shafts will be colonised by bats and provide increased roosting options. This will increase the current populations and may increase the bat diversity, and provides confidence that net gain for this CH feature can be achieved.

12.3 Conclusion regarding Capacity to Achieve No Net Loss and Net Gains

Analyses of the requirements for no net loss of biodiversity and net gain for key CH features are provided above, and achievement of these targets should be possible provided there is a strong commitment to do so. Some of the CH features are extremely data deficient and additional investigation will be required for some of the less understood CH features, particularly the Rondo Dwarf Galago. Assuming insights will be gained from further studies, there is confidence that no net loss of biodiversity and net gain targets are achievable, as some of the key actions are scalable in the extent to which they are implemented. 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 76 ha of coastal dry forest 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.

Achievement of no net loss of biodiversity and net gain targets implies that no further offsetting measures need to be investigated, which is a significant cost saving for the SGR Project.

13. REVIEW AND DATA REPORTING REQUIREMENTS

ARUP will be responsible for an annual review of this BAP, however some elements within will require special and/or local expertise to understand the effectiveness of implementation or to understand monitoring results. Sections of this BAP propose that TFCG are involved in development of programmes and subsequent evaluation. A broad agreement needs to be established between TRC, YM, ARUP and TFCG on their involvement in the project.

Support from an appropriate independent wetland organisation is also suggested to evaluate the success of wetland restoration projects. ***Section 8.1.3*** proposes development of a comprehensive wetland restoration plan, which must include monitoring and review processes. ARUP would need to have the appropriate input into that process.

14. REFERENCES

BirdLife International (2019) Important Bird Areas factsheet: Kisarawe District Coastal Forests. Available at: http://datazone.birdlife.org/site/factsheet/kisarawe-district-coastal-forests-iba-tanzania.

Dallas, H.F. 2007. South African Scoring System (SASS) Data Interpretation Guidelines. River Health Programme. The Freshwater Research Unit, University of Cape Town. Prepared for: Institute of Natural Resources and Department of Water Affairs and Forestry, South Africa. Available at: http://www.dwa.gov.za/iwqs/rhp/methods/SASS%20Interpretation%20Guidelines.pdf

DWAF. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1, September 2005. Department of Water Affairs and Forestry. Available at: http://www.dwaf.gov.za/Documents/Other/EnvironRecreation/wetlands/WetlandZoneDelineationSep05.pdf

Edge of Existence Report, 34. Rondo Dwarf Galago. Available at: www.edgeofexistence.org/species/rondo-dwarf-galago/

Jones, T., Bamford, A.J., Ferrol-Schulte, D., Hieronimo, P., McWilliam, N. and Rovero, F. 2012. Vanishing wildlife corridors and options for restoration: A case study from Tanzania. Tropical *Conservation Science*. Vol. 5(4):463-474. Available at: www.tropicalconservationscience.org

Kleynhans, C.J. 2007. River Ecoclassification Manual for Ecostatus Determination (Version 2). Module D: Fish Response Assessment Index (FRAI). Department of Water Affairs & Forestry, Resource, Quality Services, Pretoria. Available at: http://www.dwa.gov.za/iwqs/rhp/eco/EcoStatus/ModuleD_FRAI/Module%20D_FRAI.pdf

Kleynhans, C.J.; Mackenzie, J. and Louw, M.D. 2007. River Ecoclassification Manual for Ecostatus Determination (Version 2). Module F: Riparian Vegetation Response Assessment Index (VEGRAI). Department of Water Affairs & Forestry, Resource Quality Services, Pretoria. Available at: http://www.dwa.gov.za/iwqs/rhp/eco/EcoStatus/ModuleF_VEGRAI/ModuleF_VEGRAI.pdf

Muller, I. 2014. Seed viability and re-growth of grasses used for mine waste rehabilitation. Dissertation submitted for the degree of Magister Scientiae in Environmental Sciences at the Potchefstroom Campus of the North-West University. Available at: https://dspace.nwu.ac.za/bitstream/handle/10394/15455/Muller_I_2015.pdf?sequence=1

Protected Areas data has been sourced from the Protected Planet website (available at: https://www.protectedplanet.net/), which is managed by the World Database of Protected Areas.

Riggio J. and Caro T. 2017. Structural connectivity at a national scale: Wildlife corridors in Tanzania. *PLoS ONE* 12(11): e0187407. Available at: https://doi.org/10.1371/journal.pone.0187407

Save the Elephants (2017) Okita-Ouma, B.; Lala, F.; Koskei, M.; Mwazo, A.; Kibaara, D.; King, L.E. and Douglas-Hamilton, I. Tracking and monitoring of elephant movements along the Standard Gauge Railway and highways in the Tsavo Ecosystem, Kenya, (March 2016 – June 2017). Report by Save the Elephants and KWS. Available at: http://www.savetheelephants.org/wp-content/uploads/2017/08/2017_Tsavo-SGR-monitoring-one-year-report-web.pdf

TAWIRI, 2009. Jones, T; Caro, T. and Davenport, T.R.B. (Eds.) *Wildlife Corridors in Tanzania.* Tanzania Wildlife Research Institute, P.O. Box 661, Arusha. Available at: http://www.tzwildlifecorridors.org/TzWildlifeCorridors.pdf

TFCG (Tanzania Forest Conservation Group) 2016. Transforming Tanzania's Charcoal Sector, understanding the MJUMITA sustainable charcoal model. Version: November, 2016.

Thirion, C. 2007. River Ecoclassification Manual for Ecostatus Determination (Version 2). Module E: Macroinvertebrate Response Assessment Index (MIRAI). Department of Water Affairs & Forestry, Resource Quality Services, Pretoria. Available at: http://www.dwa.gov.za/iwqs/rhp/eco/EcoStatus/ModuleE_MIRAI/ModuleE_MIRAI.pdf

World Bank Group Climate Change Knowledge Portal, at: https://climateknowledgeportal.worldbank.org/

15. LINKS TO IMPORTANT DOCUMENTS AND WEBSITES

1. Alliance for Zero Extinction Global Map
2. Birdlife Important Bird and Biodiversity Areas
3. Convention on Biological Diversity
4. EDGE of Existence website
5. Guidance Notes to the IFC Performance Standards
6. IBAT (Integrated Biodiversity Assessment Tool)
7. IFC Performance Standards
8. IUCN Global Invasive Species Database (GISD)
9. IUCN Key Biodiversity Areas
10. IUCN Offsetting Guidelines
11. IUCN Red List Assessment for African Wild Dog (*Lycaon pictus*)
12. IUCN Red List Assessment for Rondo Dwarf Galago (*Galagoides rondoensis*)
13. IUCN Red List of Threatened Species (Home Page)
14. Revised Guidance Notes to the PS6 (November-2018)
15. Standard Gauge Railway Line (SGR) Project. Dar es Salaam – Makutopora, Tanzania Environmental and Social Impact Assessment. Draft Report February 2019
16. The Economics of Ecosystems and Biodiversity (TEEB)
17. Wetland delineation Procedure - A practical procedure for Identification and Delineation
18. World Database of Protected Areas (Protected Planet website)
19. WWF Terrestrial Ecoregions
20. Yapi Merkezi Environmental and Social Policy
21. Yapi Merkezi Website

APPENDIX A ACTION TABLES

Actions to be addressed during the Design Phase of the SGR Project

Management Measure (Design Phase)	Timing	Responsibility	Performance Indicator
1. Limit the Extent of the SGR Footprint			
Extent of the site footprint will be minimised through the following measures: • The clearance of natural vegetation will be limited to the minimum required strip of land needed for the SGR and service road of the future railway corridor. • For the construction of railway station building, platforms, access roads, warehouses, parking places and utility service areas, clearance of vegetation will the limited to the surface occupied by these infrastructures.	Prior to and throughout construction	Contractor	Detailed project planning designs
Avoiding locating of access roads, construction camps and materials processing plants within areas with significant vegetation or trees cover, where possible. • Avoiding locating/selecting quarries and borrow pits at areas which have significant vegetation or trees cover. • Camps and garages should not be located in the dense forest areas.	Prior to and throughout construction	Contractor	Detailed project planning designs
Haulage roads to get access to working areas and will be constructed with a width of 3.5 meters only where strictly necessary along with the necessary spots for passing and manoeuvering. As far as possible, the path of the haulage route shall avoid areas of highly sensitive vegetation	Prior to and throughout construction	Contractor	Detailed project planning designs
2. Declare Forest Reserves as No Go Areas for Workers during the Construction Phase			
Declare the Pugu Hills and Ruvu South Forest Reserves as No Go Areas for the Construction Phase. • No entry signs will be posted at access points and at regular intervals along the edges of the construction site.	Prior to and throughout construction	Contractor TRC TFSA	Policy Development Operational Reports, Site reports
4. Respect Buffer Zones around Rivers, Streams, Water Bodies and Seasonal Wetlands			
The Tanzanian Environmental Management Act of 2004 will be adhered to, which requires avoidance of that a 60-meter buffer designated from the high water mark around all rivers, streams, wetlands and water bodies	Prior to and throughout construction	Contractor	Policy Development

Management Measure (Design Phase)	Timing	Responsibility	Performance Indicator
			Operational Reports, Site reports
5. 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: • Fences need to electrified at all times. • 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. • 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.	Project Planning and Operational Controls	Design Engineers and Contractor	Detailed project planning designs; Site inspection reports
7. Minimise Loss of Fauna during Vegetation Clearing			
Areas of natural vegetation designated to be cleared will be checked by a competent faunal ecologist in advance of clearing, and all fauna is be noted. • Underground burrows located within the construction path and a 50 m buffer thereof are to be monitored to determine if these are in use, the wildlife species involved and an estimate of the number of individuals.	Throughout construction	Contractor, Competent Faunal Ecologist	Detailed project planning designs; Site inspection reports
Competent ecologists should be on site the day prior to vegetation clearing and during clearing operations to safely translocate any animals encountered that are not able to evacuate the site on their own accord.	Throughout construction	Contractor, Competent Faunal Ecologist	Operational reports Site inspection reports
Appropriate veterinary services would need to be involved in the translocation or forced movement of any medium-sized or large mammals, examples being animals having fallen into holes, become trapped or entangled by fences, crept inside vehicles or trapped within Construction Camps.	Throughout construction	Contractor, Veterinarian	Operational reports Site inspection reports

Actions to be addressed during the Construction Phase of the SGR Project

Management Measures (Construction Phase)	Timing	Responsibility	Performance Indicator
1. Limit the Extent of the SGR Footprint			
Extent of the site footprint will be minimised through the following measures: • The clearance of natural vegetation will be limited to the minimum required strip of land needed for the SGR and service road of the future railway corridor. • For the construction of railway station building, platforms, access roads, warehouses, parking places and utility service areas, clearance of vegetation will the limited to the surface occupied by these infrastructures.	Prior to and throughout construction	Contractor	Detailed project planning designs
Avoiding locating of access roads, construction camps and materials processing plants within areas with significant vegetation or trees cover, where possible. • Avoiding locating/selecting quarries and borrow pits at areas which have significant vegetation or trees cover. • Camps and garages should not be located in the dense forest areas.	Prior to and throughout construction	Contractor	Detailed project planning designs
Haulage roads to get access to working areas and will be constructed with a width of 3.5 meters only where strictly necessary along with the necessary spots for passing and manoeuvering. As far as possible, the path of the haulage route shall avoid areas of highly sensitive vegetation	Prior to and throughout construction	Contractor	Detailed project planning designs
Avoiding disposal of spoil/excess excavation materials on down-slope or in adjacent areas where it will affect vegetation/trees	Prior to and throughout construction	Contractor	Detailed project planning designs
Contractor will prohibit the unnecessary felling of trees	Prior to and throughout construction	Contractor	Detailed project planning designs
2. Declare Forest Reserves as No Go Areas for Workers during the Construction Phase			
Declare the Pugu Hills and Ruvu South Forest Reserves as No Go Areas for the Construction Phase. • No entry signs will be posted at access points and at regular intervals along the edges of the construction site.	Prior to and throughout construction	Contractor TRC	Policy Development Operational Reports, Site

Management Measures (Construction Phase)	Timing	Responsibility	Performance Indicator
			Inspection reports
3. Ban the Use of Illegal Charcoal but Promote Sustainable Charcoal Production			
Implement a ban on the purchase and use of charcoal for Ilala Camp, Soga Camp and at satellite camps associated with long-term construction sites.	Prior to and throughout construction	Contractor	Operational Reports, Site Inspection reports
Provide alternative energy sources (electricity or kerosene) for kitchens catering for job seekers outside of the camp gates.	Throughout construction	Contractor	Operational Reports, Site Inspection reports
Develop a policy that develops the staff skills and enables methods for recognizing legally sourced sustainable charcoal for Ngerengere, Mkata, Kilosa and Inhume Camps.	Prior to and throughout construction	Contractor	Policy Development Operational Reports, Site Inspection reports
Maintain a ban on charcoal purchase and use until a policy for sourcing legally sourced sustainable charcoal is developed and available for implementation.	Prior to and throughout construction	Contractor	Policy Development Operational Reports, Site Inspection reports

Management Measures (Construction Phase)	Timing	Responsibility	Performance Indicator
4. Respect Buffer Zones around Rivers, Streams, Water Bodies and Seasonal Wetlands			
Adhere to the Tanzanian Environmental Management Act of 2004, which requires avoidance of that a 60-meter buffer designated from the high water mark around all rivers, streams, wetlands and water bodies.	Prior to and throughout construction	Contractor	Policy Development Operational Reports, Site Inspection reports
Halt the loss and degradation of wetlands due to soil dumping and top soil removal for planting grass along the SGR	Throughout construction	Contractor	Operational Reports, Site Inspection reports
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.	Throughout construction	Contractor	Operational Reports, Site Inspection reports
5. 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: • Fences need to electrified at all times. • 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. • 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.	During construction	Design Engineers and Contractor	Detailed project planning designs; Site inspection reports

Management Measures (Construction Phase)	Timing	Responsibility	Performance Indicator
6. 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.	Throughout Construction	Contractor, TRC, TAWIRI	TAWIRI Reports
Install warning signs and speed control signs at all animal crossing corridors as identified by the design engineer and in consultation with local community.	Throughout Construction	Contractor, TRC	Site reports
7. Minimise Loss of Fauna during Vegetation Clearing			
Areas of natural vegetation designated that have to be cleared will be checked by a competent faunal ecologist in advance of clearing, and all fauna is to be noted. • Underground burrows located within the construction path and a 50 m buffer thereof are to be monitored to determine if these are in use, the wildlife species involved and an estimate of the number of individuals.	Throughout construction	Contractor, Competent Faunal Ecologist	Detailed project planning designs; Site inspection reports
Competent ecologists should be on site the day prior to vegetation clearing and during clearing operations to safely translocate any animals encountered that are not able to evacuate the site on their own accord.	Throughout construction	Contractor, Competent Faunal Ecologist	Operational reports Site inspection reports
Appropriate veterinary services would need to be involved in the translocation or forced movement of any medium-sized or large mammals, examples being animals having fallen into holes, become trapped or entangled by fences, crept inside vehicles or trapped within Construction Camps.	Throughout construction	Contractor, Veterinarian	Operational reports Site inspection reports
8. Prevent Contamination through Good Chemical Handling			
Implement measures to ensure safe handling of chemicals and fuels, in accordance with the Hazardous Material Management Procedure, with consideration of the following aspects: • Regular vehicle and machinery maintenance, • Correct storage and adherence to the manufacturer's Material Safety Data Sheets (MSDS) requirements, • Controlled access to and accountability in the use, • Staff training, induction and awareness programmes	Throughout Construction	Contractor	Site reports Audit reports

Management Measures (Construction Phase)	Timing	Responsibility	Performance Indicator
• Regular auditing to control and account for the use of liquid fuels, oils and chemicals and minimise unintended loss and wastage.			
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.	Prior to and throughout construction	Design Engineers and Contractor	Detailed project planning designs; Site inspection reports
A method statement should be developed and implemented that recognises the different forms of waste and guides their disposal in a manner that is not harmful to the local environment.	Prior to and throughout construction	Design Engineers and Contractor	Detailed project planning designs; Site inspection reports
All contaminated sites will be properly remediated, with consideration of the following aspects: • 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.	Throughout Construction	Contractor	Site reports Audit reports
Waste management measures and facilities that avoid creating opportunities for food scavengers (such as baboon-proof dustbins) will be developed and implemented.	Throughout Construction	Contractor	Site reports Audit reports
9. Revise the Dust Management Programme and Implement Effective Dust Suppression			
The current dust management programme is not effective in controlling dust emissions and more effective mitigation strategies need to be developed and implemented.	As soon as possible, implemented throughout Construction	Design Engineers, TRC	Revised dust management programme

Management Measures (Construction Phase)	Timing	Responsibility	Performance Indicator
10. Develop and Implement Biodiversity Protection Policies			
Biodiversity protection policies need to be developed covering the following aspects: • Prohibit the unnecessary destruction of habitats, cutting of trees or vegetation found outside the area needed for the project. • Prohibit hunting, trapping and intentional killing of wild animals by the project workers and drivers. • Prohibit the purchase of bush meat and keeping of pets.	Prior to and throughout construction	Contractor	Policy Development Operational Reports, Site Inspection reports
11. Implement Biodiversity Awareness Programmes for Contractors and Communities			
Induction programmes need to be developed for staff and contractors to raise the awareness of the diversity of animals present, risks associated with large wildlife and how to react when confronted by different species of large wildlife, and requirements to actively prevent the loss of any animals including snakes and species commonly considered to be vermin.	Prior to and throughout construction	Contractor	Policy Development Operational Reports, Site Inspection reports
Increase the awareness of drivers and equipment operators towards wildlife conservation and encourage them to avoid or minimise animal fatalities.	Prior to and throughout construction	Contractor	Policy Development, Operational Reports, Site Inspection reports
Biodiversity awareness creating measures have to be developed for both construction workers and affected communities. • Training will be delivered to constructions workers prior to the start and during construction works to increase their awareness and responsibilities concerning the surrounding natural values.	Prior to and throughout construction	Contractor Community representatives	Policy Development, Operational Reports, Site Inspection reports

Management Measures (Construction Phase)	Timing	Responsibility	Performance Indicator
12. Enforce Vehicle Speed Limits to Protect Fauna			
Where free-ranging wildlife occurs, vehicle speeds are to be reduced through implementation of speed control measures and the regular enforcement.	Throughout construction	Contractor	Operational Reports, Site Inspection reports
Post appropriate signs and apply speed limits for the sections passing through important wildlife areas by setting speed limits to safe levels, monitoring and enforcing it.	Throughout construction	Contractor	Operational Reports, Site Inspection reports
Apply good site practices incorporating appropriate mitigation measures that reduce nuisance noise levels.	Throughout construction	Contractor	Operational Reports, Site Inspection reports
13. Reduce Light Contamination into Natural Habitats at Night			
Lighting for construction and security purposes should be inward and downward facing to minimise light pollution in remote areas, and to minimize the disturbance to nocturnal wildlife, birds and invertebrates.	Throughout construction	Contractor	Operational Reports, Site Inspection reports
15. Rehabilitate Disturbed Terrestrial Sites Promptly			
All areas that have been cleared of vegetation and/or where the soil surface has been disturbed need rehabilitation of the vegetation at the earliest opportunity to minimise the establishment of invasive plants, with consideration of the following aspects: • Revegetation of disturbed sites will be implemented within the same growing season, or within the upcoming growing season for disturbances occurring during the dry season. • Non-invasive species need to be used for rehabilitation. Various non-invasive grasses currently being planted on embankments of the SGR and is suitable for this purpose. • The gradual succession process from planted species to an increasingly natural diversity must be allowed to take place, with alien plant control measures within rehabilitation sites applied to only a pre-determined list of invasive species.	Throughout construction	Contractor	Rehabilitation Plan Operational Reports, Site Inspection reports

Management Measures (Construction Phase)	Timing	Responsibility	Performance Indicator
16. Restore Destroyed and Degraded Wetlands			
The magnitude of wetland restoration is considerable, and advice from a widely-recognised organisation with professional expertise and experience in this field is required to develop a comprehensive wetland restoration plan.	During construction, as early as possible	Contractor Wetland Restoration specialist	Wetland Restoration Plan
All wetlands along the entire SGR route need to be delineated and 60-meter buffers applied, as described in Section 8.1.1 to comply with requirements of the Environmental Management Act of 2004. • Development within 60 meter buffers need to be avoided, and where non-essential developments exist, these need to be removed. • Forensic delineations may need to be applied where wetlands have been smothered by soil dumps and are no longer easily traceable on the ground.	During construction, as early as possible	Contractor Competent and recognised wetland ecologist	Wetland delineation report with accurate maps per wetland.
Restoration action plans will need to be developed for each wetland based on extent of restoration, wetland type and the local hydrology. Wetland restoration plans will need to cover the following aspects: • The extent of soil dumps within wetland boundaries that need to be removed. • Sediment accumulation from erosion and severe dust deposition needs to be removed through scraping the soil surface during the dry season (June to September). • Approaches need to be developed to restore wetlands where top soils have been removed for grass planting on SGR embankments • Establish indigenous wetland flora within wetlands cleared and/or where soils have been disturbed.	During construction, starting in the upcoming wet season (September 2019)	Contractor Competent and recognised wetland ecologist	Site-specific restoration action plans
17. Develop and Implement an Invasive Alien Species Control Plan			
Develop and implement an alien and Invasive Species Control Plan that takes cognisance of the following points: • Biological control measures may only be applied if these specific measures have been approved for application in Tanzania. Alternatively, labour intensive manual control of	During construction	Contractor Competent and recognised	Invasive Species Control Plan

Management Measures (Construction Phase)	Timing	Responsibility	Performance Indicator
invasive plants would be applied in preference to application of herbicides or other chemicals. • All alien vegetative and/or seed bearing material that is removed through control measures should be burnt on site to prevent the distribution of seed and fertile vegetative material, regardless of the status of the surrounding areas. • Vehicles and construction equipment should be washed on a regular basis and should be kept clean 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.		invasive species ecologist	

Actions to be addressed during the Operations Phase of the SGR Project

Management Measure (Operations Phase)	Timing	Responsibility	Performance Indicator
3. Ban the Use of Illegal Charcoal but Promote Sustainable Charcoal Production			
TRC are to maintain a ban on the transport of unlicensed (unsustainably produced) charcoal on their trains during the operational phase of the SGR and other rail networks. Currently no charcoal is transported by train unless there is a special permit from the Ministry of Natural Resources and Tourism (MNRT).	Throughout Operations	TRC	Reports
5. 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: • Fences need to electrified at all times. • 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.	Project Planning and Operational Controls	Design Engineers and Contractor	Detailed project planning designs; Site inspection reports

Management Measure (Operations Phase)	Timing	Responsibility	Performance Indicator
• 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.			
6. 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.	Throughout Operations	Contractor, TRC, TAWIRI	TAWIRI Reports
Install warning signs and speed control signs at all animal crossing corridors as identified by the design engineer and in consultation with local community.	Throughout Operations	Contractor, TRC	Site reports
14. Implement Controlled Access along the SGR Service Road during Operations			
Use of the SGR Service Road will only be used by TRC for maintenance and operational purposes during the operation phase as included in the ESMP. This will reduce dust emissions and prevent opening up access to northern parts of the Pugu Hills and Ruvu South Forest Reserves.	Throughout Operations	TRC	Site reports
17. Implement the Invasive Alien Species Control Plan			
Implement an alien and Invasive Species Control Plan developed during the Construction Phase	Throughout Operations	TRC	Site reports

Additional Conservation Actions to meet No Net Loss and Net Gain Requirements

Management Measure (Additional Conservation Actions)	Timing	Responsibility	Performance Indicator
Support TFCG to Implement Sustainable Charcoal Programmes			
The Tanzania Forest Conservation Group (TFCG) have piloted a new village-based approach towards sustainable charcoal production in Kilosa, Morogoro and Dodoma that empowers village communities and alleviates poverty. The programme is based on strategic harvesting of trees according to a predetermined plan, and greatly reduces unnecessary loss of miombo woodland. This programme will be rolled out more widely along the SGR route as a compensation for the loss of natural habitat. An estimated 20 additional villages will need to be brought into the sustainable charcoal programme to achieve an adequate level of biodiversity gain.	Initiated within 6 months. Duration: approx. 10 years	TFCG	• Implementation plans per village • Reports describing successful implementation; • Random site inspections. • Evidence of natural woodland habitat within supported village land after 10 years.
Re-establish Lost Dry Coastal Forest within the Pugu Hills Forest Reserve			
Tree species typical of the coastal dry forests will be planted to re-established this habitat beyond the footprint of the SGR. A Pugu Forest Restoration Plan needs to be developed, which should include (but not be limited to) the following steps: • Map the soil potential, terrain and existing forest cover within the Pugu Hills Forest Reserve as a first step to identify suitable forest establishment areas • Propagation experiments need to be conducted on a diversity of tree species using seed and other fertile material collected within the Pugu Hills Forest Reserve. Horticultural advice may be invaluable to advance this stage. • Numbers of trees and the approximate mix of species needs to be determined, based on field surveys of the existing forest, and sufficient to expand the forest habitat by approximately 15% (76 ha, pending availability of suitable soil potential).	***Develop a Forest Restoration Plan:*** 6 months ***Horticultural support:*** 3 mths after development of above plan ***Establish a tree nursery and tree planting:*** 6 mths after development of above plan	***Develop a Forest Restoration Plan:*** TFCG ***Horticultural support:*** Botany Dept. of the University of Dar es Salaam ***Establish a tree nursery and tree planting:*** TFSA	• Forest Restoration Plan • Horticultural reports. • Random site inspections to see nursery and area of planted trees. • Colonisation of planted forest needs to be demonstrated as evidence of net gain for R.D.Galago and other forest dependent species. Will need to be

Management Measure (Additional Conservation Actions)	Timing	Responsibility	Performance Indicator
• An indigenous tree propagation nursery needs to be established under the supervision of TFSA. A tree nursery exists at the TFSA offices in Kisarawe. • Develop a planting schedule that describes planting seasons, methods, equipment, personnel and safety procedures. • Follow-up invasive alien plant control. • Budget to implement the forest restoration programme.	***Nurturing and conservation of planted trees:*** approx. 10 years	***Nurturing and conservation of planted trees:*** TFSA	supported by additional botanical assessments and ecological studies of the Galago.
Create One or Two Bat Roost Caves to Replace the Lost Tunnel			
Creation of one or two mine shaft-based caves where suitable kaolin rock faces exist within the Pugu Hills Forest Reserve is therefore proposed to compensate for the loss of the large tunnel, and the following aspects need to be considered: • Suitable locations need to be identified, ideally where shaft openings can be placed high enough on a rock face to avoid easy human access to minimise future disturbances. • The depth of the tunnels and size of the internal cavities need to provide safe bat roosting habitat. Measurements can be taken from the existing mine shafts used by bats (approx. 100 meter depth), together with advice from a competent bat specialist who will consider the requirements of expected bat species. • The roof of the roost cavities needs to be irregular to provide abundant footholds from which roosting bats can hang, and needs to be advised by an appropriate bat specialist.	18 months	Yapi Merkezi	• Bat specialist reports • Monitoring reports demonstrating use of the sites by a diversity of bat species.
Conservation Support for the Pugu Hills and Ruvu South Forest Reserves			
Support is required to improve the conservation of the Pugu Hills and Ruvu South Forest Reserves, but guided by management plans developed for those reserves. This support	Memoranda of Understanding (MoU) developed within 1 year.	TRC TFSA	• MoU between TFSA and TRC with commitments to agreed actions.

Management Measure (Additional Conservation Actions)	Timing	Responsibility	Performance Indicator
will be discussed with TFSA, although the following points are suggested to guide the initial discussion: • The respective Forest Reserve Management Plans should be upgraded, specifically to include a delineation different zones to guide future development. Development and conservation zones are described, but are not spatially delineated in the current management plans. • Management plans state that boundary are weakly demarcated (boundary beacons are spaced too far apart) and boundary demarcation reinforcement is required. • Ranger Posts need to be constructed in different parts of the reserves, from which law enforcement operations can be launched. • Support towards law enforcement activities is suggested, which could be in the form of providing and/or financing training, equipment or actual logistics support. • Support the eviction of illegal occupation (as seen in the vicinity of the mine shafts close to the SGR alignment). Extensive RAP processes are developed for the SGR, and similar processes can be applied here with TFSA support. • Investigate how income generating activities for the forest reserves can be enhanced without compromising the conservation value of the forest reserves, to raise the sustainability of these forests.	Implementation of commitments over 5 years.		

Additional Studies to Support Actions to meet No Net Loss and Net Gain Requirements

Management Measure (Additional Studies)	Timing	Responsibility	Performance Indicator
Research into the Rondo Dwarf Galago Ecology			
TRC and YM will invite an international university to collaborate with a local university to conduct an in-depth of the ecology of this species. This ecology of this little primate is well suited to the use of new technologies such as camera traps and directional sound recordings to assess its population status, and the UDSM could greatly benefit from introduction of latest technologies. Engagement with the IUCN Primate Specialist Group (website: http://www.primate-sg.org/) is necessary to obtain guidance on the way forward regarding studies and the development of mitigation measures to protect this species.	Studies implemented within 1 year. Peer reviewed articles published within 3 years.	• TRC and YM; • Zoology Dept. of the University of DSM; • IUCN Primate Specialist Group	Published scientific articles in peer-reviewed academic journals on the ecology of the Rondo Dwarf Galago, with guidance on improved conservation.
Botanical Composition and Sensitivity of the Pugu Hills and Ruvu South Forest Reserves			
A local University Botany Dept. will conduct field surveys to expand the botanical documentation of these forests following a review existing botanical literature of the Pugu Hills forests with guidance from Kew Botanists.	Studies implemented within 1 year. Peer reviewed articles published within 3 years.	• TRC and YM; • Botany Dept. of the University of DSM; • IUCN Primate Specialist Group	Published scientific articles in peer-reviewed journals, with demonstrated relevance to the Rondo Dwarf Galago ecology.
Identification of Insect Specimens			
Insect samples collected during April 2019 field surveys will be identified to confirm current identifications. Findings of the invertebrate survey should be published in an appropriate scientific entomology journal, as these findings have value to a poorly understood component of the Pugu Hills ecology.in to generate baseline data to guide a critical habitat assessment.	6 months	Enviro-Insight	Published scientific articles in peer-reviewed academic journals

Management Measure (Additional Studies)	Timing	Responsibility	Performance Indicator
Assessment of Ecosystem Services			
Further information regarding the use of both priority and non-priority ecosystems will be captured for all Project Affected People, and further consultation planned (e.g. for Indigenous People and as part of the Livelihood Impact Assessment (LIA)), will include further exploratory questions relating to use of ecosystems services. This information will be fed into updated Resettlement Action Plans (RAPs), which will specify appropriate mitigation, including targeted livelihood restoration strategies where applicable.	6 months	TRC and YM	Structured ecosystem services analysis that is used for strengthening of social baselines (i.e. through RAPs, LIA and IPs).

APPENDIX B ESTIMATED IMPLEMENTATION COSTS

Table B1 Summary of BAP Implementation Costs

Cost Item Group	Estimated Cost (USD)
Design Phase - Mitigation Measures (once off cost)	18 000.00
Construction Phase - Mitigation Measures (once off cost)	2 645 000.00
Additional Conservation Actions (once off cost)	530 000.00
Additional Studies (once off cost)	130 000.00
Total Once-off Costs	**3 323 000.00**
Operations Phase - Mitigation Measures (recurring cost / annum)	99 000.00
Monitoring Actions	100 000.00
Development of Internal Biodiversity Capacity	210 000.00
Total Recurring Costs / Annum	**409 000.00**

Notes:

- Chemical handling procedures and dust management are addressed elsewhere within the ESIA and costs are therefore not estimated here.
- Costs of wetland restoration have been estimated by YM, however there is a lot of uncertainty regarding number of impacted wetlands, and what the restoration cost per wetland will be. These wetland restoration costs may overlap with wetland re-instatement costs within YM's rehabilitation budget.
- Costs for alien plant control have been estimated by YM based on their current experience and field capacity.
- Costs of additional conservation actions and studies have been estimated by YM, and represent the payments that will be that will made be to relevant organisations. Additional support will be provided in kind (e.g. accommodation, vehicles, fuel) determined on a case-by-case basis, but those costs are not included.
- Additional cost breakdowns for elephant-proof fencing, annual monitoring costs and development of internal biodiversity capacity are provided at the end of this Annex.
- Development of Internal Biodiversity Capacity has been included as an annual recurring cost, as it is based on an annual salary estimate, but may be applicable only to the construction phase and shortly thereafter.

Table B2 Breakdown of Cost Items for BAP Implementation

Cost Item (USD)		Once-off Costs	Recurring Costs per Annum
Design Phase - Mitigation Measures (once off cost)			
1. Limit the Extent of the SGR Footprint		6 000.00	
2. Declare Forest Reserves as No Go Areas during Construction		2 000.00	
4. Respect Buffers of Rivers, Water Bodies and Wetlands		2 000.00	
5. Elephant-proof Fencing of the SGR in Ngerengere & Mkata		2 000.00	
7. Minimise Loss of Fauna during Vegetation Clearing		6 000.00	
Construction Phase - Mitigation Measures (once off cost)			
1. Limit the Extent of the SGR Footprint		29 000.00	
2. Declare Forest Reserves as No Go Areas during Construction		7 000.00	
3. Ban Illegal Charcoal but Promote Sustainable Charcoal Prod.		43 000.00	
4. Respect Buffers of Rivers, Water Bodies and Wetlands		10 000.00	
5. Elephant-proof Fencing of the SGR in Ngerengere & Mkata		150 000.00	
6. Maintain Permeability of Underpasses for Wildlife Movement		10 000.00	
7. Minimise Loss of Fauna during Vegetation Clearing		140 000.00	
8. Prevent Contamination through Good Chemical Handling		not costed	
9. Revise the Dust Prog. and Better Dust Suppression		not costed	
10. Develop and Implement Biodiversity Protection Policies		8 000.00	
11. Implement Biod. Awareness for Contractors & Communities		12 000.00	
12. Enforce Vehicle Speed Limits to Protect Fauna		12 000.00	
13. Reduce Light Contamination at Night		8 000.00	
15. Rehabilitate Disturbed Terrestrial Sites Promptly		300 000.00	
16. Restore Destroyed and Degraded Wetlands	(a)	1 500 000.00	
17. Develop & Implement an Invasive Alien Species Control Plan	(a)	400 000.00	
Unplanned Actions		16 000.00	
Operations Phase - Mitigation Measures (recurring cost / annum)			
3. Ban Illegal Charcoal but Promote Sustainable Charcoal Prod.			1 000.00
5. Elephant-proof Fencing of the SGR in Ngerengere & Mkata			50 000.00
6. Maintain Permeability of Underpasses for Wildlife Movement			3 000.00
14. Implement Controlled Access along the SGR during Operations			2 000.00
17. Implement the Invasive Alien Species Control Plan			40 000.00
Unplanned Actions			3 000.00
Additional Conservation Actions (once off cost)			
Support TFCG to Implement Sustainable Charcoal Programmes	(b)	100 000.00	
Re-establish Dry Coastal Forest in the Pugu Hills FR	(b)	130 000.00	
Create One or Two Bat Roost Caves to Replace the Lost Tunnel	(a)	200 000.00	
Conservation of the Pugu Hills and Ruvu South Forest Reserves	(b)	100 000.00	
Additional Studies (once off cost)			
Research into the Rondo Dwarf Galago Ecology	(b)	100 000.00	
Botanical Studies of the Pugu Hills & Ruvu South Forest Reserves	(b)	10 000.00	
Identification of Insect Specimens		10 000.00	
Ecosystem Services Assessment		10 000.00	
Monitoring and Personnel (recurring cost / annum)			
Monitoring Actions			100 000.00
Development of Internal Biodiversity Capacity			210 000.00
Total		**3 323 000.00**	**409 000.00**

Note (a) - Lumpsum costs have been estimated by YM with consideration that construction equipment is available and already mobilised to site, which is an important cost saving.

Note (b) - Costs for additional conservation actions and additional studies represent payments proposed by YM, with additional support provided in kind (e.g. accommodation, vehicles, fuel) determined on a case-by-case basis.

Wetland Delineation and Restoration Task

Wetland occurrence has been extrapolated from estimates produced through identifying wetlands from Google Earth for selected lengths of the SGR within each ecoregion. The following table presents the data and results of calculations.

Ecoregion Unit	Wetlands intersected per km	Distance through Ecoregion	Estimated count of wetlands
Coastal Forest Mosaic	1.03	108	105.2
Eastern Miombo Woodland	1.34	203	151.9
Acacia Commiphora Bushlands	0.42	202	475.7
Total Estimate of wetland occurrence			**733**

The Wetland count is reduced from 733 wetlands to 500 functional wetlands.
Number of impacted wetlands is estimated at 150, based on the assumption there will be no further loss of wetlands.
The number of wetlands needing to be restored is unknown, and the unit cost for wetland restoration is also unknown.
Costs that need to be considered include wetland delineation costs, development of a Wetland Restoration Plan.

Elephant-proof Fencing Cost Calculation

Total distance estimated at 40 km
Construction cost / meter = USD 2.86
Based on: www.wildlifecampus.com/Help/PDF/Upfront_Cost_of_Game_ranching.pdf
Construction cost estimated at 40km x USD 2.86 x 1000 = USD 114 400.00
Miscellaneous fencing costs approx. 35 000.00
Total elephant proof fencing cost estimated at USD 150 000.00

Annual Monitoring Costs

Item	Amount (USD)
Protected Areas	3 000.00
Critical Habitat Features	30 000.00
Fauna	4 000.00
Monitoring Continuation of Migration	4 000.00
Recording of Road Kills and Faunal Translocation Incidents	2 000.00
Aquatic Ecosystems and Wetlands	20 000.00
Rehabilitation Programmes	7 000.00
Alien Plant Control	30 000.00
Total Cost	**100 000.00**

Development of Internal Biodiversity Capacity

Annual salary	70 000.00
Vehicle support	70 000.00
Accommodation etc	70 000.00
Total	**210 000.00**

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
Myanmar
The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
Thailand
UAE
UK
US
Vietnam

ERM Southern Africa (Pty) LTD
1st Floor, Building 32, The Woodlands
Office Park
Woodlands Drive, Woodmead
2148 Johannesburg
South Africa

T: +27 11 798 4300

www.erm.com

The business of sustainability

ERM