

Ministry of Public Works and Transport



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PROPOSED SIPHOFANENI-SITHOBELA-MALOMA-NSOKO (MR-14)

And

MALOMA-SIPHAMBANWENI (MR 21) ROADS UPGRADE

VOLUME II: MR-21 ROAD

Ecology Report

By

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I. INTRODUCTION

I-1 Background

The Ministry of Public Works and Transport (MoPWT), is proposing to upgrade the MR-14 and MR-21 roads. The MR-21 road project entitled “ Maloma-Siphambanwneni MR-21” in the Lubombo and Shiselweni Region of Eswatini. The project is in a national one, stretching the highveld grasslands of Mahamba in the east-south, where the road is on the catchment of the Ngwavuma River.

Our understanding is that the project is divided into two namely;

Volume I: SIPHOFANENI-SITHOBELA-MALOMA-NSOKO (MR-14)

Volume II: MALOMA-SIPHAMBANWENI (MR 21).

I-2 The Maloma-Siphambanwneni Road

It is also our understanding that additional site-specific assessments need to be carried out for Maloma-Siphambanweni road, prior to any item activity at project area.

I-3 Biodiversity Assessment

Further, it is our understanding that prior to construction of the Maloma-Siphambanweni, a Biodiversity Baseline Assessment of the project area and its associated infrastructure such as, relocation of public infrastructure to be affected by the road, and spill-over effects as a result of resettlement, needs to be carried out.

It is for these reasons that a biodiversity assessment on the Maloma-Siphambanweni road needs to be carried out, in compliance with the Eswatini Environmental Authority (EEA) with the African Development Bank (AfDB) requirements for the project.

II. PURPOSE OF THE FLORA AND FAUNA BASELINE STUDY

In accordance with MoPWT and requirements of the African Development Bank (AFDB) Group, a Biodiversity Baseline Assessment need to be carried out to provide interventions for the loss of biodiversity resources as well as forests caused by road construction and other activities such as resettlement.

This Biodiversity Assessment is therefore to document the biodiversity resources in the project area as a baseline, and to provide MoPWT with actions to protect these biodiversity resources, for the benefit of future generations.

This Flora and Fauna Study serves as a source document to inform the Biodiversity Baseline Assessment is derived from a Specialist, are to be appended to the ESIA/ESMP documents.

III. THE STUDY AREA

Based on MoPWT communication on the Maloma-Siphambanweni ESIA/ESMP (Biodiversity Baseline Assessment), and given the following activities, namely

- ✚ The approved Main ESIA and Main ESMP covered the Lubombo and Shiselweni regions, based on an Ecology Assessment of the region where Maloma-Siphambanweni road will be upgraded. However, the Ecology Assessment Report does not include detailed site-specific assessment of the project area. What is the extent of biodiversity loss due to the Maloma-Siphambanweni, more importantly the forest habitat which is currently a source of livelihood for the surrounding communities?
- ✚ The areas that will be needed for batching plant, laydown areas, alternate quarry (if it will be needed).

The Study Area for the Flora and Fauna Report therefore will encompass

- ✚ The Immediate Study Area: A strip of 23 km in length, and 38m wide. This is the legal road reserve in accordance with the Roads and Outspans Act of 1931. Associated with this is the \pm 20ha of forests that will be cleared during construction of road.
- ✚ The Immedirich Distal Study Area,

People affected by implementation of the Maloma-Siphambanweni road project will need to be resettled. In this distal area, relocation may be on forested areas, at once raising a red flag on biodiversity, this to be compounded by not only biodiversity loss to residential households and their livelihood farmlands, but to forested grazing lands (terrestrial habitat, to sensitive ecosystem (wetlands), or to positive aquatic habitats (riverine ecology).

- ✚ The Proximal Distal Area, in Maloma-Siphambanweni, this Biodiversity Assessment, in view of the planned project, would like to recognize downstream habitats as ones to suffer the brunt of ecological damage in the project area, hence a need to protect the distal area resources that will likely to be impacted, i.e., fish populations in the Ngwavuma River.

IV. METHODOLOGIES EMPLOYED IN THE FLORA AND FAUNA STUDY

A desktop study was initiated to review current literature on flora and fauna biodiversity with reference to the study area. Existing data from various sources was collected.

This was followed by undertaking of field surveys to determine the extent and nature of vegetation in the study area. This included data collection of the following:

- Vegetation community types
- Specific plant species found
- Plant species of special concern or require conservation
- Alien/invasive species

This was followed by the undertaking field surveys to determine the presence of faunal species in the study area with regards to:

- Specific animal species found
- Animal species of special concern or require conservation

A combination of methodologies was used to conduct this survey, which aimed to establish the presence and density of biodiversity resources in the proposed area as well as their conservation status. Below is a brief description of how this investigation was carried out.

i. Aerial Photos

Aerial photos were used to confirm the boundary of the study area and acquiring basic information on the habitat type of the study area.

ii. Ground Truthing

The project area was visited in a number of occasions, where the team of investigators surveyed the area on the ground with a systematic routing and recording all ecological resources that we came across. The presence of rare, protected and threatened plant species and other species of conservation concern was one of our main focus.

iii. Vegetation and Plant Species Survey

The vegetation type of the site was assessed through taking an inventory of plant species available in the area to provide information on plant species diversity and identify plant species of conservation concern. This was done through direct observation and recording.

iv. Searching for Traits

Tell-tale evidence was sought after, such as animals droppings, nests and spoors.

v. Bird Survey

Identification of bird species was done in early morning hours by direct observations and acoustic, although time could not allow the study to be conducted during the different seasons of the year.

vi. Herpetofauna (Amphibians & Reptiles) Survey

Surveys were undertaken during their active periods of herpetofauna, and weather conditions were critical, taking into consideration their ectothermic and cryptic nature. Indeed, many reptiles such as snakes and lizards are timid, secretive, and fast-moving, and cryptically coloured, which made the survey challenging.

vii. Active Searching

As mentioned prior, this method was used in association with others, for example it was used to study

mammals, avifauna and herpetofauna. Active potential breeding sites were searched, e.g., for birds- roosting sites, for herpetofauna, -shed skins, for avifauna- tree canopies and tall grasses; while mammals –burrow pits, caves, droppings.

viii. Documentation

In this investigation, checklists were compiled, following ground reconciliation with design maps provided, visual identification, use of indigenous knowledge systems, sound, tell-tale evidence such as animal droppings and spoor. Protected plants were identified using the Flora Protection Act schedules and South African Red Data Lists-Plants. Protected animals were identified using the Game Act and South African Lists for animals. Aerial photographs were used to identify possible habitat corridors that would be required for conservation and prevention of fragmentation.

V. FINDINGS

V-1. Biome Type

In the regional context, the Maloma-Siphambanweni road is located on the Southern Africa savanna, one of two distinct biomes of Eswatini located in eastern Eswatini, see Figure 2, extending north and east of Eswatini onto South Africa Mpumalanga and Mozambique.

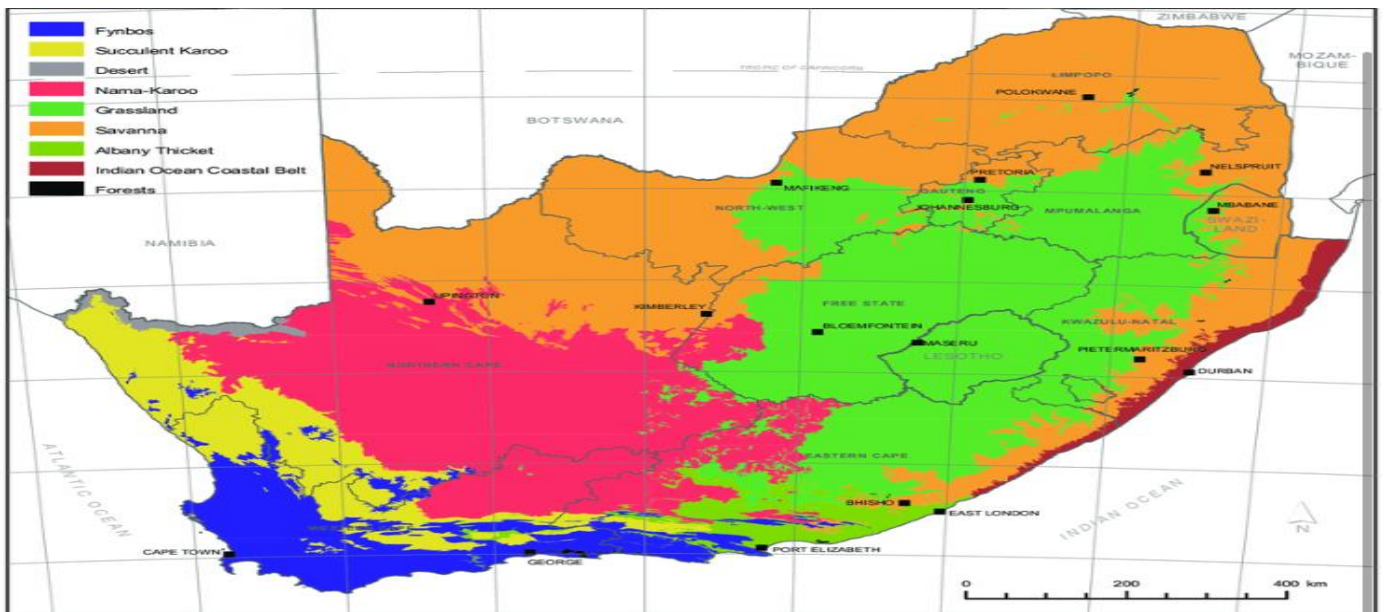


Figure 2. Orthophoto of 2 distinct Biomes

V-2. Vegetation

The vegetation in the project area can be described as mixed western lowveld bushveld (sometimes referred to as delagoa lowveld) vegetation type of the savanna biome of Southern Africa².

V-3. Climatic Conditions

The climate is subtropical, which influence the fauna found in the project area.

V-4. Flora

The settlement itself is on broken veld, see Photo 1 and 2, caused by human activities along the banks of the Ngwavuma River.



Photoplate 1- Sand Business on Ngwavuma River



Photoplate 2- Blockyard business on Ngwavuma River

In the distal study area, the vegetation along the Maloma-Siphambanweni road is pristine, but is heavily infested with alien/invasive plants, see Photo 3. In some areas of the project road, the grazing lands remain pristine see Photo 4.



Photoplate 3- Alien/invasive plants species along MR-21



Photoplate 4- Road pristine forest at grazing areas

Flora checklist

Table 1 Plant Species In Project Area

Table 1 is an abundance list of plants in the study area.

Table 1 Flora Recorded in surrounding areas

Siswati Name	Scientific Name	Type	Uses
Sitfwetfwe	<i>Acacia borleae</i>	Tree	Used for fencing
Lugagane	<i>Acacia ataxacantha</i>	Tree	Wood for fencing
Umkhaya	<i>Acacia burkei</i>	Tree	Wood for furniture
Sasane	<i>Acacia tortilis</i>	Tree	Used for fencing
Umgamba	<i>Acacia davyi</i>	Tree	Fencing
Umkhanya kudze	<i>Acacia xanthophloea</i>	Tree	Medicinal
Singa	<i>Acacia gerrardii</i>	Tree	Fencing
Inshagwe	<i>Acacia nilotica</i>	Tree	Fencing
Inhlaba*	<i>Aloe malothii</i>	Shrub	Used for making snuff
Vovovo*	<i>Cordyla Africana</i>	Tree	Bark used at emetic
Umvangati*	<i>Pterocarpus angolensis</i>	Tree	Furniture; medicine for calves
Umneyi*	<i>Berchemia zeyheri</i>	Tree	Edible fruit; wood for furniture
Umnunu*	<i>Balanites maughamii</i>	Tree	Medicinal
Umkhiwa*	<i>Ficus capensis</i>	Tree	Edible fruit
Umganu*	<i>Sclerocarya birrea</i>	Tree	Edible nuts, fruit used for making beer
Incithamuzi	<i>Ilex mitis</i>	Tree	For bidden in homes
Umntulwa	<i>Vangueria cyanescens</i>	Tree	Peg lighting
Ngcotfo	<i>Cassine transvaalensis</i>	Tree	Bark use at emetic; for luck
Imbabatane	<i>Ctenomeria capensis</i>	Shrub	Medicinal
Umsutane	<i>Lippia javanica</i>	Shrub	Cultural use
Lusekwane ^w	<i>Dichrostachys cirenea</i>	Shrub	Used at Incwala ceremony

* Represents species protected under the Flora Protection Act

+ Represents Alien Species

Table 1 Flora Recorded in surrounding areas..Ctn'd

Siswati Name	Scientific Name	Type	Uses
Umfomamasi	<i>Rauwolfia caffra</i>	Tree	Bark medicine
Sanama	<i>Acanthospermum australe</i>	Shrub	Weed
Lisundvu*	<i>Phoenix reclinata</i>	Shrub	Cultural
Umkhuhlu*	<i>Trichila emetica.</i>	Tree	Medicinal
Umvongotsi*	<i>Kigelia Africana</i>	Tree	Medicinal
Sijelele	<i>Euclea natalensis</i>	Tree	Edible fruit
Licobhe	<i>Dalbergia armata</i>	Shrub	Basket; calf muzzle
Inovi	<i>Erianthemum dregei</i>	Shrub	Bird-lime
Lijowe	<i>Datura stramonium</i>	Shrub	Medical for swellings
Litabhane	<i>Scolopia mundii</i>	Shrub	Edible (like potato)
Imbondvo lemhlophe*	<i>Combretum zeyheri</i>	Tree	Used at Incwala
Imbondvo lemnyama*	<i>Combretum molle</i>	Tree	Use for fencing
Sangongongo	<i>Plectroniella armata</i>	Tree	Edible fruit
Silevusembuti	<i>Asparagus macowanii</i>	Shrub	Medicinal
Umtfombotsi	<i>Spirostachys Africana</i>	Tree	Medicinal, Back ache
Umsenge*	<i>Cussonia natalensis</i>	Tree	Emetic
Umsiphane	<i>Grewia bicolor</i>	Tree	Root as emetic
Umvongotsi*	<i>Kigelia Africana</i>	Tree	Medicinal
Sijelele	<i>Euclea natalensis</i>	Tree	Edible fruit
Umwuwane	<i>Dombeya rotundifolia</i>	Tree	Medicinal
Umhlafulo	<i>Ricinus communis</i>	Tree	Medicinal
Umtfudvuluka	<i>Ximenia Americana</i>	Tree	Edible fruit

Umphafa	<i>Zizypus mucronata</i>	Tree	Used for bearing a corpse at burial
Umzilazembe*	<i>Dichrostachys cenera</i>	Tree	Fencing
Sigwenga	<i>Sansevieria hyacinthoides</i>	Shrub	Rope making
Sandanezwe	<i>Chromolaena odorata</i> +	Shrub	Alien
umfana-kamacentjane*	<i>Stylochiton natalensis</i>	Shrub	Medicinal
Inhlaba*	<i>Aloe arborescence</i>	Tree	Medicinal
Nukane+	<i>Tagetes minuta</i>	Shrub	Medicinal
Domoina Weed+	<i>Parthenium hysterophorus</i>	Shrub	Alien/Weed
Umsilinga+	<i>Melia azedarach</i>	Tree	Necklace-making (seed)
Bukhwebeletane+	<i>Lantana camara</i>	Shrub	Edible fruit
Intfuma+	<i>Solanum acanthoideum</i>	Shrub	Medicinal seeds
Chuchuzza	<i>Bidens pilosa</i>	Shrub	Edible leaves
Imbuya	<i>Amarantus caudatus</i>	Shrub	Edible leaves
Umvusa-nkunzi	<i>Azima tetracantha</i>	Shrub	Medicinal
Santulwane	<i>Vangueria esculenta</i>	Shrub	Edible fruit
Sihlonhlwana	<i>Euphorbia clavigera</i>	Tree	Medicinal
Ludvonca lesiganga	<i>Ceratopthea triloba</i>	Shrub	Medicine
Inhlang'shane	<i>Allophylus africanus</i>	Tree	Edible fruit
Bhungele	<i>Ehretia rigida</i>	Tree	Edible fruit
Umvallasangweni	<i>Gardenia cornuta</i>	Tree	Hut protection, Medicinal
Umhuluka	<i>Croton menyharthii</i>	Tree	Medicinal
Sihlalavane	<i>Combretum hereroense</i>	Tree	Timber
Sihlangu	<i>Maytenus heterophylla</i>	Shrub	Used for making wooden spoon

* Represents species protected under the Flora Protection Act

+Represents Alien Species

^w Wetland Species

Table 1 Flora Recorded in surrounding areas... .C'tnd

Inkhokhokho	<i>Ficus petersii</i>	Tree	Edible fruit use for carving
Liletsa	<i>Pappea capensis</i>	Tree	Use by traditional doctors
Lisololo lelikhulu (Orchid)	<i>Bauhinia acuminata</i>	Tree	Indigenous grass /erosion control
Ngwengane	<i>Cynodon dactylon</i>	Grass	Cattle Fodder
Lubabe	<i>Panicum maximus</i>	Grass	Erosion control
Umsingitane	<i>Sporobolus africanus</i>	Grass	Pig's food
Lidzangamane	<i>Aneilema dregeana</i>	Grass	Thatching
Red grass	<i>Themeda triandra</i>	Grass	Thatching
Lucunga	<i>Cymbopogon excavates</i>	Grass	Unknown
* Umtsentse	<i>Imperata cylindrical</i>	Grass	Socio-cultural
Liphakama	<i>Venonia natalensis</i>	Grass	Cultural
Insikane	<i>Cyperus fastigiatus</i>	Grass	Cultural
Libhuma	<i>Typha latifolia</i>	Grass	Grinding mats
Umuzi*	<i>Ascolepis capensis</i>	Grass	Mat making
Incoboza ^w	<i>Cyperus articulatus</i>	Grass	Indigenous grass /erosion control
Umtelemba+	<i>Anmoma senegalensis</i>	Tree	Medicinal
Umganu	<i>Sclerocarya birrea</i>	Tree	Edible fruit

* Represents species protected under the Flora Protection Act

+Represents Alien Species

^w Wetland Species

Assessment of Flora

Along the proposed route, eighty-six (86) species of plants were identified, of which Seventeen (17) are legally protected under the Flora Protection Act. Most are indigenous types concentrated in undisturbed portions of the project area.

Five (5) species of alien/invasive plants were recorded, including *Annona senegalensis*, *Chromolaena odorata*, probably the most problematic alien weed along the road.

Four (4) species of wetland plant species were recorded, notably *Cyperus articulatus*, *Phragmites australis*, *Cyperus latifolius* and *Typha latifolias*. The special wetland habitats along the Ngwavuma River are in pristine state.

Medicinal Plants

The project area boasts a large number of plants of medicinal value, the most widely distributed being the *Aloe* species, as well as *Kigelia africana*, etc. Traditional knowledge systems are widely used for medicinal formulations, and medicinal huts (tindumba) are found in the project area.

The abundance of these plants in the host area means that resettling families will be able to benefit from the host sites the resources that will be inundated by the dam, provided there is no overcrowding and the Reforestation Plan incorporates these plants species as well.

Plants of Economic Value

Plants of economic value include *Sclerocarya birrea* (umganu), and the sedges such as *Typha latifolia* (libhuma), *Cyperus articulatus* (incoboza), used for making traditional mats-contributing to the local handicraft economy by women of the project area.

There is also abundance of trees used by the locals for firewood, timber for house construction, red grass for thatching, and hard woods (*Acacia davyi*) for constructing kraals and fencing.

The abundance of these forest resource implies that resettlers and hosts can co-exist within conflict, but only if the resettler is spread over many communities to avoid overcrowding.

Exotic/Invasive/Alien Species

There are ten (10) species in total, but some are already problematic in the country having been declared a disaster. Triffid weed *Chromolaena odorata* has invaded plantations and water courses in KwaZulu Natal and is now a major problem in Eswatini. Cultivated fields and fallow land do contain invasive herbaceous species. A number of these, however, are used by the locals either as relishes or in traditional medicine. The growing of *Lantana sp.* must be actively discouraged as they are mostly used by roadside communities as landscaping tools, but has now spread onto non – residential areas in the project area.

5. FAUNA

Mammals

Since most of Eswatini's larger mammalian species have been hunted extensively, the only sizeable population of wild mammals are found in the country's parks and reserves, the nearest being the Mkhaya Nature Reserve, Nisela Nature Reserve and Jozini Royal Big Six at Lavumisa.

Hunting extinctions notwithstanding, the extensive alteration of natural vegetation throughout Eswatini for variety of economic activities continues to affect the abundance, diversity and distribution of wildlife. Despite these considerable constraints to free ranging wild animals, some animals have been sighted in areas of suitable habitats.

At project area, large mammals still roam the extensive forests, especially the well conserved lands within the settlement forests.

Table 2 is a checklist of mammals identified in the project area.

Table 2 List of Mammals Known To Occur in the Project Area

English Name	Scientific Name	Siswati Name
Mole*	<u>Amblysomus sp.</u>	Imvukunyane
Grey duiker*	<u>Sylvicapra grimmia</u>	<u>Impunzi</u>
African wild dog*	<u>Canis mesomelas</u>	<u>Inja Yesiqanqa</u>
Scrub hare*	<u>Lepus saxatilis</u>	Logwaja
Impala*	<u>Aepyceros melampus</u>	Impala
Nyala*	<u>Tragelaphus angasii</u>	Linyala
Bushbuck *	<u>Tragelaphus scriptus</u>	Imbabala
African wild cat	<u>Felis lybica</u>	<u>Ligoya</u>
Red veld rat	<u>Aethomys chrysohilus</u>	<u>Ligundvwane</u>

*Represents Protected species under the Game Act

Table 2 List of Mammals Known To Occur in the Project Area....C'tnd

English Name	Scientific Name	Siswati Name
Slender mongoose	<u>Galerella sanguine</u>	<u>Umshigwane</u>
Thick-tailed bushbaby	<u>Otolemur crassicaudatus</u>	<u>Singwe</u>
Common molerat	<u>Cryptomys hottentotus</u>	Ligundvwane
Wahlberg's epauleted fruit bat*	<u>Epomophorus wahlbergii</u>	Lilulwane
Skunk	<u>Mephitis spp</u>	Licaca
Bush squirrel	<u>Epexerus ebii</u>	Imbolwane
Vervet monkey*	<u>Pygerythrus cercopithecus</u>	Ingobiyane
Dwarf galago	<u>Galagoides demidovi</u>	Singwe
House rat	<u>Rattus rattus</u>	Ligundvwane
Multimamate rat	<u>Mastomys natalensis</u>	Ligundvwane
Warthog	<u>Phacochoerus africanus</u>	Budzayikatane
Bush pig	<u>Potamochoerus larvatus</u>	Ingulube Yesiganga
Rock dassie	<u>Hyracoidea</u>	Imbila
Angoni vlei rat	<u>Otomys anginiensis</u>	Ligundvwane
Black-backed jackal	<u>Canis mesomelas</u>	Mphungutje
Striped polecat	<u>Ictonyx striatus</u>	Licaca
Side-striped jackal	<u>Canisadustus</u>	Jakalazi

*Represents protected species under the Game Act

Assessment of Mammalian Biodiversity

A total of twenty-six (26) mammalian species were found to be occurring in the project area. Although this is less than 10% of the recorded mammals of Eswatini, still the number is quite high. Of these, nine (9) species enjoy legal protection.

The large ungulates, *Tragelaphus angasii*, *Tragelaphus scriptus*, still roam the mountain forests in the project area, while the medium-and-small-sized mammals are regularly encountered in the settlements forests.

Antelopes range in body size from small to large (linyala, imbabala) are present within the Dichrostachys vegetation type as it is of significant nutritional value in the diet of wildlife, as well as the sweet nutritious *Panicum maximum* (lubabe) grass cover.

Will the road inundate forest habitats for mammals?

Birds

A list of bird species found in the project area, is shown in Table 3.

Table 3 Birds Recorded in the Project Area

Siswati Names	Common Names	Scientific Names
Lituba	Laughing dove	<i>Streptopelia senegalensis</i>
Lituba	Cape turtle dove	<i>Streptopelia capicola</i>

All Birds Protected under the Game Act

Table 3 Birds Recorded in the Project Areas....C'tnd

Siswati Names	Common Names	Scientific Names
Litubantfontfo	Green spotted dove	<i>Turtur chalcospilos</i>
Ligwegwezi	Crowned plover	<i>Vanellus coronuta</i>
Lihhwabayi	Pied crow	<i>Corvus albus</i>
Sahhukulu	Scops owl	<i>Otus senegalensis</i>
Indlati	Speckled mouse bird	<i>Colius striatus</i>
Lishilolo	Red faced mouse bird	<i>Colius indicvus</i>
Angoli	Pied kingfish	<i>Ceryle rudis</i>
Umnguphane	Cape sparrow	<i>Passer melanutus</i>
Sangoli	Woodland kingfisher	<i>Halcyon senegalensis</i>
Ikingfishi	Brown hooded king fisher	<i>Halcyon albiventris</i>
Inkonjane	Black saw wing swallow	<i>Hirundo cucullata</i>
Lusoti	Bateleur eagle	<i>Terathopius ecaudatus</i>
Tsekwane	Harmer kop	<i>Scopus umbretta</i>
Lingangane	Hadedda ibis	<i>Bostrychia hagedash</i>
Dvoye	Secretary bird	<i>Sagittarius serpentarius</i>
Intsendzele	Natal francolin	<i>Francolinus natalensis</i>
Lintiyane	Blue waxbill	<i>Uraeginthus angolensis</i>
Sijolobela	Long tailed shrike	<i>Corvinella melanaleuca</i>
Lisomo	Fork tailed drongo	<i>Dicrurus adsimilis</i>
Umshoshaphansi	Grass veld pipit	<i>Anthus cinnamomeus</i>
Ligwegwezi	Wettled plover	<i>Vanellus senegallus</i>
Lilanda	Cattle egret	<i>Bubulcus ibis</i>
Sangoli	Woodland kingfisher	<i>Halcyon senegalensis</i>

Ikingfishi	Brown hooded king fisher	<i>Halcyon albiventris</i>
Intsengu	Southern black flycatcher	<i>Meleanornis pammeliana</i>
Livukutfu	Rock pigeon	<i>Columba guinea</i>
Lihlokohloko	Spectacled weaver	<i>Ploceus ocuralis</i>
Lohheya	Steppe buzzard	<i>Buteo buteo</i>
Lohheya	Lizard buzzard	<i>Kaupifalco monogrammicus</i>
Ligibholo	Black eyed bulbul	<i>Pycnonothus barbatus</i>
Sigwaca	Common quail	<i>Coturnix delegorguei</i>
Ncedze	Neddicky	<i>Cistocola fulvicapilla</i>
Mbalane	Small billed form	<i>Maleorus pectoralis</i>
Lihlokohloko-lelibovu	Redbishop	<i>Euplectes orix</i>
Lusoti	Brown snake eagle	<i>Circaetus cinerus</i>
Imphangele	Helmeted guinea fowl	<i>Numida meleagris</i>
Incocodzi	Little spotted wood pecker	<i>Campether acaillautii</i>
Incwincwi	Black sun bird	<i>Nectarinia amethystine</i>
Umkuwe	Grey lourie	<i>Corythaixoides concolor</i>
Inkonjane	Lesser striped swallow	<i>Hirundo abyssinica</i>
Lohheya	Lizard buzzard	<i>Kaupifalco monogrammicus</i>
Ligibholo	Black eyed bulbul	<i>Pycnonothus barbatus</i>
Limfemfe	Lilac breasted roller	<i>Coracias caudate</i>
Inhlava	Little bee-eater	<i>Merops pusillus</i>
Inyoni	Rufous bellied heron	<i>Batorides rufiventris</i>
Ligwegwezi	Black smith plover	<i>Vanellus armatus</i>
Incocodzi	Bearded wood pecker	<i>Tripias namaquus</i>
Inyoni	Brubru	<i>Nilaus afer</i>

All Birds Protected under the Game Act

Table 3 Birds Recorded in the Project Area..C'tnd

Siswati Names	Common Names	Scientific Names
Lohheya	Black shouldered kite	<i>Elanus caeruleus</i>
Inyoni	Burchell's coucal	<i>Centropus burchellii</i>
Inyoni	Common sand piper	<i>Actitis hypoleucos</i>
Jekwa	Fantailed cisticola	<i>Cisticola juncidis</i>
Likhweti	Glossy starling	<i>Lamprotornis nites</i>
Incocodzi	Golden tailed wood pecker	<i>Campethera abingoni</i>
Inyoni	Grey headed bush shrike	<i>Malaconotus blanchoti</i>
Inyoni	Grey headed sparrow	<i>Passer diffuses</i>
Inyoni	Hoopoe	<i>Upupa epops</i>
Inyoni	Klaas' cuckoo	<i>Chrysococcyx klaas</i>
Phezukomkhono	Black cuckoo	<i>Cuculus clamosus</i>
Inyoni	Little grebe	<i>Tachybuptus ruffcolis</i>
Intsengu	Little swift	<i>Apus affinis</i>
Inyoni	Long billed crombec	<i>Sylvetta rescens</i>
Intsengu	Paradise flycatcher	<i>Terpsiphone viridis</i>
Inyoni	Pintailed whydah	<i>Vidua macroura</i>
Inyoni	Puffback	<i>Dryoscopus cubla</i>
Inyoni	Purple crested louriee	<i>Tauraco porphyreolophus</i>
Inyoni	Rattling cisticola	<i>Csticola chiniana</i>
Inyoni	Red billed wood noopoe	<i>Phoeniculus purpureus</i>
Umshoshaphansi	Richard's pipit	<i>Anthus cinnamomeus</i>

Inyoni	Southern boubou	<i>Laniarius ferrugineus</i>
Inyoni	Southern black tit	<i>Parus niger</i>
Sikhova	Barn owl	<i>Tyto alba</i>
Inyoni	Black crowned tchagra	<i>Tchagra senegala</i>
Inyoni	Black headed oriole	<i>Oriolus larvatus</i>
Inyoni	Bleating warbler	<i>Camaroptera brachyuran</i>
Inyoni	Rufous bellied heron	<i>Butorides rufiventris</i>
Sikhova	Scops owl	<i>Otus senegalensis</i>
Ligibholo	Sombre bulbul	<i>Andropadus importunes</i>
Inyoni	White helmet shrik	<i>Prionops plumatus</i>
Incwincwi	White bellied sunbird	<i>Nectarinia talatala</i>
Inyoni	Spotted dikkop	<i>Burbinus capensis</i>
Inyoni	Three streaked tchagra	<i>Tchagra australis</i>
Lisoti	Warhlberg's eagle	<i>Aquila warhlbergii</i>
Inyoni	White winged widow	<i>Euplectes albonotatus</i>
Inyoni	Willow warbler	<i>Phylloscopus trochilus</i>
Inyoni	Yellow breasted apali	<i>Apalis flavida</i>
Inyoni	Yellow eyed canary	<i>Serinus mozambicus</i>
Inyoni	Yellow throated sparrow	<i>Petronia superciliaris</i>
Inyoni	Rock kestrel	<i>Falco tinnuculus</i>
Inyoni	Southern ground hornbill	<i>Bucorvus leadbeateri</i>
Inyoni	Pied barbet	<i>Tricholaema leucomelas</i>
Incwincwi	Black sunbird	<i>Nectarinia amethystine</i>
Lusoti	Martial eagle	<i>Polemaetus billicosus</i>
Inyoni	Crested francolin	<i>Francolinus sephaena</i>
Inyoni	Black crane	<i>Amaurornis flavirostris</i>

Assessment of Birds Biodiversity

A total of ninety-four (94) bird species were recorded on site. The vast forests at the fingers of the Maloma-Siphambanweni site offer suitable habitats and nesting sites for birds, especially raptors. Would the road affect the large trees to the detriment of nesting sites and habitats for bird species?

This assessment, based on the land use map (Fig 3) concludes that, vast forested areas prevail where large trees will provide nesting sites especially to the protected raptor species under threat from development in the project area.

Herpetofauna

Eswatini occupies a unique position in South-Eastern Africa where the Afro temperate and Afrotropical biomes meet, and their related herpetofauna communities represent an interesting vertebrate community in Southern Africa. As presently conceived, there are 154 forms of amphibians and reptiles recorded in Eswatini, and a bulk of the recording has been carried out at Mkhaya and Nisela Nature Reserves.

A checklist of herpetofauna in the project area is in Table 4 below.

Table 4 Herpetofauna Known To Occur in the Project Area

Type	Common Name	Scientific Name	Siswati Name
Lizard	Monitor lizard	<i>Varanus niloticus</i>	Chamu
Tortoise	Leopard tortoise	<i>Geochelone pardalis</i>	Lifudvu
Lizard	Stripped skink	<i>Mabuya striata</i>	Umgololo
Snake	African rock python*	<i>Python sebae</i>	Inhlatfu
Lizard	Cape dwarf gecko	<i>Lygodactylus capensis</i>	Umgololo
Lizard	Variiegated skink	<i>Mabuya varia</i>	Umgololo
Lizard	Tree agama	<i>Agama atricolis</i>	Intfulu
Frog	Bushveld Frog	<i>Laptopelis mossambicus</i>	Sicoco
Frog	Common plantana	<i>Breviceps adspersus</i>	Sicoco
Frog	Guttural frog	<i>Bufo gutturalis</i>	Sicoco
Snake	Black mamba*	<i>Dendroaspis polyepsis</i>	Imamba
Snake	Mozambique spitting cobra*	<i>Naja mossambica</i>	Imfeti
Snake	Puff adder*	<i>Bitis arietans</i>	Libululu
Snake	Egyptian cobra*	<i>Naja haje</i>	Phemphetfwane
Lizard	Dwarf chameleon	<i>Bradypodion spp</i>	Lunwabu
Frog	Common grass frog	<i>Rana angolensis</i>	Sicoco
Frog	Bushveld rain frog	<i>Breviceps adspersus</i>	<u>Sicoco</u>
Snake	Rhombic egg-eater	<i>Dasypeltis scabra</i>	<u>Inyoka</u>
Lizard	Velvety gecko	<i>Homopholis wahlbirqii</i>	<u>Umgololo</u>
Snake	Brown house snake	<i>Lamprophis fuliginosus</i>	<u>Inyoka</u>
Lizard	Rainbow skink	<i>Mabuya quinquetaeniata</i>	<u>Umtala-nyoka</u>
Lizard	Striated stink	<i>Mabuya striata</i>	<u>Umgololo</u>
Snake	Olive grass snake	<i>Psammophis subtaeniatus</i>	<u>Inyoka</u>
Frog	Tremelo sand frog	<i>Tomopterna cyptosis</i>	<u>Sicoco</u>
Frog	Knocking sand frog	<i>Tomopterna krugerensis</i>	<u>Sicoco</u>
Snake	Bibron's blind snake	<i>Typhlops bibronii</i>	<u>Inyoka Lengaboni</u>
Lizard	Rock monitor	<i>Varanus alobigularis</i>	<u>Chamu</u>

Represents Protected species under the Game Act

Assessment of Herpetofauna Biodiversity

A total of twenty-eight (28) species were recorded on site. The forests offer suitable habitats for snakes, which are also attracted by rats and chickens in the settlements. The rocky terrain in the mountains of the Sigwe are ideal habitats for the lizards. Five (5) are protected species.

The question is how the Maloma-Siphambanweni road project impact on herpetofauna species diversity. Naturally, herpetofauna will flee the project area soon as there is activity there (also from the batch plant, site offices). The surrounding bushlands will offer protection from harm, however, herpetofauna are not that liked in Eswatini. Some are dangerous (black mamba) so it is awareness that can prevent loss of herpetofauna diversity in this project.

Fish

Despite its small land area (17,363 km²), Eswatini is intersected by many river systems, including several that originate outside the country, including the Ngwavuma River whose waters are exploited by the Maloma-

Siphambanweni road project. As a consequence, the study area is home to at least forty species of fish. Table 5 is a list of fish species in the Ngwavuma River.

Table 5 Fish Species in the Ngwavuma River

<i>Scientific Name</i>	Common Name
Barillius zambezensis	Barred minnow
B. polylepis	Barb
Chiloglanis anoterus	Pennant tail catlet
C. paratusb	Sawfin rock catlet
C. sweirstrae	Lowveld rock catlet
Clarias gariepinus	Sharptooth catfish
Cyprinus carpio	Carp
Egraulicypris brevianalis	River sardine
Hydrocynus vittatus	Tigerfish
Labeo cylindricus	Redeye labeo
L. molybdinus	Leaden labeo
L. rosae	Rednose labeo
L. rubropunctatus	Redspotted labeo
Micralestes acutidens	Silver robber
Microterus salmoides	Largemouth bass
Sarotherodon mossambicus	Mozambique tilapia
Salmo gairdneri	Salmon

Aquatic Macro Invertebrates

Potamonautes sidneyi (crab)

Melanoides tuberculata (snail)

Bulinus speciosus (snail)

Assessment of Fishes Biodiversity

Seventeen (17) fish species are known to occur in lowveld rivers and streams, of which the barb family, which is by far the most diverse in the checklist, does not include the *B. afer*, *B. burgi*, *B. andremi* or *B. serra*, which appear on the Red Data list – Freshwater fish. The second diverse (*Labeo*) does not include the *L. seeberii*, which is threatened. The only alien fish species is *Micropterus salmoides*.

The question is how the project road will impact on the fish species. While road construction will impact on fish in the Ngwavuma River?

It is the construction phase that will be identified to fish and aquatic macro invertebrates.

Site clearance at the project area, at the alternate quarry, the batch plant, will result in siltation pollution. But mostly significant is the blockage of water in the local stream feeding the Ngwavuma River that will impact on ecological flows, water quality, and prevention of spawning in upstream rivers and stream.

V ASSESSMENT OF IMPACTS AND MITIGATIONS

V-1.0 Methodology Of Assessment Of Impacts

The impacts were evaluated, assessed, and rated on the basis of the following methodology adopted from World Bank/AfDB Guidelines for Environmental and Social Impact Assessment.

NATURE		
Include brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity		
GEOGRAPHICAL/SPATIAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance if an impact have different scales and as such bracketing ranges is often required. This is often useful during the detailed assessment of a project in terms of further defining the determined		
1	Site	Physical impact will only affect the site
2	Local/district	Will affect the local area
3	Province/region	Will affect the entire region
4	International and national	Will affect the entire country
PROBABILITY		
1	Unlikely	The chance of the impact occurring is extremely low (less than 25% chance of occurring)
2	Possible	The impact may occur (between 25% and 50% chance of occurrence).
3	Probable	The impact will likely occur (between a 50% and 75% chance of occurrence).
4	Definite	Impact will certainly occur (greater than 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environment can be successfully reversed upon completion of the proposed activity		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is reversible with moderate mitigation measures.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact will result in a complete loss of all resources
DURATION		
This describes the duration of the impacts on the environment parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years)

3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years)
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).

CUMULATIVE EFFECT - This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect, which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.

1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects

Intensity/magnitude- Describes the severity of the impact.

0	Negligible	No impact on the environment or socio-economy
1	Low	Impact is minor and will affect the quality, use and integrity of the system/component/processes in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component/processes but system/component still continues to function in a moderately modified way and maintains general integrity.
3	High	Impact affects the continued viability of the system/component/processes and the quality, use, integrity and functionality of the system. The system/component is highly impaired and may temporarily cease. It has high costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component/processes and the quality, use, integrity and functionality of the system/component. The system permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation

SIGNIFICANCE - determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

$$(Extent + probability + reversibility/irreplaceability + duration + cumulative effect) \times magnitude/intensity$$

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic, which can be measured and assigned a significance rating

Points	Impact significance rating	Description
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6 to 28	Negative impact	low	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive impact	low	The anticipated impact will have minor positive effects.
29 to 50	Negative impact	Medium	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive impact	Medium	The anticipated impact will have moderate positive effects
51 to 73	Negative impact	High	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive impact	High	The anticipated impact will have significant positive effects.
74 to 96	Negative impact	Very high	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive impact	Very high	The anticipated impact will have highly significant positive effects.

V-1-1 IMPACTS AND MITIGATIONS DURING PRE-CONSTRUCTION

DESTRUCTION OF TERRESTRIAL VEGETATION AND HABITAT FRAGMENTATION- IMPACT

Road projects are known to result in vegetation removal, which tends to impact on biodiversity resources, and cause habitat fragmentation.

It is anticipated that there will be minimal loss of biodiversity, as the alignment follows the existing one, except where the road will be widened to accommodate additional climbing lanes.

Also, biodiversity losses will be minimal, as the route, traverse's lands that are already heavily disturbed by human activities in the homesteads (Sigwe, Lulakeni,) and farmlands. (Makhava, A1, Siphambanweni).

The impact is a high negative because the road in some sections will traverse long distances. Habitat fragmentation will lead to encroachment onto the pristine lowveld bushland savanna, leading to an inevitable loss of indigeneous vegetation.

DESTRUCTION OF TERRESTRIAL VEGETATION AND HABITAT FRAGMENTATION -MITIGATION

The project will treat all areas of the MR-21 Road alignment as ecologically-sensitive, and will not be unnecessarily be encroached upon, at all times.

There will be minimal removal of vegetation on new alignments that traverse virgin land.

To minimize terrestrial habitat loss and fragmentation, the project will utilize xisting old borrow pits and spoil sites instead of opening new ones.

With these mitigation measures in place, the impact will reduce to a medium negative.

DEFORESTATION- IMPACT

The removal of vegetation during site clearance of the 38m of 25.7 km long road reserve in an area of bushland implies deforestation.

As well, the realigned sections to re-position bridges, improve sight-seeing distances, and climbing lanes, imply additional removal of forest of the lowveld bushland.

Moreover, the re-allocation of land during RAP Compensation will likely become forested bushland of the host areas, which will cause more deforestation, more so as hosts and resettlers compete over the forests for firewood, timber, medicinal resources, etc.

The impact is a very high negative given the cumulative impact of deforestation to be caused by planned and future developments (e.g., EWADE, MNWAP).

DEFORESTATION -MITIGATION

MoPWT will engage the MTEA-Forestry Department as no entity can develop within 33 yards of which indigenous timber is growing (Forestry Preservation Act, 1910)

Together with MTEA- Forestry Department, MoPWT will replace all forests removed by the MR-21 in a Reforestation Plan prior to construction. MoPWT will ensure that all stakeholders have input in the planning and implementation of the Reforestation Plan.

IMPACT ON THE SENSITIVE WETLAND HABITATS- IMPACT

The road will cross the water course at one point, at Sitilo. A bridge will be aligned, and finally wetland associated with the Sitilo Bridge (km 22+669). In these low-lying areas, patches of sensitive wetland habitat will be impacted.

Therefore, the direct major impact on the wetland ecosystem structure and functions by the MR-21 Road is a major very high negative, as wetlands are protected internationally under the Ramzar Convention.

IMPACT ON THE SENSITIVE WETLAND HABITATS -MITIGATION

The project will ensure that all wetlands associated with the river crossings are considered ecologically-sensitive by the project, and will not be encroached upon unnecessarily.

The project will ensure that all wetlands are protected through adequate drainage that ensures that run-off continues to flow via the project area's drainage channels through to the wetland.

Since wetlands thrive on either side of intrusions as long as the water flow across is not interrupted, the project will ensure that culverts of adequate size are designed so that water is allowed to flow unhindered throughout the wetland areas of the road.

IMPACT ON SENSITIVE AQUATIC HABITATS- IMPACT

The MR-21 Road, especially on river crossing, is part of the catchment of the water courses.

The impact of the proposed MR-21 Road on the aquatic habitats of the project area relates to the need to maintain ecology water, which ecological water flows are at risk of obstruction by the proposed re-alignments, and whose structures (culverts, etc.) may alter the river topography, alter the direction of run-off, produce surface collapse, change the state of the riverbed, and reduce flood discharge capacity of the river, and thereby ultimately impact negatively on this sensitive aquatic habitat.

IMPACT ON SENSITIVE AQUATIC HABITATS -MITIGATION

The project will not carry out any development within 33 m of the public rivers and streams as per the Public Stream Bank Regulations.

The project will ensure that culverts of adequate size and functionality are designed so that water is allowed to flow through all bridge structures unhindered, so as to maintain ecological flows.

The culvert design at the river crossing will be such that at the outflow end, fish and other aquatic wildlife are able to move from one side of the river to the other as some species migrate upstream during the spawning season.

V-1-2 IMPACTS AND MITIGATIONS AT CONSTRUCTION PHASE

IMPACT ON TERRESTRIAL PLANTS- IMPACT

During construction, direct impacts on flora will arise from the need to remove vegetation from the project area. Unplanned and indiscriminate vegetation will lead to destruction of wildlife habitats.

It is expected that the extent of the impact will be confined to the road prism, as well as at off-site areas such as site offices, borrow pits, service yard, batching plant, and spoil sites.

Although construction will be a temporary activity, the loss of terrestrial plants, and therefore habitats for wildlife, will be permanent.

IMPACT ON TERRESTRIAL PLANTS -MITIGATION

The contractor will treat all areas in the project area as ecologically-sensitive, and will not remove plants unless absolutely necessary.

As per the Forests Preservation Act, the project will not remove trees larger than 10cm in diameter, unless permission from the Ministry of Tourism and Environmental Affairs (Forestry Department), is obtained.

At off-site areas such as the site office, service yard, batching plant, borrow pits and spoil sites, the contractor will prepare a Method Statement prior to use of each, detailing measures to prevent plant loss and fragmentation of habitats through an Environmental and Social Management Plan (ESMP) that will be approved by the EEA prior to opening up such borrow pits and spoil sites.

IMPACT ON PROTECTED PLANT SPECIES- IMPACT

The clearing and removal of vegetation for the road project, as well as clearing at road-material extraction sites (borrow pits, quarries), will be negative and direct, especially on the protected plants found in these areas.

As there is no option but to remove vegetation in some portions of the alignment, at the borrow pit sites, and at the quarries, some of the protected species including *Annona senegalensis*, *Phoenix reclinata*, *Aloe sp*, etc., will be lost permanently.

The impact is a medium negative, although ancillary activities (resources extracted from borrow for instance) may impact on specific areas outside the project area.

IMPACT ON PROTECTED PLANT SPECIES- MITIGATION

Prior to commencement of construction, the Contractor will peg the road to demarcate its boundaries, so as to enable identification of species within the road corridor that need relocation such as *Annona senegalensis*, which will be marked with red tape.

Prior to construction, the Contractor will engage a qualified Botanist, with horticultural experience, to implement the Biota Rescue Plan for the project.

Prior to commencement of construction, the Contractor will ensure that the endangered plant (and animal) species identified are translocated to nearby areas which will act as proxy sites for the rescued plant species,

keeping in mind that rescued species have a high survival rate if transplanted to habitats similar to the area from which they are translocated, i.e., nearby areas.

The project will consult the Ministry of Tourism and Environmental Affairs, Forestry Department, prior to bush clearance, to allow the herbarium to take plant specimens, where necessary.

This will be extended to the Gene Bank as well.

With these mitigation measures in place, the impact will reduce to a medium negative.

IMPACT ON MEDICINAL PLANTS AND OTHER PLANTS OF ECONOMIC VALUE- IMPACT

A total of fifteen (15) species of medicinal plants and plants of economic value will be permanently removed from the project area during site clearance, with the deforestation of of vegetation rich in medicinal plant resources.

It is well known fact that 80% of Emaswati rely on traditional medicine for primary health care, and use many tree species to fence their kraals, and use many tree species for firewood.

In this project, such plants are widely used by Sigwe, Lulakeni, A1, Makhava, and Siphambanweni settlement residents.

As well, twenty-seven (27) species used for furl wood, timber, and other socio-cultural activities, including the *Acacias*, will be impacted, to the detriment of the communities. In particular, reed and *incoboza*, *lukhwane*, harvesting is a major source of income to the communities.

Such plants will be permanently removed from the road prism during construction. A plan to have the community sustainability utilize these resources must be developed to avoid overharvesting.

IMPACT ON MEDICINAL PLANTS AND OTHER PLANTS OF ECONOMIC VALUE- MITIGATION

The Contractor will inform the local communities of his intention to clear vegetation from the road prism, in order for local traditional practitioners to harvest this resource prior to construction.

The use of heavy machinery to clear the MR-21 vegetation will be minimized; labor intensive clearing by locals will be preferred. All cleared plants will be available for the local communities to recover medicinal plants.

Site clearance will be done mechanically. The use of fire is to be strictly avoided. The contractor will stockpile all plants cleared from the road corridor to places where they will be easily accessible to the local communities.

The contractor will ensure that his workers do not take part in any activities that will affect the habitats such as collection of firewood or muthi.

All trees greater than 10-cm in diameter will be cut to sizeable chucks and stockpiled on the side of the road to allow local communities to access them for fuelwood and timber.

IMPACT ON MAMMALS- IMPACT

The project is such that construction will clear vegetation, which acts as shelter for a number of mammalian species.

During the course of construction, workers will be tempted to poach on mammals like *Lepus saxatilis*. The impact is a high negative as such mammals are protected under the Game Act of 1993.

IMPACT ON MAMMALS- MITIGATION

To protect mammalian wildlife, the Contractor will ensure that site clearance outside the road prism is avoided, such that only vegetation in the way of construction activities can be cleared.

The Contractor will ensure that vegetation is not removed, except for the express purpose of construction.

Because mammals are likely to flee the site once clearing starts, this activity will be directional, always in the direction of the rivers, streams and forests, in order to allow mammals to migrate safely towards the riverine habitats or the mountain bushlands that will offer protection from harm.

The contractor will ensure that workers do not poach on protected mammals. Such species include the legally-protected *Lepus saxatilis*, which is a poacher's favourite outside nature reserves.

With these mitigation measures, the impact will reduce to a medium negative.

IMPACT ON BIRDS- IMPACT

A total of ninety-four (94) species of birds were identified in the project area, which all are protected under the Game Act. Construction will likely impact on birds because construction crew tend to poach on them.

As well, in the bushes associated with the roads riverine wetlands, active bird nesting sites are found on the reeds, as well as in the large trees of the mountain bushland in the Maloma, Sigwe, Lulakeni, A1, Makhava, Siphambanweni areas.

The impact on birds is a medium negative in the settlements as most of the birds are transients, there, and high negative in the pristine bushes, in the private reserves in the project area, where endangered species such as *Trigonoceps occipitalis (lingce)* are found.

IMPACT ON BIRDS- MITIGATION

The contractor will ensure that workers do not poach on birds, will educate his workforce on the Game Act of 1993, and will make workers aware of the penalties associated with bridging the Act.

The contractor will time his work program to avoid working near active bird nesting sites until the chicks fledge.

HERPETOFAUNA- IMPACT

During construction, the contractor and his/her work crews may cause loss of herprtofauna species by intentionally, or unintentionally, destroying their habitats, which on site is the wetland harbouring amphibians, which attract snakes, and the rocky crevices on Maloma hills which harbor reptiles.

As well, encroachment on the fringes of the bushes on the periphery of the settlements may result in the killing of snakes which are attracted to rats and chickens in these settlements.

There is also a strong likelihood of killing of reptiles by construction crews, especially those generally not liked in Eswatini, including snakes and frogs. The killing of legally-protected animals under the Game Act is a serious crime in Eswatini.

The impact on hepertofoana is a medium negative in the settlement areas, but high negative in the riverine areas (especially amphibians), and pristine bushes. However, most of these species will avoid the construction sites.

HERPETOFAUNA- MITIGATION

The killing of amphibians and reptiles will be strictly controlled, since without a permit, no person may kill or capture herpetofauna in accordance with the Game Act of 1993. However, such is permitted without a permit if it is in defense of human life or property.

Because herpetofauna are likely to flee the site once clearing starts, this activity will be directional, allowing herpetofauna to migrate freely to nearby riverine habitats that will offer protection from harm. Workers will be particularly vigilant when working in the crocodile-infested Ngwavuma River.

The contractor will ensure that those herpetofauna that are too slow to flee such as tortoise *Geochelone sp.*, are assisted.

SENSITIVE HABITATS- IMPACT

Construction activities may impact on the road corridor wetlands, which are sensitive areas protected in Eswatini under the Ramsar Convention. Here, polluting substances, including cement, oils, and other hazardous substances, will negatively impact on these sensitive areas.

In this project, pollution will also be exacerbated by the placing of large quantities of earth materials in the drainage lines, and the possibility of placing such materials in the wetland and/or directly in the rivers when working along bridges.

The impact of siltation and other forms of pollution, as well obstruction of the ecology water, are a high negative impact on the sensitive wetland and aquatic habitats.

SENSITIVE HABITATS- MITIGATION

No silt will be allowed to wash from the construction sites into the nearby Mbuluzi River and no stockpiled construction materials will be placed along natural drainage lines.

Because cement is expected to be used in large amounts, any contact with the nearby surface water will raise the pH of the water. As a result, no cement mixing will take place directly on the streams and wetland.

Oils from the service yard will be kept out of water bodies through bunding of these facilities, and releasing water only after passing through oil separators.

IMPACT OF INVASIVE/ALIEN PLANTS- IMPACT

As construction vehicles move on and off the project area, hauling materials from borrow pits and hauling material to spoil sites, there is a high likelihood of importation of alien seeds to the project area and surrounding communities, as well as exportation of alien seeds from the project area.

As well, there is a likelihood that new alien/invasive/exotic species may be introduced to the area during rehabilitation. This project must not be seen to be detrimental to the national effort to eradicate alien/invasive plants in Eswatini.

IMPACT OF INVASIVE/ALIEN PLANTS- MITIGATION

The Contractor will ensure that his equipment is thoroughly cleaned/dusted before being imported to site, and also thoroughly cleaned/dusted when he takes it out of site, to prevent propagation of alien plant seeds.

The contractor as per the Noxious Weed Act will actively destroy all alien species. Effective measures of destroying alien species are:

- isolated plants must be uprooted with a small hand pick.
- Uprooted plants must be left to rot.
- Chemical treatment of cut stems

The removal of alien/invasive plants species from the project area will be carried out sustainably by ensuring that for every invasive/alien species removed, there is at least one or more indigenous plant that will replace it.

V-1-3 IMPACTS AND MITIGATIONS DURING CONSTRUCTION

ROAD RESERVE AND OTHER SITE CLEARING ACTIVITIES – IMPACTS

Removed vegetation potentially causes soil erosion and loss of biodiversity through the destruction of plants.

In this project, the impact significance of vegetation removal is rated high due to the extensive clearing that will be undertaken, including site clearance on the road reserve.

The impact significance of soil erosion on water quality, in terms of sedimentation of the reservoir, local river crossing at the re-aligned roads, will adversely affect aquatic flora and fauna. This impact is rated high due to the footprint of the target areas to be cleared.

SITE CLEARING – MITIGATIONS

Vegetation removal will be mitigated by clearly demarcating all work areas prior to clearing. Specific site clearing and excavation will be closely supervised to ensure that construction activities do not encroach outside demarcated areas.

A strong mitigating measure can be the adoption of a Reforestation Plan to be agreed between the implementing agency and the local authorities.

Included in the Reforestation Plan will be the replacement or relocation of protected plant species found:

- Along the alignment of the MR-21 Road from Maloma to the Siphambanweni Junction
- At the sites for the Batching Plant/ Laydown area.
- At the alternate quarry, together with its associated site office, and temporary aggregate stockpile area.

Regarding sensitive wetlands and riverine/aquatic habitats, such areas shall be off-limits to construction activities, especially at all river crossings, and along some section of the road.

Erosion prevention and protection measures (cut-off rains), as well as silt traps, will be used to prevent siltation and sedimentation.

Regarding protected fauna, clearance of vegetation will be directional towards surrounding forests to allow animals to migrate to habitats that will give protection from harm, while nesting sites will not be removed until chicks are fully fledged.

Awareness raising among construction crew will be critical in terms of compliance of the project with the Game Act of 1993, the Flora Protection Act, No.10, 2001 as well as Forests Preservation Act, 28/1910.

In addition to the Reforestation Plan implemented at pre-construction, Biota Rescue Plan is appended for relocation of species prior to construction, which must be implemented and monitored through construction and operational stages.

EXCAVATION ON ROADS – IMPACT

During construction of the MR-21 road, the impact significance soils erosion, soil pollution by oils, and land degradation in spoil sites and borrow pits is rated high. Soil erosion will scar the landscape, while oil-polluted soils, borrow pits, and spoil areas, will leave the lands unfit for use by the communities.

EXCAVATION ON ROADS – MITIGATION

Erosion prevention and protection will be used on all areas of excavation, especially on areas of significant slopes and at stream crossings and natural water causes. This includes where materials will be stockpiled, and all spoil sites.

Cut-off drains, down chutes, V-drains will not only be stone pitched to reduce stormwater velocities, but will also follow through the drainage lines all the way to the receiving water bodies.

Regarding use of local materials for road construction, suppliers of sand from local rivers and streams will obtain the requisite Licence to Deal with Minerals from the Geological Surveys, Minerals and Mines Department, and a Permit from Swazi Sands. This department will also issue a licence to mine gravel from borrow pits.

Regarding soil pollution by oils, only one Service Yard at the batch plant area will be permitted to avoid widespread discharges of waste oil from vehicle servicing. Here a bunded fuel spill containment facility will be provided, together with oil separators and spill kits. No equipment will be washed in the local streams or rivers.

V-1-4 Decommissioning/Operational Phase Impacts

INVASIVE/ALIEN PLANT SPECIES- IMPACT

There is a likelihood that alien/invasive/exotic species may be introduced to the project area during rehabilitation. The impact of alien/invasive plants is a high negative one.

The removal of these species is now of national concern. The project must not introduce new alien/invasive species or exacerbate the problem during rehabilitation.

INVASIVE/ALIEN PLANT SPECIES- MITIGATION

The contractor, as per the Noxious Weed Act, will actively destroy all alien species that might be introduced during rehabilitation. Effective measures of destroying alien species are:

- Isolated plants must be rooted with a small hand pick.
- Rooted plants must be left to rot.
- Chemical treatment of cut stems

The Proponent, as per the Noxious Weed Act, will ensure that invasive species are destroyed at all times during road side refurbishment and maintenance. In the long-term, invasive plants removed will be promptly replaced by indigenous plants.

ROAD KILLS, WILDLIFE- IMPACT

When road construction has been completed, wildlife will be adversely affected by vehicular noise and killing by vehicles. When the road is open to traffic, the number of vehicles using the MR-21 road will increase. This implies more road kills, including the ungulates in the private nature reserve, e.g., Maloma that will be struck by moving vehicles.

As well, when the road is open to traffic, the general speed will increase to 120km/hr; in the 30-year design life of the road, the traffic will have increased to double the current ± 300 vehicles per day; this will increase substantially the severity of each animal strike, leading to more fatal accidents than currently exist.

ROAD KILLS, WILDLIFE -MITIGATION

The killing of mammalian wildlife such as ungulates will be prevented by adequate fencing of the road corridor and regular removal of overgrown grass on the road reserve to improve sight-seeing distances.

At operation, the road signs depicting wildlife (and livestock) crossing the road will be regularly maintained at all times.

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