



Ministry of works and Transport
Plot 57-59, Jinja Road
P. O. Box 7174
Kampala - UGANDA

Proposed Upgrade of Karugutu-Ntoroko (56.5km), Link to Rwebisengo (8.2km) and Ntoroko Town Roads; to Bituminous Standard

BIODIVERSITY ACTION PLAN



January 2026

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Developed by:

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LIST OF ACROYMS

BAP	-	Biodiversity Action Plan
AfDB	-	African Development Bank
BAP	-	Biodiversity Action Plan
BBOP	-	Business and Biodiversity Offsets Programme
CH	-	Critical Habitat
CHA	-	Critical Habitat Assessment
EAAA	-	Ecologically Appropriate Areas of Analysis
ESIA	-	Environmental and Social Impact Assessment
GoU	-	Government of Uganda
GPS	-	Geographical Positioning System
IBAs	-	Important Bird Areas
IFC	-	International Finance Corporation
ISS	-	Integrated Safeguards System
IUCN	-	International Union for Conservation of Nature
LC	-	Least Concern
MoWE	-	Ministry of Water and Environment
MoWT	-	Ministry of Works & Transport
NEA	-	National Environment Act
NEMA	-	National Environment Management Authority
NFA	-	National Forestry Authority
NFA	-	National Forestry Authority
NG	-	Net Gains
NNL	-	No Net Loss
NT	-	Near Threatened
OHS	-	Occupational Health and Safety
PS6	-	Performance Standard 6
QENP	-	Queen Elizabeth National Park
R-VU	-	Regionally Vulnerable
TSWR	-	Toro-Semiliki Wildlife Reserve
TSWR	-	Toro-Semiliki Wildlife Reserve
UNESCO	-	United Nations, Educational, Scientific and Cultural Organization
UWA	-	Uganda Wildlife Authority
UWA	-	Uganda Wildlife Authority
WCS	-	Wildlife Conservation Society
WWF	-	World Wild Fund

EXECUTIVE SUMMARY

A. INTRODUCTION

According to IFC Standards, the Karugutu-Ntoroko Project is Category A. This is because most of the project closely interacts with a Wildlife Protected Area, of Toro-Semliki Wildlife Reserve (TSWR); and project activities have potential adverse environmental impacts on some of the Biological resources held within. Though most of these impacts can be readily addressed through mitigation measures.

As part of PS6 requirements, this road project was assessed for those biodiversity values which render the Project area a Critical Habitat (CH). Thereafter, Net Gains (NG) can either be generated via biodiversity offsets (that achieve measurable, additional outcomes) where the Project has impacts to CH-qualifying values or via supporting additional conservation activities that are focused on CH-qualifying values for which the Project has no impact. No Net Loss (NNL) is required, where feasible, for National Habitat (NH). The Project intends to align with IFC PS6 (IFC, 2012) and other good international industry practice (GIIP) guidance such as the World Bank Group's Environmental Health and Safety Industry General and Sectoral Guidelines (World Bank Group, 2015), and OS6 (Environmental and Social Operational Safeguard 6) in the (AFDB, 2023).

This Biodiversity Action Plan (BAP) aims at describing series of actions by which the Project will demonstrate biodiversity Net Gain (NG) for Critical Habitat-qualifying features and No Net Loss (NNL) for Natural Habitat (NH); with specific objectives of; Identifying priority biodiversity values in the Project area that are subject to NNL/NG targets; Identifying and engage with key stakeholders relevant to the implementation of the BAP; Summarize the mitigation measures for implementation during construction and operation phases; Estimate residual impacts to priority biodiversity values; and, Set out a framework for biodiversity offsets, as well as monitoring and evaluation to enable the Project to demonstrate achievement of the NNL/NG targets.

Various methods were utilized to develop this BAP including; Review of the Management Plans for TSWR, Environment and Social Impact Assessment (ESIA) studies, and Biodiversity reports; Review of the design documents; Field surveys were conducted using authentic methods. Critical Habitat Area of Analysis (CHAA) for each project area was identified as an ecologically relevant area surrounding and including the anticipated extent of project influence on biodiversity.

B. BIODIVERSITY CONTEXT

The project area rhymes along Toro Semuliki Wildlife Reserve, a protected area within the Albertine Rift. The TSWR is made up of principally of the relatively flat Rift floor, but its eastern boundary runs along the top rift escarpment, thus including the eastern escarpment in the reserve. TSWR is a critical habitat for Biodiversity. Diverse habitats occur within the landscape of Toro-Semuliki Reserve supporting a variety of vegetation types such as grasslands, riverine forests, scrub woodland, swamp forests, papyrus swamps, and savannah woodland mosaic.

A total of 312 plant species from 42 families were recorded. For the species recorded shrubs registered the highest in terms of life forms, with a total of 114 species, followed by trees with 92 species, while the herbs, climbers and grasses followed with 52, 31 and 23 species respectively. During the 2017 assessments, *Tamarindus indica* was assessed as Nearly endangered on a global scale based on the IUCN Redlist (IUCN, 2017), well as during the 2025 studies, *Tamarindus indica* is rated as Least Concern (LC) on the IUCN Redlist (IUCN, 2025). While nationally *Tamarindus indica* is categorized as vulnerable (WCS 2016). Otherwise the species is relatively spread along the road corridor and enjoys a wide geographical range nationally. Hence minimal impacts are expected to the species. The invasive aliens along the road corridor were; *Dichrostachys cinerea*, *Lantana camara* & *Senna spectabilis*.

The sections outside TSWR (Rwebisengo Link, Ntoroko Town Roads, & 4km section between Karugutu and the TSWR gate) were as well assessed for mammal diversity and distribution. Most of these sections had no records

of mammal activities. However, the last 3 to 4Km of the road outside the Reserve from Kanara to Ntoroko landing site were characterized by several families of Olive Baboons *Papio Anubis* and Vervet monkeys *Chlorocebus tantalus*. This section further recorded two main Hippopotamus crossings used by Hippopotamus amphibious crossing from L. Albert to feed/graze terrestrially within the Reserve. The thickets also allowed for small mammal trapping since Sherman traps could be hidden from human sight.

Seven (07) species of Primates have been observed and recorded during previous biodiversity assessments in the TSWR; These include; Chimpanzee (*Pan troglodytes schweinfurthii*), Olive baboon (*Papio Anubis*), Black & White Colobus (*Colobus guereza*), Red-tailed Monkey (*Cercopithecus Ascanius*), Blue monkey (*Cercopithecus mitis*), Vervet Monkey (*Chlorocebus aethiops* and the Northern Lesser Bush Baby (*Galago senegalensis*).

During the 2025 surveys, only Six (6) amphibian species, belonging to 6 families and 6 genera were recorded along the proposed Road Corridor from Karugutu to Ntoroko. All these were recorded in water logged wallows and dry flood plains. The low amphibian diversity was attributed to unstable soils that are easily eroded leading to low ground vegetation cover and the long dry spell. While during the 2017 studies, fourteen (14) amphibian species were recorded in the project area as shown. The species belonged to seven genera and five families. The genera include *Phrynobatrachus*, *Ptychadena*, *Hoplobatrachus*, *Hyperolius*, *Kasina* and *Afrivalus*. The difference in amphibian species diversity is attributed to the variation in seasonality.

Nine (09) reptilian species were recorded in the project area during the 2017 studies. The species belong to nine genera and seven families. The genera include *Pelusios*, *Dipsadoboa*, *Acanthocercus*, *Trachylepis*, *Cnemaspis*, *Lygodactylus*, *Hemidactylus*, and *Varanus*. At genus level, genus *Trachylepis* was the most abundant, followed by genus *Varanus*

Among bird species of conservation concern recorded were; Martial Eagle *Polemaetus bellicosus*; that is globally Near – Threatened and Regionally Vulnerable (NT, R-VU); White-backed Vulture *Gyps africanus*; a single congregation of the White-backed Vulture *Gyps africanus* which is globally Near – Threatened, regionally Near – Threatened and nationally Near – Threatened (NT, R-NTG) was recorded with eight individuals on a kob carcass in the open grassland; Shoebill *Balaeniceps rex* which is globally Vulnerable, regionally Vulnerable and nationally Near – Threatened (VU, R-VUW), and; Grey Crowned Crane *Balearica regulorum* which is globally endangered, regionally Near – Threatened and nationally Endangered (EN, R-NTWG) are also known to occur in the Reserve but were not recorded during all surveys.

C. PRIORITY BIODIVERSITY VALUES

This BAP focuses on habitats and species that require special management measures rather than all biodiversity. The priority species for this BAP are those within at least one of the categories which are likely to be affected by the proposed road Project: Potential Critical Habitat-qualifying species; Species of stakeholder concern; or, Species highly vulnerable to poaching.

The habitats, ecosystems and designated areas, which are likely to be affected by the proposed Road project, are also priorities in this BAP including; Critical and natural habitats; Threatened ecosystems; and, legally protected areas and internationally protected areas. A list of potential species of stakeholder concern was compiled from those species with confirmed, or assumed likely presence within the project area. Some animals have higher susceptibility to poaching or any human-induced fatalities and may have a greater population-level effect due to their small population sizes or slow reproductive rates. Almost all large mammals within TSWR are susceptible to poaching for their meat, skin or any other body parts. The proposed upgrade of Toro Semuliki Wildlife Reserve is likely to opportune multiple poaching avenues.

The proposed road upgrade between Karugutu (0+000) and Rwebisengo Junction (26+700) follows mostly the existing road foot print. There will be some vegetation clearance to achieve the design considerations within the allowable and mitigatable limits. However, the section between Rwebisengo Junction and 49+100

towards Kanara follows mostly a greenfield. An estimated area coverage of **344.41 Hectares** will be cleared of vegetation to create space for construction and workspace. This will lead to clearance of bushlands, savannah grasslands and woodlands. Additionally, there will be alternation of the seasonally flooded areas. The loss of vegetation cover of this magnitude is significant and triggers a biodiversity offset.

D. POTENTIAL BIODIVERSITY IMPACTS

i) Negative impacts

Several impact parameters were evaluated using Quantitative physical and mathematical models to establishment of impact significance. The primary impact during construction phase will be the loss of, and degradation to, terrestrial habitats and direct loss of flora and fauna species. These activities will also result in disturbance to more mobile fauna species like large mammals, and may alter, or be a barrier to, their regular movement patterns. Most of these impacts will be permanent; however, all areas of temporary vegetation loss will be restored with native species.

Climate change impacts might be enhanced as a result of reduced vegetation cover. Greenhouse gases will be emitted as a consequence of all internal and external combustion equipment on site (operational machinery and generators), plus land clearing burning. Greenhouse gasses generally include all emissions of carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄). The sum of all greenhouse gasses is generally expressed as a carbon dioxide equivalent (CO₂e). Accumulation of Greenhouse gases leads to climate change; Likelihood of impact occurrence is high and impact significance accumulates with time.

Improved roads through TSWR and higher travel speed could raise incidents of animal road kills. Species including reptiles (especially snakes and tortoises) could be at risk of road kill. The main concern is with monkeys, ungulates and nocturnal animals that are slow on land and yet their populations have been drastically reducing in the recent past due to skin and meat demand.

ii) Positive impacts

The proposed project is a boundary at the interface of pastoral communities and TSWR. Boundaries ensure that priority species are contained and protected within a conservation area. This will reduce the wildlife animal conflicts especially from the elephants that raid people's crops. This boundary will as well protect TSWR from human encroachment.

Additionally, Diversion of public traffic at Kanara to Rwebisengo and then along the TSWR boundary will contribute to ecosystem recovery along the usual Karugutu-Ntoroko Road; that traverses through the TSWR. Additionally, there will be no additional excavation of borrow materials within TSWR to maintain the existing Road. The existing Karugutu-Ntoroko Road will be purely for tourism purposes.

iii) Cumulative impacts

The ESIA identified the fact that Oil companies have previously carried out oil exploration activities in the surrounding areas of Ntoroko, Lake Albert; The Fort Portal-Bundibugyo Road was upgraded to bituminous standards, a project that took over 10 years to complete, and Further infrastructural developments in form of Hydro power plants (Muzizi Hydro power plant) and transmission lines are underway in the project area and the neighborhoods

E. MITIGATION STRATEGIES

The mitigation measures adopted by the Project will follow the mitigation hierarchy: avoid, minimise, restore, and compensate/offset. Avoidance entails 'designing out' an impact or risk (e.g., through relocating a project component, avoiding a harmful activity, employing alternative technology), preventing their

expected impacts on biodiversity. Minimization reduces the severity of impacts on biodiversity by controlling or limiting the source of that impact.

A range of good-practice mitigation actions were included in the Project's ESIA's; and have been detailed in this BAP, The ESIA mitigation actions include; Analysis of four alternatives that were originally considered with the selected option considered as having the lowest biodiversity impact; High sensitive biodiversity sites were identified (being in the middle of TSWR), avoidance measures were taken, and located the proposed road on the boundary with communities; Most actions are focused on impact minimization through reduction of the Right of Way; controls on clearance or degradation of vegetation and disturbance of fauna; Restoration of habitats using native species is required as soon as possible following the end of impacts;

Finally, a restoration Offset was proposed to cater for the greenfield that will be opened up along the boundary of TSWR, however compensation actions to address this issues will be concluded between UWA & MoWT.

F. RESIDUAL IMPACT ASSESSMENT

This residual impact assessment focuses on priority biodiversity values likely to be affected by the Project, as these values are subject to NG and NNL requirements under IFC PS6. The scope of this assessment includes the main direct impacts of the Project, which include: Habitat loss under the project footprint; Habitat disturbance and Fragmentation for CH qualifying species; Species of stakeholder concern; and Species highly vulnerable to poaching.

The Project is estimated to directly affect (100% loss) 344.41 ha of which 32.66 ha is critical Natural Habitat (CH). The assessment of Modified Habitats (MH) was not prioritized in the BAP. Precautionary principle was evoked and the Quality scores for all habitat types affected by the Project were estimated as they intact habitats, with no any form of human interferences. The project will cause a loss of 344.41 Ha of Critical Natural Habitats.

Chimpanzees, Elephants and Hippopotamus are mostly likely to interact with the project corridor. Crossing from one side of the road to the other. Much as the impacts of the project during construction phase can be adequately mitigated, there are potential residual impact of Animal Road kills that might occur during the project operational phase. The certainty is very low with implementation of Speed reduction measures.

During Road construction, there will be influx of people within the TSWR, some of which might be practicing poaching; and will resort to animal kills for meat and other products. Additionally, during the operational phase of the project, an improve road network will provide ease access to TSWR for the poachers.

G. OFFSET STRATEGY

Biodiversity offsets and/or other forms of compensation are required to ensure overall NG of CH and NNL for NH, in line with IFC PS6 and National Environment Act, 2019 and the ESIA Regulations 2020 of Uganda. In principle, offsets are used as the last resource in the mitigation hierarchy, if significant residuals impacts remain after the previous steps (avoidance, minimization, restoration) have been implemented.

Offsets can include off-site habitat restoration and actions that increase a species' survival or productivity (restoration offsets), and/or measures to stop the ongoing degradation and loss of biodiversity in existing designated sites or sites proposed for designation (averted loss offsets). Additional conservation actions and other support enabling conservation are also considered in this BAP. The identification and development of offset actions in this BAP follows IFC Guidance Note 6. The offsets are targeted to priority biodiversity values with residual impacts.

i) Offset governance

According to section 115 of the NEA, Cap 181, "Mitigation hierarchy, biodiversity or other offset and compensation mechanisms"; The biodiversity offsets mechanism shall be designed and funded by the developer as long as the impacts exist or preferably in perpetuity. Implementation of offsets will be led by the Ministry of Works and Transport (MoWT); in collaboration with the Uganda Wildlife Authority (UWA). This arrangement will be supervised by the National Environment Management Authority (NEMA) in association with lead Conservation Agencies like IUCN, WCS and WWF as well as support from Local leaders and communities.

ii) Offset requirements and targets

The approach used in this BAP, where an increase of at least 50% in habitat Cover has been considered for the Natural Habitats (non-critical) and 100% for the Critical Habitats; compared to the estimated residual impact, hence a total of more than 532.95Ha will be achieved.

- **Protecting and enhancing the natural habitats:** This offset action has been specifically developed to deliver a NG for the two CH-qualifying threatened ecosystems along river Wasa (due to their support to Chimpanzee populations); and allow connectivity to other riverine tropical Rain forests within the landscape. As well as protecting the TSWR landscape. A total land cover of 532.95 Ha will be enhanced through a combination of activities targeted at reducing or stopping current threats to the ecosystem (averted loss), as well as rehabilitation of degraded areas.
- **Reducing threats and increasing habitat qualifying Species:** This offset action has been specifically developed to deliver a NG for the CH-qualifying Chimpanzees, and will also provide secondary gains for other priority large mammals. The main threats to the Chimpanzee is the loss of habitat due to conversion to agro-pastoral systems, Charcoal burning among others. While other mammals are mainly susceptible to poaching. Proposed actions within the offset area would be a combination of community-based activities encouraging the reduction in intensity or cessation of current threats, awareness-raising and support to alternative livelihood options for community members currently involved in poaching
- **Additional actions to support conservation:** It is good international industry practice for development projects to support conservation actions to contribute to the knowledge and enhancement of biodiversity in the country. These actions can cover a wide range of positive biodiversity interventions, or provide supporting information to inform future conservation actions, and are not intended to provide measurable gains that can be set against significant impacts. To further the understanding of biodiversity relevant to the Project's impacts, the Project will fund a local/ national NGO or academic institution to undertake a program of long-term scientific research on the Chimpanzee ecology within TSWR or biodiversity monitoring. This program will also focus on some of other priority species listed in this BAP.

H. BIODIVERSITY MONITORING AND EVALUATION PLAN FRAMEWORK

This Biodiversity Monitoring and Evaluation Plan (BMEP) Framework sets out the framework, indicators and approaches the Project should use to track changes in biodiversity across the construction and operation phases of the Project, and to evaluate whether the requirements of PS6 are fulfilled.

The BMEP framework for the proposed construction of Karugutu-Ntoroko (56.5km), Link to Rwebisengo (8.2km) and Ntoroko Town Roads (3.2km). Monitoring and Evaluation activities will be undertaken throughout the whole operational life of the Project for some features and for a shorter

duration for other features. The shorter monitoring duration for some features takes into consideration the fact that most operational impacts are expected in the first years of Construction phase.

1.0 INTRODUCTION

1.1 Project Background

The proposed main project road (Karugutu to Ntoroko) starts from Karugutu Trading Centre on the Fort Portal – Bundibugyo Road at UTM Arc 1960 191336E 87285N and ends at the lake shore on Lake Albert in Kanara Town Council at UTM Arc 1960 226397m E 116912m N. Over 95% of the road traverses through a gazetted Wildlife Reserve which falls under the jurisdiction of Uganda Wildlife Authority. This desired alternative route will maintain an existing road section from Karugutu to Kakara where there is a junction to Rwebisengo-and will continue all the way to Makondo an operational road covering about 16 Km that will require an opening for the upgrade and later on divert near the park boundary for 18 Km through green-field and to join the District feeder road of 3 Km to give a total length of approximately 21 km to Kanara.

The project will be implemented in accordance to IFC standards; this Biodiversity Action Plan (BAP) has been revised in accordance to IFC's Sustainability Framework. Project alignment with the International Finance Corporation's (IFC's) Performance Standard 6 (PS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC 2012, 2019) is required to meet the Project lenders' requirements. According to IFC Standards, the Karugutu-Ntoroko Project is **Category A**. This is because most of the project closely interacts with a Wildlife Protected Area, of Toro-Semliki Wildlife Reserve (TSWR); and project activities have potential adverse environmental impacts on some of the Biological resources held within TSWR, though most of them can be readily addressed through mitigation measures.

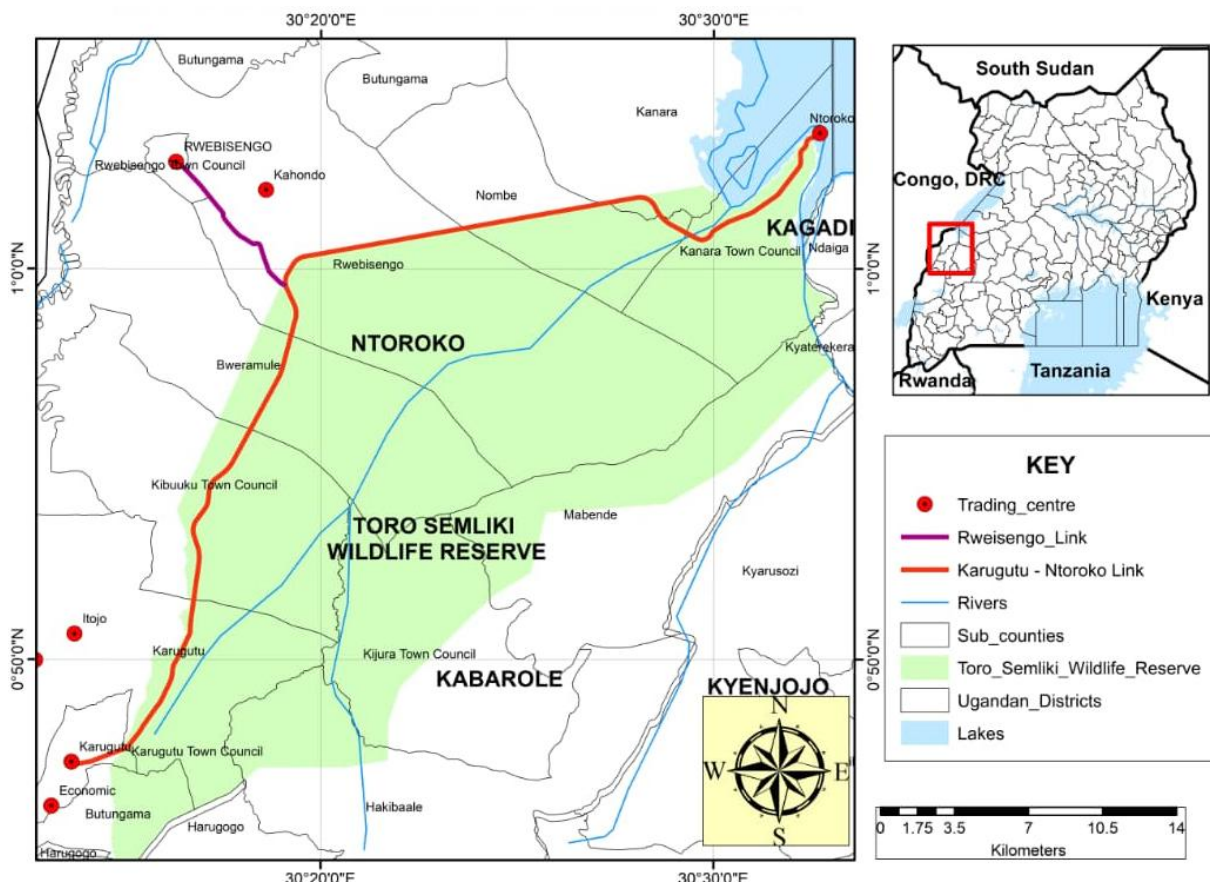


Figure 1-1: Location of the project area

1.2 Funder's requirements

The Project intends to align with IFC PS6 (IFC, 2012) and other good international industry practice (GIIP) guidance such as the World Bank Group's Environmental Health and Safety Industry General and Sectoral Guidelines (World Bank Group, 2015), and OS6 (Environmental and Social Operational Safeguard 6) in the (AFDB, 2023). Specific PS6 requirements applicable to this BAP are highlighted in the relevant sections of this document.

As part of PS6 requirements, this road project was assessed for those biodiversity values which render the Project area a Critical Habitat (CH). Net Gains (NG) can either be generated via biodiversity offsets (that achieve measurable, additional outcomes) where the Project has impacts to CH-qualifying values or via supporting additional conservation activities that are focused on CH-qualifying values for which the Project has no impact. No Net Loss (NNL) is required, where feasible, for Natural Habitat (NH).

1.3 Purpose and objectives of the BAP

This BAP aims at describing series of actions by which the Project will demonstrate biodiversity Net Gain (NG) for Critical Habitat-qualifying features and No Net Loss (NNL) for Natural Habitat (NH). NNL will also be demonstrated for other priority biodiversity values that do not trigger Critical Habitat (CH). The BAP also sets out the approach for how the mitigation hierarchy will be followed, and the roles and responsibilities for Contractor and MoWT staff.

The specific objectives of this BAP are to:

- i) Identify the priority biodiversity values in the Project area that are subject to NNL/NG targets;
- ii) Identify and engage with key stakeholders relevant to the implementation of the BAP;
- iii) Summarize the mitigation measures for implementation during construction and operation phases;
- iv) Estimate residual impacts to priority biodiversity values; and,
- v) Set out a framework for biodiversity offsets, as well as monitoring and evaluation to enable the Project to demonstrate achievement of the NNL/NG targets.

It is important to note that BAPs are 'living' documents, i.e. intended to be reviewed and updated on a regular basis. Regular review and update will take place as Project implementation takes place, and as more information becomes available on the status and ecology of priority biodiversity values, the impacts on these values and the effectiveness of mitigation actions. The BAP actions are devised in-line with the mitigation hierarchy: i.e., avoid, minimise, restore and offset. Biodiversity offsetting measures are identified and developed following IFC PS6 requirements, and guidance published by the Business and Biodiversity Offsets Programme (BBOP 2012).

1.4 Geographical and temporal scope of the BAP

The geographical scope covered by this BAP includes:

- i) Project Area of Influence, including the full extent of the Right of Way
- ii) Ecologically Appropriate Areas of Analysis (EAAA) for the threatened ecosystems, as defined in the Critical Habitat Assessment (CHA) for this Project
- iii) Other areas beyond the EAAs, which are considered for offset implementation

This BAP includes actions over the proposed lifespan of the Project (i.e., 5 years of Construction), and 10 years during the operational phase, with actions ending at different times depending on the priority biodiversity feature and target.

1.5 Stakeholder engagement and involvement

As part of the Environmental and Social Impact Assessment (ESIA), public participation and stakeholder engagements were conducted during the previous ESIA studies in 2017; and the recent ESIA updates conducted in 2024 and 2025. The results of this public consultation were taken into account in the preparation of this BAP.

IFC's PS6 strongly recommends projects to develop partnerships with recognized and credible conservation organizations, biodiversity experts and the relevant government agencies, to seek their advice during the development and implementation of a BAP. This is especially important for projects located in NH and CH, or in legally protected and internationally recognized areas (IFC 2019). Engagement with Government, communities and any local NGO representatives early and through the Project will help ensure that potential offsets receive broad support and avoid unplanned costs or delays in progress towards NNL or NG. It will also ensure that the Project can learn and incorporate useful elements from other conservation programmes elsewhere in the Albertine Graben.

Importantly, the questions addressed during the public participation process focused mainly on Socio-economic concerns of land acquisition, with less specific questions or requirements on biodiversity aspects; these were raised by the Uganda Wildlife Authority (UWA). For the development of this BAP, several stakeholders were contacted (Table 1-1), especially those holding responsibility on the designation and management of Protected Areas, those involved in the development and implementation of Uganda's offset strategy, or those that have in country experience in developing conservation work and community engagement. Stakeholders were engaged through online and physical meetings.

Table 1-1: Stakeholders that were engaged regarding the preparation of the BAP

No	Stakeholder	Relevance
1	National Forestry Authority (NFA)	Custodian of Forestes and Trees
2	Uganda Wildlife Authority (UWA)	Custodian of TSWR
3	Wildlife Conservation Society (WCS)	Wildlife experts and Biodiversity Offset Planners
4	International Union for Conservation of Nature (IUCN)	Researchers and custonians for threatened species
5	World Wild Fund	Researchers on threatened species
6	Local government & Communities	Community Wildlife interractions around TSWR

1.6 Justification for the project

Improvement of the proposed roads is expected to directly boost tourism within and around the protected area. Additionally, the proposed project falls within the Albertine Graben where an improved network is needed to enhance tourism connectivity. TSWR is among the leading source of tourism revenue contributing significantly to the management of Uganda's protected area network (MTWA, 2014). Biodiversity Protection. Secondly, the project will create an alternative route, that will divert the heavy traffic away from the TSWR at Kakara to the boundary. The heavy traffic from Karugutu to Kanara, through TSWR, is associated with numerous animal Road kills that directly impacts the gene-pool of TSWR. The proposed road will be designed will recommended traffic of 30km/hr. through a protected area; and this will significantly reduce the current high driving speed. Additionally, the project will install a wildlife-barrier along the boundary with communities; this will help to deter poaching as well as reduce the community-wildlife conflicts.

Upgrade of Karugutu-Ntoroko will enhance ecosystem recovery along the existing road corridors, since the existing road network has intense maintenance associated with continuous massive extraction of gravel, some of it from ecologically sensitive areas within the TSWR.

1.7 Associated Management Plans

Biodiversity management refers specifically to flora (vegetation, excluding weeds) and fauna (wildlife, including native and non-native animals). In addition to this BAP, the management of biodiversity should be addressed in several other sub-management plans including;

- i. Air and Dust Management Plan;
- ii. Erosion and Sediment Control Plan;
- iii. Fire Management Plan;
- iv. Invasive species Management Plan;
- v. Spoil Management Plan

1.8 Scope of the BAP

The BAP is developed for the proposed upgrade of Karugutu-Ntoroko (56.5km), Link to Rwebisengo (8.2km) and Ntoroko Town Roads through TSWR as shown in Figure 1-1. Over 95% of the road traverses at the peripheral of Toro-Semuliki Wildlife Reserve which falls under the jurisdiction of Uganda Wildlife Authority (UWA). The road starts at Karugutu Trading Centre on the Fort Portal – Bundibugyo Road at UTM Arc 1960 191336E 87285N and ends at the lake shore on Lake Albert in Kanara Town Council at UTM Arc 1960 226397m E 116912m N.

This proposed project is situated in Ntoroko District which was granted a District status by the act of parliament in 2010 curving it from Bundibugyo District effective July 2010. Ntoroko as a District is located in the western region of Uganda bordered by the Districts of Kibale in the Northeast, Kabarole in the East and Southeast, the Bundibugyo District, Democratic Republic of Congo (DRC) to the West, and Lake Albert to the North.

The existing roads are Gravel class A, maintained by MoWT and the local government. The roads are in a fair to poor condition and exhibits defects including, loss of gravel, potholes and scoring of drainage channels mainly after River Wasa towards Kanara Town Council where the road is generally flat with cotton soils that often become problematic during the rainy season.

2.0 METHODOLOGY

2.1 Literature review

2.1.1 Review of the Management Plans for TSWR, ESIA studies, and Biodiversity reports

Reports from previous studies that were conducted in 2017 and 2024 were thoroughly reviewed to supplement on the most recent studies on the project. The baseline conditions that were captured during previous studies were subjected to the prevailing conditions to determine how much of the project is accountable to changes occurring in the project area. Additionally, the Toro-Semuliki Management Plan was reviewed and the Sensitivity Atlas.

2.1.2 Review of the design documents

Road construction requires the use of design documents/ construction drawings. These offer a thorough set of guidelines to the contractors, and sub-contractors that should be adhered to throughout the project implementation process. This systematic literature review of design documents aimed at examining the adequacy of designs in addressing the potential project impacts on the environment and Socio-economic settings of the project area. Review of the design documents captured the extents of mandatory design changes that occurred so far during project implementation as well as all supplementary designs that were not included in the previous designs.

2.2 Biological environment assessment

The Biological surveys covered aspects of both wet and dry seasons; during the months of August/September and December/January respectively. Comparative data from the previous assessments was as well utilized covering natural, semi-natural, and some altered habitats along the project road with accessible locations. The focus was on identifying the presence, variety, and distribution of flora and fauna, with particular attention to critical habitat trigger species like the Chimpanzees, Elephants, Grey crowned Cranes and other endangered and endemic species in the region. The project examined flora and fauna, including herptiles, birds, and mammals. The team identified four fauna groups as key indicators, allowing for quick data collection to assess the overall terrestrial biodiversity of the area.

2.2.1 Vegetation survey methods

The project area's vegetation was divided into survey units based on land cover/use and plant community types. Field surveys were conducted at different locations where these layers were found. A quadrant sampling unit of (25 x 25) meters for woodlands & forest; (10 x 10) m for swampy & marshy vegetation; thickets and Bushy vegetation was adopted. Plant species were assessed using the DAFOR scale (Kent, 2012), where; D=Dominant, A=Abundant, F=Frequent, O=Occasional & R=Rare. Each survey location focused on the physiognomy and floristics by: (i) describing the vegetation type, with a focus on the dominant species, (ii) evaluating the vegetation structure and noting any human activities that could affect the observed structure, (iii) documenting all plant species present through on-site surveys.

Photographic records of the vegetation types and ecologically sensitive features were taken. Ecologically sensitive features were noted, and their geographical coordinates were taken. Photographic records of the vegetation types/ habitats were taken. All recorded species were assessed to determine their conservation status (IUCN, 2023; MTWA, 2018). The plant lists generated were also examined to identify the presence of invasive species (Ogwang et al., 2020) in the survey locations.

2.2.2 Fauna survey Methods

a) Mammals

Mammal occurrence was surveyed for in all the locations visited and mostly restricted to small and medium sized mammals and larger mammals that occurred in the area. Transect surveys were used to sample Medium sized mammal species diversity in project area. This involved setting out well laid transects parallel to the roads corridor. Two transects on each side of the road corridor were mapped out using GPS. These were ranging between 500m to 1km apart. Along each transects, purposeful searches and record of any live encounter for any mammal species and/or their spoor (Tracks, signs, faecal, roosts, etc.) were done.

For Rodents and shrews, non-destructive sampling was executed using baited Sherman traps, set out in a random pattern along project corridor. These were alternated every after two days (after spending two trap nights) to maximize capture. In addition, opportunistic searches for Rodent spoor especially burrows and feeding signs were done to maximize records. Captured individuals were identified and later released.

b) Avifauna

The proposed road alignment and proposed alignment (in the greenfield) was used as a transect. Birds were surveyed through areas of different habitats. A line transect count is a highly adaptable method in terrestrial systems and can be universally applied to species from different ecological categories (Gibbons and Gregory 2006). Bird identification was based on Stevenson and Fanshawe (2002). Species were assessed against the IUCN Redlist (IUCN, 2025) in order to understand their conservation status.

Species abundance assessments were based on estimated numbers of observed individuals in along the transect. Because it is not easy to obtain the exact numbers of individuals, species were categorized into the following arbitrary abundance categories: 1=<10 individual; 2=11-100 individuals; 3=101-1,000 individuals and 4=>1,000 individuals

Birds recorded were classified into categories, where possible, basing on the standard habitat classification by Bennun and Njoroge (1996) and Carswellet al. (2005). This classification is widely used in evaluation of avifauna in Uganda, Table 2-1.

Table 2-1: Classification of birds according to their habitat requirements

Category	Description	Abbreviation
Forest birds	Forest specialists, cannot survive outside the primary forest	FF
	Forest generalists or forest edge species. They can live in the forest and at the forest edge or a degraded forest	F
	Don't live in the forest, they come to the forest as 'visitors'	f
Water birds	Species restricted to wetlands/open waters. They cannot survive outside an aquatic environment	W
	Water bird non-specialist-often found near water. They can as well survive where there is no water.	w
Grassland birds	Live in grassland habitats and sometimes in cultivations	G
Wide spread	These are generally found in all habitats but tend to avoid forests	Ws
Agricultural farmland	These are species that can be found in cultivated areas like gardens and settlements.	NF

A species can fit into two ecological categories; for instance, it can be both a water non specialist at the same time forest visitor. In this categorization, it is important to note that species of the open areas are not categorized to finer details of vegetation descriptions and are based on

generalizations of natural habitat types. Bush land and human modified habitats such as gardens and settlements are not directly included. Because they are not tied to any restrictions, species in the non-specialist categories i.e. G, f, F and w can inhabit a wide range of open habitats in the landscape including bush land, woodland, and cultivated areas. The 'FF', 'F' and 'f' species also comprise of the tree species and stress the importance of trees in areas where they are recorded.

All recorded species were assessed to determine their conservation status (IUCN, 2025). The species lists generated were also examined to identify their regional and National conservation status as accorded by Wildlife Conservation Society (WCS).

c) Herptiles (Reptiles and amphibians)

The use of Visual Encounter Surveys, (VES) is a well-known method for surveying herpetofauna. They can be used to document presence of reptiles and amphibians. This constitutes moving through a habitat watching out for and recording surface-active species. The data gathered using this procedure provides information on species richness of the habitat.

Within wetlands and swamps or marshlands, a dip-net was used to scoop through aquatic habitats to sample amphibians. Opportunistic records that occurred outside the sampling points but within the project surrounding were documented. These opportunistic encounters complimented the herpetofauna checklist within the project area, because of their high mobility levels.

Identification of herptiles followed Channing & Howell (2006), The AmphibiaWeb (2014) and The Reptile Database (Uetz, P. & JiriHošek (eds.) 2014), while the conservation status will be measured against the IUCN Red Listing (IUCN 2023).

2.2.3 Hydrology & flood risks

Flooding is a common occurrence in Ntoroko and the surrounding areas due to heavy rainfall, wetland degradation, and blockage of drainage systems by various factors like structural developments, solid waste, and agricultural activities. The drainage infrastructure is often insufficient and not well-maintained. Approximately three-quarters of the current road alignment passes through low-lying areas and flood plains that are susceptible to flooding. With changing rainfall patterns, climate change, and land cover alterations, there has been an increase in rainfall run-off in the area. This raises the risk of flooding to both the road infrastructure and surrounding developments was assessed using the existing literature. Hydraulic modeling with HEC-RAS will then be used to evaluate how well the proposed structures could handle the anticipated design floods before and after the construction of the Karugutu-Ntoroko Road.

2.3 Critical Habitat Analysis

Critical Habitat Area of Analysis is only relevant to a development project if it can be impacted by that project. Consequently, a Critical Habitat Area of Analysis (CHAA) for each project area is identified as an ecologically relevant area surrounding and including the anticipated extent of project influence on biodiversity. The CHAA was used as the geographical extent to screen biodiversity features to be assessed for CH. CH was only identified and mapped at the CHAA scale as potential project effects are limited to this spatial extent. Biodiversity features of concern were screened at the species, ecosystem and landscape levels using primary data and all relevant literature from the TSWR sensitivity Atlas.

2.4 Methods for Impact Assessment and Analysis

Impact assessment included a combination of a complex of methods, including: Expert judgment; Quantitative physical and mathematical models; and Rapid Impact Assessment Matrix (RIAM).

2.4.1 Expert Judgements

Expert judgment is based on the professional opinion of experts that have considerable experience in the areas of assessed impacts especially where adequate data is available to allow for predictive modelling to explore the impacts. Expert judgments were used in conjunction with quantitative modelling and to complement modelling. This helped to interpret results and their consequences on the receiving environment and Socio-economic aspects.

Table 2-2: Rating of impact parameters to guide professional judgment

Symbol	No	minor	Low	Moderate	High	Very High	No
M=Magnitude	0	2	4	6	8	10	0
P=Probability	0	1	2	3	4	5	0
E= Extent	0	1	2	3	4	5	0
S=Significance			< 30	40-50	> 60		

2.4.2 Quantitative physical and mathematical models

During establishment of impact significance, several impact parameters were evaluated using Quantitative physical and mathematical models. The impact parameters that were assessed include Type, Timing, extent, certainty, duration, and magnitude and receptor sensitivity.

Where;

Timing	:	time frame (phase) at which an impact occurs within a project area
Duration	:	the period of persistence of an impact on receiving environment
Extent	:	Spatial occurrence by the impact on the subject environment
Magnitude	:	the strength of the impact on the environment
Certainty	:	the likelihood of occurrence of an impact
Significance	:	the overall change brought in the environment
Sensitivity	:	Level of change on the receptor environment

Table 2-3:quantitative format for ranking impacts based on parameters: magnitude and sensitivity

Significance			Sensitivity			
			Very low	Low	Medium	High
			1	2	3	4
Magnitude	Very low	1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low	2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Moderate
	High	4	4 Minor	8 Moderate	12 Moderate	16 Severe

3.0 BIODIVERSITY CONTEXT

3.1 Baseline

The project area rhymes along Toro Semuliki Wildlife Reserve, a protected area within the Albertine Rift. Gazetted as Toro Game Reserve in 1929 by General Notice 546 and since that time renamed and consolidated several times, thus 548km² conservation area is now called Toro-Semliki Wildlife Reserve (TSWR). The TSWR was originally gazetted to protect the large population of Uganda Kob (Lamprey and Michel more, 1996). The TSWR is made up of principally of the relatively flat Rift floor, but its eastern boundary runs along the top rift escarpment, thus including the eastern escarpment in the reserve. TSWR is a critical habitat for Biodiversity.

3.1.1 Vegetation and land cover

Diverse habitats occur within the landscape of Toro-Semuliki Reserve supporting a variety of vegetation types such as grasslands, riverine forests, scrub woodland, swamp forests, papyrus swamps, and savannah woodland mosaic. There were Four (04) major habitat classifications along the road as shown on the map 3-1 below.

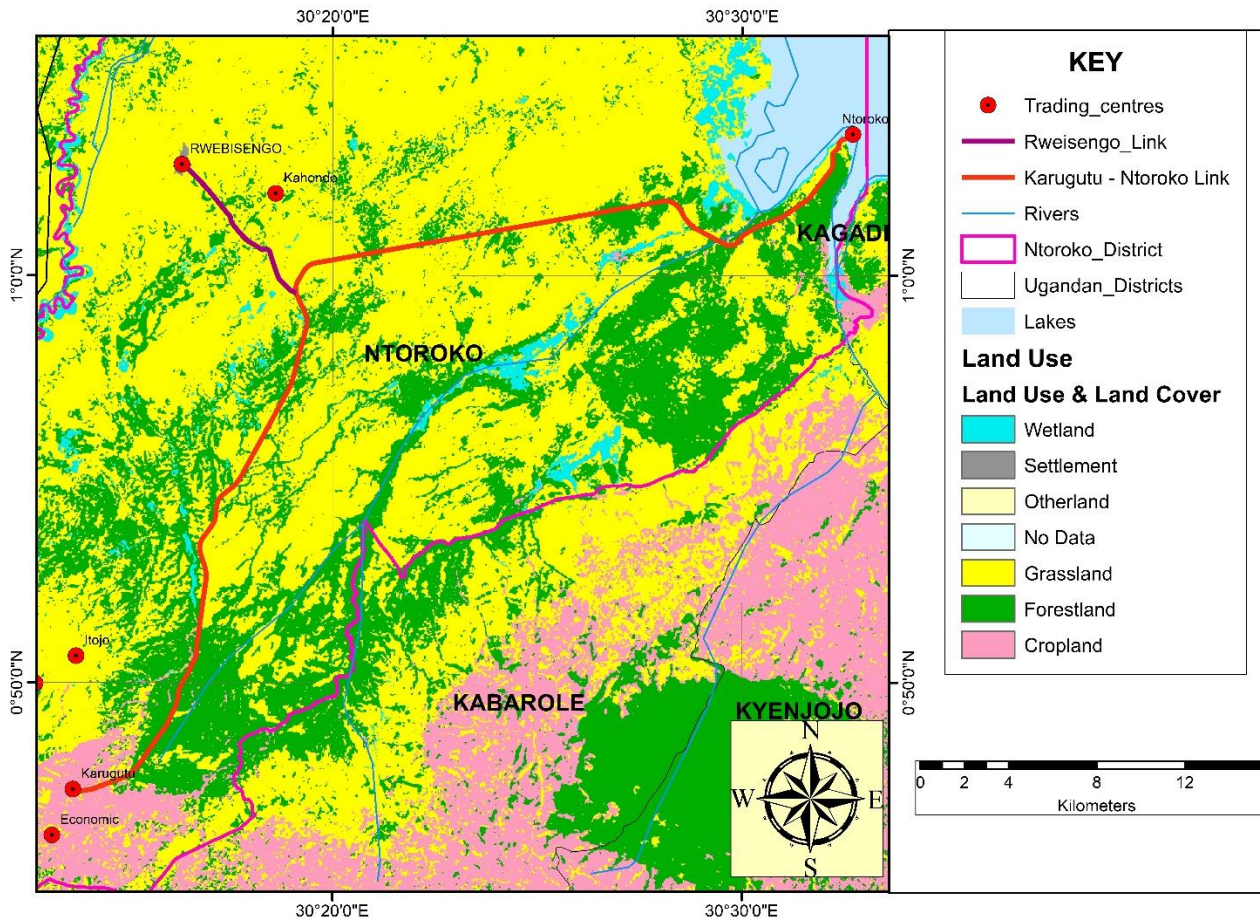


Figure 3-1: Land cover/ and Land use along the project corridor

a) Grassland habitats

These are dominated by Hyparrhenia-Themeda mosaic, Hyparrhenia filipendula, *H. dissoluta*, and Themeda triandra dominate the north-west of the reserve where there have been frequent fires and intensive grazing. Other species include Chloris spp; Sporobolus spp, a short- to-medium-height grass that occur in patches; Imperata cylindrica; and Panicum echinochloa, a tall grass mainly covering large, moist depressions such as watering holes and forming a thick band on non-forested river banks and lower grounds in the vicinity of Lake Albert.

b) Scrub Woodland /wooded grassland

This is dominated by wooded grassland characteristic of the Acacia-Hyparrhenia-Themeda woodland with Acacia sieberiana as the dominant tree species associated with Albizia grandibracteata. Others include the Acacia-Imperata, a moist wooded savanna dominated also by Acacia sieberiana, Combretum-Hyparrhenia -Themeda mixed wooded savanna dominated by Combretum spp., Tamarindus indica; and Borassus-Hyparrhenia a palm savanna dominant with other tree species scattered at lower densities. The Borassus aethiopicum palm is the frequent species although Acacia and other leguminous species are also common.

This habitat type was variable from open to dense vegetation, with shrubby species of Ziziphus pubscens, Rhus natalensis, Capparis spp, Flueggea virosa, Grewia mollis, Cadaba farinosa, mixed with varying abundances and distribution of Dichrostachyus cinerea. Dichrostachyus cinerea was among the identified yet abundantly distributed invasive plant species along the road corridor.

All the above species mentioned form thickets that variably blend with other species such as Cissus spp, Opilia celtidifolia, Stephania abyssinica, Dragea rebicunda and Sarcostemma viminalis as the commonest climbers whose growths and inter-twining nature give dense vegetation coverage over the thickets. Trees were also sparsely distributed amidst the thickets and dominated by Crateva adansonia, Acacia gerrardii, Grewia similis, Balanites aegyptiaca, Tamarindus indica and Euphorbia candelabrum.

c) Permanently flooded Wetland Vegetation

Areas of wetland vegetation are mainly located on permanently waterlogged areas adjacent to the riverine forests and along shores of Lake Albert. The areas are dominated by Phoenix reclinata swamp forest, Cyperus papyrus, and Typha papyrus swamp.

d) Modified habitats

This constituted of very limited subsistence farmlands with some herbaceous-weedy species and very sparse individual tree and shrub species growing along the road. This section covers from geographical locations (in UTM) 191271/87329 along the Karugutu junction to 193773/ 87932 which is the interface of the Community areas and TSGR, with linear settlements or homesteads. There are various habitats along the alignment that have been modified by anthropogenic activities most especially cattle grazing. This is associated with mushrooming human settlements and also encroachment on the boundaries of the wildlife reserve.



Plate 3-1: Cattle grazing with the project corridor



Plate 3-2: Settlements along Rwebisengo Link

e) Riverine habitats

A riverine habitat exists along River Wasa at geographical location 1°01'07.38" N, 30°28'51.06" E; this was described by sparse distribution of tree species characterized by *Acacia gerrardii*, *Ficus sycomorus*, *Ficus natalensis*, *Albizia coriaria*, *Pterygota mildbraedii*, *Rothamia urcelliformis*, *Phoenix reclinata*, *Magifera indica* and the invasive *Senna spectabilis* dominating the upper layer of the vegetation structure. Lower vegetation layers comprised of *Acanthus pubescens*, *Acalypha* spp, *Hibiscus ovalifolius*, *Panicum maximum* and *Harrisonia abyssinica*.



Plate 3-3: Riverine forest 1o01'07.38" N, 30o28'51.06" E

3.1.1.1 Species diversity

A total of 312 plant species from 42 families were recorded. For the species recorded shrubs registered the highest in terms of life forms, with a total of 114 species, followed by trees with 92 species, while the herbs, climbers and grasses followed with 52, 31 and 23 species respectively (Figure 3-2). The woody species altogether contributed 66% by species richness as compared to 34% of the non-woody species. The woody species constituted of trees and shrubs while the non-woody species were of herbs and grasses.

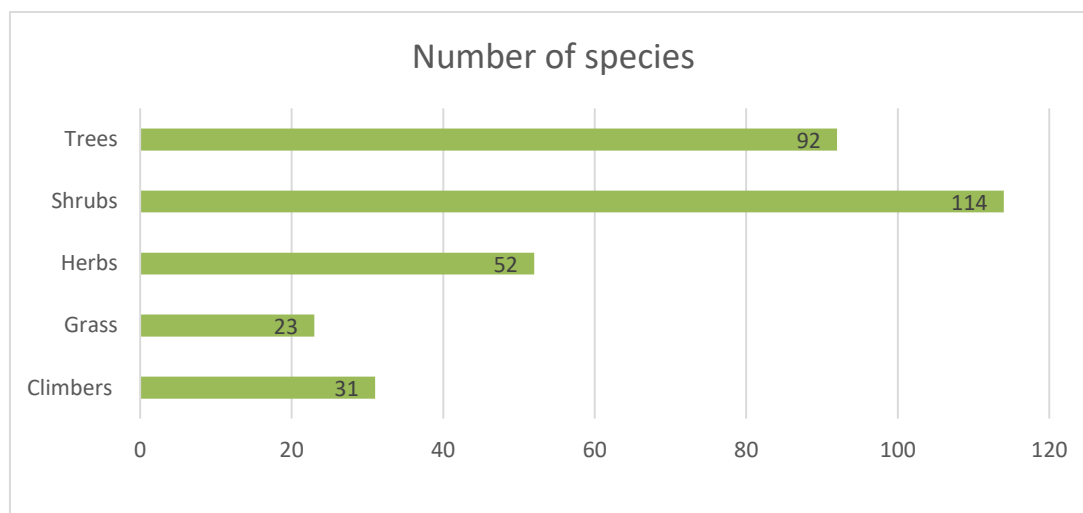


Figure 3-2: Distribution of plant life forms along the road

3.1.1.2 Relative species abundance and frequency

Transformation of the DAFOR scale as explained in the methods was done to estimate the relative abundance of species. The 10 commonest species (most frequent) and most dominant species along the road are listed in Table 3-1. This gives a quick overview of species presence and in case of future ecological restoration works, guidance can be sought from this.

Table 3-1: The top ten most abundant and frequent plant species

Rank	Most abundant species	Most frequent species
1	<i>Piliostigma thoningii</i>	<i>Panicum maximum</i>
2	<i>Grewia similis</i>	<i>Hoslundia opposita</i>
3	<i>Acacia gerrardii</i>	<i>Combretum collinum</i>
4	<i>Combretum molle</i>	<i>Sporobolus pyramidalis</i>
5	<i>Stereospermum kunthianum</i>	<i>Senna hirsuta</i>
6	<i>Setaria sphacelata</i>	<i>Cissus aralioides</i>
7	<i>Hyparrhenia filipendula</i>	<i>Acacia hockii</i>
8	<i>Crateva adansonia</i>	<i>Grewia mollis</i>
9	<i>Borassus aethiopum</i>	<i>Ficus sycomorus</i>
10	<i>Balanites aegyptiaca</i>	<i>Albizia coriaria</i>

3.1.1.3 Distribution of tree size classes within habitats

The graph below was generated following random samplings of trees as explained under methods. The presentation of tree size classes ranges from < 10 cm to > 55 cm as per their distribution along the road (Figure 3-3). **These illustrations give indications of the likely damage on the tree cover once the upgrading of the roads is implemented.** The woodland, open wooded grassland and riverine habitats have all size classes of trees, implying that saplings to mature trees will be impacted upon, causing impairment to the succession levels within the respective ecological systems of the habitats, especially when seed producers are lost. Above all great loss of biomass will follow suit.

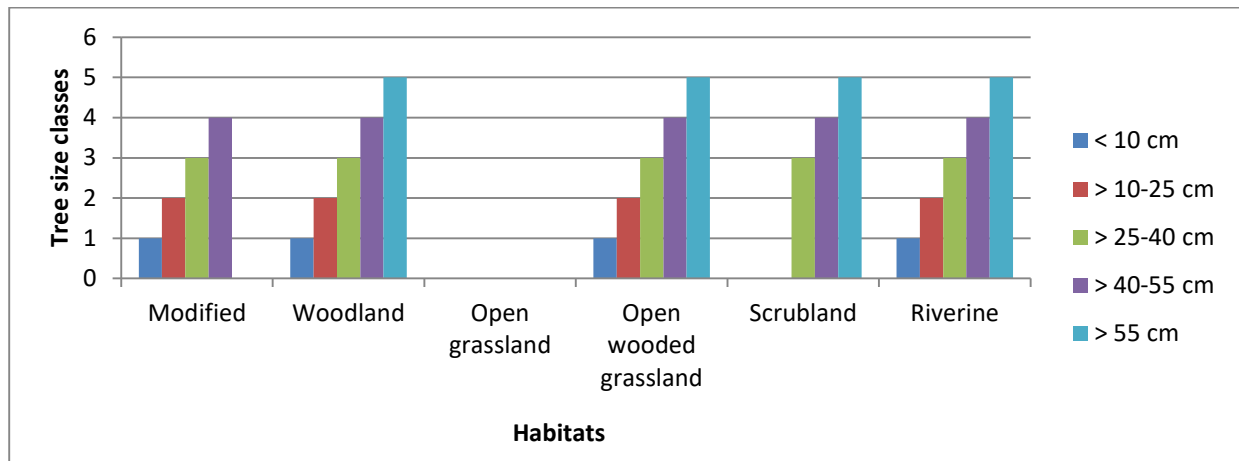


Figure 3-3: Distribution of tree size classes within habitats along the road

For the open grassland section there was absence of trees, hence biomass loss shall be minimal and restricted to grasses and a few herbaceous-weedy species. But this is short-term given that grasses and other associated plants that were recorded have short recovery periods, are easily dispersed by animals and wind and with high levels of regeneration.

The tree cover within scrublands was limited to relatively mature trees of variable species of *Crateva adansoniana*, *Acacia gerrardii*, *Grewia similis*, *Balanites aegyptiaca*, *Tamarindus indica* and *Euphorbia candelabrum* that were sparsely distributed. This occurrence and distribution of trees within scrublands could be influenced by restricted ranging and foraging of wildlife that also double as dispersers, a factor that impairs seedling recruitment. Also the dense shady coverages from thickets serve to suppress germination and growths of dispersed seeds if it happens. Under these shades, there is limited sunlight penetrating the floor of the ground to offer ambient temperatures for germination.

3.1.1.4 Plant Species of conservation concern

a) Protected Plant species

- i. National Forestry Authority (NFA) lists

These included; *Albizia coriaria*, *Tamarindus indica*, *Cynometra Alexandria*, *Kigelia africana* as per the National forestry authority list of reserved species. These are variedly distributed along the project corridor, except *Cynometra alexandria* that is located as earlier indicated above in the report. Therefore, it is critical that their habitats are protected. In this case efforts should be focused on avoiding or minimizing the cutting of such species.

- ii. IUCN Redlist

During the 2017 assessments, *Tamarindus indica* was assessed as Nearly endangered on a global scale based on the IUCN Redlist (IUCN, 2017), well as during the 2025 studies, *Tamarindus indica* is rated as Least Concern (LC) on the IUCN Redlist (IUCN, 2025). While nationally *Tamarindus indica* is categorized as vulnerable (WCS 2016). Otherwise the species is relatively spread along the road corridor and enjoys a wide geographical range nationally. Hence minimal impacts are expected to the species.

b) Invasive species

The invasive aliens along the road corridor were;

- *Dichrostachys cinerea*,
- *Lantana camara* and
- *Senna spectabilis*.

These occur in low abundances within the project at dotted spots, except *Dichrostachys cinerea* whose invasion and spread is worrying to the UWA management. Occurrence and distribution of *Dichrostachys cinerea* is limited within 15 km range for the last section of the road within the reserve. Invasive plants can be a potential threat to biodiversity conservation.

The spread of invasive plants is often triggered by disturbances in the ecological systems. Invasive plants are potential threats to conservation, and may cause economic or environmental damage (NARO, 2007). They displace native species through aggressive and altered recruitments in natural ecosystems. Therefore, their management is critical.

The IFC Performance Standard 6 (IFC 2012); on Biodiversity Conservation and sustainable management of living resources, provides that any project that wishes to be in compliance with the provisions therein in the standard, endeavors to address concerns related to invasive aliens.

3.1.2 Mammals

The sections outside TSWR (Rwebisengo Link, Ntoroko Town Roads, & 4km section between Karugutu and the TSWR gate) were as well assessed for mammal diversity and distribution. Most of these sections had no records of mammal activities. However, the last 3 to 4Km of the road outside the Reserve from Kanara to Ntoroko landing site were characterized by several families of Olive Baboons *Papio Anubis* and Vervet monkeys *Chlorocebus tantalus*. This section further recorded two main Hippopotamus crossings used by Hippopotamus *amphibious* crossing from L. Albert to feed/graze terrestrially within the Reserve. The thickets also allowed for small mammal trapping since Sherman traps could be hidden from human sight.

3.1.2.1 The Primates of TSWR

Seven (07) species of Primates have been observed and recorded during previous biodiversity assessments in the TSWR; These include; Chimpanzee (*Pan troglodytes schweinfurthii*), Olive baboon (*Papio Anubis*), Black & White Colobus (*Colobus guereza*), Red-tailed Monkey (*Cercopithecus Ascanius*), Blue monkey (*Cercopithecus mitis*), Vervet Monkey (*Chlorocebus aethiops* and the Northern Lesser Bush Baby (*Galago senegalensis*).

a) The chimpanzees

The chimpanzees of TSWR live in usually dry habitat similar to that of the early human ancestors, according to Plumptre et al. (2003); the census established about **66** chimpanzees within the wildlife reserve. Currently, chimpanzees are found in Nyaburogo and the Mugiri area. Records as far back as 1998 show that three separate chimpanzee communities in the reserve existed. In the middle of the reserve, the chimpanzee group under research is found along the flanks of the Mugiri River and

its tributaries. Currently about **40 to 50** individuals inhabit Mugiri area while less than **8** individual explore Nyaburogo (Reported by the TSWR field Rangers). The insecurity within the project area makes it hard to evaluate the actual population. However, there are on-going Chimpanzee Research Projects that will hopefully generate data with time. A separate community can be found in the far northeast along the banks of Muzizi River—although it is certainly much reduced or eliminated by habitat destruction. In the west, a population is found in forests flanking the Nyaburogo Valley. No chimpanzees were encountered during the field assessments.

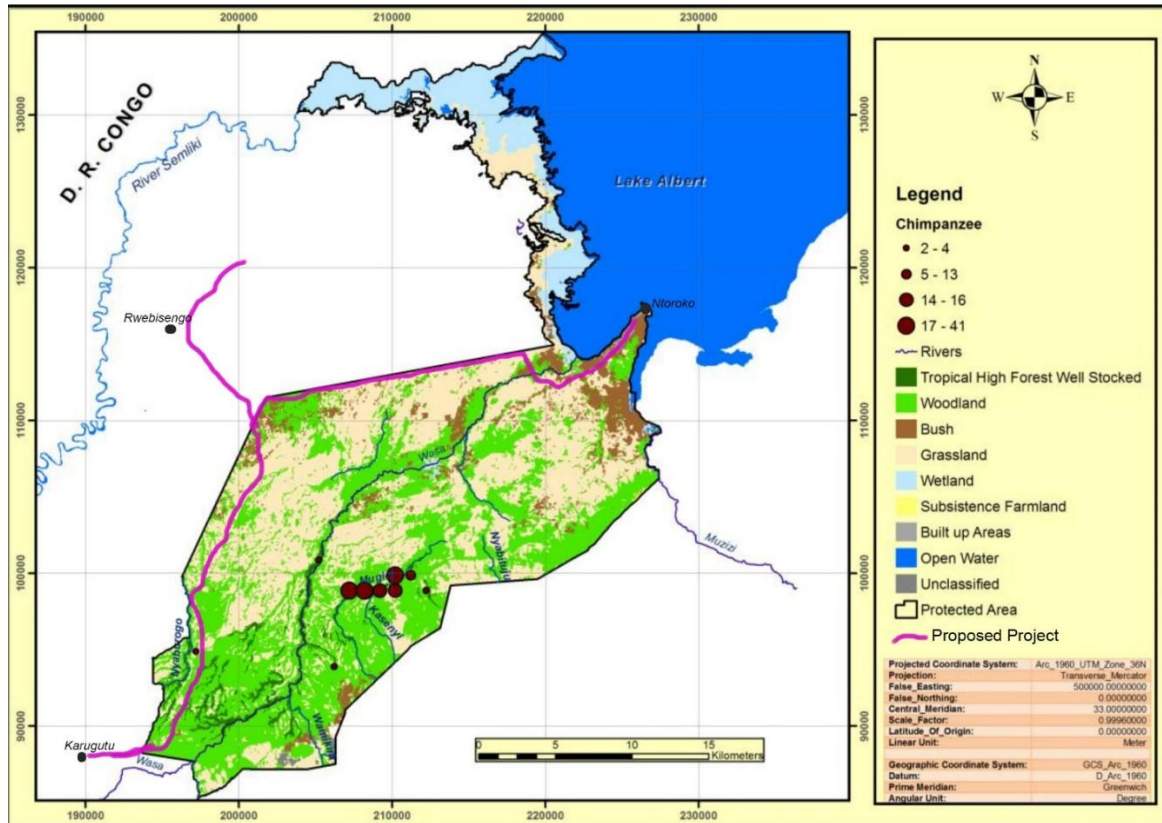



Figure 3-4: Distribution of chimpanzees within the project area (Source: TSWR GMP, 2023)

IUCN status:	Chimpanzee Pan troglodytes has most recently been assessed for The IUCN Red List of Threatened Species in 2016. Pan troglodytes is listed as Endangered under criteria A4bcde.	
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b) Black-and-White Colobus Monkeys (Colobus Guereza) & Red-Tailed Monkeys (Cercopithecus Ascanius)

The population of black-and-white colobus monkeys has not been previously estimated in TSWR. The species mainly live in the riverine forest and wooded grassland areas, especially in the areas of Muzizi, Mugiri, the SSL, Nyaburogo, Karugutu, Kakara, and Munyage. Black-and-white colobus monkeys live in territorial groups of about 10 individuals consisting of one male with a number of females and their young offspring. They are mainly herbivorous, eating fruits, leaves, flowers, and twigs. The species are mainly threatened by habitat destruction especially logging and deforestation and are vulnerable to road kills. Various Black & White Colobus monkeys were recorded along the project corridor.

Red-Tailed Monkeys (Cercopithecus Ascanius): The red-tailed monkey is primarily frugivorous and a territorial species. They range mainly in the areas of Rivers Mugiri, Munyage, where River Wasa enters

TSWR, Nyaburongo Gorge, and along River Muzizi. Some red tailed monkeys were recorded within the project foot print.

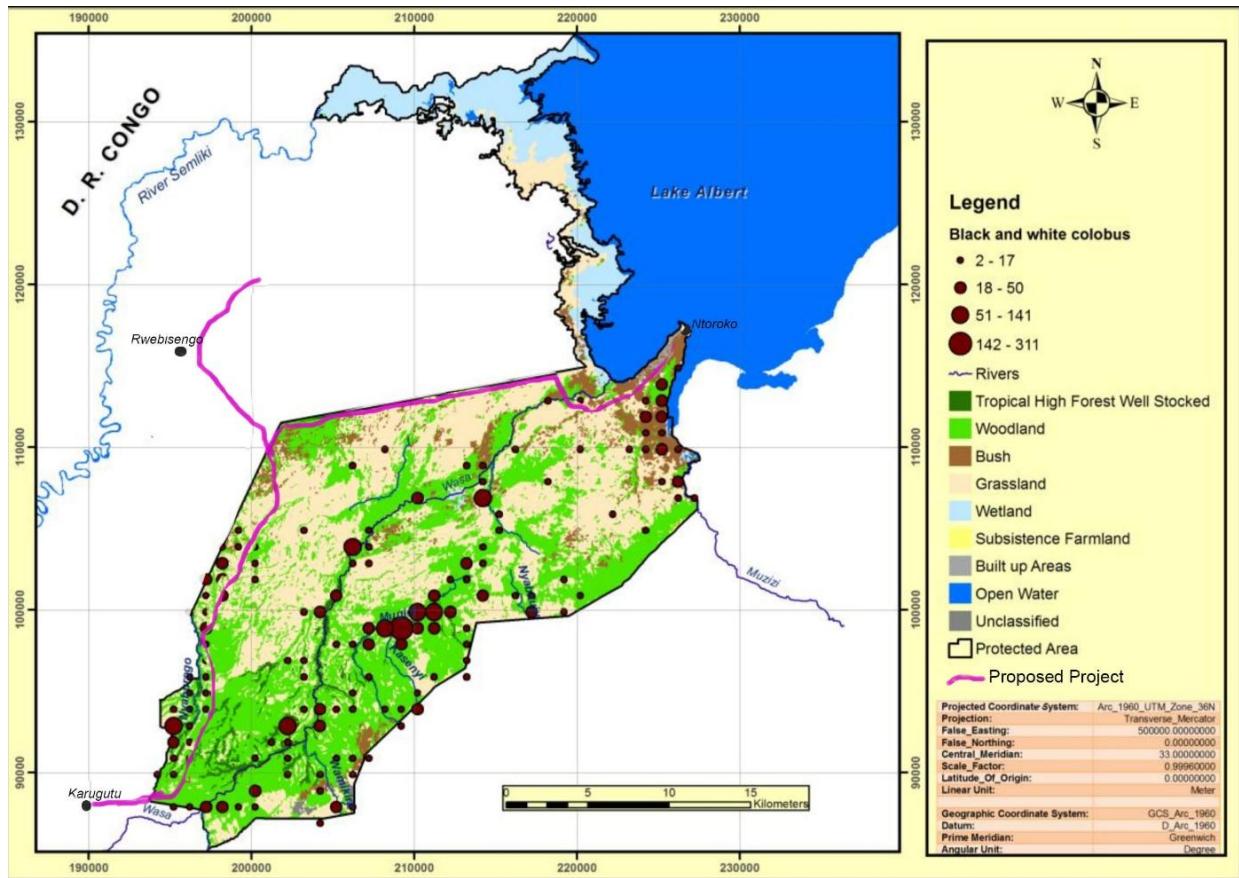


Figure 3-5: Distribution of Black & White Colobus Monkeys (Source: TSWR GMP, 2023)

3.1.2.2 Diversity of other mammals along the project corridor

A total of 18 mammal species were recorded along the project corridor belonging to 11 families and 17 genera (Table 3-2). The sparsely wooded grassland recorded the highest species richness with 11 species followed by the open grassland with 10 species, thickets with six species and degraded community areas with four species. The commonest mammals recorded were the Uganda Kob (*Kobus Kob*), Olive Baboon (*Papio anubis*) and the Warthog (*Phacochoerus africanus*).

Table 3-2: Mammal species recorded along different habitats of the road and their global threat status

No.	FAMILY	SPECIES	ENGLISH NAME	ORDER	IUCN Status
1	Cercopithecidae	<i>Chlorocebus tantalus</i>	Vervet monkey	Primate	LC
2	Cercopithecidae	<i>Colobus guereza</i>	Guereza colobus	Primate	LC
3	Cercopithecidae	<i>Papio anubis</i>	Olive Baboon	Primate	LC
4	Herpestidae	<i>Mungos mungo</i>	Banded Mongoose	Carnivora	LC
5	Proboscidea	<i>Loxodonta africana</i>	African Elephant	Proboscidea	VU
6	Tubulidentidae	<i>Orycteropus afer</i>	Aardvark	Tubulidentata	
7	Bovidae	<i>Kobus ellipsiprymnus</i>	Defassa waterbuck	Artiodactyla	NT
8	Bovidae	<i>Kobus kob</i>	Uganda Kob	Artiodactyla	LC
9	Bovidae	<i>Syncerus caffer</i>	African Buffalo	Artiodactyla	NT
10	Bovidae	<i>Tragelaphus scriptus</i>	Bushbuck	Artiodactyla	LC
11	Hippopotamidae	<i>Hippopotamus amphibius</i>	Hippopotamus	Artiodactyla	VU
12	Suidae	<i>Phacochoerus africanus</i>	Warthog	Artiodactyla	LC

No.	FAMILY	SPECIES	ENGLISH NAME	ORDER	IUCN Status
13	Suidae	<i>Potamochoerus larvatus</i>	Bush pig	Artiodactyla	LC
14	Megadermatidae	<i>Lavia frons</i>	Yellow-winged Bat	Micro-chiroptera	LC
15	Vespertilionidae	<i>Scotophilus dinganii</i>	African Yellow House Bat	Micro-chiroptera	LC
16	Pteropodidae	<i>Epomops franqueti</i>	Common Singing Fruit Bat	Mega-Chiroptera	LC
17	Muridae	<i>Mastomys natalensis</i>		Rodentia	LC
18	Muridae	<i>Aethomys hindei</i>		Rodentia	LC

Note: Same species were recorded during the 2017 surveys.

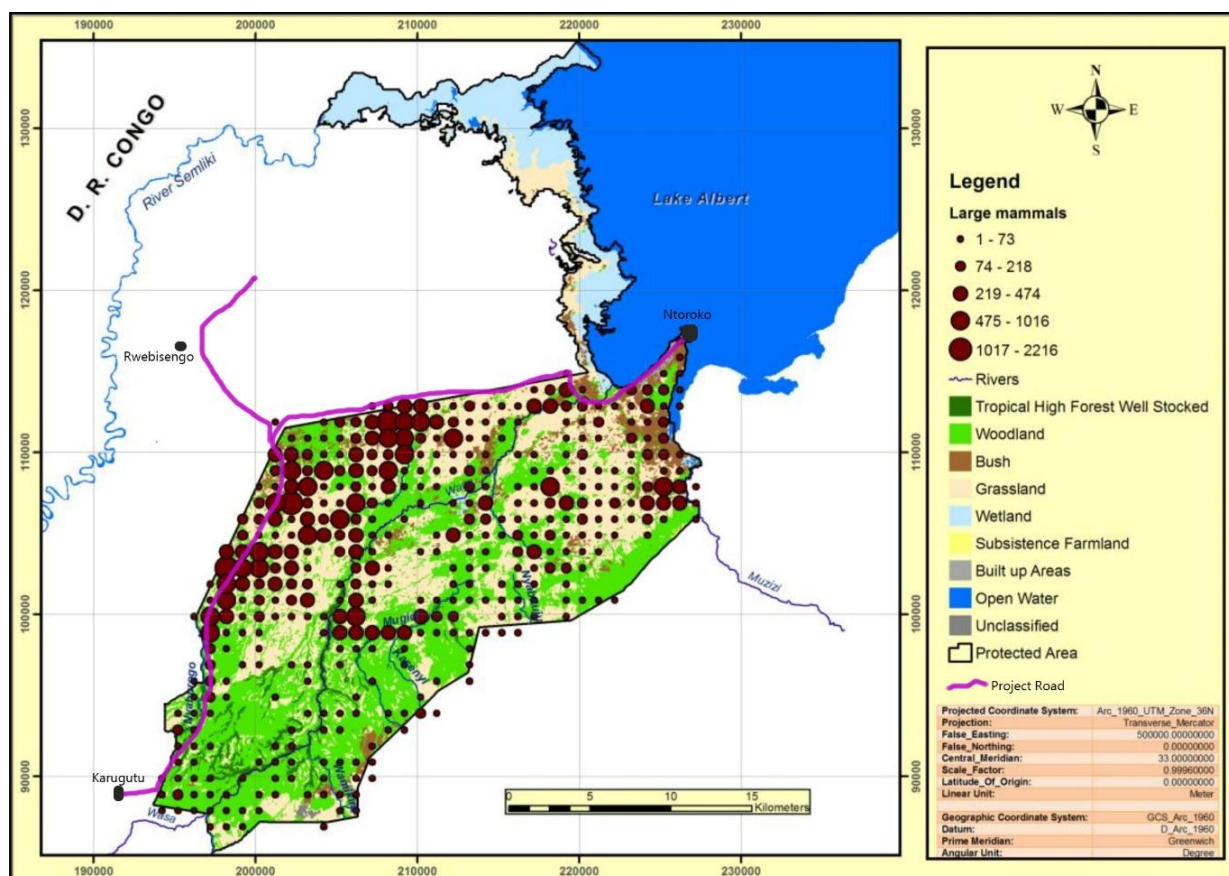


Figure 3-6: Distribution of all large Mammals in reference to the Road Project (Source: UWA, 2023)

3.1.2.3 Mammal Species of conservation concern

a) Medium to large sized mammals

Although primates such as Chimpanzees were not recorded during the field survey, they are known to exist and migrate from the Luga-Luga swamp and other areas sometimes towards the Semliki flats using the Wasa riverine forest that crosses the proposed road. These are also dependent on the riverine forest and its canopy for feeding and as a transit corridor. Other primates not recorded include several species of Galagos, Bush-babies *Guereza colobus* and Red-tailed monkeys. The Chimpanzee is globally Endangered (IUCN, 2025), and according to the national redlist (WCS 2016), it is also Endangered requiring special protection status especially of its diminishing habitat. According to an on-going study by the Indiana University, the Semliki Chimpanzee may be closer to humans than any other chimpanzees (Jonathan Wright, pers.com).

Mammal species of conservation concern include;

- i. **Chimpanzee *Pan troglodytes***: Globally threatened species such as the Chimpanzee *Pan troglodytes* (EN-IUCN) also make part of the primate population. The Chimpanzee, according to the IUCN and National Redlist is endangered requiring special protection status especially of its diminishing habitat.
- ii. **African elephant *Loxodonta Africa***: The African elephant *Loxodonta Africanis* is Vulnerable (VU) according to the IUCN and Critically Endangered according to the national Redlist owing to its being poached for ivory.
- iii. **Hippopotamus *hippopotamus amphibious***: The hippopotamus *amphibious* is also listed as Vulnerable both by the IUCN (2025) and in the National Redlist (WCS, 2016). Hippo pools are a common sighting in this section especially during the rainy season and therefore any construction phases need to take care of seasons, preferably construction done during the dry season.

b) Small mammals

Among the rodents and shrews recorded, none is of global or national concern. Most of the small sized mammals are nationally data deficient. Several Mammal sensitive areas are distributed within the project area and therefore require special attention during the project life.

3.1.3 Herptiles

3.1.3.1 Amphibians

During the 2025 surveys, **only Six (6)** amphibian species, belonging to 6 families and 6 genera were recorded along the proposed Road Corridor from Karugutu to Ntoroko. All these were recorded in water logged wallows and dry flood plains. The low amphibian diversity was attributed to unstable soils that are easily eroded leading to low ground vegetation cover and the long dry spell.

While during the 2017 studies, **fourteen (14)** amphibian species were recorded in the project area as shown. The species belonged to seven genera and five families. The genera include *Phrynobatrachus*, *Ptychadena*, *Hoplobatrachus*, *Hyperolius*, *Kassina* and *Afraxalus*. The difference in amphibian species diversity is attributed to the variation in seasonality.

Table 3-3: Amphibian species recorded along Karugutu-Ntoroko in During Jan/Feb 20225 Vs 2027

Family Name	Scientific Name	Common Name	IUCN	2017	2025
Phrynobatrachidae	<i>Phrynobatrachus natalensis</i>	Natal Dwarf Puddle Frog	LC	v	v
Phrynobatrachidae	<i>Phrynobatrachus mababiensis</i>	Mababe Dwarf Puddle Frog	LC	v	
Ptychadenidae	<i>Ptychadena mascareniensis</i>	Mascarene Rocket Frog	LC	v	
Ptychadenidae	<i>Ptychadena anchietae</i>	Anchietta's Rocket Frog	LC	v	
Ptychadenidae	<i>Ptychadena nilotica</i>	Grass frog	LC	v	
Dicroglossidae	<i>Hoplobatrachus occipitalis</i>	Eastern Groove-crowned Bullfrog	LC	v	v
Hyperolidae	<i>Hyperolius kivuensis</i>	Kivu Reed Frog	LC	v	v
Hyperolidae	<i>Hyperolius viridiflavus</i>	Common Reed Frog	LC	v	
Hyperolidae	<i>Hyperolius nasutus</i>	Sharp-nosed Reed Frog	LC	v	
Hyperolidae	<i>Kassina senegalensis</i>	Senegal Kassina	LC	v	v
Hyperolidae	<i>Afraxalus quadrivittatus</i>	Striped Leaf-folding Frog / Four-lined Spiny Reed Frog	LC	v	
Bufoidea	<i>Sclerophrys maculatus</i>	Flat-backed Toad	LC	v	v
Bufoidea	<i>Sclerophrys regularis</i>	Common Toad	LC	v	v
Bufoidea	<i>Sclerophrys kisoensis</i>	Kisolo Toad	LC	v	

The Amphibian species were generally randomly distributed. However, their distribution was dictated by the availability of water / moisture. Members of genus *Ptychadena* were encountered throughout

the project area, near water or away from water. Members of the genus *Ptychadena* have the ability to adapt and can utilize any water source for breeding be it temporary. During the baseline survey, members of this genus were found settlements, pools and ponds.

The genus *Sclerophrys* also has the ability to utilize temporary water pools for breeding and can therefore occur some distance away from permanent water source. Members of genera *Hoplobatrachus*, *Africalus*, *Hyperolius*, *Phrynobatrachus*, are associated with permanent water sources. Members of genus *Africalus* and genus *Hyperolius* are found hanging over vegetation in and around permanent water sources.

At several water pools and ponds members of *Africalus* and *Hyperolius* were recorded. The Natal Dwarf Puddle Frog *Phrynobatrachus natalensis* and Dwarf Puddle Frog *Phrynobatrachus mababiensis* also prefer wet substrate around permanent water sources to avoid desiccation. These species were encountered and are distributed in and around permanent water sources including pools and ponds.

3.1.3.2 Reptiles

Nine reptilian species were recorded in the project area during the 2017 studies. The species belong to nine genera and seven families. The genera include *Pelusios*, *Dipsadoboa*, *Acanthocercus*, *Trachylepis*, *Cnemaspis*, *Lygodactylus*, *Hemidactylus*, and *Varanus*. At genus level, genus *Trachylepis* was the most abundant, followed by genus *Varanus*.

Specifically, *Trachylepis maculilabris* was the most abundant species with eighteen individuals registered during the baseline survey. *Varanus niloticus* was the second abundant with 13 individuals encountered during the baseline survey. The least abundant was *Dipsadoboa viridis*.

Table 3-4: Reptiles recorded during the 2017 and 2025 surveys

Family Name	Scientific Name	Common Name	IUCN status	2017	2025
Pelomedusidae	<i>Pelusios gabonensis</i>	African Forest Hinged Terrapin	LC	v	
Colubridae	<i>Dipsadoboa viridis</i>	Laurent's Green Tree Snake	LC	v	v
Agamidae	<i>Acanthocercus atricolis</i>	Blue Headed Tree Agama	LC	v	v
Scincidae	<i>Trachylepis maculilabris</i>	Speckled-lipped Skink	LC	v	
Gekkonidae	<i>Cnemaspis quattuorseriatus</i>	Four-lined Forest Gecko	LC	v	v
Gekkonidae	<i>Lygodactylus gutturalis</i>	Forest Dwarf Gecko	LC	v	v
Gekkonidae	<i>Hemidactylus mabouia</i>	Tropical House Gecko	LC	v	v
Crocodylidae	<i>Crocodylus niloticus</i>	Nile Crocodile	VU	v	
Varanidae	<i>Varanus niloticus</i>	Nile Monitor	LC	v	v

Reptiles utilize the sun's energy to raise their body temperatures in order to be more active. The reptiles' basic requirements are a hiding place and a substrate on which to bask. These places and substrates are abundant in the project area, in form of trees, stone works around culverts, and broken culverts that have been replaced. They also occur in form of settlements, be it home building or institutional. Fifty percent of the reptile species encountered during the baseline survey are adaptive and can live in any habitat as long as there are substrates they can hide and bask.

These include the Blue Headed Tree Agama *Acanthocercus atricolis*, Tropical House Gecko *Hemidactylus mabouia*, Speckled-lipped Skink *Trachylepis maculilabris* and Forest Dwarf Gecko *Lygodactylus gutturalis*. Laurent's Green Tree Snake, *Dipsadoboa viridis* was found as a road kill, along the road. The Nile Monitor *Varanus nilotica* were mainly found around pools, ponds, collapsed culverts and culverts that had collected water in them. The culverts were being used for breeding

as well as refuge for the Nile monitors. The Wildlife Reserve Officials indicated that Monitor lizards are the most affected by road kills.

3.1.4 Butterflies

Butterflies are preferred indicators of habitat disturbance because of their sensitivity to environmental changes, diversity, advanced taxonomy, and lower economic and temporal costs of collection [Bonebrake et al 2010; Daily & Erlich 1995]. They also have been used as models to monitor temporal changes in plant-insect interactions, because climate change induces phenological mismatches between butterflies and their exploited plant species that can produce changes in trophic webs [Parmesan, 2006].

3.1.4.1 Species diversity

A total of 106 butterfly Individuals in five families were recorded in the different road sections sampled. Riverine woodland along River Wasa registered the highest number of species (64%) of the total butterfly fauna recorded from the entire project area. Woodlands both registered 54%, while Gallery forests and wooded grasslands registered the least number of butterflies with only 45% each of the total species recorded by these surveys. A number of habitat specific species were present for example 25 forest dependent butterfly species, 12 forests edge/woodland species, one lowland Forest species, 15 migrant species, 14 open habitat species, 37 widespread species and two wetland species.

3.1.4.2 Species of conservation concern

No IUCN threatened or endangered species would be impacted by the proposed action because none of them is present in the areas covered by this project. However, some sensitive butterfly species could be disturbed especially those that are habitat specific.

3.1.5 Birds

3.1.5.1 Species diversity

The Reserve is also known to host about 400 bird species (UWA, 2020). It is estimated that this may be more diverse than most of Uganda's National Park. This is due to its location at the confluence of Mt. Rwenzori, the high tropical forests of the Congo, Savannah grassland typical of low land areas within the Rift valley, riverine forest along several rivers and the Semliki flats within the flood plains, all contributing to the bird species diversity. During the surveys, a total of 138 species were recorded along the road section which was also limited to open grassland, sparsely wooded grassland, and grassland with thickets, riverine forest and degraded community land. The sparsely wooded areas recorded the highest species richness with a total of 72 species followed by the grassland with thickets, 68 species, Riverine forest, 52 species, degraded areas, 38 species and the open grassland with 38 species. Of the species recorded, 68% were f-species, 27% were F-species, 3% were w-species and 2% were G-species. The average number of species recorded per hour was 19 species.

Table 3-5: Species recorded in the different conservation categories

Category		Description	No. species recorded
Threat category	CR	Globally Critically Endangered	0
	EN	Globally Endangered	02
	VU	Globally Vulnerable	0
	R-VU	Regionally Vulnerable	01
	R-NT	Regionally Near Threatened	03
	R-RR	Species of Regional Responsibility	01
Habitat	FF	Forest specialist	02

Category		Description	No. species recorded
	F	Forest generalist	17
	f	Forest visitor	58
	W	Waterbird	02
	w	Bird often near water	06
	G	Grassland	04
	Ae	Mostly aerial species	2
Migrants	P	Palaearctic	02
	A	Afro-tropical	03

3.1.5.2 Species of conservation concern

Among bird species of conservation concern recorded were;

- i. **Marial Eagle** *Polemaetus bellicosus*; that is globally Near – Threatened and Regionally Vulnerable (NT, R-VU).
- ii. **White-backed Vulture** *Gyps africanus*; a single congregation of the White-backed Vulture *Gyps africanus* which is globally Near – Threatened, regionally Near – Threatened and nationally Near – Threatened (NT, R-NTG) was recorded with eight individuals on a kob carcass in the open grassland.
- iii. **Shoebill** *Balaeniceps rex* which is globally Vulnerable, regionally Vulnerable and nationally Near – Threatened (VU, R-VUW), and;
- iv. **Grey Crowned Crane** *Balearica regulorum* which is globally endangered, regionally Near – Threatened and nationally Endangered (EN, R-NTWG) are also known to occur in the Reserve but were not recorded during all surveys.

3.2 Priority biodiversity values

3.2.1 Overview

This BAP focuses on habitats and species that require special management measures rather than all biodiversity. The priority species for this BAP are those within at least one of the categories below (elaborated in subsequent sections), and which are likely to be affected by the proposed road Project:

- I. Potential Critical Habitat-qualifying species;
- II. Species of stakeholder concern; or,
- III. Species highly vulnerable to poaching

The following habitats, ecosystems and designated areas, which are likely to be affected by the proposed Road project, are also priorities in this BAP:

- IV. Critical and natural habitats;
- V. Threatened ecosystems; and,
- VI. Legally protected areas and internationally protected areas.

3.2.2 Potential Critical Habitat-qualifying biodiversity

Critical Habitat (CH) identification is required by PS6 to manage risks and avoid, mitigate, and offset impacts to areas with high biodiversity value including:

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- 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 significant global concentrations of migratory species and/or congregatory species;
- iv) highly threatened and/or unique ecosystems; and/or
- v) areas associated with key evolutionary processes.

CH designation is based on the presence and/or quantity of significant types of biodiversity (e.g., threatened species, highly threatened ecosystems) and is independent of the condition of the habitat. The criteria to determine CH are summarized in Table 3-6. In addition, IFC PS6 gives special attention to certain internationally recognized areas of high biodiversity value.

Table 3-6: IFC PS6 Critical Habitat criteria.

Criteria	Nature of thresholds	Units
Criterion 1 (C1): Critically Endangered and Endangered species	Quantitative	Percentages of global and national population sizes combined with – whenever available - minimum numbers of reproductive units
Criterion 2 (C2): Restricted-range species		
Criterion 3 (C3): Migratory/ congregatory species		
Criterion 4 (C4): Highly threatened and/or unique ecosystems		Percentage of global extent
Criterion 5 (C5): Key Evolutionary Processes	Qualitative	Presence of landscapes with high spatial heterogeneity, environmental gradients and features of demonstrated importance to climate change adaptation

Nova Consult undertook a separate CHA and the priority species identified in Table 3-7 are based on the Biodiversity assessment and numerous studies within the project area. Chimpanzees in particular were identified within the project landscape hence qualify as CH.

Table 3-7: Species assessed as qualifying for Critical Habitat

Taxa	Scientific name	Common Name	IUCN Cat	CH criteria	Presence in the Landscape
Mammals	<i>Pan troglodytes schweinfurthii</i>	Chimpanzee	EN	C1, C2, C4	Confirmed by UWA, in Nyaburongo valley which is about an average of 0.54km from the project corridor though not recorded during the surveys
Birds	<i>Polemaetus bellicosus</i>	Martial Eagle	NT	C4	Confirmed, recorded in flight
	<i>Gyps africanus</i>	White-backed Vulture	NT	C4	Confirmed was recorded with eight individuals on a kob carcass in the open grassland.
	<i>Balaeniceps rex</i>	Shoebill	VU		There were no Shoebill sightings along the project foot print. Most of the wetlands are seasonally and quickly drained of the water. However, community members reported sightings in some of the wetlands in Kanara. This implies a precaution principle will be applied to ensure the integrity of the wetlands around Lake Albert.

	<i>Balearica regulorum</i>	Grey Crowned Crane	EN	C1	known to occur in the Reserve but were not recorded during all surveys.
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3.2.3 Species of stakeholder concern

A list of potential species of stakeholder concern was compiled from those species with confirmed, or assumed likely presence within the project area. These include;

- i) Classified by IUCN as CR/EN/VU (that had not triggered CH);
- ii) Listed as CR/EN/VU in national red lists;
- iii) With cultural/economic or other interest and that have been flagged by stakeholders.

Table 3-8: Priority species of stakeholder concern.

No.	FAMILY	SPECIES	ENGLISH NAME	ORDER	IUCN Status
Mammals					
1	Proboscidea	<i>Loxodonta africana</i>	African Elephant	Proboscidea	VU
2	Bovidae	<i>Kobus ellipsiprymnus</i>	Defassa waterbuck	Artiodactyla	NT
3	Bovidae	<i>Syncerus caffer</i>	African Buffalo	Artiodactyla	NT
4	Hippopotamidae	<i>Hippopotamus amphibius</i>	Hippopotamus	Artiodactyla	VU
Reptiles					
1	Crocodylidae	<i>Crocodylus niloticus</i>	Nile Crocodile	Sauria	VU
Plants					
1	Fabaceae	<i>Albizia coriaria</i>		Fabales	Nationally Protected Medicinal trees used by communities
2	Fabaceae	<i>Tamarindus indica</i>		Fabales	
3	Fabaceae	<i>Cynometra Alexandria</i>		Fabales	
4	Bignoniaceae	<i>Kigelia africana</i>		Lamiales	

3.2.4 Species highly vulnerable to poaching

Some animals have higher susceptibility to poaching or any human-induced fatalities and may have a greater population-level effect due to their small population sizes or slow reproductive rates. Almost all large mammals within TSWR are susceptible to poaching for their meat, skin or any other body parts. The proposed upgrade of Toro Semuliki Wildlife Reserve is likely to opportune multiple poaching avenues.

Table 3-9: Species highly vulnerable to poaching

No.	FAMILY	SPECIES	ENGLISH NAME	ORDER	IUCN Status
1	Cercopithecidae	<i>Colobus guereza</i>	Guereza colobus	Primate	LC
2	Proboscidea	<i>Loxodonta africana</i>	African Elephant	Proboscidea	VU
3	Tubulidentidae	<i>Orycteropus afer</i>	Aardvark	Tubulidentata	
4	Bovidae	<i>Kobus ellipsiprymnus</i>	Defassa waterbuck	Artiodactyla	NT
5	Bovidae	<i>Kobus kob</i>	Uganda Kob	Artiodactyla	LC
6	Bovidae	<i>Syncerus caffer</i>	African Buffalo	Artiodactyla	NT
7	Bovidae	<i>Tragelaphus scriptus</i>	Bushbuck	Artiodactyla	LC
8	Hippopotamidae	<i>Hippopotamus amphibius</i>	Hippopotamus	Artiodactyla	VU
9	Suidae	<i>Phacochoerus africanus</i>	Warthog	Artiodactyla	LC
10	Suidae	<i>Potamochoerus larvatus</i>	Bush pig	Artiodactyla	LC

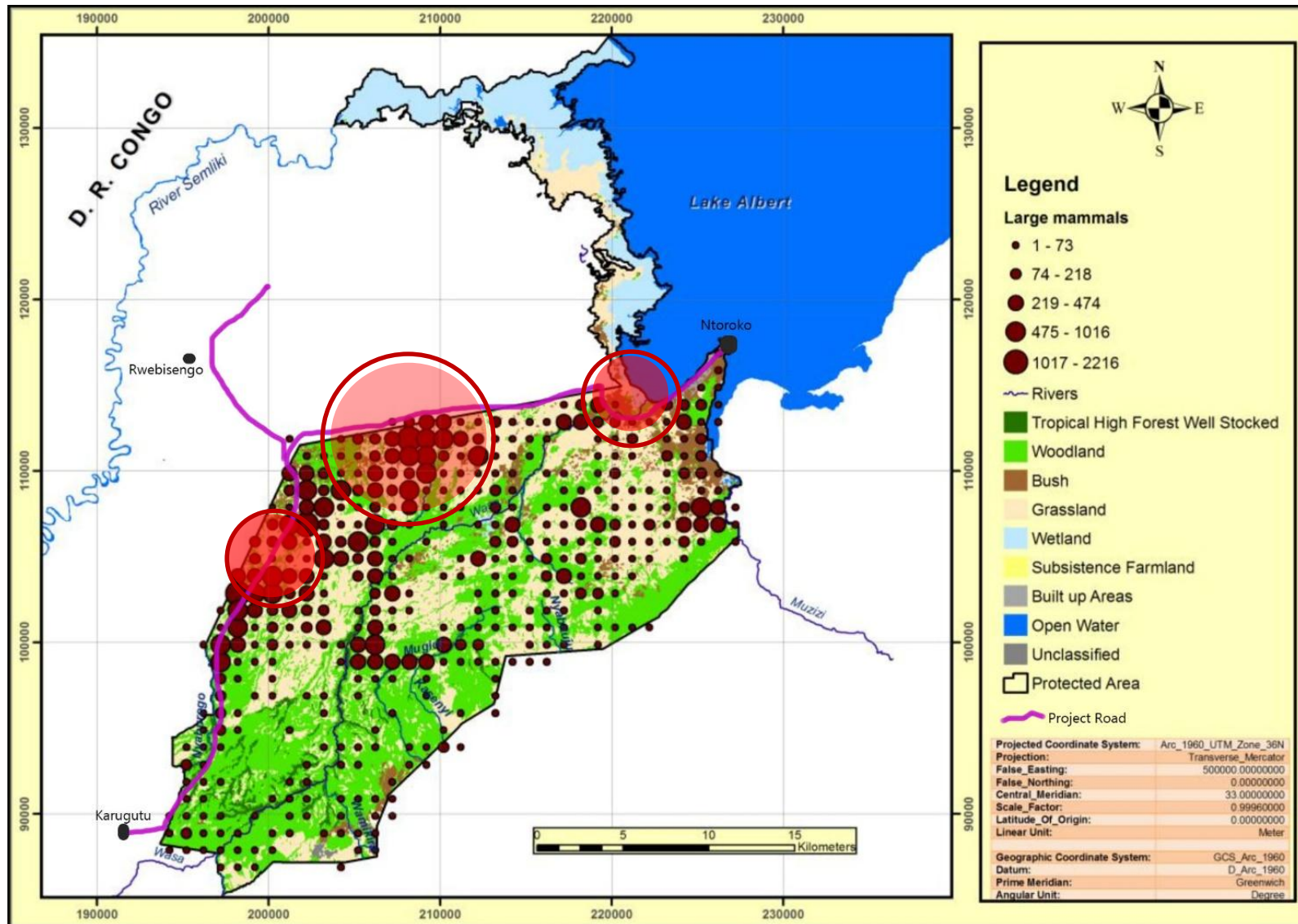


Figure 3-7: Most Critical Mammal sections along the Project Corridor (in Red)

3.2.5 Critical and Natural habitat cover

3.2.5.1 Critical vegetation habitats along the project corridor

The proposed road upgrade between Karugutu (0+000) and Rwebisengo Junction (26+700) follows mostly the existing road foot print. There will be some vegetation clearance to achieve the design considerations within the allowable and mitigatable limits. However, the section between Rwebisengo Junction and 49+100 towards Kanara follows mostly a greenfield.

An estimated area coverage of **115 Hectares** will be cleared of vegetation to create space for construction and workspace. This will lead to clearance of bushlands, savannah grasslands and woodlands. Additionally, there will be alternation of the seasonally flooded areas. The loss of vegetation cover of this magnitude is significant and triggers a **biodiversity offset**. Fortunately, most of the vegetation within the sampled plots a lot the corridor is of Least Concern (LC).

Table 3-10: Land Cover and habitat importance along the project Corridor

No.	Habitat/ Description	Importance	Specific location
1	<p>Tropical High Forests</p> <p>Tropical high forests are therefore the least expected to be found in this place. They however occur due to deep gorges in the reserve and are drained by more or less permanent rivers.</p> <p>The Karugutu-Ntoroko project corridor doesn't have significant sections of Tropical High Forest besides where it crosses River Wasa.</p>	<p>Primary Chimpanzee Habitat</p> <p>There are habitats qualified as CH due to the presence of Chimpanzees, and their potential home-range within TSWR. These are areas along the Riverine forest of Wasa River.</p> <p>Within the project foot-print, chimpanzees are found in Nyaburogo gorge, though a little away from the proposed project corridor.</p>	<p>Chimpanzees are known to have wide home ranges and are like to interface with the project, during the project life time.</p> <p>The section along Kakara-Junction to Rwebisengo-Park boundary is therefore considered a critical habitat section</p>
2	<p>Wetlands</p> <p>Seasonal wetlands were encountered along the project corridor. Permanent wetlands are found along Lake Albert in Ntoroko/Kanara.</p> <p>Here the wetlands are dominated by Cyperus spp, Typha spp, and other sedges. The edge of the wetland—between land and wetland—is dynamic depending on the level of water in Lake Albert.</p>	<p>Most animals within TSWR utilize wetlands for their survival and breeding.</p>	<p>Wetlands occur mostly along rivers in the flat terrains; as the rivers drain the reserve flow into Lake Albert, their course becomes less distinct.</p> <p>They form meanders and pools that become large during rainy seasons.</p>

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No.	Habitat/ Description	Importance	Specific location
3	<p>Woodlands</p> <p>They are more concentrated in the southwestern part of the reserve, where terrain is more ragged, and in plains and gorges. Woodlands are characterized by single-story canopy structure unlike the multi-layered canopy of Tropical High Forests.</p>	<p>Most woodlands are elephant habitat,</p> <p>All large mammals range within woodlands.</p>	<p>The Karugutu-Ntoroko project corridor interacts with woodland, along a green field between Chainage 26+600 and 49+000.</p>
4	<p>Grasslands</p> <p>Grasslands generally occur in the west, north, and eastern parts of the reserve and are interspersed with strips and patches of woodlands, creating a mosaic that provides food and shelter to wildlife.</p> <p>Grasslands in the reserve are dominated by Hyparrhenia spp, which provides good pasture to grazers.</p> <p>In the Semliki flats outside the reserve, the unpalatable Sporobolus grass is abundant.</p>	<p>Provide grazing grounds for the herbivoures</p>	<p>Grasslands are scattered over the project foot print</p>
5	<p>Bushlands</p> <p>This is a land cover type dominated by thickets and shrubs.</p>	<p>Provide grazing grounds for the herbivoures, breeding sites for birds among others</p>	<p>It is scattered in many parts of the reserve but it is most prominent in the northeast near and along the shores of Lake Albert.</p>

3.2.5.2 Estimation of vegetation cover

Table 3-9: Area (Hectares) Covered by respective Land Cover Class

No.	Habitat/ Description	Area within the TSWR (in Hectares)	Area within the Project foot print (in Hectares)
	Total area covered	54,200	323.5
1	Unclassified	143.88	0.85
2	Tropical High Forests	1,514.52	1.03
3	Wetlands	5,299.66	31.63
4	Woodlands	24,483.88	146.14
5	Grasslands	23,943.21	142.91
6	Bushlands	3,793.56	22.64
7	Built-up areas	8.28	0.05

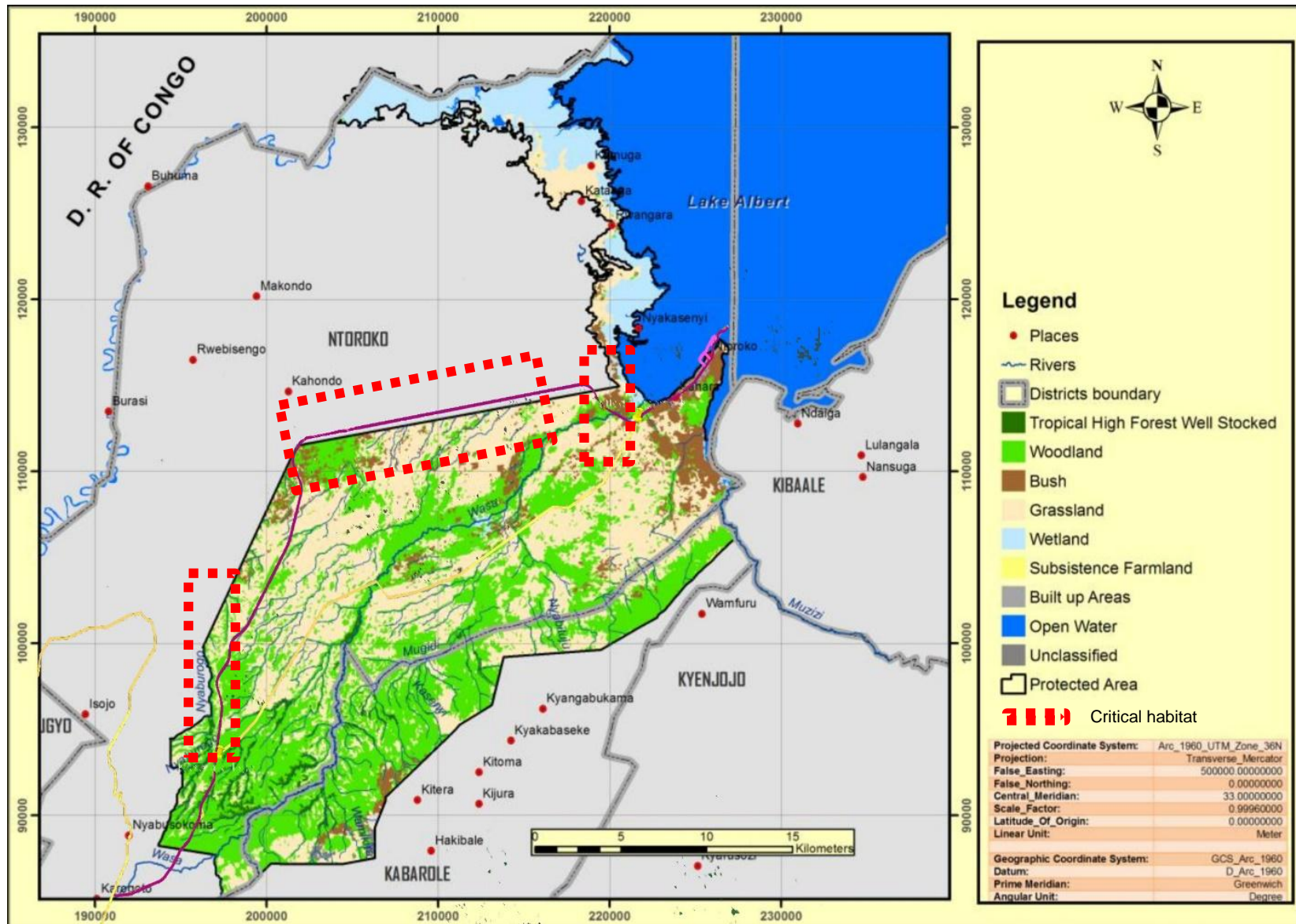


Figure 3-8: Land cover map for TSWR, relative to the project

3.2.6 Modified habitats (Built-up areas)

This constitutes of very limited subsistence farmlands with some herbaceous-weedy species, nucleated settlements, and very sparse individual tree and shrub species growing along the road. This section covers from geographical locations (in UTM) 191271/87329 along the Karugutu junction to 193773/ 87932 which is the interface of the Community areas, with linear settlements or homesteads. These are heavily modified habitats and are significantly altered by human activities, resulting in substantial changes in structure, species composition, and ecological functions. Most of these are urban-like areas and agricultural lands, contrasting with less-changed natural habitats.



Plate 3-4: Typical of modified habitats within the project foot-print

3.2.6.1 Biodiversity significance of modified habitats

These highly modified habitats still hold significant biodiversity, offering essential refuges for generalist species and even specialists, acting as stepping stones for migration, supporting ecosystem functions like pollination, and providing crucial opportunities for restoration and creating green infrastructure, though often facing challenges like fragmentation and pollution. Their significance lies in sustaining diverse species and ecosystem services within human-dominated landscapes, necessitating management that integrates conservation with productive or urban uses.

Most modified habitats lie along sections of Karugutu-Kakara junction, Kanara along Lake Albert, and within Rwebisengo. These areas hold less biological diversity due to re-curent and residential human activities. Most of the species here are habitat generalists with no worrying conservation status. Between communities and the reserve, there lies a wide buffer zone, that shock-absorbs the human impacts on the TSWR; however, on various occasions, some of the mammals especially ungulates are sighted in farmlands and are largely considered as vermins that have led to multiple wildlife conflicts.

3.3 TSWR location relative to nearest protected areas

3.3.1 Rwenzori National Park

The TSWR takes up most of the western Great Rift Valley floor between the Rwenzori Mountains and Lake Albert, two of the geographically, geologically, and ecologically unique features that surround the reserve (Hunt, 2016). It is bordered in the north by the Rwangara Community Wildlife Area and the Semliki Flats formally a Controlled Hunting Area (CHA).

The Ntoroko-Kanara Wildlife Sanctuary borders the northeastern tip of the reserve, adjoining Lake Albert. The top of the Rift Valley escarpment forms the eastern boundary. The Rwenzori Mountains foothills lie to the south of the reserve. By distance, TSWR is about 52.8 km from Rwenzori Mountains. Rwenzori Mountains National Park is a UNESCO World Heritage Site located in the Rwenzori Mountains.

Almost 1,000 km² (386 sq mi) in size, the park has Africa's third highest mountain peak and many waterfalls, lakes, and glaciers. The park is known for its beautiful plant life. Rwenzori Mountains National Park was established in 1991. It was designated a UNESCO World Heritage Site in 1994 because of its outstanding natural beauty. Rebel militias occupied the Rwenzori Mountains from 1997 to June 200. The park was inscribed on UNESCO's List of World Heritage in Danger between 1999 and 2004 because of insecurity and a lack of resources in the park.

The Karugutu-Ntoroko Road Project has no direct and indirect impacts on the Rwenzori National Park by virtue of its location. The project is located far below the mountain, in the Rift valley. However, the precautionary principle is necessary to protect regionally migrating species especially the Birds, flying mammals and insects, though not much of these were recorded during the biodiversity assessments.

3.3.2 Semuliki National Park

Semuliki National Park is a national park in Bwamba County, a remote part of the Bundibugyo District in the Western Region of Uganda that was established in October 1993. It encompasses 219 km² (85 sq mi) of East Africa's only lowland tropical rainforest. It is one of the richest areas of floral and faunal biodiversity in Africa, with bird and butterfly species being especially diverse.

The park is managed by the Uganda Wildlife Authority. The area of Semuliki National Park is a distinct ecosystem within the larger Albertine Rift ecosystem. The park is located at the junction of several climatic and ecological zones, and as a result has a high diversity of plant and animal species and many microhabitats. Most of the plant and animal species in the park are also found in the Congo Basin forests, with many of these species reaching the eastern limit of their range in Semuliki National Park.

The vegetation of the park is predominantly medium altitude moist evergreen to semi deciduous forest. The Semuliki National Park is closely associated with TSWR, Separated by a direct distance of less than 40km. The two protected areas share some of the ecosystems within the River Semuliki Catchment area.

3.3.3 River Semliki

Semliki River is a major river, 140 kilometers (87 mi) long, in the Democratic Republic of the Congo (DRC) and Uganda. It flows north from Lake Edward in Beni Territory, Nord-Kivu, D.R.C avoiding the Rwenzori Mountains on its Right (East), emptying into Lake Albert in the Albertine Rift, Irumu Territory, Ituri Province, D.R.C overlooking the Blue Mountains to its left in the west. Its mouth is near the Village of Katolingo in Kanara sub-county, Ntoroko district, Uganda. Along its lower reaches, it meanders extensively forming part of the international border between the DRC and the western Ugandan

districts of Bundibugyo and Ntoroko, near the Semuliki National Park. The project lies within Semuliki River catchment.



Figure 3-9: Location of TSWR relative to Mt. Rwenzori National Park; River semuliki, and Semuliki National Park (Source: UWA, 2025)

4.0 POTENTIAL BIODIVERSITY IMPACTS

This section provides an overview of potential biodiversity impacts related to the proposed road construction, both during the construction and operation phases of the Project. The impacts mentioned below are taken from the relevant Project ESIA and supporting documents (Management Plans, and Sensitivity Atlas of TSWR). Several impact parameters were evaluated using Quantitative physical and mathematical models to establishment of impact significance. The impact parameters that were assessed include Type, Timing, extent, certainty, duration, and magnitude and receptor sensitivity. The RIAM method was used by a multidisciplinary team to organize the analysis process into an interactive and coherent form that encourages participation throughout the process. The system made it possible to create an impact profile which allowed the practitioners to make a rapid comparison to the development options. Mitigation measures for the predicted impacts are presented in Section 5 and a quantitative residual impact assessment, assuming the successful implementation of the mitigation measures, is presented in Section 6 of this BAP.

4.1 Construction Impacts

The primary impact during construction phase will be the loss of, and degradation to, terrestrial habitats and direct loss of flora and fauna species. These activities will also result in disturbance to more mobile fauna species like large mammals, and may alter, or be a barrier to, their regular movement patterns. Most of these impacts will be permanent; however, all areas of temporary vegetation loss will be restored with native species.

Table 4-1: Summary of the Project's construction impacts.

No.	Impact type	activities/ Sources of impacts
1	Loss and degradation of terrestrial habitat, plant species and habitat for fauna species	Vegetation clearance, poor waste discharge, movement of machineries
2	Loss of, or disturbance to, fauna species	Vegetation clearance, poor waste discharge, animal road kills, zoonosis, poaching
3	Barriers to movement for mobile fauna	Stock piling, trenching, noise and vibration works, haulage of materials

4.1.1 Impacts on Bio-physical Environment

4.1.1.1 Potential loss of Biological diversity

The proposed road alignment traverse wetlands, Greenfields of variable magnitudes. An estimation of vegetation cover of 130 Hectares was established. Fauna surveys established the fact that animals within TSWR explore the entire project areas without obeying TSWR boundaries.

Clearance of the project corridor possess a very high risk of losing biodiversity held within. Some animal species utilize the project area in various ways. Some are likely to be affected due to habitat loss and hunting/poaching of wildlife in the areas due to increased access and improved roads. This will have affected large mammals. Various Amphibians and reptile species use the project area for breeding during the rainy seasons.

All habitats should be protected according to the guidance of International Finance Corporation's (IFC) Performance Standard 6 (PS6) focuses on conserving biodiversity and sustainably managing natural resource. The relevance of PS6 is in the need to conserve biological diversity and the respective habitats. The impact is rated as permanent and highly significant.

Receptor	Impact Type	Extent	Duration	Magnitude	Probability	significance
Biodiversity	Direct, Negative	5	5	10	5	100

Among the specific mitigation actions include;

- i) Update and implement protection measures for wetland habitats (swamp, river, streams, and pools) and associated species during construction and operation of the Project
- ii) Prepare and implement a habitat removal and reinstatement plan – HRRP

Residual impact:

It is expected that after proper implementation of appropriate mitigation measures, the residual impact will be minimal.

4.1.1.2 Potential impacts on Chimpanzees

The TSWR sensitivity atlas and Management plan; recognizes the fact that Chimpanzees explore some sections of Nyaburongo valley, which is about 0.5km from the project foot print (within the project proximity between KM 6+00 and 10+00). Not recorded during the surveys, there are rare chances that the chimpanzees of this area cross and interact with other sections of the TSWR and neighbouring Chimpanzee communities.

Impact severity is considered high and significance is high

Receptor	Impact Type	Extent	Duration	Magnitude	Probability	significance
Biodiversity	Direct, Negative	5	5	10	5	100

Among the specific mitigation actions include;

- i) Ensure that the maximum design speed between KM 4+00 and 15+00 is 20km/hr.
- ii) Install Road signs that indicate presence of chimpanzees within the project area

4.1.1.3 Habitat destruction for ground fauna species

The proposed road traverse a multitude of sections of different wetlands and construction may lead to distortion, Pollution, fragmentation, separation or complete loss of wetland cover along the road sections. Several rivers, streams, flood plains, marshes, animal watering points cross the different road sections to various extents. Construction activities will therefore lead to loss or drainage impairment of some wetland sections. These wetlands are utilized by Birds, Small mammals, Butterflies, Fish, amphibians and reptiles for breeding and feeding. Most of these habitats will be destroyed and polluted during construction phase.

Receptor	Impact Type	Extent	Duration	Magnitude	Probability	significance
Biodiversity	Direct and negative	4	2	8	4	56

Mitigation measures:

- i. Box culverts should be installed in routine flooding areas.
- ii. All flood plains should be connected with several box culverts (number of culverts required will depend on the size of the flood plain).
- iii. The Contractor shall ensure that potentially contaminated runoff from storage areas should be drained through oil traps.
- iv. A “soft start” approach should be used within wetlands the other ecologically sensitive areas to enable sensitive and shy animals move farther before construction begins.
- v. Avoid dumping spoil into wetlands.

- vi. Contractors shall restore all sensitive habitats like wetlands before leaving site.
- vii. The Contractor should suppress dust during earthworks through continuous watering.
- viii. Put all yards and camps outside the TSWR
- ix. MoWT shall install appropriate road signage on speed limits and animal crossing corridors.

4.1.1.4 Fire outbreaks

The presence of combustible materials especially fuels and oils from construction machinery hike the risk of fire outbreaks within the TAWR. This has a potential of putting biodiversity at verge of extensive extinctions.

Receptor	Impact Type	Extent	Duration	Magnitude	Probability	significance
Biodiversity	Direct, negative	4	2	4	2	40

Impact severity is considered medium and significance is low

Mitigation measures:

- i. The Contractor shall not dump waste oil in watercourses, drains or on land but collected and sent for recycling or reuse
- ii. Onsite combustion of waste shall not be done at the construction yard.
- iii. For fire safety, contractor shall provide fire extinguishers and signage at the yard and especially, at re-fueling areas.
- iv. Smoking area should be gazetted away from fuel storage areas and signs to this effect posted in visible areas.

4.1.1.5 Poor waste discharge

Waste discharge into ambient water and land can lead to contamination of aquatic and terrestrial habitats within and outside the TSWR. Habitat contaminations directly affect biological life hence interfering with biological processes due to deprivation of oxygen essential for survival this may result into fatalities of biological ecosystems if not controlled. The inter-connectedness of water bodies easily facilitates transportation of liquid waste from up to down streams, into animal

Receptor	Impact Type	Extent	Duration	Magnitude	Probability	significance
TSWR	indirect, Negative	4	3	6	5	75

Impact severity is considered medium and significance is high

Mitigation measures:

- i) The Contractor should install anti-pollution equipment to treat waste before discharge into the environment in compliance with the National Environment Waste Discharge into Water on Land) Regulations.
- ii) Sensitize workers about potential for environmental contamination due to improper waste management practices.
- iii) The Contractor should ensure waste types (organics, inorganic, hazardous, medical etc.) are segregated and responsibly disposed of.
- iv) Containers should be provided for safe onsite waste containment and segregation before final disposal.
- v) In the waste disposal strategy, recycling should be emphasized and all recyclable waste properly sorted and delivered or properly stored for pick up by recyclers.
- vi) Install adequate sanitation facilities (latrines) at the construction sites e.g. mobile toilets.

- vii) Waste engine oil should be collected and stored in a facility licensed by NEMA. Similarly, transport and disposal of used oil should be done by a NEMA-licensed contractor.
- viii) Ensure that relevant permitted by WRMD are granted before using or constructing hydraulic structures across rivers and streams within the project area.
- ix) The contractor should ensure proper management of spoil and stoke piles.

4.1.1.6 Increased Human-Wildlife interface

4.1.1.6.1 Increased road kills

There will be chances of increased injury or mortality occurring during road construction (e.g., inadvertent burial or death from excavations) as well as subsequent physical contact with constructing vehicles.

Mitigation measures:

- i) MoWT should install speed humps at interval of 0.2-0.5 km during construction phase.
- ii) A “soft start” approach will be used within the ecologically sensitive areas to enable sensitive and shy animals move away from the road.
- iii) Trapped individuals like reptiles and mammals should be rescued and released to safer zones.
- iv) Install wildlife crossing structures that can facilitate wildlife movement across roads. these structures include green bridges, bridges, culverts, and pipes

4.1.1.6.2 Cases of Zoonosis

Primates especially Baboons, Monkeys and Chimpanzees have a very high potential to Zoonosis (contract human diseases) especially those transmitted through human waste, littering and other forms of human-animal interactions. This puts the health of wildlife at risk in case of disease outbreaks. Impact severity is considered medium and moderate significance within savannah areas, well as in the wetlands and forests impact sensitivity is considered severe and significance high. However, there were no likely impacts on fauna diversity within the human communities.

Mitigation measures:

- i) Workers with chonical diseases (especially air borne) should seek medical attention before entering the Park

4.1.1.7 Spread of invasive/ alien species

Invasive-alien species can be compounded by disturbances to the ecosystems through excavations earthworks and through movement of machinery & equipment contaminated with materials of invasive plant species. Invasive plants suffocate growth of native species and some have potential to degrade soils fertility.

Receptor	Impact Type	Extent	Duration	Magnitude	Probability	significance
Biodiversity	Direct, Negative	2	5	10	3	51

Impact severity is considered medium and significance is moderate

Proposed mitigation measures:

- i) Sensitize workers on control measures to manage the existing invasive plant species, spread and their distribution.

- ii) Foreign plant species especially fruits and support poles should not be introduced in the TSWR.
- iii) Efforts through mechanical elimination of invasive plants within the project areas should be implemented.
- iv) Continuously monitor the occurrences of invasive plant species throughout the project cycle.

4.2 Operational phase

4.2.1 Enhancement of Climate change impacts

Climate change impacts might be enhanced as a result of reduced vegetation cover. Greenhouse gases will be emitted as a consequence of all internal and external combustion equipment on site (operational machinery and generators), plus land clearing burning. Greenhouse gasses generally include all emissions of carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄). The sum of all greenhouse gasses is generally expressed as a carbon dioxide equivalent (CO₂e). Accumulation of Greenhouse gases leads to climate change; Likelihood of impact occurrence is high and impact significance accumulates with time.

4.2.2 Increased road kills

Improved roads through TSWR and higher travel speed could raise incidents of animal road kills. Species including reptiles (especially snakes and tortoises) could be at risk of road kill. The main concern is with monkeys, ungulates and nocturnal animals that are slow on land and yet their populations have been drastically reducing in the recent past due to skin and meat demand.

4.2.3 Positive impacts on Biodiversity during operations

4.2.3.1 Protection of the TSWR boundary

The proposed project is a boundary at the interface of pastoral communities and TSWR. Boundaries ensure that priority species are contained and protected within a conservation area. This will reduce the wildlife animal conflicts especially from the elephants that raid people's crops. This boundary will as well protect TSWR from human encroachment.

4.2.3.2 Contribution to ecosystem recovery

Diversion of public traffic at Kanara to Rwebisengo and then along the TSWR boundary will contribute to ecosystem recovery along the usual Karugutu-Ntoroko Road; that traverses through the TSWR. Additionally, there will be no additional excavation of borrow materials within TSWR to maintain the existing Road. The existing Karugutu-Ntoroko Road will be purely for tourism purposes.

4.2.3.3 Increased biodiversity safety

The design of the road will increase ecosystem and biodiversity safety. The average design speed within TSWR is 30km hr. This will significantly reduce the driving speed. Additionally, the installment of wildlife crossing facilities like culverts will enhance ground fauna crossings.

4.3 Overall impact on TSWR

Most of the potential negative impacts as discussed in the **ESIA report, Section 9.3.3**; regarding Bio-physical Environment are likely to happen within the boundaries of TSWR. Most of the significant impacts will happen during construction; and the TSWR will recover progressively upon implementation of adequate mitigation measures. Additionally, there are potential opportunities of the proposed project on TSWR. These were summarized in the table 4-2 below with their significances.

Table 4-2: Impacts and their significance on TSWR

No.	Potential Impacts	Impact Significance	
	Negative		
1	Loss of Biological diversity (fauna and flora)	-100	
2	Impacts on Chimpanzees	-100	
3	Habitat destruction for ground fauna species	-56	
4	Fire outbreaks	-40	
5	Poor waste discharge and pollution	-75	
6	Increased road kills	-75	
7	Spread of invasive/ alien species	-51	
	Postive (opportunities)		
8	Protection of the TSWR boundary		+100
9	Contribution to ecosystem recovery		+100
10	Increased biodiversity safety		+100
	AVERAGE	-71	100
	Overall impact significance	29	

The overall impact significance on TSWR is **low, <30**; implying that with adequate implementation of the proposed mitigation measures under sub-sections of 9.3.3; and enhancement measures under section 9.4.3; TSWR will have a positive benefit due to the proposed upgrade of Karugutu-Ntoroko (56.5km), Link to Rwebisengo (8.2km) and Ntoroko Town Roads.

4.4 Cumulative Impact Assessment (CIA)

Cumulative Impact Assessment (CIA) under IFC Performance Standards is a structured process to identify and manage the combined environmental and social impacts from multiple activities, projects, or natural processes that may interact over time and space. With reference to IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013), the CIA considered;

- i) **Multiple projects**, operators, or natural pressures affect the same Valued Environmental and Social Components (VECs).
- ii) **Impacts may occur over time**, across space, or in combination with natural events.

The key principles that were considered during CIA for Karugutu-Ntoroko road project and associated links are;

- i) Beyond the project foot print (regional and temporal context).
- ii) Focus on VECs – Identify environmental or social components that are critical to communities, ecosystems, or livelihoods.

- iii) Multiple contributors – Considers other past, present, and reasonably foreseeable actions by other parties.
- iv) Dynamic and adaptive –iterative review and stakeholder engagement.

4.4.1 Scope of CIA

i) Spatial

The cumulative impact assessment was conducted for the Albertine Graben region, around lake Albert. Covering major development projects that have significant impacts on Socio-economic settings as well as biological diversity.

ii) Temporal

The CIA considered projects since 2010; that have been implemented as well as those that are planned within the protected areas around Lake Albert.

iii) VEC

The VEC considered; Water resources (River flow regimes, Groundwater levels), Biodiversity, livelihood Resources (Grazing lands, Fishing areas, Agricultural lands), Social Cohesion especially land tenure security.

4.4.2 Current status of VECs

Table 4-3: Summary of potential Cumulative impacts

No.	VEC	Summary of Status	Importance
1	Water resources	<p>The Albertine Rift is characterized by a chain of Rift Valley lakes formed by geological rifting. Lake Albert, the largest, is shared by Uganda and the Democratic Republic of Congo. Other significant lakes include Lake Edward and Lake George.</p> <p>Numerous rivers flow from the surrounding highlands into these lakes. Notable rivers include the Semliki (which flows from Lake Edward into Lake Albert), the Victoria Nile (which flows from Lake Kyoga into Lake Albert), and the Mpanga, Nyamwamba, and Mubuku rivers, among others.</p> <p>The Graben has two main aquifer environments: unconsolidated sediments within the trough and weathered basement rocks.</p>	<p>Ecosystems: The water resources of the Albertine Rift are vital for maintaining diverse ecosystems, including swamp-forests, woodlands, and riverine habitats, which support a wide range of wildlife.</p> <p>Human Use These water resources are crucial for human consumption, agriculture, and other economic activities.</p>
2	Biodiversity	<p>The Albertine Rift is renowned for its exceptionally high biodiversity, holding more vertebrate species than any other region in Africa. It's a hotspot for endemic species, particularly birds and mammals, and is recognized globally as a biodiversity hotspot, Endemic Bird Area, and a Global 200 Ecoregion.</p>	<p>Its exceptional biodiversity makes it a critical area for conservation efforts, facing challenges from human population growth, poverty, and conflict.</p>

No.	VEC	Summary of Status	Importance
3	livelihood Resources	<p>Livelihoods in the Albertine Rift are diverse, ranging from agriculture and fishing to timber harvesting and increasingly, oil and gas activities. The region's rich biodiversity and natural resources play a crucial role in supporting these livelihoods, but also face pressures from population growth, agricultural expansion, and resource extraction.</p>	<p>Fishing Fish landing sites along lakeshores (Albert, Edward, and George) support fishing, fish processing, and related businesses like food vending and hospitality. However, these sites often lack adequate social and economic infrastructure and water sanitation facilities.</p> <p>Oil exploration and drilling activities pose risks to fish landing sites, including potential water contamination from spills</p> <p>Artisanal and small-scale mining also contribute to livelihoods in the region, but can have negative impacts on conservation and community well-being.</p> <p>Tourism, particularly in protected areas like national parks, also offers some employment opportunities</p> <p>Agriculture Small-scale, multi-cropping subsistence agriculture is common, with some areas transitioning to larger-scale cooperative farming like tea.</p> <p>Land is often converted from forests for agricultural expansion, including cultivation of crops like maize, which is increasingly replacing traditional multi-cropping systems.</p>

4.4.3 Multiple projects in Albertine Graben

4.4.3.1 Oil and Gas

Oil companies have previously carried out oil exploration activities in the surrounding areas of Ntoroko, Lake Albert. Additionally, within the North of Lake Albert, Total Energies and China National Offshore Oil Company (CNOOC) are expediting the Oil and Gas production processes. Oil was first discovered in Uganda in 2006 by Hardman Resources and Tullow Oil in the Lake Albert Basin. Estimated reserves: Uganda holds approximately 6.5 billion barrels of oil, of which 1.4 to 1.7 billion barrels are estimated to be recoverable.

Key oil fields include;

- Kingfisher Field (operated by CNOOC Uganda Ltd.)
- Tilenga Project (operated by TotalEnergies EP Uganda)
- Kaiso-Tonya and Mputa-Nzizi-Waraga fields

Major Oil Projects

- (i) Tilenga Project Operated by TotalEnergies in partnership with Uganda National Oil Company (UNOC) and CNOOC. Covers six oil fields in Buliisa and Nwoya districts. Will produce up to 190,000 barrels of oil per day at peak.
- (ii) Kingfisher Development Area Operated by CNOOC Uganda Limited. Located in Kikuube and Hoima districts. Expected peak production of 40,000 barrels per day.
- (iii) East African Crude Oil Pipeline (EACOP) A 1,443 km heated pipeline from Hoima (Uganda) to Tanga Port (Tanzania). Jointly developed by TotalEnergies, CNOOC, UNOC, and TPDC; will transport crude oil to international markets.

Key concerns include:

- Biodiversity loss due to oil exploration in protected areas.
- Oil spills and water contamination risks.
- Displacement of communities and land acquisition issues.
- Cumulative environmental impacts from multiple developments.

4.4.3.2 Road Construction

Several road projects are underway or planned, including upgrades to existing roads and the construction of new ones, to improve connectivity and facilitate the transportation of equipment, personnel, and eventually, oil and gas. The government is investing in a network of over 700 kilometers of roads in the Albertine region to enhance connectivity and improve living standards. Some of the specific road projects include:

- i) Kabaale-Kiziranfumbi
- ii) Hohwa-Nyairongo-Kyarushesha-Butole
- iii) Kaseeta-Lwera
- iv) Hoima-Buliisa-Wanaseko
- v) Masindi-Biiso
- vi) Masindi-Paraa-Pakwach
- vii) Sambiya-Murchison Falls

The Fort Portal-Bundibugyo Road was upgraded to bituminous standards, a project that took over 10 years to complete.

4.4.3.3 Hydro power projects and Transmission lines

The Albertine Graben in Uganda has significant hydropower potential, with several projects already underway and more proposed. Key projects include the Muzizi Hydropower Project and mini-hydro sites on rivers like Wambabya and Waki, along with potential at Murchison Falls.

Uganda Electricity Generation Company Limited (UEGCL) is developing the 48MW Muzizi Hydro Power project (HPP) at the lower course of the Muzizi River in Western Uganda, South east of Lake Albert with the powerhouse approximately 6km upstream of Lake Albert at the eastern flank of the Albertine Graben. Further infrastructural developments in form of Hydro power plants and transmission lines are underway in the project area and the neighborhoods. All these infrastructural development projects have similar previous, current and future biophysical impacts all major impacts of these projects have been highlighted (Table 4-3).

4.4.4 Assessment of cumulative impacts

Table 4-4: Assessment of Cumulative Impacts on Biodiversity

No.	Impact	magnitude	Prob	Extent	Duration	Significance
1	Human wildlife conflict	2	2	2	1	10
2	Accumulation of waste	8	4	2	4	56
3	Air, water and noise pollutions	10	5	5	5	100
4	Vegetation Clearances	10	5	5	5	100
5	Loss of Threatened species	2	2	2	1	10
6	Habitat Fragmentation	6	5	3	5	70
7	Spread Colonies of Invasive plants	8	4	2	4	56
8	Habitat alteration and destruction	10	5	5	5	100
9	Pollutions and Contaminations	10	5	5	5	100

Scale of assessment

Symbol	No	minor	Low	Moderate	High	Very High	No
M=Magnitude	0	2	4	6	8	10	0
P=Probability	0	1	2	3	4	5	0
E= Extent	0	1	2	3	4	5	0
S=Significance	<10	10-20	< 30	40-50	> 60		

Where:

D=DURATION: (0 to 1 years) –1. (2 to 5 years) –2. (5 to 15 years) –3. (> 15 years) – 4 or permanent – 5

And S= (E+D+M) P

Addressing cumulative impacts is a concerted effort, the developers should benchmark good practices of addressing these impacts including addressing in their own ESIS.

5.0 MITIGATION STRATEGIES

5.1 Mitigation hierarchy

The mitigation measures adopted by the Project will follow the mitigation hierarchy: avoid, minimise, restore, and compensate/offset (Figure 5-1). Avoidance entails 'designing out' an impact or risk (e.g., through relocating a project component, avoiding a harmful activity, employing alternative technology), preventing their expected impacts on biodiversity. Minimization reduces the severity of impacts on biodiversity by controlling or limiting the source of that impact.

Such actions reduce the likelihood or magnitude of biodiversity impacts, but do not completely prevent them. Restoration seeks to recreate the original (pre-project) habitat type or to actively enhance the rate of recovery of degraded habitats on the actual Project site, with a focus on areas affected temporarily during construction. Where significant residual impacts remain, compensation/offset actions to achieve an overall NNL for NH, where feasible, and NG for CH qualifying features will need to be developed.

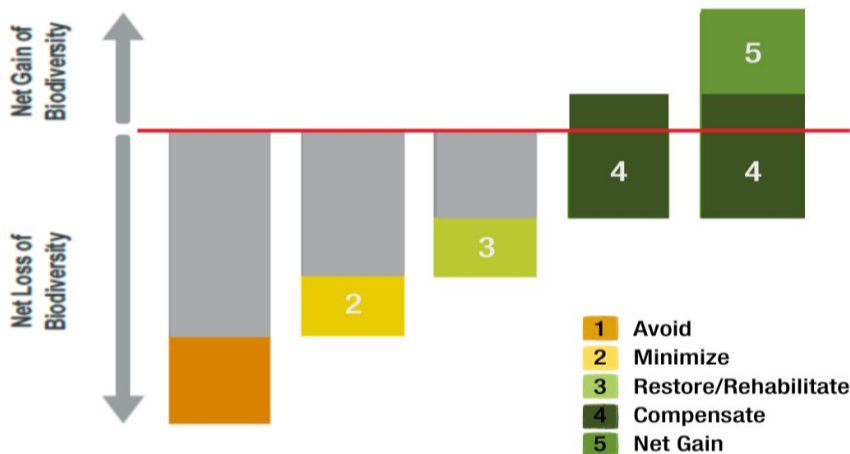


Figure 5-1: The Mitigation Hierarchy and delivery of net positive impact on biodiversity.

5.2 Mitigation actions

A range of good-practice mitigation actions were included in the Project's ESIA; and have been detailed in table 4, The ESIA mitigation actions are summarized as:

- i) In the ESIA, four alternatives were originally considered with the selected option considered as having the lowest biodiversity impact.
- ii) High sensitive biodiversity sites were identified (being in the middle of TSWR), **avoidance** measures were taken, and located the proposed road on the boundary with communities;
- iii) Most actions are focused on impact **minimization** through reduction of the Right of Way; controls on clearance or degradation of vegetation and disturbance of fauna;
- iv) **Restoration** of habitats using native species is required as soon as possible following the end of impacts;
- v) A restoration **Offset** is proposed to cater for the greenfield that will be opened up along the boundary of TSWR, however compensation actions to address this issues will be concluded between UWA & MoWT.

BIODIVERSITY ACTION PLAN

Table 5-1: Summary of the Project's general mitigation actions planned during construction and operations contained in the ESIA's

Aspect/ impact	Mitigation hierarchy	Mitigation measures	Objective	Timing	Responsibility
BMP001: All activities at all times	Avoidance	Site induction will include the following components for biodiversity management: Summary of biodiversity at the Project including ecologically sensitive areas and threatened fauna; i) Identification of potential impacts to biodiversity from the Project activities; ii) Requirement to enter and exit site through recognized vehicle access points, and to travel around site using existing/approved roads and tracks only; iii) Requirement for speed restrictions across the Project; and iv) No work to be undertaken without an approved UWA Permit.	Raise awareness of threats to biodiversity; <ul style="list-style-type: none"> Educate personnel on ways to avoid impacts; and Educate personnel on procedure to follow in the event of vehicle injuring or killing fauna. 	Before commencement of works	Project Ecological officer
	Minimise	No work should be undertaken within 10 m from the project boundaries	Avoid habitat destructions beyond the project area	At all times	All personnel, UWA management
	Minimise	Implement all aspects of the ESIA (Environmental Management Plan) including the following sub-plans: i) Air and Dust Management Plan; ii) Erosion and Sediment Control Plan; iii) Fire Management Plan; iv) Habitat restoration Plan; v) Spoil Management Plan vi) Waste Management Plan.		At all times	Occupational Health and Safety Officer
	Minimise	Seal/cover open holes, pits, trenches when not manned to prevent ground-dwelling fauna from falling in.	Reduce impacts on fauna	At all times	All personals

BIODIVERSITY ACTION PLAN

Aspect/ impact	Mitigation hierarchy	Mitigation measures	Objective	Timing	Responsibility
BMP002: Clearing of vegetation		No work to be undertaken without an approved UWA Permit	Obtain authorization.	At all times	Project managers
	Minimise	<u>Use a "Soft Start approach":</u> i) Consider applying a cool, well-managed fuel-reduction burn to all habitats to be Cleared (but not beyond), to encourage fauna to flee prior to clearing. The specifics of fuel-reduction burn to be determined in consultation with UWA prior to fire being lit. ii) If possible, plan to clear vegetation progressively and incrementally as needed, Rather than through large-scale clearing in advance.	Reduce impacts on fauna.	Prior to clearing	Occupational Health and Safety Officer AND Ecologist, UWA management
	Minimise	Minimize ground disturbance at all locations and specifically at/near Lake Albert	Minimize dust, erosion, sedimentation, habitat loss.	At all times	Project managers, UWA
	Minimise	Qualified ecologist will be present during clearing of the vegetation to identify tree species of conservation concern	Minimize impact on threatened species	At all times	Ecological unit
		Rehabilitate/stabilize cleared land progressively as activities are completed (which forms part of the Closure and Site Restoration Plan).	Restore habitats, Prevent soil erosion and dust	A activities are completed	Project managers
	Offset/ Compensate	support development and the implementation of TSWR restoration Offset Plan	Functional Biodiversity Offset	Anytime during project life	MoWT & UWA
BMP003: Noise and vibration	Minimise	Where possible, high-impact noise (e.g. blasting) will be limited to daylight hours.	Reduce impacts on Nocturnal fauna.	At all times	Project managers
BMP004: Unplanned Wildfire	Minimise	Carefully plan and identify where high-risk activities can take place.	Minimize risk of wildfire	As required	Occupational Health and Safety Officer
	Minimise	Maintain adequate fire breaks around high-risk areas/activities.	Minimize risk of wildfire	At all times	Occupational Health and Safety Officer

BIODIVERSITY ACTION PLAN

Aspect/ impact	Mitigation hierarchy	Mitigation measures	Objective	Timing	Responsibility
		Implement active fire management, using localized cool-season control burns	Minimize risk of wildfire	At all times	Occupational Health and Safety Officer
BMP005: Accumulation of waste within the Park	Minimise	As part of the Waste Management Plan, implement sound waste (garbage) Management to limit invasion/colonization by Black Rat (<i>Rattus rattus</i>).	Minimize potential impacts of vermin and pest Predators.	At all times	Ecological unit
	Avoidance	General site wastes will be managed to prevent/reduce interaction with fauna. Waste management includes: i) Identify a land fill outside the TSWR or utilize the municipal land fills ii) Regular burning of the landfill if located in proximity to the parks; iii) Fencing installed surrounding the landfill to restrict interaction with fauna; iv) Waste storage outside of the landfill is to be situated in bins with lids secured; v) Waste oils and/or hazardous substances will be kept in sealed containers and/or covered; and vi) All domestic waste outside the landfill/waste-storage facility is to be stored in vermin-proof bins with lids secured.	Avoid population increase in pest predators.	At all times	Ecological unit
BMP006: Surface and Groundwater	Minimise	Reduce attractiveness (to wildlife) of the Residue Storage Facility, Flotation Tailings Storage Facility, Sediment Basins and Process Water Ponds through the implementation of Best Practice Guidelines for Reducing Impacts of Tailings Storage Facilities on Avian Wildlife	Minimize impacts on fauna.	Design, construction and operational phases	Project Manager
	Minimise	Fence off tailings storage facilities to prevent ground-based fauna from accessing the water.	Minimize impacts on Fauna.	Construction	Project Manager

BIODIVERSITY ACTION PLAN

Aspect/ impact	Mitigation hierarchy	Mitigation measures	Objective	Timing	Responsibility
BMP007: Haulage and Vehicle Movement	i) Minimise	ii) Keep the proposed road network to a minimum and upgrade and utilize existing Vehicle tracks. iii) Ensure that all vehicles travel on these designated roads, and not on secondary or short-cut roads/tracks.	Minimize impacts on Fauna.	Design, construction and operational phases	Project Manager
	Minimise	Implement and enforce speed restriction controls for all roads across the entire Park	Minimize impacts on Fauna.	Construction and operational phases	Project Manager and UWA
	Minimise	Avoid all vehicles moving at night in sensitive habitat to reduce the likelihood of roadkill.	Minimize impacts on Fauna.	Construction and operational phases	Project Manager and UWA
	Minimise	If injured fauna is encountered, assess the situation and potential requirement to contact UWA Veterinary Doctor	Minimize impacts on Fauna.	Construction and operational phases	All personnel and UWA
	Minimise	If dead animals are found on/beside roads, the Environmental Officer is to be Notified immediately to remove the carcass a minimum of 20m into adjacent land.	Minimize impacts on Fauna.	Construction and operational phases	All personnel and UWA
BMP007: Impact on threatened species	Minimise	Threatened species monitoring program	Minimize impacts on Elephants, Chimps, Hippopotamus among others	Construction and operational phases	Project Manager and UWA
	Minimise	Work close with UWA to monitor Chimpanzees, Elephants and Hippopotamus along road section on a daily basis before commitments of any works.	Minimize attacks	Construction	Project Manager and UWA
	Minimise	Fauna Sighting and Fatality Register to be maintained.	Monitor cases of animal kills	Construction and operational phases	Project Ecologist and UWA

6.0 RESIDUAL IMPACT ASSESSMENT

6.1 Scope of this assessment

This residual impact assessment focuses on priority biodiversity values likely to be affected by the Project, as these values are subject to NG and NNL requirements under IFC PS6. Priority biodiversity values are presented in Section 3.2 above. The scope of this assessment includes the main direct impacts of the Project, which include:

- i) Habitat loss under the project footprint;
- ii) Habitat disturbance and Fragmentation for CH qualifying species;
- iii) Species of stakeholder concern; and Species highly vulnerable to poaching

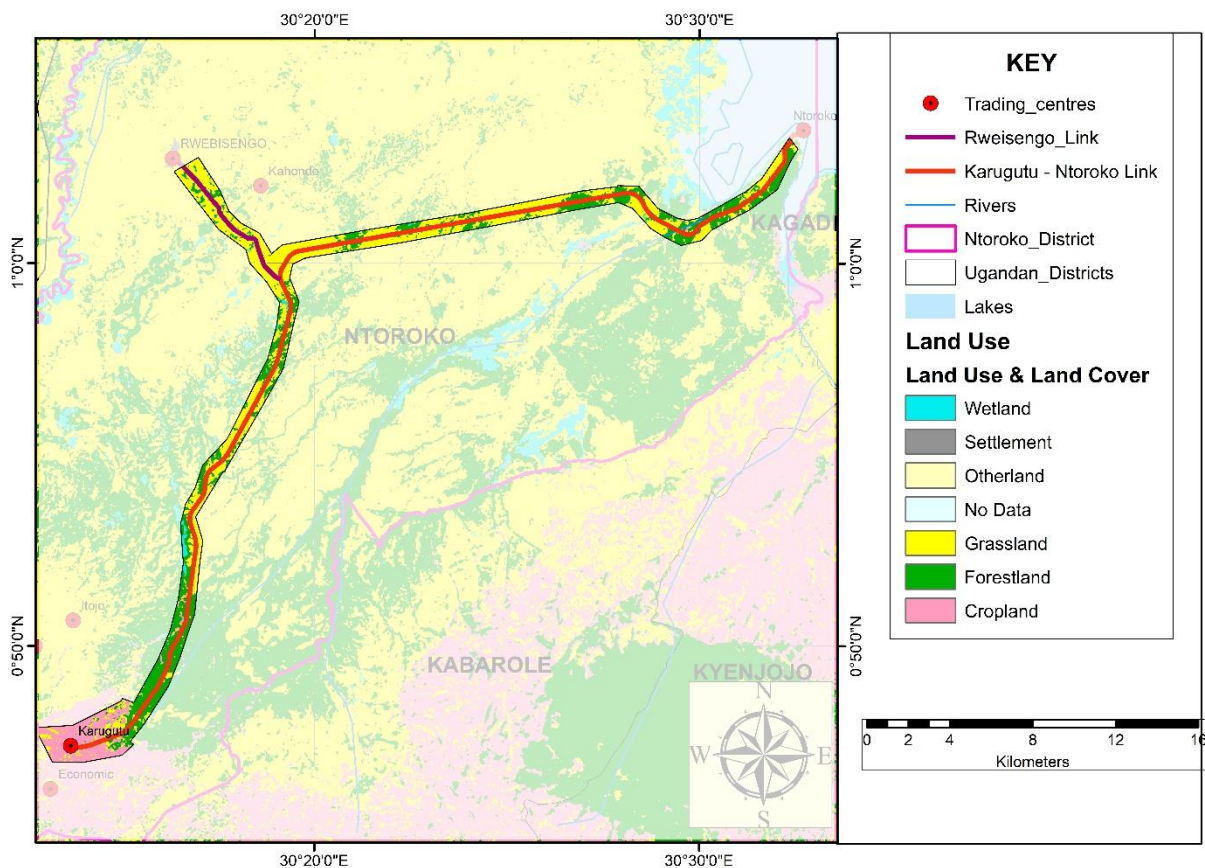


Figure 6-1 : Habitat loss under the project footprint

The Project is generally located in a landscape which is a protected area (TSWR), though with existing other land use activities including settlements, roads, and agriculture. The project baseline has been used in the quantification of residual impacts; this is considered to be a precautionary approach.

This residual impact assessment makes the following broad assumptions about the scale of impacts, and responses of priority biodiversity values to these impacts:

- i) This assessment does not take into account cumulative impacts;
- ii) This assessment is based on the Project design described in the ESIA and the kmz file.
- iii) This assessment assumes that all impact mitigations on Biodiversity as outlined in the ESIA are implemented as planned.

- iv) This assessment assumes that there will be no additional scope of works, as described in the ESIA report; additional scope will attract future revision of the BAP

6.2 Habitats

The direct footprint of the proposed road infrastructure was based on the design provided in form of a kmz file. The impact to terrestrial habitat (critical and natural) was calculated by overlaying the Project footprint layer with the land-cover/habitat map as indicated in Table 6-1.

A section of the proposed road will traverse through 1.03 Ha of a Riverine forest, a unique habitat utilized by Chimpanzees within TSWR. There will be a 30 m wide strip with and about 100m length. There will be additional loss in habitat quality due to loss of tree canopy cover. A wide range of habitats as indicated in Table 2, will be permanently lost including; Wetlands/flood plains (31.63 Ha); woodlands (146.14 Ha); Grasslands (142.91 Ha) and Bushlands (22.64 Ha), as summarized in Table 10.

Table 6-1: Expected Reduction in Vegetation cover along the project foot print

No.	Habitat/ Description	Ext. Area within the Project foot print (in Hectares)
1	Tropical High Forests	1.03
2	Wetlands	31.63
3	Woodlands	146.14
4	Grasslands	142.91
5	Bushlands	22.64
6	Others	0.06
	Total	344.41

6.2.1 Results

a) Amount of vegetation loss

The Project is estimated to directly affect (100% loss) 344.41 ha of which 32.66 ha is critical Natural Habitat (CH) comprising of Tropical Rian Forest and Wetlands (Table 10). The assessment of Modified Habitats (MH) was not prioritized in the BAP. Precautionary principle was evoked and the Quality scores for all habitat types affected by the Project were estimated as they intact habitats, with no any form of human interferences. The project will cause a loss of 344.41 Ha of Critical Natural Habitats.

b) Threatened ecosystems

As presented in Section 3.2.5.1 above, three threatened ecosystems (i.e., Tropical Rian forests, Woodlands & Wetlands) that trigger CH are priorities in this BAP. The expected loss in habitat extent and quality have been calculated and they are presented in Table 10. This uses a precautionary approach as current evidence suggests that these threatened habitats been already modified or degraded in some parts of the Project area. IFC PS6 requires to demonstrate NG or>NNL for these habitats.

6.3 Threatened mammal species (Chimpanzees, Elephants, Hippopotamus)

Chimpanzees were Confirmed by UWA, in Nyaburongo valley, though they are very rare and our sampling efforts didn't yield any results. Nyaburongo valley is about 0.54km from the project corridor. Chimpanzees are indeed highly mobile primates. They are known for their impressive ability to move through various terrains, both on the ground and in trees. Chimpanzees travel across wide areas of

their forest habitat, often covering significant distances to find food, socialize, or mate. The population of Chimpanzees in Nyaburongo Valley is still small, and with the increased conservation efforts within TSWR, the chimpanzee population is likely to rise.

Elephants were recorded during the ESIA surveys. Elephants don't typically have "movement partners" in the way that some other social animals do. While they are social animals that live in herds, they don't have designated partners for movement. Instead, they move as a family unit, with older females leading the way and younger elephants following. Their movements are primarily dictated by the availability of resources like food and water, and they exhibit complex movement patterns to navigate their environment.

Hippopotamus movement patterns are influenced by water and food availability, with hippos moving between water sources and feeding grounds. They are social animals, often found in groups, and their movement can be affected by territoriality, especially among males defending mating territories in the water.

6.3.1 Results

Chimpanzees, Elephants and Hippopotamus are mostly likely to interact with the project corridor. Crossing from one side of the road to the other. Much as the impacts of the project during construction phase can be adequately mitigated, there are potential residual impact of **Animal Road kills** that might occur during the project operational phase. The certainty is very low with implementation of **Speed reduction measures**.

6.4 Threatened Bird Species (Shoebill, Grey crowned cranes)

There are no significant residual impacts on the birds and specifically, the threatened species of the shoebill and the Grey crowned cranes. The known sites of occurrence are outside the project foot print. However, there will be reduction in the vegetation cover, some of which utilized by birds.

6.5 Species highly vulnerable to poaching

Almost all large mammals within TSWR are susceptible to poaching for their meat, skin or any other body parts. Poaching, illegal trade and trafficking of wildlife and wildlife products continues to persist despite on-going national, regional and international efforts. This is partly attributed to weak institutional capacities and coordination challenges, external influences or drivers that enable source of trafficked wildlife products as well as deficiencies in cross border collaboration.

Overtime, poaching has increasingly become widespread and commercially oriented within the project area. Over-all, there is increasing threat to the survival of many wildlife species in TSWR because of poaching. More so, poaching activities have evolved from individual poachers or adhoc gangs to increasing recurrences of poaching by well-resourced and organized groups including transnational criminal networks.

During Road construction, there will be influx of people within the TSWR, some of which might be practicing poaching; and will resort to animal kills for meat and other products. Additionally, during the operational phase of the project, an improve road network will provide ease access to TSWR for the poachers.

7.0 OFFSET STRATEGY

7.1 Offset approach

Biodiversity offsets and/or other forms of compensation are required to ensure overall NG of CH and NNL for NH, in line with IFC PS6 and National Environment Act, 2019 and the ESIA Regulations 2020 of Uganda. In principle, offsets are used as the last resource in the mitigation hierarchy, if significant residuals impacts remain after the previous steps (avoidance, minimization, restoration) have been implemented.

Offsets can include off-site habitat restoration and actions that increase a species' survival or productivity (restoration offsets), and/or measures to stop the ongoing degradation and loss of biodiversity in existing designated sites or sites proposed for designation (averted loss offsets). Additional conservation actions and other support enabling conservation are also considered in this BAP. The identification and development of offset actions in this BAP follows IFC Guidance Note 6. The offsets are targeted to priority biodiversity values with residual impacts.

7.2 Offset principles

The offset actions developed in this BAP follow good practice (IUCN 2023; WCS biodiversity Offset Principle of NG/NNL) and the National Environment Act, Cap 181.

- i) Adherence to the mitigation hierarchy: A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimization and on-site rehabilitation measures have been taken according to the mitigation hierarchy;
- ii) Limits to what can be offset: There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected;
- iii) Landscape Context: A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach;
- iv) NNL: A biodiversity offset should be designed and implemented to achieve in situ, measurable conservation outcomes that can reasonably be expected to result in NNL and preferably a NG of biodiversity;
- v) Additional conservation outcomes: A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations;
- vi) Stakeholder participation: In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation and monitoring;
- vii) Equity: A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a project and offset in a fair and balanced way, respecting legal

and customary arrangements. Special consideration should be given to respecting both internationally and nationally recognized rights of indigenous peoples and local communities;

- viii) Long-term outcomes: The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the project's impacts and preferably in perpetuity;
- ix) Transparency: The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner; and,
- x) Science and traditional knowledge: The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

7.3 Offset governance

According to section 115 of the NEA, Cap 181, "Mitigation hierarchy, biodiversity or other offset and compensation mechanisms"; The biodiversity offsets mechanism shall be designed and funded by the developer as long as the impacts exist or preferably in perpetuity.

Biodiversity offsets are more likely to be feasible in contexts with clear institutional arrangements, good governance and management responsibility, including a high level of stakeholder involvement throughout. This provides a good basis for long-lasting implementation conservation actions.

Implementation of offsets will be led by the Ministry of Works and Transport (MoWT); in collaboration with the Uganda Wildlife Authority (UWA). This arrangement will be supervised by the National Environment Management Authority (NEMA) in association with lead Conservation Agencies like IUCN, WCS and WWF as well as support from Local leaders and communities.

Important design principles for establishing a management system approach are:

- i) Use existing governance structures wherever feasible;
- ii) Ensure any new structures that are created are appropriate to the scale and stakeholders involved;
- iii) Develop downward as well as upward accountability (implementation and financial) for all management structures; and,
- iv) Ensure there is sufficient capacity and technical assistance within the governance and management structures to function efficiently.

7.4 Offset requirements and targets

The residual impacts of the Project to habitats were calculated in Section 6.2, with total habitat impacts for the Project is 344.41 Ha. There are no separate offset targets for CH-qualifying ecosystems to avoid double counting.

According to NEA, 2019; Where a biodiversity offset, other offset or compensation mechanism is considered, the developer shall design and implement it to address residual impacts and to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss (NNL) and preferably a net gain (NG) of biodiversity or other benefits.

The approach used in this BAP, where an increase of at least 50% in habitat Cover has been considered for the Natural Habitats (non-critical) and 100% for the Critical Habitats; compared to the estimated residual impact.

Table 7-1: Summary of residual impacts and offset targets for habitats

No.	Habitat/ Description	Residual Impact (in Hectares)	Offset Objective	Offset Target (in Hectares)
	Critical Habitats		NG	
1	Tropical High Forest (Riverine)	1.03	NG	>2.06
2	Wetlands	31.63	NG	>63.26
	Natural Habitats (non-critical)		NNL	
3	Woodlands	146.14	NNL	>219.21
4	Grasslands	142.91	NNL	>214.365
5	Bushlands	22.64	NNL	>33.96
6	Others	0.06	NNL	>0.09
	Total	344.41		>532.95

7.5 Proposed offsets

According to the NEA, Cap 181, Section 115 (7); The design of a biodiversity or other offset or compensation mechanism shall adhere to the “like-for-like or better” principle and shall be undertaken in accordance with best available information and in the manner prescribed by regulations. This consideration, along with other specifications of the Directive on Biodiversity Offsets, have been considered when developing the two offsets outlined below. Appropriate monitoring will be implemented for each offset to be able to demonstrate the effect of actions described and to quantify the gains to target and other actions.

7.5.1 Protecting and enhancing the natural habitats

This offset action has been specifically developed to deliver a NG for the two CH-qualifying threatened ecosystems along river Wasa (due to their support to Chimpanzee populations); and allow connectivity to other riverine tropical Rain forests within the landscape. As well as protecting the TSWR landscape. A total land cover of **532.95 Ha** will be enhanced through a combination of activities targeted at reducing or stopping current threats to the ecosystem (averted loss), as well as rehabilitation of degraded areas, including:

- i) Identification and mapping of key areas suitable for targeted action;
- ii) Development of a Socio-economic plan for the provision of alternative livelihoods and income for the landholder and/or to local communities to reduce cattle grazing, wood cutting, agriculture and anthropogenic fire pressures;
- iii) Development of education and awareness raising campaigns among local communities to reduce anthropogenic pressure on the ecosystems; and,
- iv) Fencing or protection or restoration areas;
- v) Removal of non-native invasive plant species;
- vi) Restoration of areas with degraded habitat;

A gradual increase in habitat quality is expected during the implementation of the activities listed above. Gains in NH will be predicted over a fixed time period (minimum 10 years), with a default value of 0.1 (10%) of habitat condition increment per year resulting from the restoration actions

Potential national implementation partners for the action have been identified

- Ministry of Works and Transport (MoWT);
- Uganda Wildlife Authority (UWA).
- National Environment Management Authority (NEMA)
- International Union for Conservation of Nature (IUCN)
- Wildlife Conservation Society (WCS)
- World Wild Fund(WWF)
- Local Leaders

7.5.1.1 Preferred sites

During Engagements with UWA, a number of sites were identified for this offset strategy, however, the management of UWA has not yet zeroed down to specific sites. Among the sites that were identified include, encroached areas around Kanara, the TSWR sections towards Rwebisengo.

7.5.2 Reducing threats and increasing habitat qualifying Species

This offset action has been specifically developed to deliver a NG for the CH-qualifying Chimpanzees, and will also provide secondary gains for other priority large mammals. The main threats to the Chimpanzee is the loss of habitat due to conversion to agro-pastoral systems, Charcoal burning among others. While other mammals are mainly susceptible to poaching.

Proposed actions within the offset area would be a combination of community-based activities encouraging the reduction in intensity or cessation of current threats, awareness-raising and support to alternative livelihood options for community members currently involved in poaching, including:

- i) Establishment of a baseline situation on existing illegal activities, through focused interviews with community households, regular visits to markets in the offset wider area, and interviews of market stallholders, vendors and law enforcement agencies or Conservation Area staff;
- ii) Interviews with community members, and other relevant organizations, to understand the motivations behind poaching;
- iii) Development and roll-out of an awareness campaign around the illegality of poaching;
- iv) Support to law enforcement agencies and/or conservation area staff to implement relevant laws; and,
- v) Support programs to community members to provide alternative medicinal or livelihood options.

7.5.3 Additional actions to support conservation

To further the understanding of biodiversity relevant to the Project's impacts, the Project will fund a local/ national NGO or academic institution to undertake a program of long-term scientific research on the Chimpanzee ecology within TSWR or biodiversity monitoring.

This program will also focus on some of other priority species listed in this BAP. The output from the research and monitoring program will increase knowledge of those priority species at national level and will help to understand population trends and threats, which in turn will inform the establishment and implementation of conservation programmes. T

he data from this research and monitoring will be shared widely and published. Where existing monitoring programs are being undertaken in the wider area for Project priority species, the Project will also consider support to those programs.

7.6 Road map for BAP update and offset development

7.6.1 Additional biodiversity surveys at the Project site

An additional habitat survey along the proposed Road corridor shall be conducted to update the baseline information and the residual impacts for the areas likely to be affected by the Project. During the implementation of the Project, the BAP should be updated regularly to incorporate:

- i) Changes in the Project design;
- ii) Significant findings from the biodiversity monitoring;
- iii) Recorded fatalities for each fauna species along the project corridor;
- iv) Progress with the offset implementation and gains achieved

7.6.2 Detailed offset investigations

This BAP presents two offsets which would collectively deliver the Project's NG or NNL commitment for all CH-qualifying and priority species. These actions are necessarily high-level, and if agreed as suitable between the Project and the lenders, would require detailed investigations, the results of which would form the Biodiversity Offset Management Plan for the Project. For each action, investigations should:

- i) Confirm the location of, and area to be covered by, the offset;
- ii) Determine in detail the actions that will occur to deliver the required gains for target features;
- iii) Describe the monitoring required to demonstrate the level of gains achieved by the action;
- iv) Confirm the implementing party/parties, any other relevant organizations and the governance structure of the action; and,
- v) Estimate costs, and identify any other support required, to effectively implement the actions and required monitoring.

For the final set of agreed actions;

- The scope of support – i.e., level of funding, time period, responsibilities; and,
- A set of financial and management indicators to demonstrate that the action is functioning as intended and likely to deliver the assumed gain.

7.6.3 Biodiversity Offset Management Plan

Following final agreement on offset actions, a Biodiversity Offset Management Plan (BOMP) will be prepared to define the precise activities of implementing, managing and monitoring the offsets. The BOMP will be submitted to NEMA and UWA for endorsement prior implementation. The BOMP will include the management of all final and feasible offsets and additional conservation actions. The BOMP will have specific objectives and actions, with targets, indicators and responsibilities for each action.

7.6.4 Biodiversity Management Plan

A Biodiversity Management Plan (BMP) is a practical document detailing all mitigation measures to be implemented during the pre-construction, construction and operational phases. The Project will develop a BMP to provide a description of the mitigation measures, the implementation schedule, the responsible party, and the key performance indicator to verify their implementation

When the Projects develops a BMP, the long list of non-CH priority species will be reviewed and finalized, taking into account of the vulnerability and irreplaceability of each species population, as well as the expected impacts of the Project.

8.0 BIODIVERSITY MONITORING AND EVALUATION PLAN FRAMEWORK

This Biodiversity Monitoring and Evaluation Plan (BMEP) Framework sets out the framework, indicators and approaches the Project should use to track changes in biodiversity across the construction and operation phases of the Project, and to evaluate whether the requirements of PS6 are fulfilled.

The BMEP framework for the proposed construction of Karugutu-Ntoroko (56.5km), Link to Rwebisengo (8.2km) and Ntoroko Town Roads (3.2km). Monitoring and Evaluation activities will be undertaken throughout the whole operational life of the Project for some features and for a shorter duration for other features. The shorter monitoring duration for some features takes into consideration the fact that most operational impacts are expected in the first years of Construction phase.

In case no significant changes are detected in that period then it is not proportionate to continue the monitoring for the entire life of the project. Should significant changes be detected during the periodic evaluations or at the end of the planned monitoring period, then monitoring may need to be extended. The frequency of monitoring will also vary depending on the priority biodiversity feature being monitored.

8.1 Trigger, Action and Response Plan

Table 8-1: Trigger, Action and response Plan

Responsibility	Normal situation	Level 1	Level 2
	Site activities are being managed in accordance with mitigation measures and no incidents have occurred.	Areas of vegetation to be cleared will be outside of Project boundary / existing Disturbance.	Vegetation cleared outside of approved boundary.
Site Personnel	Comply with: <ul style="list-style-type: none"> • Site Induction requirements. • Vehicle and Equipment Hygiene Procedures. • UWA conditions 		Stop work and inform the Environmental Officer of Additional disturbance.
Ecological unit and UWA	Undertake walkovers / Inspection of work areas.	Assess requirement to clear outside of Project boundary. <ul style="list-style-type: none"> i) Areas to be cleared outside of existing disturbance will be flagged to prevent over clearing. ii) Ensure top soil and seed bank are reserved to facilitate rehabilitating the area. iii) Survey additional disturbance. iv) Ensure sufficient erosion and sediment control measures are used. 	<ul style="list-style-type: none"> i) Provide guidance on rehabilitation of additional disturbance. ii) Survey additional Disturbance. iii) Ensure sufficient erosion and sediment control measures are used. iv) Undertake investigation into disturbance incident.
Project Manager, UWA	Ensure the Biodiversity Management Plan is being implemented by all Site Personnel.		Assess the ground disturbance incident and undertaken relevant Corrective measures.

Responsibility	Normal situation	Level 1	Level 2
	Fauna observed and behaving normally	Native fauna observed in the Area of the landfill, construction and/or operational activities.	Native fauna injured or killed due to Project activities.
Contractor	Continue to operate diligently in accordance with site induction flora and fauna components.	Encourage or wait for native fauna to vacate construction areas. Report sighting to the Environment Officer.	Report to Project manager. If fauna is killed, remove from road at least 20 m into adjacent bush land.
Ecological unit	Enter sighting into Fauna Sighting and Fatality Register		If fauna is injured, assess the situation and potential requirement to euthanize UWA veterinary Doctor. If fauna is killed, remove from road at least 20 m into adjacent land. Record incident in Fauna Sighting and Incident Register (Appendix A). Determine if species is a threatened species and if the death activates additional contingency measures. Record death within Fauna Sighting and Fatality Register (Appendix A) or record as an environmental incident in the case of a threatened species death.
Project Manager, UWA	Ensure the Biodiversity Action Plan is being implemented by all Site Personnel.		Assist the Environmental Officer in addressing potential installation of contingency measures.

8.2 Monitoring and Threat Reduction Program

8.2.1 Purpose and approach

Monitoring programs will be established in ways that allow baseline information to be compared against subsequent repeat surveys. If monitoring indicates that the current mitigation efforts are inadequate, then revised or increased mitigation measures will be implemented to protect biodiversity. Uganda signed the Convention on Biological Diversity (CBD) in 1992 and ratified it in 1993. The CBD requires Contracting Parties to conserve their biological diversity and promote sustainable use of biological resources. Additionally, the proposed Project site lies within a sensitive ecosystem hence a requirement to observe World Bank PS6 to ensure survival of the habitats and the biodiversity held within.

This plans identify research, management and other actions needed to ensure the long-term survival of native species and ecological communities affected by key threatening processes. Threat Reduction Plans are directly relevant to fauna at the Project site and these include:

- i) Chimpanzees
- ii) Crocodiles (Locally threatened by construction activities)
- iii) Elephants
- iv) Hippopotamus
- v) Water & wetland associated Birds
- vi) Terminalia indica, Cynometra Alexandria, & Kigelia africana

Accordingly, monitoring at the Project will focus on these threatened species.

8.2.2 Assessment Criteria

Monitoring of threatened species within the Project area will be undertaken at regular intervals as detailed in Table 8-2. The data will be utilized to determine if the population has increased, decreased or remained unchanged and can be assessed against historical data to indicate trends. Triggers and responses will be determined by predicted 'levels of acceptable change'. The accepted Levels of change are determined by known species characteristics and for this program include three Scenarios as follows:

<p>A. Known to Fluctuate</p> <p>– If a species/community is known to fluctuate broadly in numbers or activity patterns, then a higher level of change (as determined through monitoring) is acceptable, because that level of change may simply reflect natural fluctuations.</p>
<p>B. Generally Consistent</p> <p>– If a species/community is known to remain consistent in numbers or activity patterns, then a lower level of change is acceptable, because any change at all may indicate that the project is having an effect.</p>
<p>C. Unknown</p> <p>– If the populations or activity levels of a species/community are not understood adequately to determine the natural levels of variability, then the less known about the dynamics of a species/community, the smaller the level of change that should be accepted until more can be learned.</p>

With the understanding of species characteristics, levels of acceptable change have been developed for each monitoring and management plan. A summary of acceptable levels of changes and associated definitions are provided in Table 8-2.

Table 8-2: Levels of Acceptable Change

Acceptable level of change	When to apply
No increase	When the species/community being investigated is known to have naturally very small variation in population size or activity patterns. Thus, detection of any deleterious change (as found through monitoring) suggests that the project may be having an effect.
Small Change	When the species/community being investigated is known to have naturally small variation in population size or activity patterns. Thus, detection of small deleterious change (as found through monitoring) suggests that the project may be having an effect.

Moderate change	When the species/community being investigated is known to have naturally moderate variation in population size or activity patterns. Thus, small changes (as found through monitoring) may simply reflect natural variation, and more substantial changes would need to be detected to suggest that the project may be having an effect.
Large change	When the species/community being investigated is known to have naturally high variation in population size or activity patterns (e.g. boom-bust or irruptive species). Thus, even moderate changes (as found through monitoring) may simply reflect natural variation, and large consistent long-term changes would need to be detected not suggest that the project may be having an effect.

8.2.3 Assessment Criteria

Monitoring of threatened species within the Project area will be undertaken at regular intervals as detailed in Table 5-5. The data will be utilized to determine if the population has increased, decreased or remained unchanged and can be assessed against historical data to indicate trends. Triggers and responses will be determined by predicted 'levels of acceptable change'. The accepted Levels of change are determined by known species characteristics and for this program include three Scenarios as follows:

8.2.4 Threatened species management plan

Independent Monitoring plans will be developed established to determine if mitigation measures at the Project are sufficient.

The plans include:

- i) Invasive species Monitoring Plan
- ii) Wildlife fatality Register
- iii) Threatened Species Monitoring Plan - Elephants
- vii) Threatened species monitoring Plan - Chimpanzees
- viii) Threatened species monitoring Plan – Crocodiles
- ix) Threatened species monitoring Plan – Hippopotamus
- x) Threatened species monitoring Plan – Water birds
- xi) Threatened species monitoring Plan – *Termalindus indica*, *Cynometra Alexandria*, & *Kigelia africana*

Some details of the monitoring plan are as shown below;

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Table 8-3 : Monitoring plan for Invasive Species Monitoring Plan, Wildlife Fatality, Chimpanzees & Elephants

Programme	Survey Effort				Trigger points		Contingency	
	Survey	Operation	Timing	Personnel				
Invasive Species Monitoring Plan	Establish baseline on invasive data by transect and Quadrant survey prior to construction,		Three months after every excavations and filling.	Botanist	<p><i>Lantana camara</i>, <i>Amaranthaceous sp.</i></p> <p>Acceptable level of change: No increase</p> <p>Any increase in colonization is likely to be detrimental to biodiversity. Action required if >10% increase in coverage detected across the project area is detected.</p>	<p><i>Senna spectabilis</i> and any woody invasive species</p> <p>Acceptable level of change: Moderate change</p> <p><i>Senna spectabilis</i> is a tree species that take time to establish. However, over-abundance of <i>Senna sp.</i> is likely to be detrimental to native species threatened species.</p> <p>Action required if >30% increase in abundance across the project are</p>	Implement or increase invasive species control program as required	
Wildlife Fatality Monitoring	Establish a record for all wildlife fatalities that may occur during the project life	All time	Daily	Ecological Unit	<p>Terrestrial Amphibians and reptiles TSWR</p> <p>Acceptable level of change: Moderate</p> <p>Any fatality within the TSWR directly affects the Genepool is detrimental to biodiversity.</p>	<p>Large mammals and ground dwelling birds, water birds, crocodiles,</p> <p>Acceptable level of change: No increase</p> <p>Most Large mammals have been subjected to numerous pressures and their</p>	Implement speed control mechanisms throughout the project area	

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Programme	Survey Effort				Trigger points		Contingency	
	Survey	Operation	Timing	Personnel				
					<p>Action required if >10% increase in Wildlife-collions.</p> <p>populations are already declining.</p> <p>Action required if "only one" individual is knocked or suffers any form of fatality arising from the project activities.</p> <p>Work has to stop until sound mitigation measures have been Implemented to prevent further incidents.</p>			
Chimpanzees & Elephants Monitoring Plan	Visual Encounter Survey method, signs like fecal distribution along the project area, Camera traps.	All time	Daily	Ecological Unit	<p>Elephants,</p> <p>Acceptable level of change: Moderate</p> <p>Elephants have got wide home ranges and it's possible that they will still access the project area amidst construction activities. Action is required if elephants are less than 200m from the project</p>	<p>Chimpanzees</p> <p>Acceptable level of change: None</p> <p>Chimpanzees have got restricted home ranges</p> <p>it's possible that they will still access the project area amidst construction activities. There should not be any Chimpanzee fatalities within the TSWR</p>	Continuously monitor the behaviors of Chimpanzees within TSWR	

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Programme	Survey Effort				Trigger points		Contingency	
	Survey	Operation	Timing	Personnel				
					area especially during intense and loud activities. There should not be any elephant fatalities within the TSWR. Action required if one elephant dies due to project related activities. All activities have to stop immediately			

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Appendices

Appendix 1: List of Plants that were recorded along the Project Corridor (2025)

Family	Species	Life form
Papilionaceae	<i>Abrus precatorious</i>	Climber
Malvaceae	<i>Abutilon angulatum</i>	Shrub
Malvaceae	<i>Abutilon mauritianum</i>	Shrub
Mimosaceae	<i>Acacia abyssinica</i>	Tree
Mimosaceae	<i>Acacia drepanolobium</i>	Shrub
Mimosaceae	<i>Acacia gerrardii</i>	Tree
Mimosaceae	<i>Acacia hockii</i>	Shrub
Mimosaceae	<i>Acacia kirkii</i>	Tree
Mimosaceae	<i>Acacia pentagonia</i>	Climber
Mimosaceae	<i>Acacia polyacantha</i>	Tree
Mimosaceae	<i>Acacia senegal</i>	Shrub
Mimosaceae	<i>Acacia sieberiana</i>	Tree
Euphorbiaceae	<i>Acalypha pyliosctachyus</i>	Shrub
Euphorbiaceae	<i>Acalypha bipartita</i>	Shrub
Euphorbiaceae	<i>Acalypha neptunica</i>	Shrub
Euphorbiaceae	<i>Acalypha ornata</i>	Shrub
Euphorbiaceae	<i>Acalypha vicaulis</i>	Shrub
Acanthaceae	<i>Acanthus pubscens</i>	Shrub
Passifloraceae	<i>Adenia cissampeloides</i>	Climber
Papilionaceae	<i>Aeschynomene elaphroxylon</i>	Shrub
Zingiberaceae	<i>Afromomum mildabraedii</i>	Herb
Agaveceae	<i>Agave sisalina</i>	Shrub
Asteraceae	<i>Ageratum conyzoides</i>	Herb
Caesalpiniaceae	<i>Albizia andianthifolia</i>	Tree
Caesalpiniaceae	<i>Albizia coriaria</i>	Tree
Caesalpiniaceae	<i>Albizia grandibracteata</i>	Tree
Caesalpiniaceae	<i>Albizia zygia</i>	Tree
Euphorbiaceae	<i>Alchornia cordifolia</i>	Shrub
Sapindaceae	<i>Allophylus africanus</i>	Shrub
Sapindaceae	<i>Allophylus dummeri</i>	Tree
Aloaceae	<i>Aloe sp</i>	Shrub
Amaranthaceae	<i>Alternanthera pungens</i>	Herb
Fabaceae	<i>Alysicarpus rugosus</i>	Shrub
Annonaceae	<i>Annona senegalensis</i>	Tree
Moraceae	<i>Antiaris toxicaria</i>	Tree
Euphorbiaceae	<i>Antidesma venosum</i>	Tree
Fabaceae	<i>Arachis hypogea</i>	Herb
Euphorbiaceae	<i>Artocarpus heterophyllus</i>	Tree
Poaceae	<i>Arundinaria alpina</i>	Shrub
Asparagaceae	<i>Asparagus africana</i>	Shrub
Asparagaceae	<i>Asparagus racemosus</i>	Climber
Asteraceae	<i>Aspilia africana</i>	Herb

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Family	Species	Life form
Aspleniaceae	<i>Asplenium africanum</i>	Herb
Acanthaceae	<i>Asystasia gangetica</i>	Herb
Salvadoraceae	<i>Azima tetracantha</i>	Shrub
Balanitaceae	<i>Balanites aegytiaca</i>	Tree
Caesalpiniaceae	<i>Bauhinia variegata</i>	Tree
Asteraceae	<i>Berkheya spekeana</i>	Shrub
Asteraceae	<i>Bidens pilosa</i>	Herb
Acanthaceae	<i>Blepharis maderaspatensis</i>	Herb
Sapindaceae	<i>Blighia unijugata</i>	Tree
Urticaceae	<i>Boehmeria macrophylla</i>	Shrub
Nyctginiaceae	<i>Boerhavia diffusa</i>	Herb
Palmae	<i>Borassus aethiopum</i>	Tree
Poaceae	<i>Brachiaria brizantha</i>	Grass
Phyllanthaceae	<i>Bridelia micrantha</i>	Tree
Phyllanthaceae	<i>Bridelia scleronuera</i>	Tree
Acanthaceae	<i>Brillantaisia cicatricosa</i>	Shrub
Capparaceae	<i>Cadaba farinosa</i>	Shrub
Cairicaceae	<i>Cairica papaya</i>	Tree
Achariaceae	<i>Calancoba schweinfurthii</i>	Tree
Myrtaceae	<i>Callistemon citrinus</i>	Shrub
Apocynaceae	<i>Cantharusus roseus</i>	Herb
Capparaceae	<i>Capparis erythrocarpos</i>	Shrub
Capparaceae	<i>Capparis tomentosa</i>	Shrub
Sapindaceae	<i>Cardiospermum grandiflorum</i>	Climber
Apocynaceae	<i>Carrisa spinarum</i>	Shrub
Apiaceae	<i>Centella asiatica</i>	Herb
Ulmaceae	<i>Chaetacme aristata</i>	Shrub
Poaceae	<i>Chloris gayana</i>	Grass
Sapotaceae	<i>Chrysophyllum albidum</i>	Tree
Menispermaceae	<i>Cissampelos mucronata</i>	Climber
Vitaceae	<i>Cissus araliodes</i>	Climber
Vitaceae	<i>Cissus quadrangularis</i>	Climber
Vitaceae	<i>Cissus rotundiflora</i>	Shrub
Rutaceae	<i>Citrus aurantium</i>	Tree
Ranunculaceae	<i>Clematis hirsuta</i>	Climber
Verbenaceae	<i>Clerodendron capitulum</i>	Climber
Verbenaceae	<i>Clerodendron myricoides</i>	Shrub
Verbenaceae	<i>Clerodendron rotundifolium</i>	Shrub
Rutaceae	<i>Cleusena anisata</i>	Shrub
Sterculiaceae	<i>Cola gigantea</i>	Tree
Combretaceae	<i>Combretum aculeatum</i>	Shrub
Combretaceae	<i>Combretum adenogonium</i>	Tree
Combretaceae	<i>Combretum collinum</i>	Tree
Combretaceae	<i>Combretum molle</i>	Tree
Commelinaceae	<i>Commelina africana</i>	Herb

Family	Species	Life form
Commelinaceae	<i>Commelina benghalensis</i>	Herb
Commelinaceae	<i>Commelina diffusa</i>	Herb
Asteraceae	<i>Conyza floribunda</i>	Shrub
Asteraceae	<i>Conyza sumatrensis</i>	Shrub
Molluginaceae	<i>Corbichonia decumbens</i>	Herb
Capparaceae	<i>Crateva adansonia</i>	Tree
Papilionaceae	<i>Crotalaria cleomephylla</i>	Shrub
Papilionaceae	<i>Crotalaria incana</i>	Shrub
Euphorbiaceae	<i>Croton macrostachyus</i>	Tree
Poaceae	<i>Ctenium newtonia</i>	Grass
Curcubitaceae	<i>Cucumis figarei</i>	Herb
Araceae	<i>Culcasia falcifolia</i>	Climber
Curcubitaceae	<i>Curcubita sphaerica</i>	Climber
Araliaceae	<i>Cussonia scheffleri</i>	Tree
Amaranthaceae	<i>Cyathula cylindrica</i>	Herb
Poaceae	<i>Cynodon dactylon</i>	Grass
Cyperaceae	<i>Cyperus articulatus</i>	Herb
Cyperaceae	<i>Cyperus dubius</i>	Herb
Cyperaceae	<i>Cyperus latifolius</i>	Herb
Cyperaceae	<i>Cyperus papyrifera</i>	Herb
Vitaceae	<i>Cyphostemma adenocaulis</i>	Climber
Vitaceae	<i>Cyphostemma cyphopetalum</i>	Climber
Fabaceae	<i>Delonix regia</i>	Tree
Papilionaceae	<i>Desmodium adscendens</i>	Herb
Papilionaceae	<i>Desmodium repandum</i>	Herb
Papilionaceae	<i>Desmodium salicifolium</i>	Herb
Papilionaceae	<i>Desmodium uncinatum</i>	Herb
Papilionaceae	<i>Desmodium vetilunum</i>	Herb
Convolvulaceae	<i>Dichondra repens</i>	Herb
Mimosaceae	<i>Dichrostachyus cinerea</i>	Shrub
Ebenaceae	<i>Diospyros abyssinica</i>	Tree
Flacourtiaceae	<i>Dovyalis macrocalyx</i>	Shrub
Draceanaceae	<i>Dracena fragrans</i>	Shrub
Ascepidaceae	<i>Dragea rubicunda</i>	Climber
Pontederiaceae	<i>Eichhornia crassipes</i>	Herb
Mimosaceae	<i>Entada abyssinica</i>	Tree
Poaceae	<i>Eragrostis sp</i>	Grass
Papilionaceae	<i>Erythrina abyssinica</i>	Tree
Euphorbiaceae	<i>Erythrococa bongensis</i>	Shrub
Erythroxylaceae	<i>Erythroxylum fischeri</i>	Shrub
Myrtaceae	<i>Eucalyptus sp</i>	Tree
Ebenaceae	<i>Euclea racemosa</i>	Shrub
Euphorbiaceae	<i>Euphorbia candelabrum</i>	Tree
Euphorbiaceae	<i>Euphorbia glomerifera</i>	Herb
Euphorbiaceae	<i>Euphorbia hirta</i>	Herb

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Family	Species	Life form
Euphorbiaceae	<i>Euphorbia prostrata</i>	Herb
Euphorbiaceae	<i>Euphorbia triculi</i>	Shrub
Moraceae	<i>Ficus natalensis</i>	Tree
Moraceae	<i>Ficus ovata</i>	Tree
Moraceae	<i>Ficus sur</i>	Tree
Euphorbiaceae	<i>Flueggea virosa</i>	Shrub
Apocynaceae	<i>Funtumia elastica</i>	Tree
Rubiaceae	<i>Gardenia ternifolia</i>	Tree
Asteraceae	<i>Garlisona parviflora</i>	Herb
Malvaceae	<i>Gossypium Sp</i>	Herb
Tiliaceae	<i>Grewia mollis</i>	Shrub
Tiliaceae	<i>Grewia similis</i>	Tree
Proteaceae	<i>Grivellea robusta</i>	Tree
Asteraceae	<i>Gynura scandens</i>	Herb
Simaroubaceae	<i>Harrisonia abyssinica</i>	Shrub
Guttiferae	<i>Harungana madagascariensis</i>	Tree
Rhamnaceae	<i>Helinus mystacinus</i>	Shrub
Poaceae	<i>Heteropogon contortus</i>	Grass
Malvaceae	<i>Hibiscus cannabidis</i>	Shrub
Malvaceae	<i>Hibiscus ovalifolius</i>	Shrub
Malvaceae	<i>Hibiscus fuscus</i>	Shrub
Labiatae	<i>Hoslundia opposita</i>	Shrub
Poaceae	<i>Hyparrhenia filipendula</i>	Grass
Poaceae	<i>Hyparrhenia ruffa</i>	Grass
Poaceae	<i>Hyparrhenia dissoluta</i>	Grass
Balsaminaceae	<i>Impatiens sp</i>	Shrub
Poaceae	<i>Imperata cylindrica</i>	Grass
Papilionaceae	<i>Indigofera arrecta</i>	Shrub
Papilionaceae	<i>Indigofera dendroides</i>	Shrub
Papilionaceae	<i>Indigofera emerginella</i>	Shrub
Papilionaceae	<i>Indigofera paniculata</i>	Shrub
Papilionaceae	<i>Indigofera spicata</i>	Shrub
Convolvulaceae	<i>Ipomoea cairica</i>	Climber
Convolvulaceae	<i>Ipomoea involucratus</i>	Climber
Bignoniaceae	<i>Jacaranda mimosifolia</i>	Tree
Oleaceae	<i>Jasminium abyssinicum</i>	Climber
Oleaceae	<i>Jasminium eminii</i>	Shrub
Euphorbiaceae	<i>Jatropha curcas</i>	Shrub
Bignoniaceae	<i>Kigelia africana</i>	Tree
Asteraceae	<i>Laggera alata</i>	Shrub
Boraginaceae	<i>Lansea barberi</i>	Tree
Boraginaceae	<i>Lansea schweinfurthii</i>	Tree
Verbenaceae	<i>Lantana camara</i>	Shrub
Verbenaceae	<i>Lantana trifolia</i>	Shrub
Lamiaceae	<i>Leonitis nepetifolia</i>	Shrub

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Family	Species	Life form
Lamiaceae	<i>Leucas martinicensis</i>	Herb
Mimosaceae	<i>Leucena leucocephala</i>	Shrub
Flacourtiaceae	<i>Lindackeria sp</i>	Shrub
Oleaceae	<i>Linociera johnsonii</i>	Tree
Verbenaceae	<i>Lippia abyssinica</i>	Shrub
Apocynaceae	<i>Landolphia buchananii</i>	Climber
Poaceae	<i>Loudetia arundinacea</i>	Grass
Capparaceae	<i>Maerua angolensis</i>	Tree
Myrsinaceae	<i>Maesa lanceolata</i>	Tree
Rhamnaceae	<i>Maesopsis eminii</i>	Tree
Euphorbiaceae	<i>Manihot esculenta</i>	Shrub
Melastomataceae	<i>Maranthacloa leucantha</i>	Shrub
Anarcadiaceae	<i>Mangifera indica</i>	Tree
Bignoniaceae	<i>Markhamia platycalyx</i>	Tree
Celestraceae	<i>Maytenus senegalensis</i>	Shrub
Meliaceae	<i>Melia azederach</i>	Tree
Poaceae	<i>Melinus repens</i>	Grass
Asteraceae	<i>Microglossa angolensis</i>	Shrub
Asteraceae	<i>Microglossa pyrifolia</i>	Shrub
Moraceae	<i>Melicia excelsa</i>	Tree
Moraceae	<i>Milicia excelsa</i>	Tree
Mimosaceae	<i>Mimosa pigra</i>	Shrub
Mimosaceae	<i>Mimosa pudica</i>	Shrub
Molluginaceae	<i>Mollugo sp</i>	Herb
Apocynaceae	<i>Mondia whitei</i>	Climber
Annonaceae	<i>Monanthes buchananii</i>	Shrub
Caesalpiniaceae	<i>Milletia dura</i>	Tree
Vitaceae	<i>Mormodica foetida</i>	Climber
Moringaceae	<i>Moringa oleifera</i>	Tree
Commelinaceae	<i>Murdamia simplex</i>	Herb
Moraceae	<i>Morus lactea</i>	Tree
Musaceae	<i>Musa paradisiaca</i>	Tree
Musaceae	<i>Musa sapientum</i>	Tree
Labiatae	<i>Ocimum gratissimum</i>	Shrub
Labiatae	<i>Ocimum rothii</i>	Shrub
Cecropiaceae	<i>Myrianthus holstii</i>	Tree
Oleaceae	<i>Olea africana</i>	Tree
Opiliaceae	<i>Opilia celtidifolia</i>	Climber
Cactaceae	<i>Opuntia cacti</i>	Shrub
Polygonaceae	<i>Oxygonum sinuatum</i>	Herb
Poaceae	<i>Panicum infestum</i>	Grass
Poaceae	<i>Panicum maximum</i>	Grass
Poaceae	<i>Panicum polystachion</i>	Grass
Poaceae	<i>Panicum sp</i>	Grass
Fabaceae	<i>Parkinsonia aculeata</i>	Shrub

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Family	Species	Life form
Sapindaceae	<i>Paulinia pinnata</i>	Climber
Poaceae	<i>Pennisetum purpureum</i>	Grass
Salicaceae	<i>Oncoba spinosa</i>	Tree
Lauraceae	<i>Persea americana</i>	Tree
Fabaceae	<i>Philenoptera laxiflora</i>	Tree
Poaceae	<i>Phragmites mauritianum</i>	Herb
Phyllanthaceae	<i>Phyllanthus capillaris</i>	Herb
Phyllanthaceae	<i>Phyllanthus nimularifolia</i>	Shrub
Phyllanthaceae	<i>Phyllanthus ovalifolius</i>	Shrub
Palmae	<i>Phoenix reclinata</i>	Tree
Caesalpiniaceae	<i>Piliostigma thoningii</i>	Tree
Piperaceae	<i>Piper umbellatum</i>	Herb
Pittoporaceae	<i>Pittosporum manii</i>	Shrub
Polypodiaceae	<i>Platyserium elephantitis</i>	Herb
Labiatae	<i>Plectranthus sp</i>	Shrub
Polygonaceae	<i>Polygonum setosulum</i>	Herb
Papilionaceae	<i>Pseudarthria hookeri</i>	Shrub
Pinaceae	<i>Pinus sp</i>	Tree
Meliaceae	<i>Pseudocedrella kotschyi</i>	Tree
Guttiferae	<i>Psorospermum febrifugum</i>	Shrub
Pteridaceae	<i>Pteris linearis</i>	Herb
Anarcadiaceae	<i>Pseudospondias microcarpa</i>	Tree
Sterculiaceae	<i>Pterygota mildbraedii</i>	Tree
Celastraceae	<i>Reissantia parviflora</i>	Climber
Icacinaceae	<i>Rhaphiostylis beninensis</i>	Climber
Vitaceae	<i>Rhoicissus tritedanta</i>	Climber
Anarcadiaceae	<i>Rhus natalensis</i>	Shrub
Anarcadiaceae	<i>Rhus vulgaris</i>	Shrub
Fabaceae	<i>Rhynchosia sp</i>	Climber
Palmae	<i>Raphia farinifera</i>	Tree
Poaceae	<i>Saccharum officinarum</i>	Herb
Draceanaceae	<i>Sansaveria dawei</i>	Shrub
Draceanaceae	<i>Sansaveria nilotica</i>	Shrub
Rubiaceae	<i>Rothmannia urcelliformis</i>	Tree
Euphorbiaceae	<i>Sarcostemma vimnalis</i>	Climber
Amarylidaceae	<i>Scadoxus multiflorus</i>	Herb
Rhamnaceae	<i>Scutia myrtina</i>	Shrub
Euphorbiaceae	<i>Sapium ellipticum</i>	Tree
Asteraceae	<i>Senencio angulatus</i>	Shrub
Caesalpiniaceae	<i>Senna hirsuta</i>	Shrub
Caesalpiniaceae	<i>Senna obtusifolia</i>	Shrub
Caesalpiniaceae	<i>Senna occidentalis</i>	Shrub
Polygalaceae	<i>Securidaca longipendunculata</i>	Tree
Caesalpiniaceae	<i>Senna spectabilis</i>	Shrub
Pedaliaceae	<i>Sesamum angustifolium</i>	Shrub

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Family	Species	Life form
Poaceae	<i>Setaria paretiana</i>	Grass
Poaceae	<i>Setaria sphacelata</i>	Grass
Poaceae	<i>Setaria verticillata</i>	Grass
Malvaceae	<i>Sida ovata</i>	Shrub
Solanaceae	<i>Solanum incanum</i>	Shrub
Scrophulariaceae	<i>Sopubia racemosa</i>	Shrub
Caesalpiniaceae	<i>Senna samea</i>	Tree
Rubiaceae	<i>Spermacoce princeae</i>	Herb
Poaceae	<i>Sporobolus africana</i>	Grass
Poaceae	<i>Sporobolus pyramidalis</i>	Grass
Araliaceae	<i>Steganoteania araliacea</i>	Shrub
Menispermaceae	<i>Stephania abyssinica</i> ,	Climber
Boraginiaceae	<i>Spathodea campanulata</i>	Tree
Sterculiaceae	<i>Sterculia setigera</i>	Tree
Loganiaceae	<i>Strychnos innocua</i>	Shrub
Asteraceae	<i>Synedrella nodiflora</i>	Herb
Bignoniaceae	<i>Stereospermum kunthianum</i>	Tree
Myrtaceae	<i>Syzygium cordata</i>	Tree
Papilionaceae	<i>Tamarindus indica</i>	Tree
Rutaceae	<i>Teclea nobilis</i>	Tree
Papilionaceae	<i>Tephrosia linearis</i>	Shrub
Papilionaceae	<i>Tephrosia pumila</i>	Shrub
Papilionaceae	<i>Tephrosia punctatum</i>	Shrub
Lamiaceae	<i>Tectona grandis</i>	Tree
Combretaceae	<i>Terminalia brownii</i>	Tree
Combretaceae	<i>Terminalia glaucescens</i>	Tree
Euphorbiaceae	<i>Thecacoris lucida</i>	Shrub
Apocynaceae	<i>Thevetia peruviana</i>	Shrub
Thelypteridaceae	<i>Thylepteris dentalus</i>	Herb
Combretaceae	<i>Terminalia sp</i>	Tree
Cannabaceae	<i>Trema orientalis</i>	Tree
Asteraceae	<i>Tridax procumbens</i>	Herb
Tiliaceae	<i>Triumfetta macrophylla</i>	Shrub
Tiliaceae	<i>Triumfetta rhomboidea</i>	Shrub
Fabaceae	<i>Tylosema fassoglensis</i>	Climber
Urticaceae	<i>Urera trinervis</i>	Climber
Meliaceae	<i>Trichilia sp</i>	Tree
Asteraceae	<i>Vernonia amygdalina</i>	Shrub
Asteraceae	<i>Vernonia campanea</i>	Shrub
Asteraceae	<i>Vernonia cinerea</i>	Shrub
Viscaceae	<i>Viscum bagshawei</i>	Herb
Annonaceae	<i>Uvariopsis congensis</i>	Tree
Malvaceae	<i>Wissadula amplissima</i>	Shrub
Poaceae	<i>Zea mays</i>	Grass
Rhamnaceae	<i>Ziziphus pubscens</i>	Shrub

Family	Species	Life form
Labiatae	<i>Vitex doniana</i>	Tree

Appendix 2: List of Butterflies

Family/Species	Ecotype	IUCN status	River Wasa	Gallery Forest	Woodland	Wooded grassland
Nymphalidae						
<i>Acraea acerata</i>	W	NE	1		1	
<i>Acraea alicia</i>	W	NE	1		1	
<i>Acraea egina</i>	W	NE	1	1	1	
<i>Acraea encedon</i>	W	NE	1		1	
<i>Acraea eponina</i>	W	NE				1
<i>Acraea jodutta</i>	F	NE	1	1		
<i>Acraea penelope</i>	F	NE	1	1		
<i>Acraea pharsalus</i>	f.	NE	1	1	1	
<i>Acraea pseudEGINA</i>	W	NE				1
<i>Acraea zetes</i>	W	NE	1			
<i>Amauris niavius</i>	W	NE	1	1	1	1
<i>Amauris tartarea</i>	f.	NE	1	1		
<i>Aterica galena</i>	F	NE	1	1		
<i>Bebearia absolon</i>	F	NE	1	1	1	
<i>Bicyclus jefferyi</i>	f.	LC	1	1	1	
<i>Bicyclus safitza</i>	W	NE			1	1
<i>Bicyclus vulgaris</i>	W	NE	1	1	1	1
<i>Byblia anvatarata</i>	M	NE		1	1	1
<i>Charaxes bipunctatus</i>	F	NE	1		1	1
<i>Charaxes brutus</i>	F	NE	1		1	1
<i>Charaxes candiope</i>	W	NE	1		1	
<i>Charaxes etesipe</i>	f.	NE	1	1	1	
<i>Charaxes eupale</i>	F	NE	1			
<i>Charaxes fulvescnes</i>	FL	NE	1	1		
<i>Charaxes jasius</i>	O	NE	1		1	1
<i>Charaxes numenes</i>	f.	NE	1	1		
<i>Charaxes varanes</i>	W	NE	1	1	1	
<i>Charaxes zoolina</i>	O	NE		1		
<i>Cymothoe jodutta</i>	F	NE	1			
<i>Danaus chrysippus</i>	M	NE	1	1	1	1
<i>Euphaedra preussi</i>	F	NE	1			
<i>Euriphene ribensis</i>	F	NE	1			
<i>Eurytela dryope</i>	W	NE		1	1	
<i>Gnophodes bestimena</i>	F	NE	1		1	
<i>Hamanumida daedalus</i>	W	NE			1	1
<i>Henotesia perspicua</i>	O	NE				
<i>Hypolimnas misippus</i>	M	NE			1	1
<i>Hypolimnas salmacis</i>	F	NE	1	1		

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<i>Junonia chorimene</i>	O	NE	1	1	1	1
<i>Junonia oenone</i>	W	LC	1	1	1	1
<i>Junonia orithya</i>	M	NE	1	1		1
<i>Junonia sophia</i>	W	NE	1	1	1	
<i>Junonia stygia</i>	F	NE	1			
<i>Junonia terea</i>	W	NE		1	1	1
<i>Junonia westernanni</i>	F	NE	1			
<i>Melanitis leda</i>	W	NE		1		1
<i>Neptidopsis ophione</i>	f.	NE		1		
<i>Neptis melicarta</i>	F	NE	1			
<i>Neptis saclava</i>	W	NE	1	1	1	1
<i>Neptis serena</i>	W	NE	1	1	1	1
<i>Precis Octavia</i>	W	NE	1			
<i>Salamis parphassus</i>	f.	NE	1		1	
<i>Sallya garega</i>	M	NE			1	1
<i>Tirumala petiverana</i>	M	NE	1	1	1	1
Pieridae						
<i>Appias epaphia</i>	M	NE			1	
<i>Appias sabina</i>	F	NE	1	1		
<i>Belenois aurota</i>	M	NE	1	1	1	1
<i>Belenois creona</i>	M	NE			1	1
<i>Belenois solilucis</i>	O	NE	1		1	
<i>Belenois subeida</i>	f.	NE	1		1	
<i>Belenois thysa</i>	f.	NE	1		1	
<i>Catopsilia florella</i>	M	NE			1	1
<i>Colotis antevippe</i>	O	NE				1
<i>Colotis aurigineus</i>	W	NE				1
<i>Colotis auxo</i>	W	NE				1
<i>Colotis danae</i>	W	NE			1	1
<i>Colotis eucharis</i>	W	NE				1
<i>Colotis evagore</i>	M	NE			1	1
<i>Dixeia pigea</i>	W	NE		1	1	
<i>Eronia cleodora</i>	O	NE			1	
<i>Eurema brigitta</i>	M	LC	1	1	1	1
<i>Eurema hapale</i>	S	NE	1			
<i>Eurema hecabe</i>	M	NE	1	1	1	1
<i>Eurema regularis</i>	W	NE			1	1
<i>Leptosia alcesta</i>	W	NE	1	1		
<i>Leptosia nupta</i>	F	NE	1	1		
<i>Leptosia wigginsi</i>	F	NE	1	1		
<i>Mylothris rubricosta</i>	S	NE	1			
<i>Nepheronia argia</i>	F	NE	1			
<i>Nepheronia buqueti</i>	O	NE		1	1	
Hesperiidae						

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<i>Ankola fan</i>	F	NE	1			
<i>Borbo fallax</i>	O	NE			1	1
<i>Coeliades forestan</i>	W	NE		1		
<i>Eretis lugens</i>	W	NE		1	1	1
<i>Pardaleodes incerta</i>	F	NE	1			
<i>Sarangesa maculata</i>	O	NE			1	1
<i>Spialia spio</i>	O	NE				1
Lycaenidae						
<i>Abisara neavei</i>	F	NE	1			
<i>Anthene amarah</i>	O	NE				1
<i>Anthene larydas</i>	F	NE	1			
<i>Anthene lunulata</i>	W	NE			1	1
<i>Cupidopsis cissus</i>	W	NE				1
<i>Eicochrysops hippocrates</i>	W	NE				1
<i>Euchrysops malathana</i>	O	NE				1
<i>Leptotes pirithous</i>	M	NE				1
<i>Tuxentius cretosus</i>	O	NE			1	1
<i>Zizeeria knysna</i>	W	NE	1	1	1	1
<i>Zizina antanossa</i>	W	LC	1	1	1	1
<i>Zizula hylax</i>	W	NE	1	1	1	1
Papilionidae						
<i>Graphium polices</i>	f.	NE	1			
<i>Papilio bromius</i>	f.	NE	1	1	1	
<i>Papilio cynorta</i>	F	NE	1			
<i>Papilio dardanus</i>	W	NE	1	1	1	
<i>Papilio demodocus</i>	M	NE	1	1	1	1
<i>Papilio nireus</i>	f.	NE	1	1		
<i>Papilio phorcas</i>	F	NE	1	1		
106			68	48	57	48

Appendix 3: List of Birds recorded within the project area (some extracted from the available literature)

Atlas No.	COMMON NAME	Scientific Name (Alternative Name)	Class	C-Species
24	PURPLE HERON	<i>Ardea purpurea</i>	R-NTW	R-NTW
26	BLACK-HEADED HERON	<i>Ardea melanocephala</i>	w	w
28	HAMERKOP	<i>Scopus umbretta</i>	w	w
32	ABDIM'S STORK	<i>Ciconia abdimii</i>	AMAG	AMAG
33	WOOLLY-NECKED STORK	<i>Ciconia episcopus</i>	R-NTW	R-NTW
35	SADDLE-BILLED STORK	<i>Ephippiorhynchus senegalensis</i>	R-VUW	R-VUW
36	MARABOU STORK	<i>Leptoptilos crumeniferus</i>	w	w
37	SHOEBILL	<i>Balaeniceps rex</i>	VU, R-VUW	VU, R-VUW
42	SACRED IBIS	<i>Threskiornis aethiopicus</i>	W	W
47	FULVOUS WHISTLING DUCK	<i>Dendrocygna bicolor</i> (Fulvous Duck)	AMW	AMW
48	WHITE-FACED WHISTLING DUCK	<i>Dendrocygna viduata</i> (White-faced Duck)	W	W
50	EGYPTIAN GOOSE	<i>Alopochen aegyptiaca</i>	WG	WG
71	EUROPEAN HONEY BUZZARD	<i>Pernis apivorus</i>	PMPF	PMPF
73	BLACK-SHOULDERED KITE	<i>Elanus caeruleus</i>	G	G
75	BLACK KITE	<i>Milvus migrans</i>	pA	pA
86	BROWN SNAKE EAGLE	<i>Circaetus cinereus</i>	R-NT	R-NT
88	BATELEUR	<i>Terathopius ecaudatus</i>	NTG	NTG
90	AFRICAN HARRIER HAWK	<i>Polyboroides typus</i> (Gymnogone)	f	f
108	GRASSHOPPER BUZZARD	<i>Butastur rufipennis</i>	AMA	AMA
116a	TAWNY EAGLE	<i>Aquila rapax</i>		
118	WAHLBERG,S EAGLE	<i>Aquila wahlbergi</i>		
119	AFRICAN HAWK-EAGLE	<i>Hieraaetus spilogaster</i>		
125	MARTIAL EAGLE	<i>Polemaetus bellicosus</i>	NT, R-VU	NT, R-VU
142	HELMETED GUINEAFOWL	<i>Numida meleagris</i>	G	G
154	CRESTED FRANCOLIN	<i>Francolinus sephaena</i>		
178	BLACK CRAKE	<i>Amaurornis flavirostris</i>	W	W
185	GREY CROWNED CRANE	<i>Balearica regulorum</i>	EN,R-NTWG	EN,R-NTWG
193	JACANA	<i>Actophilornis africana</i>	W	W
248	WOOD SANDPIPER	<i>Tringa glareola</i>	PMPW	PMPW
250	COMMON SANDPIPER	<i>Actitis hypoleucos</i>	PMPW	PMPW
268	AFRICAN GREEN-PIGEON	<i>Treron calvus</i>	F	F
271	BLUE-SPOTTED WOOD DOVE	<i>Turtur afer</i>	F	F
272	BLACK-BILLED WOOD DOVE	<i>Turtur abyssinicus</i>		
283	RED-EYED DOVE	<i>Streptopelia semitorquata</i>	f	f
285	VINACEOUS DOVE	<i>Streptopelia vinacea</i>		
309	RED-CHESTED CUCKOO	<i>Cuculus solitarius</i>	AF	AF
317	AFRICAN EMERALD CUCKOO	<i>Chrysococcyx cupreus</i>	F	F
319	KLAAS' CUCKOO	<i>Chrysococcyx klaas</i>	f	f
320	DIDRERIC CUCKOO	<i>Chrysococcyx caprius</i> (Diederik or Didric Cuckoo)		
323	WHITE-BROWED COUCAL	<i>Centropus superciliosus</i>		
358	AFRICAN PALM SWIFT	<i>Cypsiurus parvus</i>		
369	SPECKLED MOUSEBIRD	<i>Colius striatus</i>		

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Atlas No.	COMMON NAME	Scientific Name (Alternative Name)	Class	C-Species
371	NARINA,S TROGON	Apaloderma narina	F	F
372	CHOCOLATE-BACKED KINGFISHER	Halcyon badia	FF	FF
373	GREY-HEADED KINGFISHER	Halcyon leucocephala (Chestnut-bellied Kingfisher)	Afw	Afw
374	BLUE-BREASTED KINGFISHER	Halcyon malimbica	Fw	Fw
375	WOODLAND KINGFISHER	Halcyon senegalensis	A	A
376	STRIPED KINGFISHER	Halcyon chelicuti		
378	AFRICAN PYGMY KINGFISHER	Ceyx pictus	fw	fw
388	SWALLOW-TAILED BEE-EATER	Merops hirundineus	R-NTA	R-NTA
389	RED-THROATED BEE-EATER	Merops bullocki	W	W
394	EUROPEAN BEE-EATER	Merops apiaster	PMPf	PMPf
401	BROAD-BILLED ROLLER	Eurystomus glaucurus	Afw	Afw
408	EURASIAN HOOPOE	Upupa epops (Includes African Hoopoe)	PMp	PMp
409	ABYSSINIAN GROUND-HORNBILL	Bucorvus abyssinicus		
418	AFRICAN PIED HORNBILL	Tockus fasciatus	F	F
420	AFRICAN GREY HORNBILL	Tockus nasutus		
422	BLACK-AND-WHITE CASQUED HORNBILL	Bycanistes subcylindricus	F	F
426	SPECKLED TINKERBIRD	Pogoniulus scolopaceus	F	F
430	YELLOW-THROATED TINKERBIRD	Pogoniulus subsulphureus	FF	FF
431	YELLOW-RUMPED TINKERBIRD	Pogoniulus bilineatus	F	F
433	YELLOW-FRONTED TINKERBIRD	Pogoniulus chrysoconus	f	f
437	SPOT-FLANKED BARBET	Tricholaema lachrymose	R-RR	R-RR
441	BLACK-BILLED BARBET	Lybius guifsobalito		
443	DOUBLE-TOOTHED BARBET	Lybius bidentatus	f	f
445	YELLOW-BILLED BARBET	Trachyphonus purpuratus	FF	FF
455	GREATER HONEYGUIDE	Indicator indicator (Black-throated Honeyguide)	f	f
456	LESSER HONEYGUIDE	Indicator minor	f	f
465	NUBIAN WOODPECKER	Campethera nubica		
470	BROWN-EARED WOODPECKER	Campethera caroli	FF	FF
473	CARDINAL WOODPECKER	Dendropicos fuscescens		
498	WHITE-HEADED SAW-WING	Psalidoprocne albiceps (White-headed Rough-wing)	R-RRf	R-RRf
500	COMMON SAND MARTIN	Riparia riparia (Bank Swallow)	PMPW	PMPW
530	RED-SHOULDERED CUCKOO-SHRIKE	Campephaga phoenicea		
539	LITTLE GREY GREENBUL	Andropadus gracilis	R-NTFF	R-NTFF
541	SLENDER-BILLED GREENBUL	Andropadus gracilirostris	FF	FF
543	HONEYGUIDE GREENBUL	Baeopogon indicator	FF	FF
556	WHITE-THROATED GREENBUL	Phyllastrephus albigularis	FF	FF
558	RED-TAILED BRISTLEBILL	Bleda syndactylus	FF	FF
562	COMMON BULBUL	Pycnonotus barbatus (Yellow-vented Bulbul)	f	f
563	WESTERN NICATOR	Nicator chloris	F	F
576	WHITE-BROWED ROBIN-CHAT	Cossypha heuglini	f	f
577	RED-CAPPED ROBIN-CHAT	Cossypha natalensis	F	F
578	SNOWY-CROWNED ROBIN-CHAT	Cossypha niveicapilla	Fw	Fw

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Atlas No.	COMMON NAME	Scientific Name (Alternative Name)	Class	C-Species
579	FIRE-CRESTED ALETHE	<i>Alethe diademata</i>	FF	FF
586	SPOTTED PALM-THRUSH	<i>Cichladusa guttata</i> (Spotted Morning Thrush)		
584	RUFIOUS FLYCATCHER-THRUSH	<i>Stizorhina fraseri</i>	FF	FF
589	WHITE-BROWED SCRUB-ROBIN	<i>Cercotrichas leucophrys</i>		
601	SOOTY CHAT	<i>Myrmecocichla nigra</i>		
612	AFRICAN THRUSH	<i>Turdus pelios</i>	f	f
621	MOUSTACHED GRASS WARBLER	<i>Melocichla mentalis</i> (African Moustached Warbler)		
638	RED-FACED CISTICOLA	<i>Cisticola erythrops</i>	w	w
639	SINGING CISTICOLA	<i>Cisticola cantans</i>		
641	TRILLING CISTICOLA	<i>Cisticola woosnami</i>		
645	RATTLING CISTICOLA	<i>Cisticola chiniana</i>		
647	WINDING CISTICOLA	<i>Cisticola galactotes</i>	w	w
650	CROAKING CISTICOLA	<i>Cisticola natalensis</i>	G	G
658	TAWNY-FLANKED PRINIA	<i>Prinia subflava</i>	fw	fw
662	RED-WINGED WARBLER	<i>Heliolais erythroptera</i>	F	F
663	RED-WINGED GREY WARBLER	<i>Drymocichla incana</i>	R-NTw	R-NTw
664	BUFF-BELLIED WARBLER	<i>Phyllolais pulchella</i>	f	f
667	YELLOW-BREASTED APALIS	<i>Apalis flavida</i>	f	f
677	GREY-BACKED CAMAROPTERA	<i>Camaroptera brachyura</i>	f	f
682	YELLOW LONGBILL	<i>Macrosphenus flavicans</i>	FF	FF
686	GREEN-BACKED EREMOMELA	<i>Eremomela pusilla</i>		
691	RED-FACED CROMBEC	<i>Sylvietta whytii</i>	F	F
692	GREEN CROMBEC	<i>Sylvietta virens</i>	F	F
701	GREY-CAPPED WARBLER	<i>Eminia lepida</i>	R-RRfw	R-RRfw
707	YELLOW-BELLIED HYLIOTA	<i>Hyliota flavigaster</i> (Yellow-breasted Hyliota)	F	F
709	GREEN HYLIA	<i>Hylia prasina</i>	F	F
723	AFRICAN DUSKY FLYCATCHER	<i>Muscicapa adusta</i>	F	F
739	AFRICAN PARADISE-FLYCATCHER	<i>Terpsiphone viridis</i>	f	f
740	RED-BELLIED PARADISE-FLYCATCHER	<i>Terpsiphone rufiventer</i>	F	F
742	BLACK-AND-WHITE FLYCATCHER	<i>Bias musicus</i> (Vanga Flycatcher)	f	f
743	CHESTNUT WATTLE-EYE	<i>Dyphorophya castanea</i>	FF	FF
746	BROWN-THROATED WATTLE-EYE	<i>Platysteira cyanea</i> (Common Wattle-eye)	f	f
758	PUVEL'S ILLADOPSIS	<i>Illadopsis puveli</i>	F	F
761	BROWN BABBLER	<i>Turdoides plebejus</i>		
771	WHITE-WINGED BLACK TIT	<i>Parus leucomelas</i> (Black Tit or White-shouldered Tit)	f	f
776	WESTERN VIOLET-BACKED SUNBIRD	<i>Anthreptes longuemarei</i>	Af	Af
779	LITTLE GREEN SUNBIRD	<i>Anthreptes seimundi</i>	FF	FF
787	SCARLET-CHESTED SUNBIRD	<i>Chalcomitra senegalensis</i>	f	f
794	COLLARED SUNBIRD	<i>Hedydipna collaris</i>	F	F
801	BEAUTIFUL SUNBIRD	<i>Cinnyris pulchellus</i>		
811	AFRICAN YELLOW WHITE-EYE	<i>Zosterops senegalensis</i>	f	f
812	COMMON FISCAL	<i>Lanius collaris</i>	G	G

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Atlas No.	COMMON NAME Scientific Name (Alternative Name)	Class	C-Species
815	GREY-BACKED FISCAL <i>Lanius excubitoroides</i>	Afw	Afw
821	YELLOW-BILLED SHRIKE <i>Corvinella corvina</i>		
828	SULPHUR-BREASTED BUSH-SHRIKE <i>Telophorus sulfureopectus</i>	f	f
831	BROWN-CROWNED TCHAGRA <i>Tchagra australis</i> (Brown-headed Tchagra)		
833	BLACK-CROWNED TCHAGRA <i>Tchagra senegalus</i>		
836	NORTHERN PUFFBACK <i>Dryoscopus gambensis</i>	F	F
841	TROPICAL BOUBOU <i>Laniarius aethiopicus</i>	f	f
843	BLACK-HEADED GONOLEK <i>Laniarius erythrogaster</i>	f	f
844	BRUBRU <i>Nilaus afer</i>		
845	WHITE HELMET-SHRIKE <i>Prionops plumatus</i> (White-crested Helmet-shrike)	f	f
848	WESTERN BLACK-HEADED ORIOLE <i>Oriolus brachyrhynchus</i>	F	
853	FORK-TAILED DRONGO <i>Dicurus adsimilis</i> (Common Drongo)	f/F	f/F
858	PIAPIAC <i>Ptilostomus afer</i>		
870	LESSER BLUE-EARED STARLING <i>Lamprotornis chloropterus</i> (Glossy Starling)		
872	RUPPELL'S STARLING <i>Lamprotornis purpuropterus</i> (Ruppell,s Long-tailed Starling)		
878	YELLOW-BILLED OXPECKER <i>Buphagus africanus</i>	R-VU	R-VU
891	CHESTNUT-CROWNED SPARROW-WEAVER <i>Plocepasser superciliosus</i>		
895	LITTLE WEAVER <i>Ploceus luteolus</i>		
896	BLACK-NECKED WEAVER <i>Ploceus nigricollis</i>	f	f
897	SPECTACLED WEAVER <i>Ploceus ocularis</i>	f	f
903	LESSER MASKED WEAVER <i>Ploceus intermedius</i>		
915	COMPACT WEAVER <i>Ploceus superciliosus</i>	fw	fw
922	RED-HEADED WEAVER <i>Anaplectes rubriceps</i>		
925	RED-BILLED QUELEA <i>Quelea quelea</i>	A	A
928	BLACK-WINGED BISHOP <i>Euplectes hordeaceus</i> (Fire-crowned Bishop)		
933	YELLOW-MANTLED WIDOWBIRD <i>Euplectes macrourus</i>	G	G
959	RED-BILLED FIREFINCH <i>Lagonosticta senegala</i>		
974	RED-CHEEKED CORDON-BLEU <i>Uraeginthus bengalus</i>		
980	BRONZE MANNIKIN <i>Lonchura cucullata</i>		
981	BLACK-AND-WHITE MANNIKIN <i>Lonchura bicolor</i> (Red-backed Mannikin)	f	f
985	PIN-TAILED WHYDAH <i>Vidua macroura</i>	G	G
995	YELLOW-FRONTED CANARY <i>Serinus mozambicus</i>		
1006	BROWN-RUMPED BUNTING <i>Emberiza affinis</i>	G	G

PHOTOS



Meeting with UWA management of TSWR

ANNEXES

FRAMEWORK FOR HABITAT RESTORATION

A widely recognized framework for habitat restoration, endorsed by organizations like the Society for Ecological Restoration (SER) and the UN Decade on Ecosystem Restoration, follows a structured process organized into five main components. The general framework is as follows.

1. Assessment

The initial phase involves a comprehensive understanding of the degraded site and its surrounding landscape.

- a) **Identify the problem:** Define the cause, nature, and extent of the habitat degradation.
- b) **Conduct site assessment:** Evaluate the site's biophysical and socioeconomic conditions, including geology, hydrology, soil quality, and existing flora/fauna.
- c) **Establish a reference ecosystem:** Identify an appropriate native reference ecosystem (either nearby or historical data) to serve as a model or benchmark for the desired outcome of the restoration.
- d) **Engage stakeholders:** Identify and consult with local communities, UWA, and experts to ensure collaboration and long-term support for the project.

2. Planning and Design

This stage translates the assessment information into a detailed, actionable plan.

- a) **Define clear goals and objectives:** Establish specific, measurable, achievable, realistic, and time-bound (SMART) targets for recovery, based on the reference ecosystem's key attributes.
- b) **Develop strategies:** Determine the appropriate restoration techniques, such as invasive species removal, soil erosion control, native species reintroduction, or hydrological restoration.
- c) **Create a detailed plan:** Outline specific tasks, responsibilities, timelines, budgets, and required permits or licenses.
- d) **Incorporate adaptive management:** Design flexibility into the plan to allow for adjustments based on monitoring results or unforeseen challenges.

3. Implementation

This phase involves putting the restoration plan into action.

- a) **Site preparation:** Carry out initial actions like removing threats (e.g., fencing to exclude livestock) or controlling invasive species.
- b) **On-ground works:** Implement the core restoration activities, such as planting native species, re-grading landforms, or restoring water flow.
- c) **Documentation:** Maintain thorough records of all actions, resources used, and any on-site observations

4. Ongoing Management and Maintenance

Restoration does not end with initial planting; ongoing care is vital for success.

- a) **Maintenance:** Conduct regular maintenance activities, such as watering new plants, continued weed control, and protecting the site from ongoing threats (e.g., fire, unauthorized access).
- b) **Long-term protection:** Ensure strategies for the sustained protection and management of the restored ecosystem are in place

5. Monitoring, Evaluation, and Adaptive Management

Continuous monitoring is essential to measure progress and make informed decisions.

- a) **Monitor progress:** Collect data using defined indicators and protocols to track whether goals and objectives are being met.
- b) **Evaluate success:** Periodically assess the effectiveness of the interventions by comparing outcomes to the baseline data and performance indicators.
- c) **Report results:** Document and share findings to inform stakeholders and contribute to the body of knowledge on restoration.
- d) **Adapt the plan:** Use the evaluation results to make necessary adjustments to management strategies, embracing the principles of adaptive management

FRAMEWORK FOR CHIMPANZEE MANAGEMENT & MONITORING

An effective framework for chimpanzee monitoring, guided by best practices from conservation bodies like the IUCN, integrates various methods to assess population status, health, threats, and habitat conditions. The framework is typically structured around the following core components.

1. Planning and Design

- a) **Define Objectives:** Clearly state what needs to be monitored (e.g., population size, density, health, habitat change, threats like poaching/disease).
- b) **Select Methodology:** Choose appropriate survey methods based on objectives and available resources. Common methods include:
- c) **Indirect Counts:** Using signs like nightly nests or dung piles along line transects is a standard method for estimating abundance and density, especially for hard-to-survey species.
- d) **Direct Observation/Focal Follows:** For habituated populations, researchers can follow individuals or groups to collect detailed data on behavior, social dynamics, diet, and health.
- e) **Non-invasive Genetics:** Analyzing DNA from fecal samples (dung) can identify individuals, determine population size/composition, and assess genetic health and connectivity.
- f) **Camera Trapping:** Placing motion-activated cameras in specific areas can provide data on presence, abundance, and population composition.
- g) **Establish Baseline Data:** Collect initial data on the population and habitat conditions before implementing management or conservation interventions to measure future change.
- h) **Develop Indicators:** Identify specific, measurable, achievable, results-oriented, and time-limited (SMART) indicators to track progress (e.g., number of nests per kilometer, percentage of tree cover, frequency of disease signs)

2. Data Collection

- a) **Standardized Protocols:** Implement rigorous, standardized field protocols for data collection to ensure consistency and reliability of results. This includes detailed guidelines for recording data and minimizing human disturbance.
- b) **Trained Personnel:** Ensure field teams (rangers, researchers, community monitors) are well-trained in data collection methods, navigation, and safety procedures.
- c) **Regular Frequency:** Conduct monitoring efforts at regular intervals (e.g., annually, seasonally) to detect trends over time.
- d) **Technology Integration:** Utilize technology like GPS, GIS, remote sensing (satellite imagery), and specialized modeling approaches to improve data accuracy and spatial analysis.

3. Data Analysis and Evaluation

- a) **Data Entry and Management:** Establish robust data management systems to store, clean, and organize collected information.
- b) **Modeling:** Use statistical and spatial modeling techniques to analyze data (e.g., distance sampling models for density, occupancy models for occurrence probability).
- c) **Threat Assessment:** Analyze data in conjunction with human impact data (e.g., human-wildlife conflict reports, poaching incidents, habitat loss) to understand pressures on the population.
- d) **Evaluation:** Compare current data to baseline conditions and defined targets/indicators to evaluate the population's status and the effectiveness of conservation strategies.

4. Adaptive Management and Reporting

- a) **Inform Decision-Making:** Use the results from the analysis to inform management decisions, such as identifying areas needing urgent protection, adjusting anti-poaching patrols, or implementing disease prevention protocols.
- b) **Stakeholder Coordination:** Share findings with a wide range of stakeholders, including, UWA, government agencies, NGOs, local communities, and donors, to coordinate efforts and build support for conservation actions.
- c) **Reporting:** Document and report findings transparently through formal reports, publications, or public platforms to ensure accountability and inform global conservation efforts

ALIEN INVASIVE SPECIES MANAGEMENT FRAMEWORK

An effective framework for managing alien invasive species typically follows a hierarchical, multi-stage approach recommended by international bodies like the Convention on Biological Diversity (CBD). This framework prioritizes action at different stages of the invasion process, from preventing initial entry to managing established populations.

The Hierarchical Framework

The most cost-effective management strategy is to prioritize actions in the following order:

1. Prevention
2. Early Detection and Rapid Response (EDRR)
3. Control and Management (including Containment and Eradication)
4. Restoration and Rehabilitation

1. Prevention

Prevention is the most critical and cost-effective stage of invasive species management. This stage aims to stop alien species from being introduced in the first place.

- a) **Policy and Legislation:** Develop and enforce strong national and international policies, legislation, and quarantine measures to regulate the intentional and unintentional introduction of alien species.
- b) **Risk Assessment:** Conduct rigorous risk assessments for any proposed alien species introduction (e.g., for aquaculture, agriculture, or the pet trade) to determine if they pose a threat to the environment or economy.
- c) **Pathway Management:** Identify and manage the primary pathways through which invasive species enter new areas (e.g. Contaminated soil on equipment, movement of plant material).
- d) **Public Awareness:** Implement education and public awareness campaigns to inform stakeholders (industry, general public, tourists) about responsible behaviors that prevent the spread of invasive species, such as cleaning gear before moving between sites.

2. Early Detection and Rapid Response (EDRR)

If prevention fails, the next step is to quickly detect and eliminate new incursions before they establish and spread.

- a) **Surveillance and Monitoring:** Establish regular surveillance and monitoring programs in high-risk areas to detect new invasive species as early as possible.
- b) **Rapid Response Plans:** Develop and have ready specific action plans for rapid eradication immediately upon detection of a new invasive species.
- c) **Information Exchange:** Ensure effective information sharing and communication between government agencies, scientists, and local communities to quickly alert authorities about new sightings.

3. Control and Management

When a species is already established and cannot be eradicated, the focus shifts to containment, control, and damage reduction.

- a) **Prioritization:** Prioritize management efforts based on scientific assessment of the impact (environmental, social, economic) and the feasibility of control, focusing resources where they will have the highest impact.

- b) **Integrated Management:** Employ a range of control methods (manual/physical, chemical, biological, and cultural) in an integrated approach to maximize effectiveness and minimize negative side effects.
- c) **Containment:** If total eradication is not feasible, strategies should aim to limit the spread of the established population to contain it within a defined boundary.
- d) **Ongoing Control:** Management of established species is often a long-term commitment that requires sustained, regular follow-up actions to prevent re-infestation.

4. Restoration and Rehabilitation

The final stage involves minimizing or reversing the adverse effects of invasive species on the ecosystem.

- a) **Site Rehabilitation:** Restore landscapes and habitats affected by invasive species by using indigenous, locally occurring species in revegetation efforts.
- b) **Monitoring Recovery:** Monitor the recovery of the native ecosystem to ensure the restoration is successful and to prevent the re-establishment of the invasive species.
- c) **Sustainable Ecosystems:** Aim to restore ecosystem function and integrity to reduce the vulnerability of the area to future invasions

FRAMEWORK FOR MANAGING CONSTRUCTION ACROSS WATERCOURSE

Managing construction across watercourses requires a structured framework that prioritizes environmental protection, regulatory compliance, and safety. This framework typically involves planning, implementation of best management practices (BMPs), and post-construction monitoring/restoration.

1. Planning and Regulatory Compliance

Effective planning is the foundation of a successful watercourse crossing project.

- a) **Minimize Crossings:** Route projects to minimize the number of watercourse crossings and avoid environmentally sensitive areas like wetlands or fish spawning sites.
- b) **Site Selection:** Choose crossing points on straight, stable stream sections with low banks to minimize disturbance and the need for extensive training works.
- c) **Obtain Permits:** Secure all necessary permits and approvals from relevant regulatory agencies (e.g., environmental protection agencies, fisheries departments). These agencies often impose specific conditions and timing restrictions on in-stream work to protect sensitive life stages of aquatic species.
- d) **Develop a Construction Environmental Management Plan (CEMP):** Create a detailed CEMP that outlines the specific procedures, mitigation measures, roles, and responsibilities for managing potential environmental impacts during construction. This plan should include a specific Water Management Plan or Watercourse Crossing Method Statement

2. Implementation and Best Management Practices (BMPs)

During construction, a range of BMPs should be implemented to prevent pollution and minimize physical disruption.

- a) **Timing:** Schedule in-stream work during low-flow periods, typically the dry season, to minimize the impact of high flows on water quality and aquatic life.
- b) **Isolation of Work Area:** Use methods like dam and pump or fluming to dewater the immediate work area, diverting the live flow around the site to maintain downstream flow and prevent sediment-laden water from entering the active channel.
- c) **Erosion and Sediment Control:**
 - Install robust erosion and sediment controls (e.g., silt fencing, sediment traps, coffer dams) prior to any ground disturbance.
 - Minimize the removal of riparian vegetation and clearly demarcate work areas to limit the disturbance footprint.
 - Stabilize disturbed areas, particularly banks and approaches, immediately after in-channel work is complete using methods like seeding, mulching, and erosion control matting.
- d) **Machinery Management:**
 - Ensure all machinery is clean, free of fluid leaks, and maintained regularly.
 - Refuel and service machinery a minimum of 30 meters away from the watercourse.
 - Use vegetable-based hydraulic oils if machinery must work within the water.

- e) **Material Management:** Stockpile all construction materials (e.g., topsoil, overburden) away from the water's edge, using covering or bunding to prevent run-off into the watercourse

3. Design and Structure Type

The choice of crossing structure impacts long-term environmental outcomes.

- a) **Prioritize Bridges/Spans:** Bridges or clear-span structures that do not require in-stream supports are generally preferred as they minimize disturbance to the bed and banks and allow natural passage of fish and wildlife.
- b) **Culvert Design:** If culverts are necessary, they should be designed and installed to mimic natural stream conditions, be set a minimum of 500mm below the natural bed level to allow for substrate passage, and be appropriately sized to accommodate flood flows and fish passage.
- c) **Avoid Impediments:** Ensure the design prevents the creation of barriers to fish and mammal passage (e.g., avoiding raised aprons, providing mammal ledges in culverts)

4. Monitoring and Maintenance

The framework continues after construction to ensure compliance and long-term success.

- a) **Inspection:** Regularly inspect the crossing and associated control measures during and after construction, especially after heavy rainfall or high flow events.
- b) **Adaptive Management:** Use monitoring results to adjust management strategies and address any issues promptly, such as erosion, silt accumulation, or blockages.
- c) **Decommissioning:** For temporary crossings, all structures and materials must be completely removed upon completion of the project, and the site restored to its pre-construction condition.

FRAMEWORK FOR POACHING MANAGEMENT

Poaching management requires a comprehensive and multi-faceted framework that combines enforcement, community engagement, and policy implementation. A successful framework, often guided by principles from organizations like the IUCN and CITES, generally incorporates the following pillars:

1. Situational Assessment and Planning

- a) **Intelligence Gathering:** Systematically gather data on poaching hotspots, methods used by poachers, trade routes, key species targeted, and market dynamics (demand).
- b) **Threat Analysis:** Use intelligence to identify key threats, vulnerabilities in protection efforts, and the drivers of poaching (e.g., poverty, corruption, demand for specific products).
- c) **Strategic Planning:** Develop site-specific anti-poaching strategies and conservation management plans that prioritize actions, allocate resources efficiently, and establish clear objectives and performance indicators.
- d) **Legal and Policy Review:** Ensure national laws and regulations provide a strong framework for prosecuting wildlife crime and incorporate international obligations (e.g., CITES commitments).

2. Prevention and Deterrence

This pillar focuses on stopping poaching before it occurs through a combination of visible presence and demand reduction.

- a) **Law Enforcement:** Implement effective and ethical law enforcement strategies, including regular patrols (foot, vehicle, aerial), surveillance (camera traps, drones), and the use of technology for early detection.
- b) **Demand Reduction:** Implement initiatives aimed at reducing consumer demand for illegal wildlife products through public awareness campaigns, education, and international diplomacy.
- c) **Transnational Cooperation:** Enhance cooperation between national borders and international agencies (e.g., INTERPOL, WCO) to disrupt transnational organized crime syndicates involved in the illegal wildlife trade.

3. Community Engagement and Development

Securing the cooperation of local communities living near wildlife areas is essential for long-term success.

- a) **Benefits Sharing:** Ensure that local communities benefit directly from wildlife conservation and tourism initiatives (e.g., employment as rangers or guides, revenue sharing, infrastructure development).
- b) **Incentives and Disincentives:** Develop programs that provide economic alternatives to poaching while imposing clear, non-violent penalties for illegal activities.
- c) **Local Ownership:** Empower communities to participate in conservation management and decision-making processes, fostering a sense of ownership and stewardship over local wildlife resources.

- d) **Awareness and Education:** Conduct local education and awareness programs about the value of wildlife and the negative consequences of poaching.

4. Investigation and Prosecution

Effective legal action is necessary to ensure accountability and provide a credible deterrent.

- a) **Forensics and Investigation:** Train personnel in crime scene management, evidence collection, and forensic analysis to build strong legal cases.
- b) **Prosecution and Judiciary Capacity:** Work with legal partners to build the capacity of prosecutors and judges to effectively handle complex wildlife crime cases, ensuring appropriate sentences are delivered.
- c) **Anti-Corruption Measures:** Implement strict anti-corruption policies within enforcement agencies and wildlife management bodies to ensure integrity and effectiveness of management efforts

5. Monitoring, Evaluation, and Adaptive Management

Continuous improvement requires data-driven decision-making.

- a) **Monitoring Poaching Levels:** Regularly monitor indicators such as carcass locations, patrol effort, arrest rates, and wildlife population trends to measure the effectiveness of management interventions.
- b) **Evaluation:** Conduct periodic evaluations of anti-poaching strategies to determine what is working and what is not.
- c) **Adaptive Management:** Use monitoring data and evaluation results to adapt and refine management strategies in response to changing conditions and new threats