**FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA**

**ETHIOPIAN ROADS ADMINISTRATION**

# Biodiversity Impact Mitigation Action Plan for the Melka Jilo – Awash Express Road Project

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# Acronyms

| | |
|---|---|
| AfDB | African Development Bank |
| ANP | Awash National Park |
| BAP | Biodiversity Action Plan |
| CBD | Convention on Biological Diversity |
| CMS | Convention on Migratory Species |
| EIMP | Environmental Impact Management Plan |
| EPA | Environmental Protection Authority |
| ERA | Ethiopian Roads Administration |
| ESIA | Environmental and Social Impact Assessment |
| EWCA | Ethiopian Wildlife Conservation Authority |
| FDRE | Federal Democratic Republic of Ethiopia |
| GIS | Geographical Information System |
| IUCN | International Union for the Conservation of Nature |
| LC | Least Concern |
| MoARD | Ministry of agricultural and rural development |
| NP | National Park |
| NT | Near Threatened |
| RoW | Right of Width |
| USGS | United State Geological Survey |
| VU | Vulnerable |

# Executive Summary:

The construction of a new Melka Jilo – Awash expressway that stretches for 67 kms will occupy about 600 ha of land with a 90 m RoW and impacts an area of about 39,900 ha, presents significant threats to the biodiversity of the entire corridor, particularly affecting endangered and critically endangered species such as vultures, eagles, and large mammals. The negative impact of this road will permanently eliminate a significant area of vegetation where a large number of woody species are found. This road will lead to habitat fragmentation, increased wildlife mortality, pollution, and disturbances that could result in long-term ecological degradation. To address these challenges, this action plan has been developed to mitigate the negative impacts and ensure the continued survival of the park's unique wildlife and ecosystems.

The action plan includes several key strategies and measures designed to minimize the adverse effects of the road. It proposes the establishment of wildlife corridors and underpasses at critical crossing points to reduce roadkill incidents and maintain ecological connectivity. Additionally, it recommends the installation of speed reduction measures such as speed bumps, wildlife crossing signs, and reduced speed limits in areas where wildlife activity is high, with the goal of lowering vehicle speeds and preventing collisions with animals however the speed limit installation is only applicable at the construction stage. To further minimize disturbances to wildlife, the plan advocates for the use of noise-dampening road surfaces, sound barriers, and motion-sensor lighting systems to reduce both noise and light pollution, which can severely disrupt the behavior of diurnal and nocturnal species.

Furthermore, the plan calls for stringent pollution control and waste management practices, including the enforcement of waste disposal regulations, the use of eco-friendly construction materials, and regular monitoring to minimize environmental contamination. It emphasizes the importance of habitat restoration and rehabilitation, with efforts aimed at reconnecting fragmented habitats and restoring the ecological integrity of affected areas. The plan also highlights the need for public awareness campaigns to educate local communities and road users about the importance of

wildlife conservation and road safety, promoting greater understanding and engagement in conservation efforts.

To address the immediate risk to wildlife, the action plan includes the formation of an emergency response team to handle wildlife incidents, which will be crucial in reducing mortality from road-related accidents. Continuous monitoring and research are also integral components of the plan, with regular assessments of biodiversity, roadkill incidents, and the effectiveness of mitigation measures to ensure that strategies can be adapted based on real-time data and changing conditions.

The implementation of this action plan involves a range of key stakeholders, including the Ethiopian Roads Administration, the Ministry of Transport, the Ethiopian Wildlife Conservation Authority, the Awash National Park Office, research institutions, and the Ethiopian Environmental Authority, each with specific roles and responsibilities, from implementing road design modifications to enforcing environmental regulations and conducting continuous monitoring.

The expected outcomes of this action plan include a reduction in wildlife mortality through fewer roadkill incidents and safer passage for animals, minimized ecological disturbances due to lower levels of noise, light, and chemical pollution, improved habitat connectivity through the restoration of fragmented habitats, and enhanced engagement and awareness among local communities regarding conservation efforts.

In conclusion, this action plan provides a comprehensive framework for mitigating the ecological challenges posed by the new road passing through Awash National Park. By focusing on targeted interventions, fostering collaboration among stakeholders, and adopting adaptive management approaches, the plan aims to balance the demands of infrastructure development with the urgent need to preserve the biodiversity of this road corridor and protect its valuable wildlife and habitats for future generations.

# 1. Introduction

## 1.1 The Global Context

Global biodiversity is changing at an unprecedented rate as a result of several human-induced changes in the global environment (Benítez-López, A. et al. 2010). Biodiversity loss at the species level tends to result in the so-called homogenization process (Lockwood and McKinney, 2001). This process is generally characterized by a decrease in the abundance of many species, culminating in an increase in the number of threatened species and the extinction of others, in combination with a simultaneous increase in the abundance of a few opportunistic species.

Among the many drivers of biodiversity loss, linear infrastructure, particularly roads, plays a critical role. The ubiquity of road networks and the growing body of evidence of their negative impacts on wildlife and ecosystems suggest that infrastructure development represents a major driving factor of biodiversity decline. The most commonly reported impacts from roads and utility corridors include habitat loss, fragmentation, intrusion of edge effects in natural areas, isolation of populations, barrier effects, road mortality, and increased human access (Benítez-López, A. et al. 2010). Roads often lead to the proliferation of invasive species, disruption of migration routes, and degradation of sensitive ecosystems, compounding the effects of climate change.

Globally, various mitigation measures have been employed to address the environmental impacts of road construction. For instance, wildlife corridors and eco-ducts have been widely implemented to reconnect fragmented habitats and reduce the barrier effects of roads. In the Netherlands, the development of over 600 wildlife crossings, including tunnels and bridges, has significantly reduced roadkill and enhanced population connectivity for species such as badgers and deer. Wildlife overpasses and underpasses are also used in countries like Canada and the United States to minimize road mortality for species like elk, bears, and mountain lions, especially in national parks such as Banff and Yellowstone.

In Australia, where roads intersect critical habitats of species such as koalas, a combination of fencing, rope bridges, and culverts has been utilized to facilitate safe passage across highways. Similarly, in Costa Rica, arboreal wildlife crossings have been installed to aid in the movement of canopy species like sloths and monkeys. These interventions are critical for maintaining the ecological integrity of protected areas and biodiversity hotspots, which are often bisected by road networks.

Additionally, the use of noise barriers, speed reductions, and warning systems in Europe has been shown to lower road-related disturbances to wildlife, especially in areas adjacent to forests and nature reserves. In places like Brazil's Amazon, stringent environmental impact assessments and road offset schemes have been introduced to mitigate the encroachment of roads into sensitive ecosystems and to compensate for habitat destruction by restoring equivalent areas elsewhere.

However, despite these advances, the challenge remains vast. Roads in biodiversity-rich regions like Southeast Asia and Sub-Saharan Africa often lack adequate mitigation measures, contributing to significant deforestation, wildlife displacement, and illegal hunting. In these areas, ongoing efforts by conservation organizations focus on strengthening policies, engaging local communities, and incorporating ecological planning into infrastructure projects to prevent irreversible biodiversity loss.

Even if the expansion of road networks continues to be a significant threat to global biodiversity, particularly in developing regions, the lessons learned from global experiences in mitigating the ecological impacts of road construction provide a valuable foundation for integrating biodiversity conservation into infrastructure development. These efforts underscore the importance of using a multi-pronged approach, involving technology, policy frameworks, and stakeholder engagement, to safeguard biodiversity while meeting human development needs.

This report presents a biodiversity action plan for a proposed expressway traversing 67 kilometer from Melka Jilo to Awash. The expressway is expected to bring numerous socio-economic benefits, including improved transportation and regional connectivity. However, it also poses significant threats to biodiversity, including habitat fragmentation, wildlife disturbance and increased mortality and causes other illegal activities on wildlife and habitats. The express way crosses the Awash National Park for 13.2 kms. To address these challenges, the report outlines a comprehensive strategy to minimize the negative environmental impacts of the road project. The action plan focuses on implementing mitigation measures, promoting stakeholder collaboration, and ensuring long-term conservation of the unique ecosystems and wildlife while balancing the developmental needs.

## 1.2. Description of the Adama- Awash Lot 2, Melkajilo-Awash Express project

As part of its 10 years development program, the government of Ethiopia is working to expand the country's road network. In order to achieve this target, several road projects have been aggressively launched in many parts of the country and the Adama-Awash Lot II Melkajilo – Awash expressway road construction project, which covers about 67 km, is the one for which the Ethiopian Roads Administration (ERA) has planned to develop, and AfDB has shown interest to finance the project.

Adama- Awash Lot 2, Melkajilo-Awash Express project is the continuation of Adama – Malkajilo, located in the central eastern part of Ethiopia, and traverses 3 regional states Oromia, Amhara and Afar respectively; and four Woredas such as Minjar shankora of Amhara, Fantale woreda of Oromia and Awash Fantiale and Amibara of Afar regional states. The road project falls within the corridor of the existing Addis Ababa – Adama – Awash – Djibouti trunk road.

The proposed Expressway will run parallel to the existing asphalt road on the left side and Ethio-Djibouti railway. The geographic coordinates are 39.65152E, 8.940343N, and 40.201174E, 9.039782 N at the start and end points respectively.

The project is designed to AASHTO's Freeway standards for main road with total length of 67km, and DC-5 standard for Link Roads, having a right of way (ROW) of 90m. It traverses flat and rolling land for about 55.7% and 44.3% respectively of the total length. There will be two lanes of 3.60m width on each carriageway that means 2x(2x3.6) which is equal to 14.4, 1.5m wide inner hard shoulder,3m wide outer hard shoulder, 0.75m wide outer soft shoulder in each side of the expressway, and 9m median at the center (ERA Final ESIA Report, 2024).

Even if the express way project will have a significant economic and social importance, it will have an inevitable negative impact on the environment in general and on the wild fauna and flora in particular. This express way crosses the Awash National Park for about 13.2 km length and this will adversely impact the park and its biodiversity including the vegetation, vertebrates, invertebrates and its ecological integrity.

The road project work comprises of, design, construction, and maintenance during warranty period activities. The design and feasibility study work mainly focus on site investigation and site surveying, material investigations, quarry and borrow site identification, assessment of existing environmental and social conditions.

The construction work activities include site clearing for proposed expressway road length as well as road width, excavation and grading, filling, compacting, improvements in drainage structures, waterways crossing, paving, quarry and borrow material development, establishing camps, garage site and material storage sites, temporary roads construction and maintenance.

The construction phase activity deploys a number of workforces, machinery and transport vehicles.

**Main project activities**

The construction of the road carriage way will constitute the principal activities of the project. It has several specialized physical components (drainages, bridges, culverts, soil retaining structures and over and underpasses etc.) that have to be undertaken to meet the required design standard by taking into consideration environmental and social issues. Therefore, the major activity components of the principal work are briefly described as follows.

**Earthwork**

Earthworks will mainly comprise site clearance, paving, excavations, embankment fills associated with vertical alignment adjustments to ease very depressed grounds and to improve sight distances and avoid water inundation. In addition, as the road line is new alignment need to be fixed to avoid the overflow and flooding problems. High rise embankments are required at several locations, to protect the paved road from flooding damages and water inundation. At some locations retaining structures may also be required at steep sloped cut hill sides, at river crossings & to support the raised embankments, and to stabilize the fills.

**Construction of structures**

Awash River is the only perennial river that can be crossed by the expressway, and there are seasonal streams and drainage lines that encounter along the route and that require crossing structures, bridges, and culverts etc. New bridges and culvert structures will be constructed along the major new alignment section of the road over those seasonal streams and drainage lines. Accordingly, 3 bridges and 69 culverts were proposed throughout the stretch of the expressway road.

**Drainage and Channelization works**

Along the road stretches where necessary, especially in rural areas, lateral drainages will have to be constructed. These will generally comprise open triangular or trapezoidal channels, where necessary the channels will be lined with concrete or stone pitching to protect erosion. Discharge points will be provided at reasonable intervals to maintain the natural drainage line of the runoff water as far as possible. Energy dissipaters and erosion protection works at drainage outlet will be installed where necessary to reduce erosion effects.

**Construction of Over and Underpasses**

The Expressway is a closed type that shouldn't be interrupted by motorized and none motorized crossing, so that roads and foot path crossings should be constructed as over or Under Passes at different intervals as required avoiding defragmentation of social cohesion.

**Link and Interchange Roads Construction**

**Link roads**

Being the Expressway is aligned far from towns and densely settled areas, link roads will be constructed to access those settlement areas and that can serve also as inlets outlets route for the expressway.

Accordingly, three link roads were proposed for the Melkajilo - Awash section of expressway. Detailed explanations that indicate the location or chain age and the name of the town or villages to be linked with the expressway presented in the table below.

**Interchanges**

Interchanges vary from single ramps connecting local streets to complex and comprehensive layouts involving two or more highways. Hence depending on the site condition three interchanges at Km93+100, at Km118+100 and at Km 125+800 were proposed.

**Ancillary Facilities**

There is need of significant ancillary facilities that will enable the contractor to realize the performances of the major road construction activities. Among these construction material extraction site development and asphalt plant sites, construction workers camp site and workshops are important. The following ancillary facility and activities will be major areas of focus along the road corridor.

**Borrow Pits Development**

Burrow pit development will be one of the material sources required for sub-base construction of the express way along the road project, and may be needed for fill in sections where adequate spoil from cut to fill material is not available or quite impossible due to its quality. Furthermore, in the flat terrain areas, water inundation and flooding of the road pavement can be challenging. To overcome this problem, high embankment fill will have to be constructed over substantial length of the road segment.

Therefore, several borrow pits are needed to be opened by the contractor along the alignments. The material investigation has identified potential material sites as part of the design service. The contractor, subject to the approval of the engineer, will determine the location of additional sites that may be needed upon commencement. Though major material sites are identified during the design, and the locations are defined accordingly.

There are adequate potential sources for burrow pit material along the road route, and within economical distances. Some of the burrow materials for Embankment/Fill for the project are identified at Sites listed as in tables below.

The dominant land cover of the material site is bush cover and shrubs, and no major impacts of vegetation clearance may be caused. Additionally, the following activities very important at borrow pit sites:

- ☞ Constructing dry pits latrines near these borrow areas;
- ☞ Site clearance (removal of the existing overburden the vegetation and top soil);
- ☞ Stockpile top soil (Minimize the storage period of topsoil stockpile to control erosion and run– off and maintain top soil quality);
- ☞ Tree planting and grassing;
- ☞ Handing over site to the community or local administration.

**Quarry Sites**

Large quantities of crushed stone will be needed for base course and surfacing material. To fulfil this demand, quarry sites are identified at different sites along the road corridor by the consultant during the design and any additional sites that may be required upon execution of the work will be determined by the contractor to meet further needs of the road construction work but it will be subject to the approval of the Engineer. Quarry sites for selected material are needed at about 10kms interval, while quarries of stone blocks for gravel are required at 30-kms interval along the road. Quarry material sources are available within reasonable haulage distances and adjacent to the road alignments; but need access roads to material sites are inevitable. The quarry sites identified and located by the material investigation team are indicated in the table below. Furthermore, the following facilities and activities are very important during quarry site developments:

- ☞ Constructing access road to quarry site;
- ☞ Constructing dry pits latrines;
- ☞ Site clearance (removal of the existing overburden, vegetation and top soil);
- ☞ Extracting stone quarry using jack hammer machineries or blasting;
- ☞ Leveling spoil stockpile after completing material excavation; Ethiopian Roads Administration
- ☞ Spreading topsoil stockpiled over leveled spoil stockpile;
- ☞ Tree planting and grassing;
- ☞ Handing over site to the community or local administration.

**Natural Sand for Mortar and Cement Concrete Works**

Two Natural Sand sources have been identified that are deemed for mortar and concrete work is available in the road corridor.

**Water source for construction works**

Large volume of water is required both for the construction activities and for the domestic uses of the workforce. Water is required for soil compaction in embankment, sub-grade and for concrete works. Searching for and identifying potential water sources is, therefore, essential tasks for the contractor.

The Weredas traversed by the Expressway are water stressed areas, and finding water sources at reasonable distances may be one of the constraints for the Contractor. Awash River is the only perennial river along the road route, and that can be dependable for the project as surface water source. However, there are some seasonal rivers and streams in the area within acceptable distances and also along the road route. The Contractor may have to look into developing its own water sources, in areas where natural surface water source is scarce. However, the following water resource locations were proposed.

**Construction Camp Site and Workshops**

The Contractor will establish main construction camps at convenient location within the specified sites along the road corridor. The facilities will include offices and residential accommodation for senior supervisory consultant staff and contractor workforce, workshops and vehicle maintenance facilities and storage areas. Subsidiary camps may also need to be established, with considerably reduced facilities and preferably away from residential and urbanized areas. One central main camp will be required for the respective consultant and contractor work forces.

## 1.3 The Problem Statement

Ethiopia, recognized as one of the most biodiversity-rich nations globally, boasts several biodiversity hotspots teeming with diverse species of flora and fauna. These unique ecosystems are not only valuable in their own right but also play a critical role in supporting local livelihoods and contributing to global environmental health. However, the sustainability of this precious natural resource is increasingly under threat. Among the most pressing challenges is the rapid expansion of infrastructure, which, while essential for economic growth and development, often proceeds with insufficient consideration for its environmental impacts. Infrastructure projects, such as roads, dams, and urban developments, are frequently implemented without adequately assessing or mitigating the potential harm they pose to ecosystems. This leads to habitat fragmentation, disruption of wildlife migration routes, and the loss of biodiversity. The lack of integrated planning and coordination between development sectors and environmental conservation efforts exacerbates the issue, highlighting the need for a more holistic approach to infrastructure development that balances economic progress with the preservation of Ethiopia's irreplaceable natural heritage.

The Melka Jilo-Awash expressway that runs for 67 kms crosses several areas having biodiversity significance for this particular area where this road passes.

Awash National Park, one of Ethiopia's most important protected areas, is already facing significant challenges that threaten its conservation and long-term ecological health. The park suffers from the unsustainable and overuse of its resources, such as overgrazing by livestock, settlement expansion by local communities, and various forms of pollution. Additionally, several major infrastructure developments have already fragmented the park's landscape and disrupted its ecosystems. The existing Addis-Djibouti highway, which serves as the country's main transportation corridor, and the Addis-Djibouti Railway both cut through the park, causing considerable ecological damage and increasing the mortality rates of wildlife through roadkill incidents and habitat degradation. Moreover, power lines traverse the core areas of the park, further fragmenting critical habitats and posing additional threats to biodiversity.

These infrastructure projects, combined with other anthropogenic pressures, have placed Awash National Park under severe strain, effectively putting it under siege and threatening its role as a home for diverse wildlife and a source of valuable ecosystem services. The proposed construction of a new 13.2 kilometer expressway through the park will exacerbate these existing challenges. This new road threatens to intensify habitat fragmentation, increase mortality rates for endangered and critically endangered species such as vultures, eagles, and large mammals, and introduce additional pollution in the form of noise, light, and chemical contaminants. Without effective and comprehensive mitigation measures, the cumulative impact of these existing and proposed infrastructures could lead to irreversible ecological degradation, a significant loss of biodiversity, and a severe decline in the conservation value of the park.

Given these existing challenges and the potential for further harm, this report seeks to analyze the expected impacts of the new road on the biodiversity within the corridor of this new expressway, propose a detailed action plan to mitigate these impacts, and offer strategic recommendations for achieving a balance between necessary infrastructure development and the urgent need to protect the biodiversity and vital ecosystems.

## 1.4 Objectives

To develop a comprehensive action plan that minimizes the negative impacts of the proposed highway on the biodiversity of the Melka Jilo – Awash Expressway, ensuring the long-term conservation of wildlife, maintenance of habitat connectivity, and preservation of ecosystem integrity while balancing infrastructure development needs.

**Specific Objectives**

- Assess and Monitor Biodiversity Impacts**:** Conduct a thorough baseline assessment and continuous monitoring of the expressway's impacts on the biodiversity of Melka Jilo – Awash Expressway. This includes identifying and mapping critical habitats, wildlife corridors, and key species affected by the road construction and operation to establish a clear understanding of the project's ecological footprint.
- Implement Habitat Protection and Restoration Measures**:** Develop and execute targeted habitat protection and restoration measures to minimize habitat loss and fragmentation. This includes creating and maintaining wildlife corridors, implementing reforestation and habitat restoration projects, and designing effective buffer zones to reduce the road's impact on sensitive ecosystems.
- Facilitate Safe Wildlife Movement**:** Design and implement wildlife-friendly infrastructure solutions, such as underpasses, overpasses, and fencing, to ensure safe movement and migration of wildlife across the road. These measures will help maintain habitat connectivity and reduce wildlife mortality due to road traffic.
- Reduce Disturbance and Pollution**:** Develop strategies to minimize noise, light, and air pollution during the construction and operational phases of the highway. This includes implementing construction best practices, enforcing speed limits, using low-noise road surfacing materials, and establishing buffer zones to protect wildlife from direct human disturbance.
- Strengthen Stakeholder Collaboration**:** Foster effective collaboration among all relevant stakeholders, including government agencies, park authorities, local

communities, and conservation organizations, to ensure coordinated action in implementing mitigation measures. Facilitate regular communication and capacity-building activities to enhance stakeholders' understanding and commitment to biodiversity conservation.

- Promote Community Engagement and Awareness**:** Engage local communities living in and around Melka Jilo – Awash Expressway in conservation efforts by raising awareness about the importance of biodiversity and the potential impacts of the highway. Develop community-based programs that promote sustainable land use practices and alternative livelihoods to reduce human-wildlife conflicts and reliance on park resources.
- Ensure Compliance with Environmental Regulations**:** Monitor and ensure compliance with national and international environmental regulations, standards, and best practices throughout all phases of the expressway project. Regularly review and update the action plan in response to evolving regulatory requirements and environmental conditions.
- Develop an Adaptive Management Framework**:** Establish an adaptive management framework that allows for continuous evaluation and adjustment of mitigation measures based on monitoring data, new scientific knowledge, and feedback from stakeholders. This approach will ensure the long-term effectiveness of conservation efforts and the resilience of Melka Jilo – Awash Expressway ecosystems particularly Awash National Park.
- Minimize Invasive Species Risk**:** Develop and implement protocols to prevent the introduction and spread of invasive species along the highway corridor, including regular monitoring, early detection, and rapid response plans to control and eradicate invasive species that threaten native biodiversity.
- Balance Infrastructure Development with Conservation Needs**:** Ensure that infrastructure development is aligned with the conservation objectives of biodiversity by promoting environmentally sustainable road design, construction practices, and maintenance activities that minimize ecological impacts while meeting transportation needs.

## 1.5 Description of the Awash National Park

Awash NP was the first of two parks to be legally gazetted in Ethiopia following the advices of Petrides (1961) and UNESCO missions. Selection for national park status was justified for the following reasons;

• Firstly, most of the area under consideration was already protected as a private hunting reserve for his Imperial Majesty Haile Selassie the 1st. As a result, there was an abundance of game in the area; and

• Secondly it is an extraordinary interesting area from a physiographic and geological perspective where the rift valley fans out. In addition and from the view point of scenery, wildlife and its proximity to the capital, Addis Ababa, this reserve would seem eminently suitable as a national park representative of the dry low land type (UNESCO MISSION, 1964). The Park was established as a 'strict conservation area', which according to UNESCO excludes all types of consumptive utilisation. Early management efforts attempted to adhere to this definition and to follow the management plan which had been prepared following its establishment (Roberson 1970).

It was considered the last protected stronghold of the East African oryx (Oryx beisa), Soemmerring's gazelle (Nanger soemmerringii) and Grévy's zebra (Equus grevyi); and because of the variety of wildlife, the scenery and the warm climate, it came to be regarded as the capital's national park where the city dwellers could enjoy nature and freedom.

The Awash National Park is located in the Rift Valley System of Ethiopia at the southern edge of the Afar Triangle. Administratively it falls within two regional states, i.e. Awash Fentale Woreda (Zone 3) of the Afar Regional State and Fentale Woreda (East Shewa Zone) of the Oromia Regional State. Geographically the Park has a north-south extent of just more than 30 km from 9°08'07" N to 8°49'57" N latitude and a west-east extent of almost 35 km from 39°51'15" E to 40°09'54" E longitude.

Two significant towns are located just outside the southern boundary of the Park namely Metehara in the south west and Awash in the south east. To the north is the small town of Sabure. Both Metehara and Awash Towns owe their existence to the main Addis

Ababa – Djibouti transport corridor which includes an intensively used tarmac highway and a newly constructed railway line. The latter replaces the old railway line which was constructed by the French from 1897 to 1917 and which is still in place, although not in use. Additionally there are eight Kebeles or villages which surround the Park namely Doho, Dudub, Fateledi, Benti, Kobo, Gelcha, Illala and Ebite.

When it was created as a royal hunting ground in 1966 and gazetted as Ethiopia's first National Park in 1969 it extended over an area of 756 km². It has been subjected to changes in size since then with a new boundary demarcation and re-gazzettement in 2014. The recent extent of the Park abandons the Sabober plains to the west of the Fentale Mountain. As a result it has been reduced by more than 20% of its original size to 591 km². The Park includes important geographic features such as the Fentale Mountain, a dormant stratovolcano with a large caldera in the west, the Ilala Sala plains to the southeast, approximately 28 km of the Awash River Gorge on its southern boundary, and the Filwuha Hot Springs in the north.

The above features are illustrated in Figure 1 below.

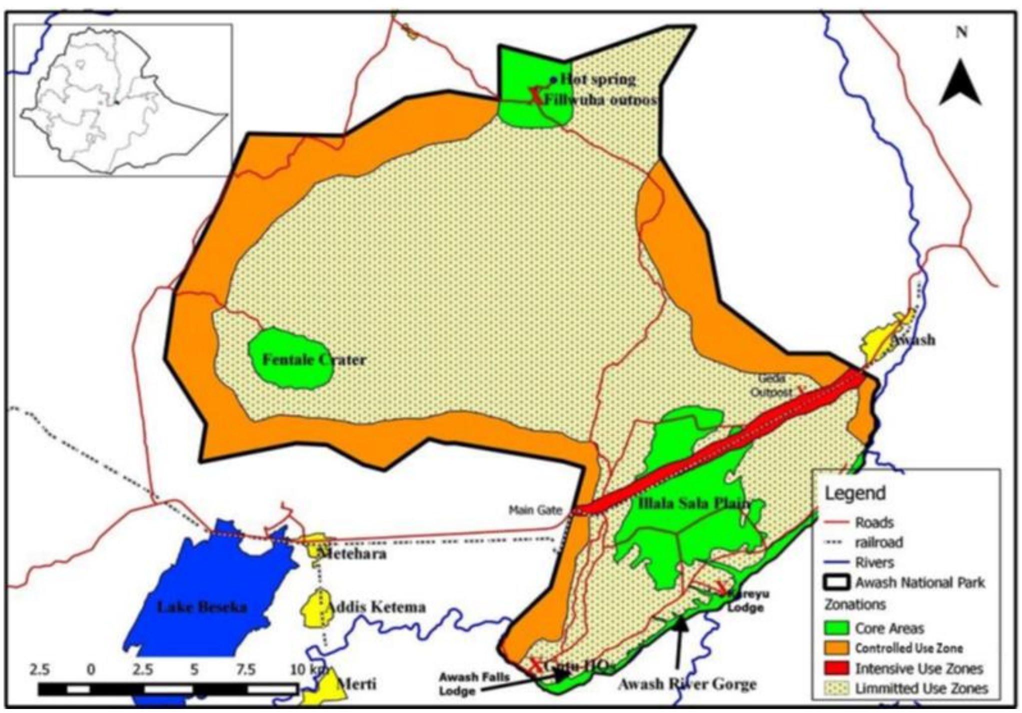



*Figure 1: Awash National Park and its management zonation*

# 2. Methodology

The preparation of this Biodiversity Action Plan involved a multidisciplinary approach, combining desk-based research, field observations, stakeholder consultations, and remote sensing techniques. This integrated methodology ensured a comprehensive understanding of the potential impacts of the expressway project on Awash National Park's biodiversity and allowed for the development of targeted mitigation strategies.

The process began with an extensive review of the Environmental and Social Impact Assessment (ESIA) report prepared for the expressway project. This report provided critical information on the road design, potential environmental impacts, proposed mitigation measures, and key stakeholders involved. To supplement this data, additional literature and study reports were reviewed to obtain up-to-date information on the ecological resources of Awash National Park, including the distribution of wildlife and plant species along the planned road corridor.

Field observations were conducted to validate the desk-based findings and to assess the current status of the park's habitats and wildlife, particularly in areas directly impacted by the proposed road alignment. During these field visits, specific attention was given to identifying sensitive habitats, wildlife corridors, and areas with high biodiversity value that could be affected by the construction and operation of the expressway.

Stakeholder consultations were carried out with a range of relevant parties, including park management authorities, local communities, environmental experts, and government agencies. These consultations provided diverse perspectives on the potential impacts of the project and helped identify additional mitigation measures that could be integrated into the action plan. Engaging stakeholders also fostered a collaborative approach to addressing biodiversity conservation challenges.

Remote sensing and Geographic Information System (GIS) techniques were utilized to analyze current land cover and habitat types within the areas where the road will cross the park. High-resolution satellite imagery from the 2023 Landsat dataset, obtained from the United States Geological Survey (USGS), was used to map vegetation cover and land use patterns. This spatial analysis helped identify critical habitats and biodiversity hotspots that may be adversely affected by the road project.

Previous experiences from similar infrastructure projects in other regions were also reviewed to understand the potential magnitude of impacts on both flora and fauna. These case studies provided valuable insights into the types of impacts likely to occur and effective mitigation strategies that have been successfully implemented elsewhere.

Based on the findings from these various methods, three impact levels were identified: high, medium, and low. These impact zones were then mapped within a 3-kilometer width on both the right and left sides of the proposed road alignment. This zoning allows for the targeted application of mitigation measures to reduce the project's impact on the biodiversity of this road corridor and to prioritize areas for appropriate mitigation actions

# 3. Scope of the Action Plan

This Biodiversity Action Plan (BAP) focuses on mitigating the negative environmental impacts of the Melka Jilo – Awash Expressway with a total distance of 67kms. The scope of this plan encompasses the identification, assessment, and management of potential threats to the biodiversity of this area resulting from the construction, operation, and maintenance of the road. The primary goal is to minimize the adverse effects on the park's unique ecosystems, wildlife, and plant species while ensuring compliance with national and international environmental standards.

# 4. Legal and Policy Framework for Environment and Biodiversity

Similar to other development projects the Melkajilo- Awash road section project triggers several policies and legislations pertinent to the environment. Those were assessed and are presented in this section.

Ethiopia's environmental and other related policies includes ES OS 6 are highly relevant to its Biodiversity Action Plan, providing the legal and institutional framework for conservation and sustainable use of biodiversity. These policies, including the Constitution, Environmental Policy, and various proclamations, address conservation, sustainable development, and access to genetic resources. The Biodiversity Action Plan builds upon these policies, outlining specific targets and actions to address biodiversity loss and promote its conservation and sustainable use.

To align with these policies includes ES OS 6, particularly the Biodiversity Action Plan (BAP), project implementing bodies must integrate conservation and sustainable use of biodiversity into their activities. This includes adhering to the National Biodiversity Strategy and Action Plan (NBSAP), by developing the proportional management plan, promoting community participation, and ensuring equitable benefit-sharing.

## 4.1 Environmental Policy of Ethiopia

The environment policy of Ethiopia (EPA) which was approved in April 1997, constitutes ten sectorial and ten cross- sectorial policy elements, its overall policy goal is to improve and enhance the health and quality of life all Ethiopians and to promote sustainable social and economic development through the sound management and use of natural, human- made and cultural resources and the environment as a whole.

## 4.2 National biodiversity conservation and research policy

The national biodiversity conservation and research policy adopted in 1998, the policy contains directives with regard to the need to explore, collect, characterize, evaluate, conserve and utilize biodiversity. Regulations of access to genetic resources through various measures including legislation and building appropriate institutional structures and mechanisms are also incorporated in the directives. Provides policy directives with regard to conservation, development and sustainable utilization of the genetic resources and essential ecosystems of the country as well as the need to build national capacity to collect, evaluate, conserve and utilize the country's biodiversity.

## 4.3 Wildlife Policy and Law

- Proclamation no.541/2007.a proclamation to provide for the development conservation and utilization of wildlife
- Proclamation No. 575/2008 Ethiopian Wildlife Development and Conservation Authority Establishment Proclamation
- Awash National Park is gazette by regulation No. 329/2014.

  The major objectives of the Proclamation include:

  • properly developing and administering the country's wildlife resources;

  • capacitate the sector to contribute fully to the nation economy development process;

  • protecting the wildlife resources and their habitats and

  • maintaining the balance of nature for posterity in accordance with international wildlife conventions and agreements to which the country is a signatory.

## 4.4 Forest Policy

Proclamation No. 542/2007, issued in September 2007, provides for the development, conservation and sustainable utilization of forests in satisfying the needs of the society for forest products and in the enhancement of national economy in general. It provides the basis for sustainable utilization of the country's forest resources. The proclamation categorizes types of forest ownership as private forest and state forest. The proclamation then goes on to give some specific direction for the development and utilization of private and state forests. Part two of the proclamation contains provisions for the promotion of the utilization of private forest, while part three gives provisions for conservation, development and administration of state forest. Lastly, part four comprises miscellaneous provisions that, among others, include prevention of forest fire, production and movement of forest products, prohibitions, forest guards and inspectors of forest products movement, and powers and duties of the MoARD and regional states.

Regulation number 544/2024 council of Forest development protection and utilization regulation, This Regulation may be cited as the "Forest Development, Protection and Utilization Regulation No.544 /2024".

## 4.5 Proclamation on environmental pollution control

This Proclamation (No. 300/2002), is mainly based on the right of each citizen to have a healthy environment, as well as on the obligation to protect the environment of the country and its primary objective is to provide the basis from which the relevant ambient environmental standards applicable to Ethiopia can be developed, and to make the violation of these standards a punishable act. The proclamation states that the “polluter pays” principle will be applied to all persons. Under this proclamation, the EPA is given the mandate for the creation of the function of Environmental Inspectors. These inspectors (to be assigned by EPA or regional environmental agencies) are given the authority to ensure implementation and enforcement of environmental standards and related requirements.

## 4.6 Convention on Biological Diversity (CBD):

Adopted in 1992, the CBD focuses on conserving biodiversity, sustainable use of its components, and fair sharing of benefits from genetic resources. Ethiopia is committed to establishing protected areas, rehabilitating ecosystems, and promoting species recovery under this framework.

## 4.7 Oromia Regional State:

Proclamation No. 72/2003 and Regulation 122/2009 established an autonomous organization responsible for wildlife and forest conservation. The region's laws impose strict penalties for illegal activities, making them among the most stringent in the country.

## 4.8 Amhara Regional State:

The region's legal framework focuses on conservation strategies, promoting community participation, issuing permits, and managing protected areas. However, it lacks specific provisions for penalizing offenses against wildlife.

## 4.9 AfDB's ES OS 6: Habitat and Biodiversity Conservation, and Sustainable Management of Living Natural Resources

This Environmental and Social Operational Safeguard (OS) outlines the requirements for the Borrower to: (i) identify and implement opportunities to conserve and sustainably use biodiversity and natural habitats; and (ii) observe, implement, and respond to requirements for the conservation and sustainable management of priority ecosystem services.

The OS reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote the sustainable management and use of natural resources. It also aligns with the Ramsar Convention on Wetlands, the Convention on the Conservation of Migratory

Species of Wild Animals, the Convention on International Trade in Endangered Species of Wild Flora and Fauna, the World Heritage Convention, the United Nations Convention to Combat Desertification, and the Millennium Ecosystem Assessment. Its recommendations also align with the International Plant Protection Convention, which covers the movement of invasive alien species and pests, as well as pest risk analysis for quarantine pests, including an analysis of the risks and impacts of genetically modified organisms.

OS6 recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development. 'Biodiversity' is defined as the variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are a part, which includes diversity within species, between species, and of ecosystems. Biodiversity often underpins ecosystem services valued by humans; hence, impacts on biodiversity can often adversely affect the delivery of ecosystem services.

OS6 recognizes the importance of maintaining core ecological functions of habitats, including forests, and the biodiversity they support in a changing climate. 'Habitat' is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment. All habitats support complexities of living organisms and vary in terms of species diversity, abundance, and importance.

This OS also addresses the sustainable management of primary production and the harvesting of living natural resources.S6 recognizes the need to consider the livelihoods of project-affected parties, including vulnerable groups, whose access to, or use of, biodiversity or living natural resources may be affected by a project. The potential, positive role of project-affected parties, including vulnerable groups, in biodiversity conservation and sustainable management of living natural resources is also considered.

The objectives of OS6 are as follows;

- To protect and conserve biodiversity and different types of habitats.

- To apply the mitigation hierarchy211 and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity, with the aim of conserving biological diversity and ecosystem integrity.
- To reinstate or restore biodiversity informed by the mitigation hierarchy, including where some impacts are unavoidable, through implementing biodiversity offsets to achieve “no net loss but net gain” of biodiversity.
- To promote the sustainable management of living natural resources.
- To support livelihoods of local communities, including vulnerable groups, and inclusive economic development through the adoption of practices that integrate conservation needs and development priorities.
- To sustain the availability and productivity of ecosystem services to maintain benefits for the affected communities and sustain project performance.
- To integrate natural resources effectively into sustainable economic development and protect the vital local and global environmental services and the values of natural resources.

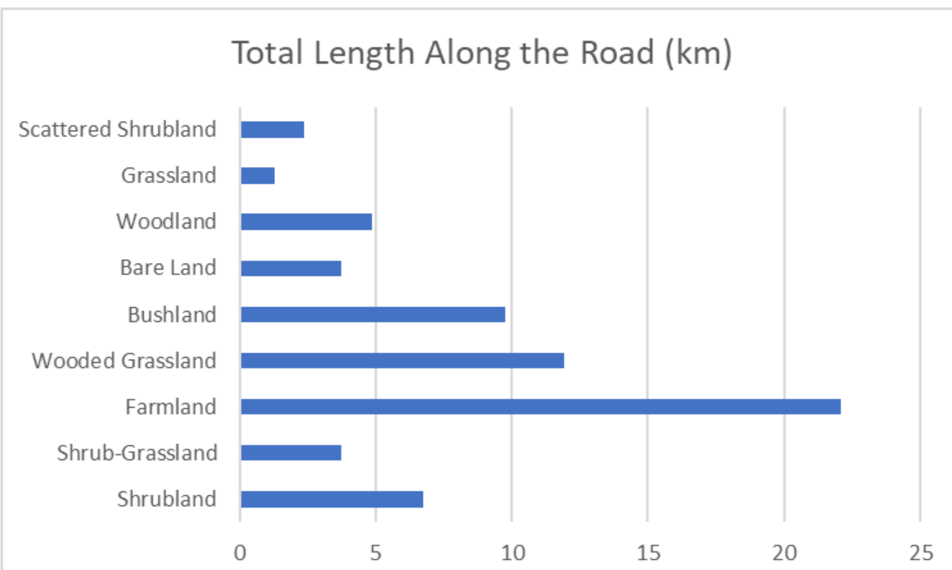
Therefore, this operational safeguard is triggered by the proposed Adama- Awash Lot II, Melkajilo - Awash (km-66.6) expressway road project as it passes through Awash National park one of biological diversity conservation area of the county. The Ethiopian Roads Administration has prepared this Biodiversity Management Plan as part of the safeguard instruments and implemented in consultation with the park authorities and other relevant stakeholders.

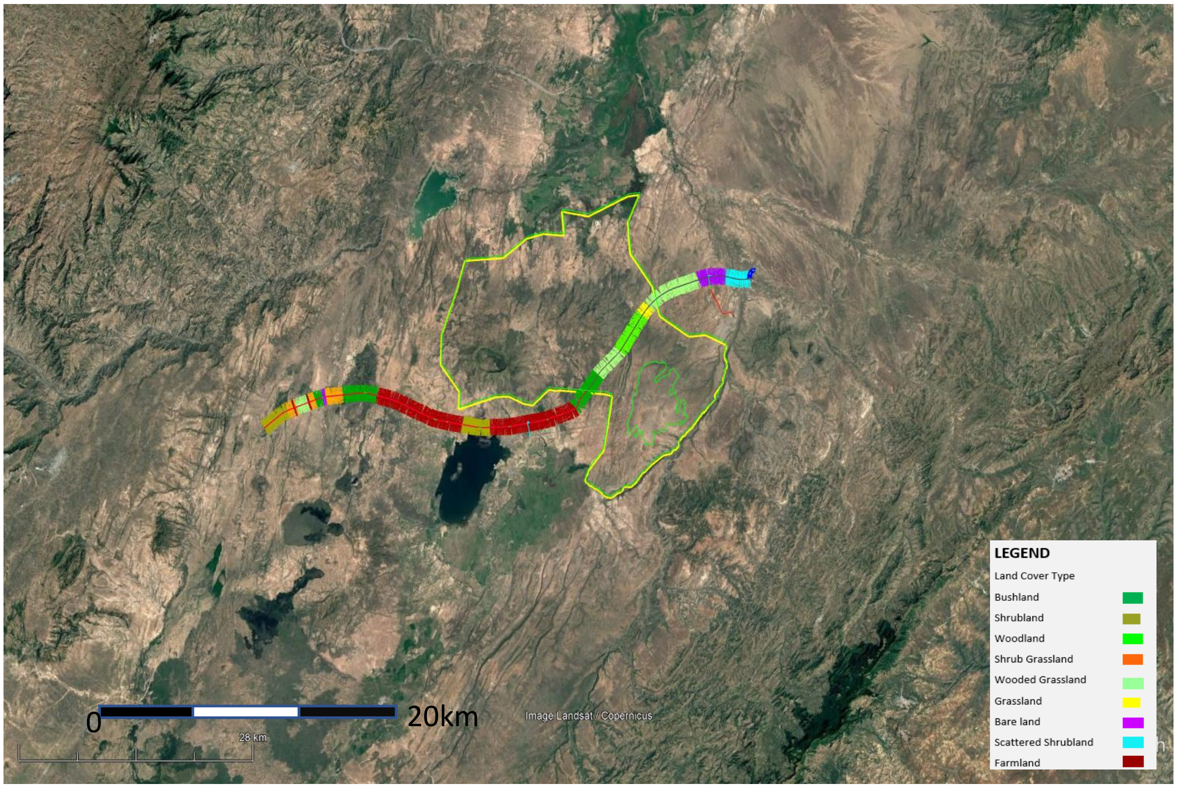
# 5. Biodiversity of the Area and the Corresponding Impact

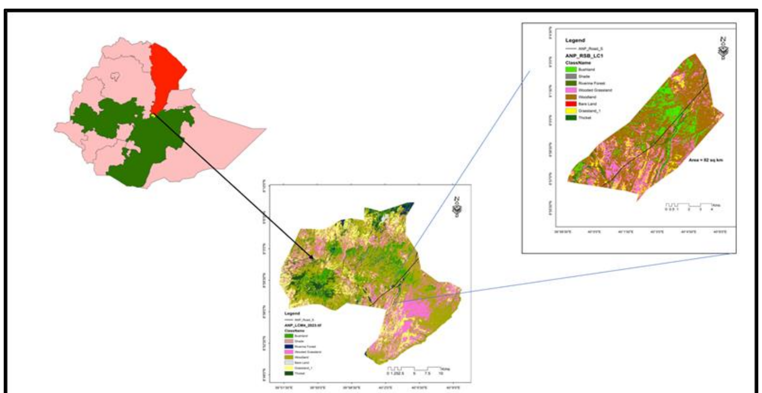
## 5.1 Landcover and Vegetation Types of the Impacted Area

Land Cover Type Along the Road

| Land Cover Type | Total Length (km) | Proportion |
|---|---|---|
| Shrubland | 6.73 | 10.12 |
| Shrub-Grassland | 3.74 | 5.62 |
| Farmland | 22.07 | 33.19 |
| Wooded Grassland | 11.93 | 17.94 |
| Bushland | 9.78 | 14.71 |
| Bare Land | 3.74 | 5.62 |
| Woodland | 4.86 | 7.31 |
| Grassland | 1.28 | 1.92 |
| Scattered Shrubland | 2.37 | 3.56 |
| Total | 67 | 100 |





| Landcover | Area (Sq km) |
|---|---|
| Bushland | 9.93 |
| Riverine Forest | 2.11 |
| Wooded Grassland | 15.65 |
| Woodland | 46.25 |
| Bareland | 0.48 |
| Grassland | 5.36 |
| Thicket | 1.26 |

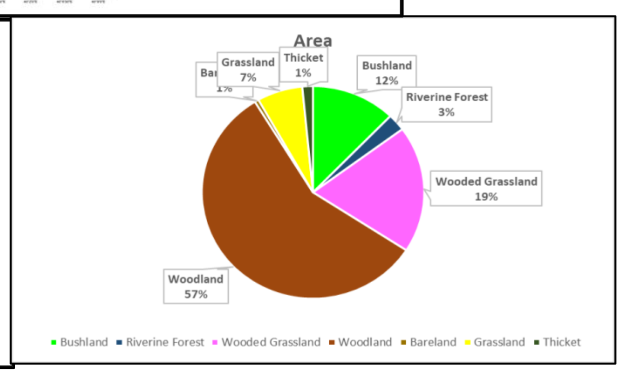





*Figure 2: Land Cover Map of Awash National Park and the Impacted Area of Road Section*

## 5.2 Flora of the Site

As part of the Melka Jilo Awash expressway project, the area under the impact of this road project has the following major woody and herbaceous plant species

Diversity and Abundance of Woody Species

*Table 1: Flora of the Area Under the Impact of the Road*

| **Family** | **Species** | **Habitat dominance** |
|---|---|---|
| Fabaceae | Acacia tortilis | Woodland, wooded grassland |
| | Acacia seyal | Woodland wooded grassland |
| | Acacia nilotica | Riverine, woodland |
| | Acacia brevaspica | woodland |
| | Acacia senegal | Bushland |
| | Acacia mellifera | Bushland |
| | Acacia oerfota | Bushland |
| | Acacia prasinata | Woodland, wooded grassland |
| | Acacia robusta | Woodland |
| | Dichrostachys cinerea | Bushland |
| Zygophyllaceae | Balanitis aegyptica | Woodland, wooded grassland |
| | Balanites rotundifolia | Woodland, wooded grassland |
| Burseraceae | Commiphora africana | Woodland |
| | Boswellia papyrifera | Woodland |
| Malvaceae | Grewia villosa | Bushland |
| | Grewia bicolor | Bushland |
| | Grewia viscosa | Bushland |
| | Grewia schweinfurthii | Bushland |
| | Grewia tenax | Bushland |
| | Grewia trichocarpa | Bushland |
| Combretaceae | Combretum molle | Wooded grassland |
| Boraginaceae | Cordia garaf | Bushland, wooded grassland |
| Rhamnaceae | Ziziphus spp. | Riverine |
| Salvadoraceae | Dobera glabra | Riverine |

| | | |
|---|---|---|
| | Salvadoris persica | Riverine |
| | Cadaba farinose | Bushland |
| Solanaceae | Solanum incanum | Grassland |

| Family | Species | Habitat dominance |
|---|---|---|
| Poaceae | Sporobolus spp | Grassland |
| | Themeda thriandra | Grassland |
| | Cenchrus celiaris | Grassland |
| | Chloris spp. | Grassland |
| | Aristidia spp | Grassland |
| | Inchaemum afrum | Grassland |
| | Chrysopogon plumulosus | Grassland |
| | Bothriochloa radicans | Grassland |

## 5.2 Fauna of the Site

*Table 2: Fauna of the Area Under the Impact of the Road Section in Awash National Park*

| **Class** | **Species** | **Habitat type** | **IUCN Red list** | **Possible impact of the road on the species** | **Level of impact** |
|---|---|---|---|---|---|
| Mammals | Beisa Oryx (Oryx beisa) | Grassland and Wooded Grassland | Endangered | Loss of ecological corridor, road kill | Moderate |
| | Greater Kudu (*Strepsiceros strepsiceros)* | Bushland and Woodland | LC | Loss of habitat, impact by pollution, road kill | High |
| | Lesser Kudu (Strepsiceros imberbis) | Bushland | NT | Loss of habitat, impact by pollution, road kill | High |
| | Warthog (Phacochoerus africanus) | All habitats of the area | LC | Blockage of ecological corridor, habitat loss, disturbance, road kill | Moderate |
| | Salt's Dik dik | Bushland | LC | Loss of habitat, disturbance, impact of | High |

| | | | | | |
|---|---|---|---|---|---|
| | | | | reproduction, local migration, road kill | |
| | Abyssinian Hare | Bushland, woodland and wooded grassland | LC | Loss of habitat, effect of behavior, road kill | High |
| | Klipspringer (*Oreotragus oretragus*) | Hilly slopped and rocky bushlands and woodlands | LC | Disturbance | Low |
| | Hamadryas Baboon *(Papio hamadryas)* | All habitats | LC | Blockage of corridor, road kill | Moderate |
| | Anubis Baboon (*Papio anubis*) | All habitats | LC | Blockage of corridor, road kill | Moderate |
| | Grivet Monkey (*Chlorocebus aethiops)* | Riverine | LC | Loss of habitat, disturbance, effect on behavior | Moderate |
| | Egyptian Mongoose | Bushland and woodlands | LC | Loss of habitat, effect on behavior | High |
| | Crested Porcupine *(Hystrix cristata)* | All habitats | LC | Habitat loss and disturbance | High |
| | Ground Squirrel | Bushlands and woodlands | LC | Loss of habitat and disturbance | High |
| | Spotted Hyaena | All habitats with hyena dens inside | LC | Possible destruction of hyena caves along the road line, obstruction of movement corridors, disturbance from vehicle lights during the night | High |
| | Striped Hyaena | All habitats with hyena dens inside | VU | Possible destruction of hyena caves along the road line, obstruction of movement corridors, disturbance from vehicle lights during the night | High |
| | Aardwolf *(Proteles cristatus)* | Bushland, woodlands and wooded grasslands | VU | Habitat loss, blockage of corridor | High |
| | Leopard (*Panthera* | Riverine, bushland, | NT | Blockage of corridors and | Moderate |

| | | | | | |
|---|---|---|---|---|---|
| | *pardus*) | woodlands and wooded grasslands | | prey loss | |
| | Lion (*Panthera leo)* | Bushland, woodlands, wooded grasslands, grasslands and riverine | VU | Blockage of corridors and prey loss | Moderate |
| | Common Jackal | All habitats | LC | Destruction of habitat, blockage of corridors and prey loss, road kill | High |
| | Black backed Jackal | All habitats | LC | Destruction of habitat, blockage of corridors and prey loss, road kill | High |
| | Bat Eared Fox (Otocyon megalotis) | Wooded Grasslands, Grasslands and woodlands | NT | Destruction of habitat, blockage of corridors and prey loss, road kill | High |
| | Caracal (*Felis caracal*) | Wooded Grasslands | LC | Destruction of habitat, blockage of corridors and prey loss, road kill | Moderate |
| | Egyptian Mongoose *(Herpestes ichneumon*) | All habitats | LC | Destruction of habitat, blockage of corridors and prey loss, road kill | High |
| | Black Tailed Mongoose | All habitats | LC | Destruction of habitat, blockage of corridors and prey loss, road kill | High |
| | Honey Badger (Mellivora capensis) | All habitat types in the area | VU | Destruction of habitat, blockage of corridors and prey loss, road kill | Moderate |
| | Common Genet (*Genetta genetta*) | All habitat types | LC | Destruction of habitat, blockage of corridors and prey loss, road kill | Low |
| | Rock Hyrax | Rocky hilled bushlands and woodlands | LC | Noise disturbance, habitat loss | Low |
| Reptiles | Snakes of all available species | All habitats | Some are vulnerable | Habitat loss, road kill | Moderate |
| | Pythons | All habitats | One | Habitat loss | Moderate |

| | | | | | |
|---|---|---|---|---|---|
| | | | species Endangered | | |
| | Gekos | All habitats | N/A | Impact from dust pollution during construction | Moderate |
| | Lizards | All habitats | N/A | Impact from dust pollution during construction | Moderate |
| | Monitor Lizard | All habitats | N/A | Impact from dust pollution during construction | Moderate |
| Amphibians | Amphibians of all type in the area | All habitats | Some species vulnerable | Impact from dust pollution during construction | Moderate |
| Birds | White-backed Vulture (*Gyps africanus*) | Grasslands and wooded grasslands | Critically endangered | Road kill | High |
| | Hooded Vulture (Necrosyrtes monachus) | Grasslands and wooded grasslands | Critically endangered | Road kill | High |
| | Rueppell's Vulture (Gyps rueppelli) | Grasslands and wooded grasslands | Critically endangered | Road kill | High |
| | Egyptian Vulture (Neophron percnopterus) | Grasslands and wooded grasslands | Critically endangered | Road kill | High |
| | Lappet-faced Vulture (Torgos tracheliotos) | Grasslands and wooded grasslands | Critically endangered | Road kill | High |
| | Banded Barbet ( Lybius undatus) | woodlands | LC | Road kill | Low |
| | White-winged Cliff-chat (Monticola semirufus) | Cliffs and rocky areas | LC | Road kill | Low |
| | Steppe Eagle Aquila nipalensis | Grasslands and wooded grasslands | Endangered | Road kill | High |
| | Yellow-throated Seedeater *Crithagra flavigula* | Bushlands | Endangered and endemic | Road kill | Low |
| | Martial Eagle *Polemaetus bellicosus* | All habitats | Endangered | Road kill | High |
| | Secretary bird *Sagittarius serpentarius* | Grasslands | Endangered | Habitat loss | Low |

| | | | | | |
|---|---|---|---|---|---|
| | Tawny Eagle *Aquila rapax* | Wooded Grasslands | Vulnerable | Road kill | High |
| | Northern Ground-hornbill *Bucorvus abyssinicus* | Grasslands and wooded grasslands | Vulnerable | Habitat and prey loss | High |
| | Bateleur *Terathopius ecaudatus* | Grasslands and wooded grasslands | Endangered | Road kill | High |
| | Eastern Yellow-billed Hornbill *Tockus flavirostris* | Grasslands and wooded grasslands | LC | Road kill | Low |
| | Pallid Harrier *Circus macrourus* | Wooded Grasslands | Near Threatened | Road kill | Low |
| | Sombre Rockchat *Oenanthe dubia* | Rocky bushlands | LC | Road kill | Low |
| | Banded Barbet *Lybius undatus* | Woodlands | LC | Road kill | Low |
| | Helmeted Guineafowl *Numida meleagris* | All habitats | LC | Road kill | Moderate |
| | Crested Francolin *Ortygornis sephaena* | Woodlands and bushlands | LC | Road kill | Moderate |
| | Chestnut-naped Spurfowl *Pternistis castaneicollis* | Woodlands and bushlands | LC | Road kill | Moderate |
| | White-bellied Bustard *Eupodotis senegalensis* | Grassland and Wooded Grasslands | LC | Road kill | Moderate |
| | Chestnut-naped Francolin *Pternistis castaneicollis* | Woodlands and bushlands | LC | Road kill | Moderate |
| | Yellow-necked Spurfowl *ternistis leucoscepus* | Woodlands and bushlands | LC | Road kill | Moderate |
| | African Collared-Dove *Streptopelia roseogrisea* | Woodlands and bushlands | LC | Road kill | High |
| | Mourning Collared-Dove *Streptopelia decipiens* | Woodlands and bushlands | LC | Road kill | High |
| | Red-eyed Dove | Woodlands and | LC | Road kill | High |

| | | | | | |
|---|---|---|---|---|---|
| | *Streptopelia semitorquata* | bushlands | | | |
| | Ring-necked Dove *Streptopelia capicola* | Woodlands and bushlands | LC | Road kill | High |
| | Laughing Dove *Spilopelia senegalensis* | Woodlands and bushlands | LC | Road kill | High |
| | Emerald-spotted Wood-Dove *Turtur chalcospilos* | Woodlands and bushlands | LC | Road kill | High |
| | Namaqua Dove *Oena capensis* | Woodlands and bushlands | LC | Road kill | High |
| | Chestnut-bellied Sandgrouse *Pterocles exustus* | Grasslands | LC | Road kill | Low |
| | Lichtenstein's Sandgrouse *Pterocles lichtensteinii* | Grasslands | LC | Road kill | Low |
| | Four-banded Sandgrouse *Pterocles quadricinctus* | Grasslands | LC | Road kill | Low |
| | Arabian Bustard *Ardeotis arabs* | Grasslands and Wooded Grasslands | Near Threatened | Road kill | Low |
| | Kori Bustard *Ardeotis kori* | Grasslands and Wooded Grasslands | Near Threatened | Road kill | Low |
| | Buff-crested Bustard *Lophotis gindiana* | Grasslands and Wooded Grasslands | LC | Road kill | Low |
| | Hartlaub's Bustard *Lissotis hartlaubii* | Grasslands and Wooded Grasslands | LC | Road kill | Low |
| | Bare-faced Go-away-bird *Corythaixoides personatus* | Bushland, woodland | LC | Road kill | Moderate |
| | White-bellied Go- | Bushland, | LC | Road kill | Moderate |

| | | | | | |
|---|---|---|---|---|---|
| | away-bird *Criniferoides leucogaster* | woodland | | | |
| | Eastern Plantain-eater *Crinifer zonurus* | Woodlands | LC | Road kill | Moderate |
| | White-browed Coucal *Centropus superciliosus* | Bushlands and Woodlands | LC | Road kill | Low |
| | Blue-headed Coucal *Centropus monachus* | Bushland and riverine | LC | Road kill | Low |
| | Sombre Nightjar *Caprimulgus fraenatus* | Wooded grasslands, grasslands, woodlands | LC | Road kill | Moderate |
| | Plain Nightjar *Caprimulgus inornatus* | Wooded grasslands, grasslands, woodlands | LC | Road kill | Moderate |
| | Star-spotted Nightjar *Caprimulgus stellatus* | Wooded grasslands, grasslands, woodlands | LC | Road kill | Moderate |
| | Slender-tailed Nightjar *Caprimulgus clarus* | Wooded grasslands, grasslands, woodlands | LC | Road kill | Moderate |
| | Abyssinian roller *Coracias abyssinicus* | Wooded grassland, woodland, bushland | LC | Road kill | Low |
| | Somali Bunting *Emberiza poliopleura* | Wooded grassland, woodland, bushland | LC | Road kill | Low |

## 6. Impacts on Biodiversity

The Melka Jilo Awash expressway spans 67 km having a 90m RoW will occupy an area of 600 ha of land along this route, with significant impacts on biodiversity within a 6 km wide corridor (3 km on each side of the road). The expressway also crosses the Awash National Park for 13.2 km distance within the limited and controlled use zones of the park and touches the area of Kudu Valley, a critical habitat for Greater and Lesser Kudus, and is expected to impact the park's overall ecological integrity, local migratory species, and its tourism value.

| **Topical Issue of Impacts** | **Description of impacts on biodiversity** |
|---|---|
| **Land Form (Indirect)** | |
| Unstable slopes | The road construction could lead to the destabilization of slopes, resulting in landslides or soil erosion, which would have severe consequences for local flora and fauna. Disruption of slope stability can also increase sedimentation in nearby water bodies, affecting aquatic ecosystems. |
| Extensive disruption to or displacement of the soil | The removal and compaction of soil during construction will disrupt the natural soil profile, harming the vegetation, burrowing animals and micro-organisms that rely on undisturbed soil for growth and nutrient cycling |
| Changes in ground contours, stream channels, or river banks | Alterations to the natural landscape can divert watercourses, disturb riverbanks, and change hydrological patterns, leading to habitat loss and increased erosion. |
| Increased water erosion of soils | Without proper soil stabilization measures, the construction activities will lead to accelerated water erosion, stripping the land of nutrient-rich topsoil, which will reduce plant productivity and damage ecosystems dependent on stable soils. |
| **Air (Indirect)** | |
| Air pollutant emissions which will exceed standards or cause deterioration of ambient air quality | During road construction and operation, emissions from machinery, vehicles, and dust will exceed air quality standards, leading to poor air quality that affects both flora and fauna, potentially reducing the growth rates of sensitive plant species and causing respiratory issues in animals. |
| Emissions of hazardous air pollutants | Hazardous air pollutants, such as those released from heavy machinery or construction materials, can have toxic effects on the local environment, leading to long-term health problems for both wildlife |
| **Water (Indirect)** | |
| Discharge wastewater into the environment | Construction activities often result in wastewater discharge, which can introduce harmful chemicals, oils, and other pollutants environment and may harm biodiversity. |
| Changes in absorption rates, drainage patterns, or the rate and amount of surface water runoff | The road construction will alter the natural absorption of rainwater by soils, increase surface runoff, and disrupt drainage patterns, which can lead to flooding or drought-like conditions in adjacent ecosystems and affecting plant and animal life. |
| Alterations to the course or flow of flood waters | By modifying the natural landscape, the road could change floodwater flows, leading to increased flood risks in some areas and reduced water availability in others. |

| | |
|---|---|
| Alter surface water quality | Construction activities could lead to the contamination of surface waters with sediments, pollutants, and debris, negatively affecting the quality of water bodies that are vital for plant and animal life |
| Alteration of the direction or rate of flow of groundwater | Disturbances to the soil structure and hydrology could shift groundwater flow, affecting local water availability and the health of plant and animal species dependent on specific groundwater conditions. |
| Impact on or construction in a wetland or inland floodplain | The road may cross through or affect wetlands or floodplains, which are critical habitats for many species. Construction in these areas could destroy habitats, reduce water retention capacity, and disrupt the floodplain's ecological balance. |
| **Solid Waste (Indirect):** | |
| Generate significant spoil material | Excavation and construction will produce large amounts of waste material (e.g., soil, rock), which, if not properly managed, could contribute to landscape degradation and pollution of nearby areas which in turn affects both plan and animal life. |
| Generate chemical hazardous waste | Construction processes may produce hazardous chemicals (e.g., from fuels, paints, or solvents) that could contaminate the environment and threaten local biodiversity. |
| Generate biological hazardous waste | The project could result in waste from biological sources (e.g., clearing vegetation or wildlife mortality) that, if not handled properly, could disrupt local ecosystems. |
| **Noise (Direct)** | |
| Increase existing noise levels during construction phase | The heavy machinery and increased traffic will elevate noise levels, which can disrupt animal communication, disturb breeding and feeding activities, and drive sensitive species away from the area. |
| **Plant Life (Direct)** | |
| Change the diversity or productivity of species or number of any species of plants (including trees, shrubs, grass, and aquatic plants) | The road will reduce the variety of plant species in the area by eliminating habitats and introducing stress factors (e.g., pollution, fragmentation). This could lead to the loss of plant diversity and lower overall productivity in affected ecosystems. |
| Reduce the numbers or affect the habitat of any state or federally designated unique, rare, or endangered species of plants | The road could directly threaten state or federally designated rare or endangered plant species by destroying their habitats, leading to a decline in their population and potential local extinctions. |
| **Wildlife (Direct)** | |
| Reduce the habitat or numbers of any unique, rare, or endangered species of animals | The road could reduce the available habitat for unique or endangered animals, driving their populations down and increasing their vulnerability to extinction. |
| Cause defragmentation of animal life | By creating barriers, the road may isolate animal populations, reducing their ability to migrate, breed, or access resources, which can lead to population declines. |
| Harm existing wildlife habitats | |
| Cause emigration resulting in human–wildlife interaction problems | Construction activities will destroy or degrade wildlife habitats, leading to displacement, reduced food availability, and increased mortality for many species. |
| Cause fragmentation of animals' habitat | As animals are displaced from their natural habitats, they may move into human settlements, increasing the risk of conflicts such as crop raiding or livestock predation. |

| | |
|---|---|
| **Land Use (Direct and Indirect)** | |
| Impact a component of the National Park system, then National Wildlife Refuge system, the National Wild and Scenic River system, the National Wilderness system, or National Forest land | The road could infringe on areas designated as part of the National Park system or other protected areas, threatening the conservation of biodiversity and natural resources. |
| **Natural Resources (Direct)** | |
| Increase the use rate of any natural resource | The construction and maintenance of the road will increase the extraction and use of natural resources, such as water, fuel, and building materials, putting additional pressure on local ecosystems. |
| Substantially deplete any non–reusable natural resource | The project may lead to the depletion of finite resources such as minerals, soil, and fossil fuels, which could harm the environment and limit their availability for future use. |
| Be located in an area designated as or being considered for wilderness, wild and Scenic River, national park, or ecological preserve | he road passes through or near areas considered for wilderness, national parks, or ecological preserves, where construction activities could degrade these sensitive environments. |
| **Energy (Indirect)** | |
| Use substantial amounts of fuel or energy | The construction and operation of the road will consume significant amounts of energy, contributing to greenhouse gas emissions and other environmental impacts. |
| Substantially increase the demand on existing sources of energy | The project will increase pressure on local energy infrastructure, potentially leading to shortages or environmental degradation from the increased extraction of fuel or other energy resources. |

## Mitigation Measures of Impacts on Biodiversity

**Mitigation of Indirect Impacts**

**Impacts on Slope Instability and Gully Formation**

The existing trend on soil conservation is based on traditional and modern ways of soil conservation through erosion protection and gully treatments. These are terracing and counter ploughing are traditional, while check dam construction and gully treatment are modern methods of soil conservation practiced in the road corridor.

Due to the construction of proposed express way, land sliding problems may occur during at some location especially km 124+000 to 125+000 where the road along foot of mountain, if slope cut is not properly done.

Road construction project are important contributor to soil erosion, primarily because they concentrate and distribute runoff as channel flow rather than a uniform overland or subsurface flow. Roads also dissect fields and interrupt established drainage; at crossings they risk disrupting peak flows, accentuating backwater, and accelerating bank erosion.

During construction, soil erosion can be a serious environmental problem at any section(s) of the project as the alignment traverse different landscapes. The water concentrated in side ditches and diverting drains will cause severe erosion resulting in deeper and wider gullies in the ditches and diverting drains themselves and at downstream areas.

**Mitigation Measures**

A clause shall be included in the Works Contract that requires the Contractor to implement both physical structures and bio - engineering mitigation measures to avoid soil erosion, slope failure and to stabilize road side slopes as required. Bio–engineering measures including grassing & vegetation cover to stabilize slopes and to serve as sediment trap along the Right-of-Way edges so as to reclaim marginal areas. Physical structures like masonry retaining walls, gabion, benching of excessively steep slopes etc. Shall be implemented as found appropriate by the geotechnical and engineering design parameters. Penalty clause shall be included in the Works Contract that makes the Contractor responsible for non-conformance in complying with the relevant clauses. Furthermore, the contractor shall deploy practicable mitigation measures to minimize slop instability through undertaking the following proposed mitigation measures.

- Avoid loading of sensitive slopes with fill or dump materials;
- Minimize excavating in such sensitive slopes to the extent possible;
- Avoiding side-casting of excavation materials on down-slope by depositing it only in approved disposal sites;
- Controlling surface water infiltration to reduce seepage forces by providing adequate side drains, interceptor drains, etc.;
- Use existing material sources that have been used for the road construction and maintenance by previous road along the road.
- Avoid indiscriminate disposal of surplus or unsuitable excavation materials by depositing it only at approved disposal sites and, on completion, by landscaping and planting such sites with appropriate tree, shrub or grass species to improve the aesthetic quality of those sites,
- Reserving spoil materials and utilizing it in back-filling of quarries or borrow pits when exploitation of those sites is completed.

**Impacts on Air Quality**

The proposed project along the selected route option will have adverse impact on air quality. This occurs as a result of dust and smoke releases during construction period. The major effects on air quality during the construction period will be an increase in suspended particles from blasting, excavation, and movement of heavy machinery and other vehicles over unpaved or dusty roads. Good site practices must be followed by the contractor to minimize dust production and vehicle emissions.

However, the impacts will be minimized acceptably by taking proper dust abatement measures (e.g. watering) where necessary, and by using properly handled /maintained machineries.

**Mitigation measures**

Emissions of dust particulate matters, pollutant gases shall be reduced to acceptable levels by adopting the recommended measures. An environmental clause will be included in the works contract that requires the contractor to implement the following mitigation measures to minimize the possible air pollution:

- ❖ The Contractor shall reduce dust from construction sites, access roads by watering at least three times a day when the same are located in sensitive areas, road side crops and villages. Availing adequate water trucks and operators must be considered.
- ❖ Use of modern and well-maintained equipment (with mufflers where appropriate or bag filters), regular maintenance of diesel-powered machinery and vehicles to reduce excessive exhaust emissions
- ❖ Regular maintenance of emission intensive plants like stone crusher and bitumen mixer and application of dust suppressant mechanisms.
- ❖ Locating the aggregate production and bitumen mixing plants at a maximum distance away from sensitive areas such as residential areas, health units, schools and religious areas.
- ❖ Avoiding burning of materials such as tiers, plastic, rubber products or other solid waste materials that creates heavy smock, hazardous smoke or nuisance odor and disposing of any volatile chemicals to near, schools, religious places, and drinking water supply sources.
- ❖ Construction contractor and his workers must comply with relevant health and safety standards pertaining to noise emissions, such as wearing ear protection when operating plants or heavy machinery.

- ❖ Implementing well-designed traffic management plan that considers traffic safety and working hours for materials transport thereby minimize transport-related disturbances to local residents and road users, and reduce traffic accidents.
- ❖ Avoiding disposing of any volatile chemicals to the air; and

**Noise and Vibration Impact**

It is predicted that Noise and vibration impacts might result from construction activities in general as well as during the operation and maintenance phase. Particularly, the most noticeable sources of noise will be from machinery, heavy earthmoving equipment. Other operations generating significant noise include concrete mixing plants, blasting in areas of rock excavation and stone crushing.

During construction, vibration will increase temporarily because of the operations of machineries and equipment like vibrating rollers, and explosives. Being the expressway passes through Awash National Park where different wildlife inhabits, noise pollution significantly affects their life. Similarly, some rural villagers may be affected by noise and vibration during construction and the impact is temporary and short term.

During the construction phase, the noise and vibration impacts adversely affect the workforces especially on the operators working with heavy machines such as excavator, roller, bulldozer and loader. Furthermore, workforces working in the crusher and asphalt plant sites adversely affected by noise.

**Mitigation measures:**

It should be noted that a clause will be included in the Works Contract that requires the Contractor to implement the following mitigation measures to minimize possible noise and vibration impacts:

- ❖ The Contractor shall not operate noisy operations like crushing plants near the noise Sensitive areas such as Awash National park, settlement areas, health institutions, and schools.
- ❖ Erection and operation of crusher borrow pit and other ancillary facilities within and near the Awash National park is prohibited.
- ❖ Construction activities that generate disturbing noise levels are to take place during conventional working hours wherever possible
- ❖ The Contractor shall screen equipment producing high levels of noise when working near the settlement areas, clinics and religious areas.

- The Contractor shall minimize the use of explosives and promote a systematic blasting schedule.
- The Contractor shall provide safety equipment pertaining to noise, such as ear protection mufflers whenever necessary for the workers.

**Impacts on Water Resources and water quality**

The direct effect on water resource in the project area is moderate as there is an only Awash perennial river along the road stretch, and some seasonal streams are traversed by the road. Surface water quality deterioration associated with high silt material during the construction phase is of critical. Accordingly, the following impacts should be anticipated during the construction and operational phases.

Apart from the surface water quality degradation problem due to the sedimentation of eroded soil, the road project can cause both surface and ground water pollution. The likely sources of impacts include redirecting water courses at bridges and culverts; heavy excavations for foundation of structures, discharge of sewage and other liquid wastes from contractor's site facilities, and spillage of pollutants.

The major surface run off generates from the hill side on the left side of the proposed road and it will be concentrated as the road diverts it natural flow direction and then flood over the farm lands along the road sides especially that found on left side of the road which pose moderate adverse impacts that may be long lasting and localized to its extent and significant.

The road may interfere with and modest flow of surface water resulting in concentrated flows at certain points and increasing flow velocities. These changes can contribute to soil erosion, flooding, channel modification, downstream scouring and sedimentation in river and stream courses.

Adverse impacts on local water resources and drainage are usually related to flow modification and enhanced erosion due to the earth moving works during construction. Modification of the natural flow of surface water and drainage patterns resulting in concentrated flows at certain points and increased speed of flows was observed in significant part of the project areas especially along the end of road section near Awash River. These changes will contribute to soil erosion, flooding, channel modification and siltation of streams and other waterways. The impacts on water resource can also extend to the downstream during rainy season as sediment can easily carried by erosion.

Accidental spillage of oil and greases used for the machinery and vehicles during construction works and waste generated in camps and garages could also be sources of pollution to the water resources in the project influence area.

**Mitigation Measures**

Effective implementation of the following mitigation measures for adverse impacts on water resources can be minimized. Hence, environmental clause shall include in the Works Contract that requires the Contractor to full fil the following mitigation measures;

- ❖ Provide adequate cross-sectional area to drainage structures to allow sufficient passage for the discharge and shall put energy dissipaters, where important, for safe disposal of the discharge.
- ❖ Protect slopes with stabilizing structures such as V-cut surface drainage behind the top of cut slopes and cut off drains, retaining walls, wire basketry, gabions, and other physical structures including check dams, and other energy dissipating structures such as chutes, cascades, etc.
- ❖ Implement Bio-engineering conservation techniques to protect and stabilize unstable slopes, and also shall use appropriate local variety grass species, which have multiple purposes, like vetiver grass, together with a physical engineering measures as soon as possible after completion of the works.
- ❖ Construct cut-off drains above cut slopes.
- ❖ Rehabilitate existing road side gullies and landslides sites and also at other following Engineer ‘s instruction and approval.
- ❖ Pave side drains, depending on site conditions, for instance, nature of the soil, gradient/slope of the area, and other factors and construct all energy-dissipating structures at the drainage outlets and discharging points.
- ❖ Provide cross drainage structures as close as possible to minimize concentrated flow from side ditches and to let the flood lead to the nearest stream easily without scouring the side walls.
- ❖ Avoid disposal of construction spoil from earthworks and bridge construction sites at or near the rivers, natural waterways and streams;
- ❖ Avoid disposal of hazardous substances such as oil, fuel, detergents and cement at and near water point to avoid water pollution risks due to spillages.
- ❖ Avoid disposal of solid and liquid wastes generated by construction works near water sources and water points; and

- ❖ Execution of the potentially impacting road construction and drainage works during the dry season when river flows are minimal or non-existent, to minimize interference in river flows and reduce erosion, sedimentation and water pollution risks;
- ❖ Avoidance of leakages from vehicles and construction equipment by regular and effective maintenance.

**Impacts on Water Supply Systems and Competition for Water**

It is obvious that contractors use substantial volume of water for various construction purposes such as for adjustment of moisture content of fill, sub-base and base courses, and watering of haul routes to suppress dust. In addition, the water requirements at the base camps will be relatively high, although these will be much lower than those needed in connection with construction. The probability of meeting contractor water requirement from water resource is very less as the road corridor has shortage of water supply.

All watercourses in the project area are almost seasonal except Awash rive which is found at the end of the road section and even the existing water sources are used for drinking, irrigation, and cattle watering purposes by the local community. Therefore, any amount of withdrawals by contractors could reduce water availability to existing downstream users. In view of the widespread need for contractor abstraction over a large part and the serious implications of reduced supplies for the local communities especially for low flowing watercourses potential impact is considered to be very significant. Thus, use of water from existing sources for the road works and campsite requirements may cause significant competition with existing users.

**Mitigation Measures**

The following mitigation measures are suggested to overcome the competition on the water resources:

- ❖ The contractor shall make his own arrangements for water supply for construction and other purposes without affecting the quality or availability of groundwater or surface water resources to existing uses both for domestic and other economic uses.
- ❖ In the event of any valid dispute regarding the effect the contractor's arrangements on the water supply of others, the contractor shall be responsible, at his own expense, for providing an alternative supply to those affected, which is not inferior in quantity or quality to that previously enjoyed.
- ❖ The contractor shall not interfere with farmer’s Irrigation cannels and should not damage canals and water crossing structures;

- ❖ maximum precautions shall be taken not to affect the quality as well as quantity of the existing water supply sources used by the local communities for human, animal or irrigation purposes;
- ❖ Do not abstract water from rivers, streams, artificial pons and springs for the use of road construction unless permitted by the local administration, water office or local community include the developed water supply sources of the villages & towns along the road & perennial streams during low flows.

**Adverse impact on the climate change**

It was explained that under land use land cover identifications the land use along the road stretch is covered by vegetation especially in the Awash National park. This will be removed during earth clearing within the RoW. In addition to this there are trees going to be cut down due to land accusation for ancillary faculties. Moreover, the road corridor climate condition is semi-arid to arid which highly prone to desertification and vulnerable to climate changes. Therefore, removing vegetation and trees in the RoW, other construction material extraction sites and ancillary facilities will instigate climate change with moderate adverse impact on the regional to global is significant.

**Mitigation Measures**

The recommended mitigation measures for climate change adaptation are the following:

- Watershed management through water and soil conservation,
- Compensatory tree planting along the road corridor in collaboration with local administration;
- Avoiding vegetation degradation in the park especially in the core zone of the park by constructing bridge which has dual purpose, that means avoid habitat defragmentation and removal of trees.

**Negative impacts from Borrow pits and quarry sites**

Rock waste and removed overburden are the main inert wastes produced by quarrying activities. Hazardous wastes may be generated from impurities and trace components included in the exploited (waste) rocks (e.g. asbestos or heavy metals or minerals that could result in acidic runoff).

**Mitigation measures**

The recommended prevention and control methods to reduce wastes include the following:

- ❖ Operational design and planning should include procedures for the reduction of waste production (e.g. blending high-quality rock with poor rock);
- ❖ Topsoil, overburden, and low-quality materials should be properly removed, stockpiled near the site, and preserved for rehabilitation;
- ❖ Hazardous and non- hazardous waste management plans should be developed and adopted during the planning phase. Impacts associated with specific chemical and / or physical properties of extracted materials should be considered during the environmental and social management plan preparation, and impacts from waste rock impurities should be adequately controlled and mitigated by covering waste disposals with none contaminated soil.
- ❖ Stockpiles and batters are a potential source of dust and sediment run-off. Additional recommended controlling measures to those covered previously are outlined as below:
- ❖ Locate stockpiles away from drainage lines to where they are protected from wind;
- ❖ Minimize the number and size of stockpiles. Keep topsoil separate from under burden when stockpiling soil;
- ❖ Construct the stockpile with no slope greaterthan2:1 (horizontal to vertical). A less steep slope may be required where the erosion risk is high;
- ❖ Mulch, roughen and seed with grasses any batter or topsoil stockpile which is to be maintained for longer than 28days;
- ❖ Treat under burden stockpiles in the same way, but check whether they need a layer of topsoil to provide a media for grass seeds before seeding;
- ❖ Circle all unsterilized stockpiles and batters with silt fences or a drainage system that will collect and correctly dispose of contaminated water;
- ❖ Locate stockpiles within ten meters of a water way only if no other alternatives exist. This situation should be identified in the risk assessment;
- ❖ Hand water or install temporary sprinklers to suppress dust from unsterilized stockpiles and batters;
- ❖ Finish and contour any stockpiles located on a floodplain so as to minimize loss of material in a flood or rainfall event.

**Enhancement measures and Complementary Initiatives**

Complementary community initiatives are planned to enhance project benefits, improve socio-economic conditions of the local communities, and ensure project sustainability. The proposed interventions are tree planting; establish water supply schemes in the camp, Road safety campaign. The complementary interventions are proposed based on the general understanding of the road project area & constraints grasped during the ESIA study and consultations, and hence require further onsite assessment & consultation with concerned stakeholders.

**Tree Planting Initiative:** The project plans to prepare 100,000 tree seedlings to be planted on median of the road and the roadside and also in selected degraded land along Melkajilo – Awash expressway road corridors and micro catchment. The main purpose of this enhancement measure is to:

- ☞ improve stability of road structure;
- ☞ prevent soil erosion in the micro-catchment, whilst enhancing local communities' soil and water conservation initiatives;
- ☞ provide shade and stabilize micro climate in the area;
- ☞ replace lost vegetation in the new road corridor;
- ☞ Contribute to climate change adaptation and mitigation initiatives.

The project plans to use indigenous tree species like *Gravelia robusta*, *Jakaranda mimisipholia*, *Acacia melanox* and selected multipurpose local flora species. Selection of species and location of targeted degraded area for planting will be determined based on consultation with local community, woreda agriculture, environment protection authority offices and research institution like Adama University. This complementary initiative is expected to contribute to the regional & national effort of combating global warming & climate change as the planted trees can serve as $CO_2$ sink, following maturity & full vegetative growth.

**Road Safety Awareness Campaigns:** The project will include an item of road safety campaign and education programs for the road users during construction and operation. The existing road is one of the roads identified as high-risk roads in the country being import and export corridor through Djibouti.

During operation, educational campaigns will have to target all users including operators of animal driven carts. The service provider for this activity will have to collaborate with Police and Traffic Controllers of Amhara, Oromia and Afar Transport Authority. Part of inputs to be procured during the road safety educational campaigns would be distribution of reflectors to all carts in the area an intervention which is already showing significant results in Oromia and Amhara Regions.

**Mitigation of Direct Impacts on Biodiversity**

## Negative impacts on Flora

During the field visit and study period of the ESIA, impacts of Adama–Awash Lot II, Melkajilo - Awash expressway project on flora has been assessed. Accordingly, construction of the project will have vegetation damage and loss of flora, due to the land use change for the road ROW formation; quarry area; construction of the camp site, access roads.

The road will be constructed primarily within 90ms right-of-way. The proposed project route corridor is mainly covered with vegetation type of semi-arid agro-ecological zone such as species of thorny Acacia and Prosopsi trees mostly in combination with bushes and shrubs are found. Therefore, there will be significant, unavoidable, significant permanent impacts on the vegetation within the RoW and ancillary facilities. Being the area is semi-arid even a removal of single tree will adversely affect as it contributes in stabilising the micro climate, ecological functions such as soil conservation and preserving flora and fauna of the area.

**Mitigation Measures**

The mitigation measures recommended to minimize loss of roadside vegetation and small scale protected community forests include the following

- Adopting ‘half-width’ construction method as the RoW is very wide passing through areas containing important indigenous or exotic trees or vegetation that would be affected if detour roads are constructed;
- Limit earthworks and earthmoving activities to the imperative area necessary for the road works to avoid any unnecessary loss of trees or vegetation,
- Avoid side-casting of excavation materials on down-slope where it may affect indigenous trees/ vegetation,
- Replanting appropriate tree species at areas affected due to temporary activities and at locations to be recommended by the Weredas’ natural resources conservation or environmental protection experts to compensate for trees/vegetation lost. In the planting program, indigenous tree species shall be given priority in species selection.
- Replanting trees and shrubs in areas adjacent to the road and at areas affected due to operation of quarries and borrow pits. Indigenous and exotic species which are environmentally friendly and adapted to the agro-ecology of the areas are proposed.
- Proper siting of construction camps and facilities i.e. not at or near areas of conservation worthy vegetation, and controlling cutting of vegetation by the construction work force.

- ❖ Controlling cutting of the vegetation due to activities induced by easy physical access, such as establishment of settlements, production of fuel wood and charcoal, construction work for commercial purposes, expansion of cultivation, etc.
- ❖ Establish a nursery at the project area to propagate and plant indigenous and endangered tree species in areas adjacent to the road and at areas affected due to operation of quarries and borrow pits.
- ❖ Plant at least 10 seedlings for each and every affected mature trees and water them
- ❖ Aware construction work force, not to cut tree for any purpose without prior approval of Environmental supervisor and local forestry department
- ❖ Avoiding side-tipping of spoil/excess excavation materials on down-slope where it can affect vegetation/trees;
- ❖ The Contractor Shall select location of campsites in collaboration with local authorities, RE and with ESOS officers of ERA, and camps shall only be established at places/locations approved by ERA's ESOS officers and the RE in collaboration with local Officials and community members
- ❖ The RE and the contractors shall take photograph of the campsite before the construction of any structure in order to compare the level of environmental degradation before and after the establishment of the camp site and to plan rehabilitation work. Any removal activities of trees for camping shall be done in the presence of environmentalist from the supervision Team and a Forester from Local Forestry Department
- ❖ The contractor should undertake the clearing operation along ROWs of the proposed project during the construction period in consultation with ERA's ESMT, the RE and the proposed projects targeted administrative site of environmental protection and forestay department office,
- ❖ The Contractor shall take lists of all the tree species found in the proposed quarry sites, borrow areas and detour roads and other affected sites on ROW. The exact number of trees to be affected in the presence of Environmentalist from the Supervision Team and a Forester from the Woreda Forestry unit.

**Negative impacts on Fauna/Wildlife**

The proposed road project passes through Awash National Park that inhabited by different wildlife, scattered or spares vegetation cover and grazing lands. Hence, there is significant wildlife found in the area. Therefore, a number of wild lives inhabiting the park will be affected due to the proposed expressway construction activities.

Furthermore, deliberate poaching to the wildlife nearby the project which is outside the RoW may occur during construction by construction work forces.

**Mitigation measures**

If the road construction labour force interested and involved in buying and eating of wild meet, local people may hunt wildlife and avail for sell to construction labour. If this happened, the impact of the road construction on wildlife would be significant.

Therefore, the contractor shall prevent his workers from involving in eating and trading of bush meet and other parts of the wildlife in addition to practically implementing the following mitigation measures.

- Avoid defragmentation of wild life habitat through construction of bridges and wildlife crossing in the park.
- Avoid or minimize sound pollution in the park, through implementation states of arts and limiting work time to the acceptable time for the park administrator.
- Strictly prohibit illegal hunting by the workforce and killing of wild animals due to deliberate killings or reluctances of drivers like over speeding of vehicles,
- Avoiding disposal of excavation materials on the small scale protected community forests.
- Do not use and trade wild meet and other parts of wildlife.
- Avoid illegal hunting.

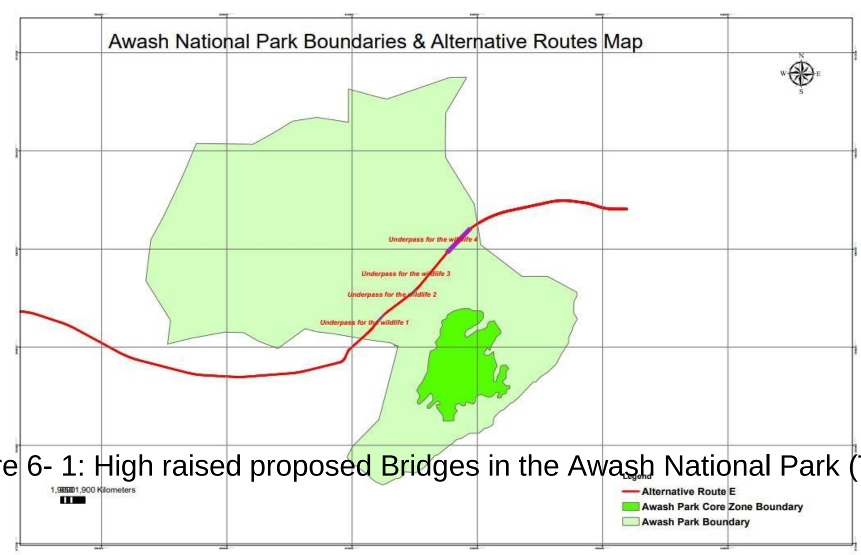



Figure 6- 1: High raised proposed Bridges in the Awash National Park (Taken from ESIA report)

**Adverse impact due to Human-carnivore conflicts**

Human wildlife conflict is common in the parks and the community living around the park due to the community goes to parks and wildlife habitats for hunting them. Similarly in some areas the community inter into the parks to farm of tree clearing to prepare for the farm land; during these activities wildlife especially carnivores can easily attach the person get into the wildlife habitat. In the similar manner, there are different carnivores such as Lion, tigers and chaeta's inhabiting Awash National Park in which the express road construction is going to be implemented for 13km in the parks section. Therefore, during the earth clearing and other activities in the park as well as near the park`s boundary, these carnivores can easily attach the construction works and fatality can occur. In the reverse, the construction workers especially, drivers can affect the wildlife during construction period through traffic accident and illegal hunting.

**Mitigation measures**

Practical implementation of the following recommendation mitigation measures will minimize the adverse impacts.

- ❖ Any intervention in the park`s section of the express road shall be done during the working hours.
- ❖ The contractor has to work closely with the park`s administration and especially with scouts.
- ❖ Continuous risk assessment shall be conducted before any activities
- ❖ Hunting and deliberately disturbing wildlife going to their specific living area is strictly prohibited.
- ❖ Very slow traffic speed shall be set out by contractor during construction.
- ❖ Eating, transporting and trading of wildlife meat or its body part will lead to court.
- ❖ Daily based safety instruction for the workers working in the park must be conducted.

## Analysis of Impact Levels Based on the Distance from the Road

### 6.1 High Impact Zone (0–1 km from the Road)

This zone faces the most severe consequences due to its proximity to the expressway. Direct impacts are more prominent here, including habitat destruction, disturbance to wildlife, and pollution from construction and traffic.

- **Habitat Loss**: The clearing of Bushland, Shrubland, Grassland, and Woodlands is expected to be substantial in this zone, particularly affecting dominant woody species like **Acacia tortilis, Acacia nilotica, Balanites aegyptica,** and **Commiphora Africana**. Removal of these species directly reduces available food, shelter, and nesting sites for fauna.
- **Wildlife Displacement**: Species such as the **Beisa Oryx, Greater Kudu, Lesser Kudu, and Warthog** will experience habitat fragmentation, causing them to move away from the road corridor. Particularly in the Awash National Park where Larger mammals like **Lions** and **Leopards** are found, the pressure will be more significant and may result in either abandoning territories or becoming exposed to human-wildlife conflict.
- **Birds**: The presence of **critically endangered** and **vulnerable bird species** makes this zone especially sensitive. Habitat destruction and vehicle movement can cause a reduction in bird populations due to disturbance and mortality.
- **Ecological Barriers**: The road may act as a physical barrier, preventing movement of wildlife across habitats, causing genetic isolation for certain species, and increasing road mortality, particularly for mobile species such as **baboons**, **jackals**, and **hyenas**.
- **Pollution**: Increased pollution from construction dust, vehicle emissions, and noise will alter the natural environment, affecting sensitive species and their behavior.

### 6.2 Moderate Impact Zone (1–2 km from the Road)

In this zone, the impact is less intense compared to the first kilometer but still substantial due to indirect influences from the road.

- **Habitat Alteration**: While vegetation like **Shrubland** and **Wooded Grassland** will be less disturbed compared to the high-impact zone, secondary effects such as edge effects (altered light, temperature, and humidity levels) will alter plant composition. More resilient species like **Acacia senegal** and **Ziziphus** species may dominate, while more sensitive flora might recede.

- **Wildlife Disturbance**: Mammals and birds that inhabit this zone, such as **Clip Springers** and **Greater Kudus**, will experience disruptions due to noise and light pollution, leading to reduced foraging opportunities and displacement. Species that are more sensitive to human presence may move further into undisturbed areas.
- **Birds**: While less affected compared to the high-impact zone, bird populations might still suffer from the effects of road noise and reduced food sources. The area's significance as an Important Bird Area (IBA) means some bird species may be displaced from nesting or breeding grounds.
- **Fragmentation**: The road still poses a barrier for wildlife, particularly in large-ranging mammals like **hyenas** and **lions**, which may face disruptions in their hunting territories, potentially leading to increased human-wildlife conflict.

## 6.3 Lower Impact Zone (2–3 km from the Road)

The lower impact zone is expected to experience minimal disturbance compared to the previous two zones, but indirect effects from the road still influence this area.

- **Vegetation**: Vegetation such as **Scattered Shrubland** and **Wooded Grassland** may face minor changes due to edge effects, but the plant diversity may remain largely intact. Species like **Grewia bicolor** and **Boswellia papyrifera** are likely to continue thriving, though overall biodiversity may slightly decrease due to road effects.
- **Wildlife Behavior**: Animals like **jackals** and **hyenas** may still feel the indirect effects of the road in this zone, but the disturbance will be less pronounced. Nocturnal species might alter their activity patterns to avoid road noise and light pollution, but displacement will be minimal compared to the closer zones.
- **Birds**: Bird species in this zone may experience reduced disturbance, especially the more sensitive species that have moved farther away from the road corridor. However, the overall species richness in this area might still be slightly reduced due to the proximity of the expressway.

- **Indirect Pollution**: Runoff from the road may lead to minor pollution in this zone, particularly during the rainy season, when contaminants from vehicles or co

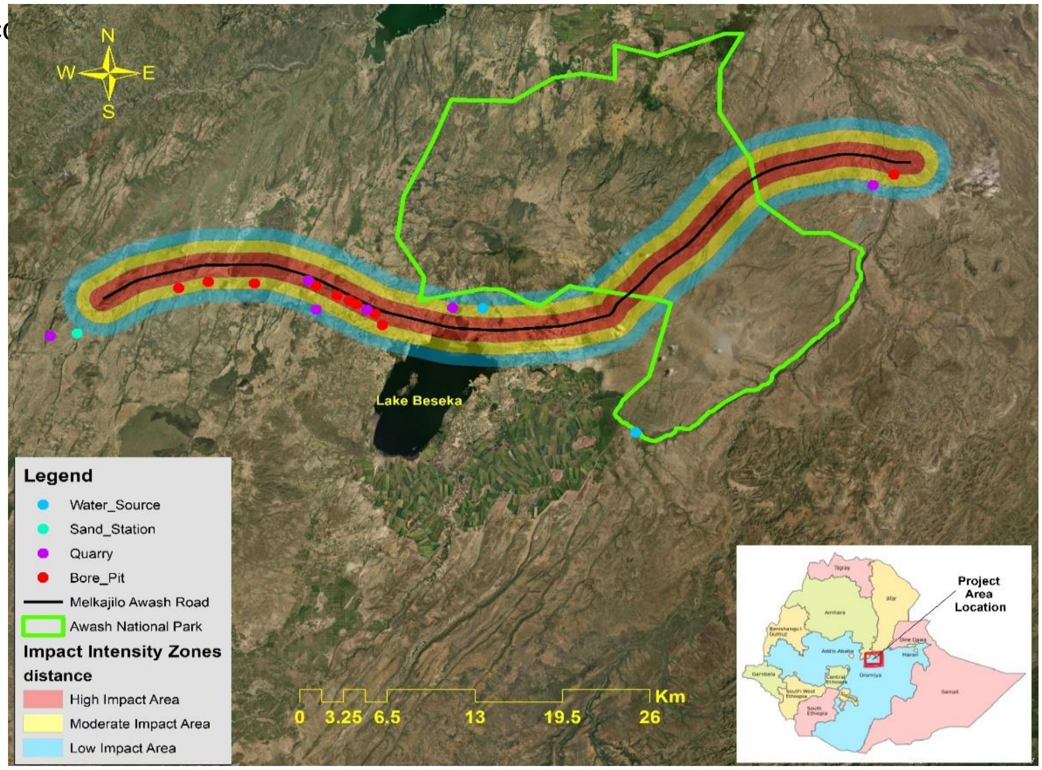



*Figure 3: The different Impact Levels of the Road Side*

## 6.4 Affected Species and Ecosystems

The affected area is home to diverse wildlife, including:

- Mammals: Greater and Lesser Kudus, Lions, Leopards, Spotted Hyenas, Anubis Baboons, and more.
- Birds: Over 200 species, including critically endangered species like the White-backed Vulture and endangered species like the Martial Eagle.
- Reptiles and Amphibians: A rich diversity, including various snake, lizard, and amphibian species.
- Vegetation: Diverse habitats such as bushland, woodland, riverine grassland, and wooded grassland that harbor a wide range of biological diversity.

*Table 3: Results Framework for Biodiversity Action Plan of the Melka Jilo Awash Expressway Project*

| Outputs | Indicators | Activities | Period | 0 – 10 years Cost Estimate (Birr) |
|---|---|---|---|---|
| **Strategic Objective 1: Ecosystem and habitat protection and restoration ensured** | | | | |
| Outputs 1.1: Appropriate engineering techniques adopted to reduce damage on the flora of the area | Percentage of vulnerable flora identified and protected from damage (Target: 90%). | Adopting 'half-width' construction method as the RoW is very wide passing through areas containing important indigenous or exotic trees or vegetation that would be affected if detour roads are constructed; | Construction phase | Engineering estimate |
| | | Avoid side-casting of excavation materials on down-slope where it may affect indigenous trees/ vegetation, | Construction phase | Engineering estimate |
| | | Limit earthworks and earthmoving activities to the imperative area necessary for the road works to avoid any unnecessary loss of trees or vegetation | Construction phase | Engineering estimate |
| Output 1.2: A variety of alternative measures adopted to avoid any permanent destruction of the ecosystem along the road way | Number of alternative ecosystem-friendly measures adopted along the roadway (Target: 5 techniques implement | Implement soil stabilization and erosion control techniques. | Construction phase | Engineering estimate |
| | | Avoiding side-tipping of spoil/excess excavation materials on down-slope where it can affect vegetation/trees; | Construction phase | Engineering estimate |
| | | Proper siting of construction camps and facilities i.e. not at or | Construction phase | Engineering estimate |

| | | | | |
|---|---|---|---|---|
| | | near areas of conservation worthy vegetation, and controlling cutting of vegetation by the construction work force | | |
| Output 1.3: Adequate measures implemented in order to ensure restoration of damaged ecosystems along the road side | Hectares of restored roadside ecosystem (Target: 80% of disturbed areas restored). | Reforest or revegetate disturbed areas using native plant species. | Operation phase | 40,000 |
| | | Establish nurseries to propagate local flora for restoration. | Operation phase | 200,000 |
| | | Monitor restored areas for ecological recovery. | All phases | 10,000 |
| Output 1.4: Appropriate habitat connectivity ensured along the road corridor | Number of actions taken and results achieved (target 3 actions) | Take measures to connect fragmented ecosystems through appropriate habitat management interventions | Operation | 150,000 |
| | | Replanting trees and shrubs in areas adjacent to the road and at areas affected due to operation of quarries and borrow pits | All phases | |
| Output 1.5: Project actions that cause indirect impacts on the ecosystem mitigated | Number of mitigated indirect impacts from construction activities (Target: >90% of identified impacts mitigated). | Rehabilitate existing road side gullies and landslides sites and also at other following Engineer 's instruction and approval | Construction phase | Engineering estimate |
| | | Use of modern and well-maintained equipment (with mufflers where appropriate or bag filters), regular maintenance of diesel-powered machinery and vehicles to reduce excessive exhaust emissions | Construction phase | Engineering estimate |
| | | Erection and operation of crusher borrow pit and other ancillary facilities within and near the Awash National park is prohibited | Construction phase | Engineering estimate |

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| Output 1.6: Introduction of invasive species adequately controlled | Incidence rate of invasive species introductions (Target: Less than 5 new introductions annually). | Implement biosecurity protocols for construction equipment and materials. | All phases | 100,000 |
| | | Regularly monitor the area for early detection of invasive species. | All phases | |
| | | Develop a rapid response plan for eradicating newly detected invasive species. | All phases | |
| Output 1.7: Ecosystem pollutants along the road corridor reduced or eliminated | Percentage reduction in pollutant levels along the road corridor (Target: 80% reduction in pollutants). | Avoid disposal of harmful chemicals, wastes (both solid and liquid) | All phases | N/A |
| | | Regularly monitor air and water quality along the road corridor. | All phases | |
| | | Avoiding burning of materials such as tiers, plastic, rubber products or other solid waste materials that creates heavy smock, hazardous smoke or nuisance odor and disposing of any volatile chemicals | All phases | |
| **Strategic Objective 2: Impacts on wildlife adequately mitigated and reduced** | | | | |
| Output 2.1: Wildlife mortality due to road collisions reduced | Number of underpasses constructed<br><br>Baseline: data from existing Addis-Djibouti highway | Install wildlife crossing signs and at high-risk zones for collisions. | Construction phase | Engineering estimate |
| | | Construct underpasses of adequate size and quality based on international standards for wildlife crossing | Construction phase | Engineering estimate |
| Output 2.2: Wildlife disturbance from road noise and lights Reduced | Decrease in disturbance-related behavioral changes in key wildlife species (Target: 60% reduction in disturbances). | Use sound barriers in areas where noise-sensitive species are present (particularly in Awash National Park) | All phases | Engineering estimate |
| | | Implement low-intensity, directional lighting along the roadway to minimize light | All phases | Engineering estimate |

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| | | pollution. | | |
| | | Restrict construction and road usage during nocturnal wildlife activity periods | Construction phase | N/A |
| Output 2.3: Killing of wildlife or collection of their products effectively protected | Number of incidents of illegal wildlife killing or collection reported (Target: Zero incidents annually). | Deploy patrols and surveillance in critical areas to deter poaching or illegal collection | All phases | 150,000 |
| | | Install monitoring cameras along the road to detect wildlife poaching activities | Construction phase | Engineering estimate |
| | | Collaborate with local communities and law enforcement agencies to prevent wildlife trafficking | All phases | N/A |
| Output 2.4: Human wildlife conflict that has emerged as a result of the new road well addressed and controlled | Reduction in human-wildlife conflict incidents (Target: 80% decrease in reported incidents). | Establish early-warning systems for local communities about wildlife movement near the road | Construction phase | 5,000 |
| | | Set up barriers or fencing in areas prone to conflict to prevent wildlife from straying into human settlements | Construction phase | Engineering estimate |
| | | Collaborate and get technical assistance with ANP staff and wildlife authorities to reduce incidences of human wildlife conflict | All phases | N/A |
| Output 2.5: Environmental codes of conduct and wildlife safety measures respected by construction workers during construction and road users during operation | Percentage of workers and road users adhering to wildlife safety protocols (Target: 95% compliance rate). | Develop and implement training programs for construction workers on wildlife protection and environmental codes. | Construction phase | 30,000 |
| | | Disseminate information to road users through signs, leaflets, and digital platforms on respecting wildlife safety. | Construction phase | 20,000 |
| | | Conduct regular compliance audits to ensure that codes of | Construction phase | 10,000 |

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| | | conduct are followed. | | |
| Output 2.6: Contacts with wildlife including feeding and or capturing or chasing attempts adequately avoided | Number of reported incidents of wildlife contact by road users or locals (Target: Zero incidents annually). | In collaboration with the local and national wildlife authorities, establish strict regulations and penalties against any attempts to feed, capture, or chase wildlife | All phases | 10,000 |
| | | Educate workers and other stakeholders on the prohibition of any attempt to contact, feed or seize wild animals | Construction phase | 20,000 |
| | | Install clear signage along the road warning against any form of wildlife interaction. | Construction phase | Engineering estimate |
| **Strategic Objective 3: Appropriate systems established for Implementing mitigation measures and monitoring impacts** | | | | |
| Output 3.1: Data collection and reporting systems implemented | Number of reports generated and submitted on time (Target: 100% timely submission of reports). | Design and deploy a digital monitoring system for real-time data collection on environmental impacts. | Construction phase | 100,000 |
| | | Establish standardized reporting formats and schedules for regular updates. | Construction phase | 5,000 |
| | | Train field personnel on the use of data collection tools and techniques. | Construction phase | 50,000 |
| Output 3.2: Capacities of the relevant institutions and the staff involved capacitated to adequately implement mitigation measures | Percentage of staff trained and demonstrating improved capacity in mitigation implementation (Target: 90% staff participation in training programs). | Conduct tailored training workshops for staff on mitigation measures, environmental management, and monitoring. | All phases | 60,000 |
| | | Provide institutional support for acquiring new technologies or equipment to support mitigation activities. | All phases | 100,000 |
| | | Facilitate exchange programs and learning visits with other organizations implementing | All phases | 80,000 |

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| | | similar projects. | | |
| Output 3.3: Adaptive and innovative management systems in place | Number of adaptive management measures adopted and adjusted annually (Target: 3 adaptive measures implemented annually). | Integrate a feedback mechanism that allows for rapid adjustments to mitigation measures based on field data. | Operation phase | N/A |
| | | Encourage innovation by piloting new management practices and technologies for reducing environmental impacts. | Operation phase | 10,000 |
| | | Develop a risk management framework to guide decision-making in unpredictable situations. | Operation phase | 20,000 |
| Output 3.4: Stakeholder engagement mechanisms and platforms established and implemented | Number of stakeholder engagement events held annually (Target: 4 events per year). | Create multi-stakeholder forums for regular consultation and collaboration on mitigation actions | All phases | 80,000 |
| | | Develop a mechanism where by key stakeholders play a role in the implementation and monitoring of mitigation measures | All phases | |
| | | Facilitate quarterly stakeholder and community meetings to discuss project progress and concerns | All phases | |
| Output 3.5: Effective communication systems established among stakeholders | Stakeholder satisfaction with communication effectiveness (Target: 85% satisfaction rate from stakeholders). | Set up a centralized communication hub to streamline information sharing among stakeholders. | All phases | 200,000 |
| | | Implement mobile communication apps or platforms for instant updates and coordination during critical phases of the project. | All phases | |
| | | Ensure transparent and consistent reporting to all | All phases | |

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| | | stakeholders through newsletters, reports, and social media. | | |
| Output 3.6: Environmental auditing strategy developed and implemented | Number of successful environmental audits conducted annually (Target: 2 audits per year with satisfactory outcomes). | Develop an environmental audit framework aligned with national and international guidelines and best practices. | Operation phase | 30,000 |
| | | Schedule regular internal and external audits to assess the effectiveness of mitigation measures. | Operation phase | N/A |
| | | Use audit results to refine and improve environmental strategies and processes. | Operation phase | N/A |
| **Strategic Objective 4: Biodiversity Offset Schemes and Management Interventions Provided for Addressing Long Term Impacts on Species and Ecosystems After the Mitigation Measures** | | | | |
| Output 4.1: Biodiversity offset strategy developed and approved | Biodiversity offset strategy officially approved by regulatory bodies (Target: Strategy approved by the end of year one). | Conduct stakeholder consultations to define offset goals and align them with national biodiversity priorities. | Operation phase | 20,000 |
| | | Develop a comprehensive biodiversity offset framework, including criteria for selecting offset sites and species. | Operation phase | 20,000 |
| | | Present the strategy to relevant government bodies and environmental authorities for approval. | Operation phase | N/A |
| Output 4.2: Offset and intervention sites identified on participatory basis and approved by the concerned authorities for further intervention | Number of offset sites approved for intervention (Target: At least 3 offset sites approved). | Facilitate participatory mapping exercises with local communities, conservation experts, and government agencies to identify potential offset sites. | Operation phase | 10,000 |
| | | Submit identified sites for approval to the relevant government bodies and obtain | Operation phase | 10,000 |

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| | | necessary permits. | | |
| | | Implement the biodiversity offset strategy | Operation phase | 500,000 |
| Output 4.3: Long-term funding and resource management secured | Amount of funding secured for long-term biodiversity offset management (Target: $2 million secured within 3 years). | Develop a financial sustainability plan that includes partnerships with donors, government agencies, and the private sector. | Operation/maintenance phase | 10,000 |
| | | Explore co-financing options with international conservation programs and NGOs. | Operation phase | N/A |
| Output 4.4: Effectiveness of the biodiversity offset schemes and management interventions monitored and improvement measures taken | Percentage of offset schemes showing improvement in biodiversity health indicators (Target: 80% of schemes demonstrate positive outcomes). | Develop and implement a monitoring and evaluation framework to track biodiversity health and ecosystem services in offset sites. | Operation phase | 50,000 |
| | | Conduct annual audits to assess the effectiveness of offset interventions and propose adaptive management strategies. | Operation phase | |
| | | Engage independent environmental auditors to provide objective assessments of the offset schemes. | Operation phase | |
| **Strategic Objective 5: Awareness on wildlife policies and laws raised and illegal activities on wildlife and habitats reduced** | | | | |
| Output 5.1: Awareness raising materials produced and disseminated to users | Number of awareness-raising materials produced and distributed (Target: 10,000 units of materials disseminated across communities). | Develop educational materials such as brochures, posters, videos, and online content that highlight wildlife policies and legal frameworks. | All phases | 60,000 |
| | | Disseminate the materials to relevant workers, road users, stakeholders and communities | All phases | 40,000 |
| Output 5.2: Collaboration made with wildlife and protected area authorities to enhance awareness | Number of collaborative initiatives with wildlife authorities (Target: 5 joint | Hold regular meetings with wildlife conservation authorities and protected area managers to | Construction phase | 50,000 |

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| | initiatives carried out annually). | plan joint awareness campaigns. | | |
| | | Co-organize community sensitization events, media campaigns, and educational tours with authorities. | Construction phase | 20,000 |
| | | Develop a shared communication strategy that aligns with national and regional conservation goals. | Construction phase | 30,000 |
| Output 5.3: Adequate signages installed at selected and appropriate locations to provide information on the prohibited activities that harm wildlife and habitats | Number of signage installations at key locations (Target: 50 signs installed in critical areas). | Identify strategic locations within protected areas and along roads to install informative signage. | Construction phase | 80,000 |
| | | Design and produce signs that clearly explain illegal activities and their penalties, using graphics for better comprehension. | Construction phase | |
| | | Regularly maintain and update the signage to ensure they remain visible and relevant over time. | Maintenance phase | |
| **Strategic Objective 6: Monitoring and Evaluation Plan Implemented and Adaptive Mitigation Actions Enhanced** | | | | |
| Output 6.1: Agreements made with the concerned authorities (EWCA, ANP, EPA) to regularly monitor and evaluate impacts on wildlife and habitats along the road corridor | Number of formal agreements signed with concerned authorities (Target: 3 MoUs signed by year one). | Organize initial meetings with Ethiopian Wildlife Conservation Authority (EWCA), Awash National Park (ANP), and the Ethiopian Environmental Protection Authority (EPA) to outline monitoring and evaluation responsibilities | Construction phase | 5,000 |
| | | Draft and sign Memoranda of Understanding (MoUs) between the project and concerned authorities, specifying roles and schedules for regular monitoring | Construction phase | N/A |
| | | Set up a joint task force involving | Construction phase | N/A |

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| | | representatives from EWCA, ANP, and EPA for continuous collaboration and information sharing | | |
| Output 6.2: Develop a monitoring and evaluation strategy on participatory basis | Completion and approval of the participatory monitoring and evaluation strategy (Target: Strategy approved by all stakeholders within six months). | Prepare a standardized monitoring system that will be used by the concerned technical staff | Construction phase | 15,000 |
| | | Integrate feedback mechanisms into the strategy to allow for adaptive management based on the findings | All phases | N/A |
| Output 6.3: Capacity building for monitoring and evaluation implemented | Percentage of trained personnel equipped to conduct M&E activities (Target: 80% of staff and stakeholders trained and equipped by the end of year one). | Organize training sessions for relevant authorities, local monitors, and project staff on data collection, evaluation methods, and reporting | All phases | 40,000 |
| | | Provide necessary equipment such as GPS devices, drones, and monitoring software to improve the effectiveness of M&E activities | All phases | 70,000 |
| | | Conduct periodic refresher training and updates on new M&E technologies and methodologies. | All phases | 60,000 |
| **Total Cost Estimate (excluding engineering estimate)** | | | | **2,570,000** |

# 7. Special Attention to Endangered and Critically Endangered Bird Species:

Endangered and critically endangered bird species, such as the White-Backed Vulture, Lappet-Faced Vulture, Hooded Vulture, Egyptian Vulture, Rüppell's Vulture, and Steppe Eagle, are given special attention due to their high risk of extinction and their crucial ecological roles. These species are particularly vulnerable to threats such as habitat destruction, roadkill incidents, and pollution from the new road in Awash National Park.

Endangered and critically endangered bird species are already facing severe population declines. Additional threats from the road could further increase their risk of extinction. Special attention helps prevent further decline and contributes to global conservation efforts. Many of these birds, especially vultures, play critical roles in the ecosystem as scavengers. They help maintain environmental health by consuming carrion and preventing the spread of diseases. Their loss would disrupt ecological balance and harm other wildlife. These birds often serve as indicators of environmental health. A decline in their population can signal broader ecological problems, making their protection essential for maintaining the overall integrity of Awash National Park. Protecting endangered species aligns with international conservation agreements and commitments, such as the Convention on Biological Diversity (CBD) and the Convention on Migratory Species (CMS), highlighting the importance of proactive measures for these species.

Giving special attention to these birds ensures the preservation of biodiversity, supports ecological balance, and aligns with national and international conservation priorities.

## **7.1** Analysis of Impacts of the New Road on Endangered and Critically Endangered Bird Species in Awash National Park

The new road passing through Awash National Park poses several significant threats to endangered and critically endangered bird species, particularly vultures and other large raptors:

- Roadkill Incidents: Vultures and eagles often feed on carrion, including animals killed by vehicles. This behavior makes them particularly susceptible to vehicle collisions. The large size of these birds makes it difficult for them to take off quickly, increasing their risk of being struck by fast-moving vehicles.
- Noise Pollution: Continuous noise from vehicles can disturb birds' natural behavior, including feeding, mating, and nesting activities. It can also interfere with their ability to detect prey or scavenge, affecting their survival and reproduction.
- Light Pollution: Artificial lights from vehicles and road infrastructure can disorient birds, especially nocturnal and crepuscular species, causing them to collide with vehicles or infrastructure or affecting their navigation and migration patterns.
- Habitat Fragmentation and Degradation: The road can lead to habitat loss and fragmentation, reducing the availability of nesting sites and foraging areas for vultures and eagles. Changes in vegetation due to road construction and operation can also impact the prey base and carrion availability.
- Poisoning and Pollution: Construction and maintenance activities may introduce pollutants (e.g., chemicals, heavy metals) into the environment. Additionally, some vultures may ingest poisons or toxins from contaminated carrion near the road, leading to direct mortality.

## 7.2 Mitigation Measures

To reduce the negative impacts on endangered and critically endangered bird species, the following mitigation measures are recommended:

1. **Install Bird Diverters and Reflectors:**

- Use bird diverters, such as reflective strips or flags, along the road to increase visibility and reduce collision risks.
- Place reflectors that redirect light away from the road, helping birds detect and avoid vehicles.

2. **Create Safe Feeding Zones:**

- Establish designated feeding sites away from the road, providing safe access to food resources for vultures and other raptors.
- Ensure these sites are managed to prevent poisoning risks and maintain adequate food supply.

3. **Roadside Vegetation Management:**

- Manage roadside vegetation to reduce cover for small prey and carcasses, making the road less attractive to vultures and other scavenging birds.
- Ensure vegetation is maintained to prevent attracting prey species that could increase roadkill incidents.

4. **Implement Signage and maintain proper fencing:**

- Install signs and maintain proper fencing in critical bird habitats and feeding grounds to reduce collision risks.
- Erect warning signs for drivers to be aware of bird crossing areas.

5. **Noise and Light Reduction Strategies:**

- Implement noise-dampening road surfaces and sound barriers to reduce noise pollution.
- Use low-intensity, downward-facing lights along the road to minimize light pollution.

6. **Conduct Regular Roadkill Monitoring and Rapid Response:**

- Develop a rapid response team to remove roadkill promptly, preventing vultures and other scavengers from being attracted to the road.
- Implement regular monitoring programs to identify high-risk areas and adjust mitigation measures as needed.

7. **Public Awareness Campaigns:**

- Conduct awareness campaigns for local communities and road users about the importance of vultures and the risks of roadkill.
- Encourage safe driving practices and compliance with speed limits.

## 7. 3 Action Plan for Mitigation

*Table 4: Special Mitigation Action Plan for Endangered Bird Species in Awash National Park Under the Impact of the Road Section*

| Activity | Implementing Party | Milestones | Expected Results | Monitoring and Evaluation Plan |
|---|---|---|---|---|
| **1. Install Bird Diverters and Reflectors** | Ethiopian Roads Authority (ERA), Toll Road Enterprise of Ethiopia (TREE) | Design and procurement (Month 1-2); installation (Month 3-5) | Reduced bird collisions; improved visibility for birds | Quarterly monitoring of collision rates; adaptive placement of diverters based on results |
| **2. Establish Safe Feeding Zones** | Ethiopian Wildlife Conservation Authority (EWCA), Awash National Park Office (ANPO) | Identification of sites (Month 1-2); site management (ongoing) | Reduced roadkill incidents; safe feeding areas for vultures and raptors | Monthly inspections of feeding zones; analysis of bird activity and health |
| **3. Roadside Vegetation Management** | ANPO, TREE, Ethiopian Environmental Authority (EEA) | Vegetation assessment (Month 1); ongoing maintenance (bi-monthly) | Decreased attractiveness of road for prey and scavengers; lower roadkill risk | Bi-monthly vegetation surveys; review of roadkill incidents |
| **4. Implement Speed Limits and Signage** | ERA, TREE, Ministry of Transport (MoT) | Signage design (Month 1); installation (Month 2-3); enforcement (ongoing) | Lower vehicle speeds in critical areas; increased driver awareness | Traffic speed assessments quarterly; driver compliance checks |
| **5. Noise and Light Reduction Strategies** | TREE, ERA, MoT | Installation of noise barriers and lighting systems (Month 4-6) | Reduced disturbance to bird species; minimized noise and light pollution | Noise and light level assessments every 3 months; bird behavior surveys |
| **6. Roadkill Monitoring and Rapid Response** | ANPO, EWCA, Research Institutions (RIs) | Team formation (Month 1); regular roadkill monitoring (ongoing) | Reduced mortality of scavenging birds; timely removal of carcasses from roadsides | Weekly roadkill data collection; quarterly analysis and adaptive management recommendations |
| **7. Public Awareness Campaigns** | ANPO, EWCA, MoT | Develop materials (Month 1-2); initiate campaigns | Increased public awareness of bird | Pre- and post-campaign surveys to assess changes in attitudes and behaviors |

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| | | (Month 3-12) | conservation issues; improved driver behavior | |

### 7.4 Monitoring and Evaluation Plan

- Roadkill Monitoring: Implement a systematic roadkill monitoring program to record bird mortality rates, identify high-risk areas, and assess the effectiveness of mitigation measures.
- Behavioral Surveys: Conduct regular bird behavior surveys to evaluate the impacts of noise, light, and other disturbances on bird populations.
- Vegetation and Habitat Assessments: Monitor roadside vegetation to ensure it does not attract prey species or provide cover for scavengers.
- Public Compliance Checks: Evaluate the effectiveness of fencing, signage, and public awareness campaigns through periodic traffic assessments and community feedback.

By implementing this focused action plan, we aim to protect endangered and critically endangered bird species in Awash National Park, reducing their mortality and preserving their critical habitats for the long term.

# 8. Monitoring and Evaluation Plan for the Biodiversity Impact Mitigation Action Plan

This Monitoring and Evaluation (M&E) plan is designed to ensure the effective implementation of the biodiversity impact mitigation measures for the Melka Jilo – Awash Express Road Project in Awash National Park. The plan outlines the key indicators, methods, frequency, responsible parties, and reporting requirements for each intervention area. It provides a structured approach to track progress, assess impact, and make necessary adjustments to achieve desired conservation outcomes.

*Table 5: Monitoring and Evaluation Plan for the Biodiversity Action Plan*

| Intervention Area | Indicators | Monitoring Methods | Frequency | Responsible Parties | Reporting Requirements |
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| Establish a collaboration platform among stakeholders | Number of stakeholder meetings held; joint decisions made; level of stakeholder satisfaction | Meeting minutes review; stakeholder surveys; joint work plan analysis | Quarterly | ERA, EWCA, Awash NP, Local Communities | Quarterly progress reports to all stakeholders |
| Develop and implement a biodiversity monitoring and evaluation program | Baseline biodiversity data; changes in species populations; habitat quality indicators | Field surveys; remote sensing (e.g., drones, satellite); camera traps; data analysis | Biannually | EWCA, EPA, Awash NP | Biannual M&E reports; adaptive management updates |
| Implement measures to avoid road kills of wildlife | Number of wildlife roadkills; installation of warning signs; frequency of patrols | Field patrols; roadkill incident reports; camera traps; surveys of motorists | Monthly | ERA, EWCA, Awash NP | Monthly incident report; quarterly summary report |
| Enhance safe movement of wild animals through underpasses/overpasses | Number and usage rate of underpasses/overpasses by wildlife; species diversity observed | Camera traps at crossing points; field observation; wildlife tracking and telemetry | Monthly (initially); Quarterly (after 1 year) | ERA, EWCA, Awash NP, Research Institutions | Quarterly usage report; annual wildlife movement analysis |
| Implement measures to reduce noise, light, and dust pollution | Noise levels (dB); light levels (lux); dust particle concentration (PM10/PM2.5) | Noise meters; light meters; air quality monitoring stations | Quarterly | ERA, EPA, Awash NP | Quarterly pollution monitoring report |
| Avoid dumping of waste, pollutants, or excavated material | Incidence of waste dumping; number of waste audits; compliance with waste management plan | Waste audits; field inspections; community reporting | Monthly | ERA, EPA, Awash NP | Monthly compliance reports; incident logs |
| Enhance awareness of conservation among project staff and local communities | Number of training sessions; participant feedback; change in awareness levels | Pre- and post-training surveys; attendance records; feedback forms | Quarterly | EWCA, Awash NP, Local Communities | Quarterly training and awareness report |
| Improved adherence to environmental and conservation policies | Number of policy breaches; reported illegal activities; enforcement actions taken | Field inspections; community patrol reports; incident reporting | Monthly | ERA, EWCA, EPA, Awash NP, Local Communities | Monthly enforcement and compliance report |
| Avoid activities triggering human-wildlife conflict | Number of conflict incidents; compensation claims; community feedback | Incident reports; community surveys; field observations | Monthly | EWCA, Awash NP, Local Communities | Monthly conflict monitoring report |
| Enhance habitat quality and develop watering points for wildlife | Number of functional watering points; vegetation health indicators; wildlife presence | Field inspections; water quality testing; remote sensing | Quarterly | EWCA, Awash NP | Quarterly habitat quality report |
| Implement restoration measures on damaged | Area of habitat restored; species diversity in | Field surveys; vegetation | Quarterly | EWCA, EPA, Awash NP | Quarterly restoration |

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| habitats | restored areas; survival rate of planted species | sampling; remote sensing | | | progress report |
| Minimize risks of disseminating invasive species | Number of invasive species incidents; area affected by invasive species; response time | Field surveys; incident reports; stakeholder consultations | Quarterly | EWCA, EPA, Awash NP | Quarterly invasive species management report |
| Prevent settlement and business activities in park territory | Number of illegal settlements/businesses detected; enforcement actions taken | Field patrols; community monitoring; aerial surveys | Monthly | ERA, EWCA, Awash NP, Local Communities | Monthly monitoring report; annual settlement analysis |
| Establish a permanent management system for sustained impact reduction | Existence of management framework; staff capacity building sessions; funding availability | Document review; staff performance evaluation; budget tracking | Annually | ERA, EWCA, Awash NP, EPA | Annual management review report |
| Revegetate roadside with indigenous and local plant species | Area revegetated; survival rate of planted species; growth rate indicators | Field surveys; vegetation sampling; drone/satellite imagery | Biannually | ERA, EWCA, EPA, Awash NP | Biannual revegetation report |
| Work in close collaboration with Awash National Park authorities | Number of joint activities; shared response plans; communication logs | Document review; interviews with staff; joint activity monitoring | Quarterly | ERA, EWCA, Awash NP | Quarterly collaboration report |

Key Elements of the Monitoring and Evaluation Plan

1. Indicators: Specific, measurable, and time-bound indicators have been established for each intervention area to track progress and impact effectively.
2. Monitoring Methods: A combination of quantitative (e.g., field surveys, remote sensing, noise meters) and qualitative (e.g., stakeholder consultations, community surveys) methods are used to gather data.
3. Frequency: Monitoring activities are conducted at varying frequencies (monthly, quarterly, biannually, or annually) depending on the nature of the intervention and the expected rate of change.
4. Responsible Parties: Key stakeholders, including the Ethiopian Roads Administration (ERA), Ethiopian Wildlife Conservation Authority (EWCA), Ethiopian Environmental Protection Authority (EPA), Awash National Park (ANP), and local communities, are assigned specific roles and responsibilities to ensure accountability.

5. Reporting Requirements: Regular reporting (monthly, quarterly, biannually, annually) is mandated to communicate progress, challenges, and recommendations to all relevant stakeholders.

Adaptive Management and Feedback Loop

The M&E plan incorporates an adaptive management framework, allowing for continuous learning and improvement:

- Data Collection and Analysis: Regular data collection will enable stakeholders to assess the effectiveness of mitigation measures.
- Review and Adjustment: Based on monitoring results, strategies and actions can be adjusted to enhance effectiveness, mitigate new or unforeseen impacts, and ensure alignment with project objectives.
- Stakeholder Engagement: Regular consultations and feedback sessions with stakeholders will ensure transparency, foster collaboration, and promote shared responsibility in achieving biodiversity conservation goals

# 9. Key Stakeholders and Roles

- Ethiopian Roads Authority (ERA): Oversees road design modifications, speed reduction measures, and infrastructure development.
- Ministry of Transport (MoT): Coordinates national transportation policies and ensures alignment with biodiversity conservation efforts.
- Ethiopian Wildlife Conservation Authority (EWCA): Provides guidelines for wildlife protection and biodiversity management.
- Toll Road Enterprise of Ethiopia (TREE): Responsible for road maintenance, implementing noise and light management, and ensuring safe wildlife crossings.
- Awash National Park Office (ANPO): On-ground implementation of mitigation measures, community engagement, and monitoring.
- Research Institutions (RIs): Conduct biodiversity impact assessments and develop adaptive management strategies.
- Ethiopian Environmental Protection Authority (EPA): Monitors compliance with environmental regulations and oversees environmental impact assessments.
- Local Communities around Awash National Park: The local communities play a vital role in their engagement to conserve the park and its biodiversity as part of their cultural identity and property.

# 10. Scenario on the Short-Term and Long-Term Impacts of the Road Project on Awash National Park's Biodiversity

## A. If We Fail to Implement the Mitigation Measures:

Short-Term Impacts: Within the first few months of the road becoming operational, there will likely be a significant increase in wildlife mortality, particularly among species such as vultures, eagles, and large mammals, due to frequent roadkill incidents. High levels of noise, light, and chemical pollution will disturb the behavior, feeding, and breeding patterns of many species, leading to habitat abandonment by sensitive species and immediate declines in local populations.

Long-Term Impacts: Over the next several years, the continued absence of mitigation measures will result in extensive habitat fragmentation, loss of biodiversity, and a dramatic reduction in the populations of endangered and critically endangered species. The park's ecological integrity will deteriorate, potentially leading to the extinction of local populations of species such as the White-Backed Vulture and the Steppe Eagle. The park will suffer from reduced tourism appeal due to the decline in wildlife sightings, and the degradation of its natural landscapes could lead to irreversible ecological damage.

### B. If We Take the Mitigation Measures, but They Are Not Sufficient:

Short-Term Impacts: In the initial months, there may be some reduction in the immediate negative impacts, such as fewer roadkill incidents or slight decreases in noise and light pollution, but these improvements will be marginal. Key species will still experience disturbance, and some wildlife will continue to avoid the road area due to persistent threats, leading to partial habitat fragmentation.

Long-Term Impacts: Over time, insufficient mitigation measures will lead to only moderate benefits. While some species might adapt or benefit marginally, others, particularly those that are highly sensitive or have specific habitat requirements, will continue to decline. Endangered and critically endangered species may face continued population reductions, with some species potentially disappearing from the park entirely. The partial success of these measures could lead to a gradual but steady degradation of biodiversity, impacting ecosystem functions and reducing the overall health and resilience of the park.

### C. If We Fully Implement the Mitigation Measures Adequately:

Short-Term Impacts: In the short term, the implementation of comprehensive mitigation measures, such as wildlife corridors, pollution controls, and public awareness campaigns, will significantly reduce the immediate negative impacts of the road. There will be fewer roadkill incidents, and noise and light pollution levels will decrease, leading to reduced stress on wildlife. Wildlife populations will start to stabilize, and the natural behavior of species will begin to normalize.

Long-Term Impacts: Over the long term, fully implemented mitigation measures will allow for the recovery and sustainability of the park's biodiversity. Endangered and critically endangered species will have a higher chance of survival and population growth due to improved habitat connectivity, reduced mortality, and safer environments. The park's ecological integrity will be maintained, and its value as a wildlife sanctuary and tourist destination will be preserved. The park will continue to function as a critical habitat for diverse species, contributing to broader conservation efforts and supporting ecosystem services essential for local communities and the environment.

# 11. Conclusion

The construction of the new Melka Jilo Awash expressway poses serious threats to the biodiversity and ecological integrity of the entire road corridor and particularly impacting endangered and critically endangered bird species, large mammals, and other wildlife. The road's alignment through ecologically sensitive areas including the Awash National Park leads to habitat fragmentation, increased wildlife mortality, and environmental pollution, all of which can result in significant long-term damage to the unique lowland semi-arid ecosystems of this area. Recognizing these challenges, the action plan we have developed includes a range of mitigation measures designed to minimize the negative impacts on biodiversity and the corresponding ecological processes. These measures, which involve the installation of wildlife corridors, proper and maintain fencing, noise and light management strategies, pollution control efforts, habitat restoration initiatives, invasive species management, control of illegal activities including poaching and public awareness campaigns, will help to safeguard the ecological balance within this road corridor and its vicinities.

Successful implementation of these measures will require the collaboration of multiple stakeholders, including Ethiopian Road Administration (ERA), the Ministry of , the Ethiopian Wildlife Conservation Authority, the Awash National Park Office, research institutions, and the Ethiopian Environmental Authority. Their collective efforts, supported by continuous monitoring, adaptive management, and engagement with local communities, are essential to achieving a balance between infrastructure development and biodiversity conservation. This approach will help to protect the natural resources of the area including the Awash National Park and maintaining its ecological functions.

# 12. Recommendations

- It is crucial to establish a robust framework for collaboration among all stakeholders, including government agencies, conservation organizations, research institutions, and local communities. Regular communication and coordination should be maintained to ensure effective implementation of the action plan and prompt resolution of any emerging issues. A stakeholder coordination committee could be formed to oversee the execution of the mitigation measures and to address any conflicts or challenges.
- Continuous monitoring of wildlife populations, roadkill incidents, noise and light pollution levels, and habitat conditions should be prioritized to assess the effectiveness of the mitigation measures. Regular data collection and analysis will provide the necessary insights to adapt strategies as needed. Research institutions should be actively involved in conducting ecological assessments, while the Awash National Park Office and the Ethiopian Wildlife Conservation Authority should lead monitoring efforts on the ground.
- The Ethiopian Roads Authority and the Toll Road Enterprise of Ethiopia should prioritize the use of environmentally friendly materials and construction techniques to minimize ecological damage. Future infrastructure projects should incorporate biodiversity considerations from the planning stage, including thorough environmental impact assessments and the development of comprehensive mitigation plans.
- Special attention should be given to endangered and critically endangered species, particularly vultures, eagles, and large mammals, which are most at risk from the road development. Specific conservation programs, such as the creation of safe feeding zones, wildlife rescue and rehabilitation efforts, and the

installation of bird diverters, should be implemented to protect these species from further decline.

- Local communities should be actively involved in the conservation process through education, awareness-raising programs, and community-led initiatives. Building local capacity and fostering a sense of stewardship among residents can contribute significantly to reducing human-wildlife conflicts and promoting sustainable use of natural resources. Collaborative programs could be developed to train community members in wildlife monitoring, anti-poaching activities, and habitat restoration.
- The Ethiopian Environmental Authority, in collaboration with the Ministry of Transport and other relevant bodies, should enforce strict compliance with environmental regulations to mitigate the road's impact on the park. Regular audits, inspections, and penalties for non-compliance should be employed to ensure that all parties adhere to the agreed-upon measures.
- Adequate funding should be allocated for ongoing research, monitoring, and the implementation of mitigation measures. Government agencies, international donors, and private sector stakeholders should be encouraged to support conservation efforts and give special concern to the Awash National Park. Financial resources should also be directed toward capacity-building initiatives for local communities and park management staff.
- Given the dynamic nature of ecological systems and the uncertainties associated with road development impacts, an adaptive management framework should be adopted. This approach would allow stakeholders to adjust strategies and actions based on new data, research findings, and changing conditions of this area.

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